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This means that you can distribute or sell your software freely and without the need for ROMs, to run on either of the above machines.

Price/availability matrix
<table>
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<tr>
<th></th>
<th>BBC 'B'</th>
<th>ELECTRON</th>
<th>C64</th>
<th>SPECTRUM</th>
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<td>DISC</td>
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<td>£49.95</td>
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<tr>
<td>CASSETTE</td>
<td>£39.95</td>
<td>£59.95</td>
<td>£22.95</td>
<td>Available April 1st 1985</td>
</tr>
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</table>

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<th>ALL 25 LINES.</th>
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<tr>
<td>DB2V 2 WAY SWITCH</td>
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<td>DB3V 3 WAY SWITCH</td>
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<td>DB4V 4 WAY SWITCH</td>
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**PARALLEL DATA SWITCHES**

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<th>36 WAY CENTRONICS SOCKETS</th>
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<td>CN4V 4 WAY SWITCH</td>
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<tr>
<td>CN2X 2 WAY CROSSOVER</td>
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<th>Printer Model</th>
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<td>Juke 6100 (P)</td>
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<td>Brother HR15 (P and S)</td>
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On the hardware side, there's a special QL monitor to make the most of that high-resolution 512 x 256 pixel display. There are memory expansion boards, Winchester disk drives, printers, and low-cost Microdrive cartridges.

In fact, there's so much going on, we'll be running these regular Newsletters just to keep you in touch!

If you already own a QL, the next few pages will give you a taste of the exciting year ahead.

And if you don't... take a look at what you're missing. It should be all the persuasion you need!

Now read on... the quantum leap into serious computing starts here.

Nigel Searle, Managing Director, Sinclair Research Limited.

From sophisticated business packages to superb animated games... QL software makes the most of the computer's extraordinary specification.

New QL Software

Utilities, languages, games and business packages... with more on the way!

Two things are now certain about QL software. First, there's going to be plenty of it. And second, it's going to set completely new standards for microcomputers...

At the moment, there are well over 100 software programs in development. And the first software releases, shown here, demonstrate how exceptional the best QL software will be.

The QL already has five languages, superb programs for software developers, a top quality accounting package and in QL Chess it has its first game.

QLUB: 10,000 members and growing!

QLUB is the special Users Bureau for Sinclair QL owners. There are now well over 10,000 QLUB members, and membership is growing all the time.

For their annual subscription of £35, QLUB members are enjoying a whole range of information and advisory services, exclusive offers and special discounts.

One of the most important QLUB benefits is the special news magazine, appearing six times a year. The magazine provides a forum for QL owners to exchange views and keep in touch with all the latest developments.

Each issue is packed with updates on QL hardware and software, tips on applying the four QL Programs, and news of how other people are using the QL. QLUB members also receive a range of special discounts, with savings of at least 20% on selected software products.

Current special offers include:
- QL Chess for £14.95
- QL Toolkit for £19.95
- QL Assembler for £31.95
- QL Cash Trader for £54.95

Special subscription rates for Personal Computer News and QL User.
The multilingual Sinclair QL
BCPL – a forerunner of C, BCPL has been described as a systems programmer's delight. In the words of QL User, this compiler is a 'brilliant compromise between a high-level language and a low-level systems language'. Whilst not for beginners, this is an essential buy for anyone with a good knowledge of systems programming Complete with manual. Available from Metacomco - £59.95. Tel: 0272 428781.

LISP – already well-known for its artificial intelligence applications, LISP is a powerful and versatile language. This is a sophisticated implementation of LISP, by one of its leading exponents, Dr Arthur Norman. This package features full QL graphics, and a full manual is supplied. Available from Metacomco - £59.95. Tel: 0272 428781.

Pascal – probably the most popular high-level language of all. Pascal is particularly well-suited to structured programming, sophisticated data manipulation and algorithmic problems. Pascal interpreter complete with 87-page manual. Available from Computer One – £29.95. Tel: 0223 862616.

Forth – this 'new generation' language is proving both popular and easy to learn. The program provides a full implementation of the latest Forth 83 standard with graphics and sound extension. Available from Computer One – £29.95. Tel: 0223 862616.


Software at work
QL Touch 'n' Go – a unique approach to learning touch-typing skills. The program is designed to give you mastery of the standard QWERTY keyboard in just 24 hours. With practice, you should soon reach 40 words per minute, with over 95% accuracy. Written by Harcourt – £24.95.*

QL Cash Trader – a unique computerised book-keeping system for small businesses. The program provides a complete course in the principles of accountancy, and goes on to become an essential aid in the day-to-day running of a business. Complete with comprehensive manual. Written by Accountancy Software of Torquay – £69.95.*

World-beating chess!
QL Chess – fresh from its victory at the World Microcomputer Chess Championship. This program sets a completely new standard for games software. There's a high resolution display, animated 3-D graphics, and 28 levels of play from novice to champion. Features include an openings book of nearly 4000 moves, HINT and TAKEBACK functions that help you learn from your mistakes, and the option to play a human opponent or the computer. Written by Psion – £19.95.*

Psion trouble-shooting service
All QLUB members can obtain special assistance from Psion on using the QL Quill, Abacus, Archive and Easel programs supplied with the computer. Psion will normally answer any queries within 48 hours.

This title is available from Sinclair Research on 0276 686100, and selected Sinclair stockists nationwide.
New QL Hardware

An industry is born

From the moment of its launch, the revolutionary QL attracted massive interest from all quarters.

In one area, the interest quickly turned to action, as high-tech hardware manufacturers realised the immense potential of the QL for vast expansion, for system development and for widespread networking. Already the list of peripherals for the QL is very exciting – and lengthening by the day!

Here, we've covered many of the latest, most important developments.

As more appear, be sure to keep in touch with QL News!

---

The dedicated Sinclair Vision QL monitor

Once you see the incredible graphics capabilities of the QL you may decide an ordinary TV just can't do them justice.

If that's the case, a high-resolution monitor is needed. (And if you're creating presentation-quality charts, for example, it's quite essential.)

The new Vision QL monitor is specially designed for the computer by Kaga Electronics, with full support from Sinclair Research.

So it exploits the QL's maximum 512 x 256 pixel resolution to the full, with a pin-sharp 85 column display.

It's also specially styled to suit the QL – in looks, and in use. There's a 12" non-glare tube, and etched screen to diffuse reflections.

So the display is bright, sharp, much easier to look at... and invaluable for those late-night programming sessions!

And like the QL, the Vision monitor is designed with space in mind: it has a compact footprint of just 12½" by 15" – no more than a typical portable typewriter.

It's available from MBS Data Efficiency on 0442 60155 and selected Sinclair stockists.
Microdrive cartridges. Another Sinclair first!

Microdrive cartridges are the QL’s own unique storage media. Each stores up to 100K of information, on a cartridge no bigger than a matchbox! Access is within seconds. And in tests, Microdrive cartridges have made over 50,000 passes without loss of data.

Over 500,000 cartridges are now being used throughout Britain. And QL Microdrives themselves are standard equipment on the new ICL One Per Desk.

Powerful hard-disk system

For the QL business user, the new Firefly QL Winchester disk will boost the QL’s power in one huge leap.

Designed by Quest, it uses CP/M and offers all the benefits of Winchester technology: fast access, reliability, compact size and quiet operation.

With 7.5 Mb storage, the Quest Firefly is ideal for large databases such as stock or customer lists. And at under £1200, it represents exceptional value for money.

The Firefly will be available very shortly from Quest on 04215 66488.

Expansion boards for up to 4 times more memory!

Also from Quest, a simple and inexpensive way to expand the QL's RAM: with memory expansion boards.

These compact units connect to the standard QL expansion port, using the QL's internal power source or, for larger boards, an external power source.

The units range from 64K and 128K RAM boards to massively powerful 256K and 512K RAM boards, so there's something for every user.

Interface options

The QL comes complete with two built-in RS-232C interfaces.

In addition, interfaces for Centronics printers are widely available from manufacturers such as CST, Miracle Systems and Sigma Research . . . with prices from only £35.

And that's just the beginning. For attaching scientific and laboratory instruments to the QL, CST even offer an IEEE-488 interface, which can handle up to 16 connected devices simultaneously!

Where to find the QL. The Sinclair QL is available at selected branches of Dixons, W H Smith, John Lewis Partnership, Currys, Greens in Debenhams and Ultimate, and larger branches of Boots, John Menzies and specialist computer stores nationwide.

Sinclair Research Ltd
Camberley, Surrey, GU15 3BR
Tel: Camberley (0276) 686100.
Part Numbers

**5.25” Red Diskettes**
- R1/D: S/Sided D/Density 48 tpi
- R2/D: D/Sided D/Density 48 tpi
- R1/DD: S/Sided D/Density 96 tpi
- R2/DD: D/Sided D/Density 96 tpi

**5.25” Orange Diskettes**
- O1/D: S/Sided D/Density 48 tpi
- O2/D: D/Sided D/Density 48 tpi
- O1/DD: S/Sided D/Density 96 tpi
- O2/DD: D/Sided D/Density 96 tpi

**5.25” Yellow Diskettes**
- Y1/D: S/Sided D/Density 48 tpi
- Y2/D: D/Sided D/Density 48 tpi
- Y1/DD: S/Sided D/Density 96 tpi
- Y2/DD: D/Sided D/Density 96 tpi

**5.25” Green Diskettes**
- G1/D: S/Sided D/Density 48 tpi
- G2/D: D/Sided D/Density 48 tpi
- G1/DD: S/Sided D/Density 96 tpi
- G2/DD: D/Sided D/Density 96 tpi

**5.25” Pale Blue Diskettes**
- P1/D: S/Sided D/Density 48 tpi
- P2/D: D/Sided D/Density 48 tpi
- P1/DD: S/Sided D/Density 96 tpi
- P2/DD: D/Sided D/Density 96 tpi

**5.25” Blue Diskettes**
- B1/D: S/Sided D/Density 48 tpi
- B2/D: D/Sided D/Density 48 tpi
- B1/DD: S/Sided D/Density 96 tpi
- B2/DD: D/Sided D/Density 96 tpi

**General Prices**

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Prices & Quantities are per 5-PACK

**Post Packing & Ins.**

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<td>10+</td>
<td>5-PACKS</td>
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**Quality Promise**

Like all diskettes from DISKING, these Coloured Diskettes are individually certified, and are from a leading world manufacturer. We offer our usual no-quibble money-back warranty.

**What you get**

All Coloured diskettes are supplied in packs of five (5) of ONE colour. They come in a FREE plastic library box, and with colour coder pens. You will also be entitled to any other applicable promotions at the time of ordering.

Please state when ordering, the number of 5-PACKS you require, and the type number of the diskettes. For example, supposing you want five red diskettes for your IBM PC, and five green diskettes for your (double sided) ACT Sirius, you would order One pack of R2/D & one pack of G2/DD.
"I'll use the orange ones for my IBM, the blue ones for my Sirius, and the green ones for my Apple."

"No! We'll use the red ones for Masters, the pale blue for bought ledger and the yellow for word processing."

FREE Plastic Library Box with every ‘One-Colour’ 5-Pack.
Choose from six RED, ORANGE, YELLOW, GREEN, PALE BLUE or BLUE.
Or Treat yourself to six 5-Packs, one of each colour!

Attention the trade:- Our usual minimum orders will apply & library boxes will be charged extra.
Now everyone with a BBC or IBM PC will want to get their paws on CUB's sleek new D series plastic cabinet—a triumph of ergonomics and up to the minute design. Within it is the CUB 653 MEDIUM RESOLUTION colour monitor—the perfect mate for computer users who wish to combine the advantages of brilliant, low cost colour graphics with 80 column processing software.

CUB 653's remarkable depth of colour is enhanced by minimal screen glare, thanks to a super high contrast CRT. Even in well lit environments the 653 (H) x 585 (V) resolution and 0.43mm dot pitch produces 80 column text which is pin-sharp and easy to read. Owners of SHARP, RML480Z, APPLE Series, WANG and other leading computers needn't feel left out, because CUB 653's compatibility extends to these models and many more.

PICK ONE UP FOR JUST £299 inc. VAT

NEW LOW PRICE, NEW PLASTIC CABINET—THERE'S NEVER BEEN A BETTER TIME TO BUY.

Standard Resolution version also available in new cabinet. Both Standard Resolution models and Medium resolution models produced in metal cabinets if required.

Available from High Street Computer Retailers and selected branches of W. H. Smith, Hamrods, John Lewis Partnership, John Menzies with selected models available from larger branches of Boots.
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- 30 Microdisk capacity (or 12 compact 3" disks) stored in 3 compartments. Smart two tone beige brown with strong steel hinges.
  - **Part No:** Description: Price exc VAT
  - BM 30 Microdisk capacity: 39.90
  - BM 30 Microdisk capacity: 39.90

### POPULAR RANGE

**Disting Swing-Lid Lockable Box**
- 60 Microdisk capacity, complete with keys, dividers and even built in carrying handles.
  - **Part No:** Description: Price exc VAT
  - B60B: 60 microdisk capacity: 49.90
  - If buying 3 to get one FREE, P&P @ 4 unit rate please.

### EXECUTIVE RANGE

**Executive Mini 100**
- 100 5.25" microdisk capacity complete with removable lid, dividers, tabs, lock, and 2 keys.
  - **Part No:** Description: Price exc VAT
  - EN100: 100 microdisk capacity: 98.90
  - If buying 3 to get one FREE, P&P @ 4 unit rate please.

### EXECUTIVE RANGE

**The Ultimate in Quality, these Beautiful Austrian Made Storage Boxes in Luxurious Two Tone Deep Brown**
- Complete with everything one could want. The lids not only swing open and shut, but are also removable if shelf space is prohibitive. They come with Ingenious dividers where even the tabs are adjustable and protected from dirty finger marks. The wonderfully engineered locking mechanism comes with 2 keys and a master filing tab.

### DISKETTE STORAGE

Choose the box you like, buy three and get the fourth one FREE.
Dysan For The Discerning

5½ Diskettes

Prices and quantities relate to Ten-Packs

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To order the colour your choice, just precede the line number with the appropriate letter: (R) RED, (O) ORANGE, (Y) YELLOW, (G) GREEN, (B) BLUE & (P) PALE BLUE. For the actual colours, please see our full colour advertisement back a couple of pages, or call and ask for our full colour brochure

FREE CLOCK

With every 20 Diskettes ordered at these prices

When you buy twenty 5.25", 8" or 3.5" diskettes at these prices, from any of our manufacturers, you will receive completely FREE of charge, this superb calendar clock with a large easy to read 24mm LCD display. Buy forty diskettes and you will receive two clocks and so on.

Offer ends 30th April 1985

PLUS

FREE with every Ten-Pack of diskettes from DISKING, (or Five-Packs if coloured disks)

The superb SEE10 Library Box. Also available individually for £2.50 exc VAT, either for 5½" Disks (SEE10), or 3½" Disks (SEE10-3). Now also available for 6" Disks (SEE10-6) at £3 exc VAT

PLUS

FREE DISKING Colour Coders

A multi-coloured pack of ten fibre tipped pens for colour coding your diskette labels. Available individually at 49p exc VAT

Very Urgent Orders

If ordering by telephone, and by 3pm, you may request Dispatch which delivers the next morning at 9am. Minimum cost is £10 for the first 5kw - please call

Desperate Orders

Just call and ask for Joan or Roger and we will do whatever we can to help you with your problem. If you are not too far we can probably organise a taxi or courier

Bargain Corner Diskettes

5½" Diskettes

Complete with a FREE SEE10 library box and Colour coders, these disks are certified and are from one of the manufacturers in this ad Prices and quantities relate to Ten-Packs

EXC VAT No hub ring

UL1D S/S 48 tpi | 13.90 | 12.90 | 11.90 |
UL20 D/S 48 tpi | 20.90 | 19.90 | 18.90 |
UL1D S/S 96 tpi | 20.90 | 19.00 | 18.90 |
UL20 D/S 96 tpi | 24.90 | 23.90 | 22.90 |

Suitable for single OR double density

EXC VAT with hub ring

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UL2DHR D/S 48 tpi | 21.90 | 20.90 | 19.90 |
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UL2DHR D/S 96 tpi | 25.90 | 24.90 | 23.90 |

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Disking Supermailers

These diskette mailers come packed in 100s and are of a very clever copyright design. They will hold up to 4 diskettes complete with envelopes and are extremely robust

Part No. Description Price exc VAT

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FREE Aeroplane

Our latest aeroplanes have sound, so you'll have no trouble waking up those sleepy software engineers, when you throw it at them. Just call and ask for our flier, and we'll send you our latest trade pack with prices, special offers and sample unlabelled diskette. We'll also enclose a DPC (Disking Priority Customer Card) application form telling you how to buy at our 10,000 prices yet order in 50s.

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The latest computer care range from Memorex represent fantastic value for money, and are available individually or with a discount if purchasing all three.

Part No. Description Price

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THE KEYBOARD FOR ZX SPECTRUM COMPUTERS

* EASY FITTING
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The Saga 1 Emperor, equipped with 87 keys, is a carefully designed replacement keyboard incorporating many special functions for the popular Spectrum Computer. For business or pleasure, the Emperor will make your computing time more productive and enjoyable. The Saga 1 Emperor will enable you to use the Spectrum as a powerful programming tool easier and faster.

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You don't need to be told about the information revolution - you already know that without efficient data communications, you and your business may not survive it.

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This is why you should choose Modem WS2000 from Miracle Technology.

**Quality** — In concept and construction Miracle Technology sets the standards other modem manufacturers aim for.

Quite simply, WS2000 is one of the best designed, best made modems you can buy. It is approved for PTT use in the UK and Holland, with approval pending in other European countries.

**Flexibility** — As a multi-speed, multi-standard modem, WS2000 enables data transfer between almost any two computers - worldwide.

WS2000 gives instant access to the vital information sources of Prestel, Micronet, Telecom Gold and a vast range of public and private databases.

WS2000 can also convert your computer to a telex terminal, giving you inexpensive 2-way international telex facilities.

WS2000 is suitable for use with a wider range of computers than virtually any other modem, and we can offer software packages for most makes.

**Versatility** — No other modem offers all the facilities available with WS2000.

Its unique versatility means it can be expanded by the addition of autodial and autoanswer options (presently undergoing approval testing with BABT), plus direct computer software control of the modem and much more.

WS2000 is the modem chosen by the BBC to demonstrate a UK-USA datalink live on TV; selected by Cable & Wireless/Western Union for their Easylink Telex Service; taken round the world on Operation Raleigh; in action for CBS News, sending front-line war reports around the world.

WS2000 is the modem used by people who need reliable data communications today - and every day.

WS2000, with BT telephone lead, mains power supply and comprehensive operating manual costs only £129.95 exc. (£154.73 inc. VAT & UK delivery) — you may also need a computer lead (£10.35 inc.) — specify computer when ordering.

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Germany: Marcom Computersubstanz GmbH, Podbielskistr. 311, 3000 Hannover 1, Tel: 922816
Other Countries: Dennison International Company, 43/5 Erkrahl I, Matthias-Gaudin-Straße 9, Tel: 858 6600
New - the official Spectrum Upgrade!

Turn your Spectrum into a Spectrum+ for just £20

Here's some exciting news for 48K Spectrum owners… the official Spectrum Upgrade Kit.

The £20 Kit has everything you need to turn your Spectrum into the stylish new Spectrum+. You don't even need an understanding of electronics, just the ability to solder a few wires together! The leaflet in the kit gives clear, step by step instructions.

If you're not sure about doing it yourself, don't worry. Simply return your 48K Spectrum to Sinclair and for £30 we'll upgrade it for you.

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Fooling yourself
You may not realise that IBM has to buy its equipment from IBM, like the rest of us. Worse, you may not have realised that IBM doesn't like it any more than the rest of us.

The non-appearance of IBM's PC/AT in Europe is due to a simple finance battle inside the corporation. The computer itself is known to be difficult to build. The disks, for instance, are rather advanced and, therefore, highly unreliable. Some of the chips inside are rare, and still in short supply if you want them to work.

However, IBM has been counting the cost of its late launch of the PC in Europe, and angry words have been expressed by European executives to their American counterparts who couldn't release sufficient PCs to supply buyers over here. Even when they did, it will be remembered, there was a shortage of some kind.

So it was decreed that the AT would be supplied to Europe as well, at a certain price. And it would be sold, at another price, dangerously similar to the first.

European executives, having cast their eyes over the price list (not for divulging to us outsiders) have sent back memos, the broad gist of which is: Thanks very much and all that, but if you want big orders, the price will have to come down. We have to make a certain amount of profit on each million we spend, they said. And anyway, the things don't work. Get your fingers out.

It's a rich man's world
Thriving on editorial diversity is the motto of this particular story. My original intention was not to report on Sinclair's CS5 vehicle: apart from commenting wryly that it's truly amazing, how many computer specialists have gone into print with their opinions on the thing?

The editor, however, disagreed. Hence the picture story which appears later in this column (and which, I hasten to add, was written by someone with more knowledge of cars than I have).

While the vehicle may be of interest because of the Sinclair connection, I have to add that Sinclair worship is a strange phenomenon. I think this fascination with the hobbies of a rich man is a symptom of the morbidity of our civilisation (I'm going to get into Private Eye's Pseud's Corner if it kills me).

My argument runs something like this: if Sinclair takes his sponsorship of orchestras further and writes a symphonic opus, will the motoring specialists join in with the computer writers in producing criticism? And can we now expect the athletics magazines, who cover the marathon runs that Clive specialises in, to start reporting on the computer industry?

Sir Clive has many private interests. He is a poetry freak. He has tried his hand at publishing novels. He's got a leading light in the IQ club, Mensa. He has political and social theories. And he has given evidence, on the one or two occasions when I've met him, of an interest in women, and in alcohol.

The editor permitting, none of these subjects will become the object of anything more than passing, humorous comment here.

Did you know, by the way, that the vehicle isn't even produced by the same company that makes the computers? Sinclair Vehicles Ltd is a separate entity from Sinclair Research. And the only possible interest to users of microcomputers is this: if the car business drains Sinclair's money away, then he may not have the cash to plough back into the next generation of micros.

Switched on
While everyone else is trying to buy cellular radio phones to prove their status as traveling salesmen? I've gone one better and installed my own PABX.

There are lots of private branch exchanges on the market these days, but the trouble with most of them is that they require special telephones, or a switchboard operator, or both.

The Small Systems model, the SS12, uses plain vanilla phones and, more important, uses only two wires.

The reason these two facts are important is that I have several computers in my office, and need to connect them to the phone system through modems.

On all too many systems which try to offer inter-office switching without a switchboard console, they have to install extra wires to carry control signals. Alternatively they use special tones which a computer could accidentally duplicate. Either way, to attach computers to the phone system you need a new, special line.

The system comes, complete with wiring for twelve 'lines', at a package price of around what you'd pay for a two-disk CP/M system — approximately £1200. The central processor is an Intel 8085 and it controls all switching.

It sounds like a lot of money for very little hardware, but the problem of getting it cheaper falls into two rather tricky areas. One, of course, is the question of how many you can sell, and this is still not a mass market.

Systems like the SS12 may change all that, but not unless everyone can afford them. And as long as it takes two years from original design to appraisal, the sheer bank overdraft problems of designing a unit make the prospect of cheap ones rather remote.

The nice feature of the system is that you don't have to have hundreds of lines to...
People will tell you that Jazz is the product which Lotus hopes will be as popular on Macintosh as 1-2-3 was on the IBM PC. Lotus is right.

The company will also tell you that it's a version of Symphony, the follow-up IBM product, but for the Macintosh. True, it will be wrong.

The new product is superficially like Symphony in that it includes a proper database (1-2-3 had a rudimentary file searcher), a full-featured word processor (not just a pad scratcher) and also includes graphics and communications.

But where Symphony is a single database, with a series of different 'interfaces' to interpret the data in graphic, or spreadsheet, or text, or database mode, Jazz is actually five programs, integrated with automatic (but cancellable) matching.

In other words, a spreadsheet in both Symphony and Jazz can be arranged so that data displayed in graphic mode will automatically change if you change the spreadsheet.

But in Symphony, the change arises as soon as you ask for the display change in the graphics. In Jazz, the graphics program has its own file, and gets changed only when the changes are passed over from the spreadsheet. And it's possible to retain the old data, give it a new name, and file it.

The product will make a lot of difference to the Mac. With Symphony, the change from 1-2-3 to the new product was not clear-cut enough for many commentators. All they saw was the complexity, and marveled aloud whether anybody would buy it. To the users, however, the additional database capabilities, plus the comms function, was enough to justify the switch.

With Mac, however, there isn't a 1-2-3 product to compare it with, and users of the computer will compare its five functions with separate spreadsheet, word processor, and so on.

To Mac users, no more need to be said.

Those of us who know (and love) the machine are still driven mad by the thoughtful, painstaking, nit-picking and endless way it refuses to be hurried while sorting out its disk drives. To switch from one application to another can take as little as half a minute, or as much as a minute and a half, if there are complex files to open and close.

The prospect of being able to switch from editing a letter, into storing the reply in the database, into getting on with the spreadsheet work you stopped to write the letter in the first place — well, it's like magic.

Or at least, it will be if Jazz lives up to its promise.

The launch of Jazz in the UK in January was a pathetically low-key affair compared with the razamatazz we saw in Las Vegas in November.

In Vegas, we were in an aircraft hangar because there wasn't anywhere else big enough to accommodate the cinema screen, the aeroplane (what was that for?), the crowd of 300 important and self-important people, and the tables groaning under a load of glassware and crockery and floral arrangements. And the real live jazz combo (a big band) and jazz singer, of course.

In London, we were stuffed into a Park Lane Hotel room and made to watch the video of the jazz combo, and a Lotus executive did a demo of Jazz on a giant mockup of the Macintosh, six feet tall. (In Vegas, there was a 12ft tall working model. Ah well.)

But we did have more impressive news here in London — the news that Apple is extending its Test Drive program to include Jazz.

The idea, according to Apple boss David Hancock, is that the test drive schemes will become more directly aimed at specific markets. And in April, the specific market will be the Jazz market, and people who borrow the machine overnight will get Jazz to play with.

One question which is being asked a lot is simply: Will it sell? And, more specifically, will it sell better than Symphony?

The Symphony problem is largely in the mind. There are those who think that Symphony requires a degree in computer science to understand. And there are those who mutter, darkly, that it has 'flopped'.

It's always possible that Lotus executives tell me fibs from time to time, but I haven't caught them at it yet, and they claim that, in Europe, Symphony sales are running level with 1-2-3 sales.

This means that IBM users are actually buying more copies of Symphony than of 1-2-3. The logic is simple: there are more lookalikes in Europe than in America, but Symphony is not yet available for most lookalikes. Lotus 1-2-3, however, is. So a large proportion of 1-2-3 sales are for the lookalikes, and very few of the Symphony sales will run on them.

As to whether Jazz will sell, I feel very happy sticking my neck out and saying 'Yes, very well indeed'.
reporting on the collapse of the home computer market. It is, it reports, over. But the home computer boom is far from being over. Indeed, it hasn’t yet started.

The evidence of the collapse of the industry is simple — manufacturers who had a wonderful time at Christmas 1983/84 had a pretty poor time last Christmas. And the software business had a rotten year, especially on the games side. However, the question of who had the rotten time last Christmas has some interesting answers.

Primarily, Acorn caught a cold, although the company says it sold twice as many machines this Christmas as last. Interestingly, Commodore didn’t do as well as expected. And, despite all the predictions of doom, Sinclair did rather well.

However, the reasons for all this have nothing to do with the collapse of the market. Rather, they have to do with the neglect of the market by the manufacturers.

Clive Sinclair, uniquely in Britain, did launch a new machine with noticeably more features than his old one. The QL excited people and they bought it, even before it existed. Afterwards, fingers burned, they held back a bit — but by Christmas, all the chain store buyers were assuring me the QL was selling again.

Commodore launched the Plus/4. It wasn’t noticeably better than the 64, and it didn’t run 64 software. It was sufficient to put some buyers off the 64 (out of date? they asked themselves) but not enough to swamp the market with its excitement.

Amstrad did pretty well, just launching a machine which brought the ‘value for money’ level into a different bracket.

To put it politely, the Amstrad is not very far from a souped-up Sinclair Spectrum with a proper operating system, a built-in tape player and a free monitor. But the free monitor was a new, even exciting, thing to get for £250 including the computer.

Acorn, complacent sure of its school sales, refused to change the BBC Micro or bring the price down. Yet it must be obvious to the most ignorant that the cost of building it had halved in the three years since it was first available, and that if it had been re-engineered it could be built for closer to a third of the price.

Now, the schools scheme has come to an end. Schools don’t have money without such schemes — certainly not computer money. Many of them are short even of writing paper. And the result is that shops started dumping BBCs at discount prices. But the reason they started dumping them wasn’t just a fear of not being able to sell them.

Around the beginning of December, rumours of the issue 10 version of the BBC board began to circulate. It would, said ‘informed sources’, sell for £150-£170, and Acorn would stop supporting the old one.

Shopkeepers who weren’t quite sure if this made sense still knew enough to move out of the firing line. If a new model is coming out, they reasoned, now is the time to get shot of the old, even at cost — or even at a loss. So they did.

The fact of the matter, however, is that no-one, yet, sells a home micro.

What has flooded the market, to the point where potential buyers mostly already have it, is a programmer’s exercise bike, usable for sophisticated games. For home use, it’s a joke.

How can you manage your history notes on a system with only 100k of data? And if you log on to a remote database with history information, you can’t compare it with your own notes to see if they relate because the comms program is separate from the text program.

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When the rumours first emerged about Hewlett-Packard releasing a Unix-based portable, a few eyebrows were raised. But it all turns out to have been true. Dubbed the Integral Personal Computer, the 68000-based machine weighs 25lbs and includes a built-in Thinkjet printer and 32-line, 710k capacity disk drive.

The screen provides 31 lines of 80 characters on a 9in electroluminescent amber display. HP Windows is included and allows the multi-tasking system to display several applications simultaneously. Surprisingly though, it’s a single-user system.

The operating system is Hewlett-Packard’s UX, derived from Unix System III, as is Xenix which is due to be available on IBM’s PC/AT this year.

Also included is Personal Applications Manager, which may help to appease Unix opponents as it allows you to access the machine without having to use standard Unix commands.

The £5450 Integral is aimed primarily at scientists and engineers, but standard business packages such as Multiplan and dBase II can be implemented. Availability is scheduled for March.

By the end of the year, the Macintosh will cost £1000, its Atari rival previewed in this issue will be available, and there will be one or two interesting machines like the Mind Set and Amiga, and others we haven’t heard of yet because they are still secret.

If those machines show no sign of creating new markets, then I’ll consider, seriously, the possibility that the home computer boom is over.

As of today, however, I’m still waiting for it to start.

Any offers?

Now that Coleco has killed off its Adam micro, we will never know whether it failed because the design didn’t appeal to enough people, or because they never managed to build any that worked.

However, the company (now concentrating on cabbage patch dolls) does still have a computer product up its sleeves — a phone which runs Apple II software.

The plan is to sell this for £500, but the plan isn’t Coleco’s. That company hopes to find a sucker — sorry, buyer — to take over the design.

Sneaking suspicion

Tactless though it was of Timefame to allege foul play and unauthorised hacking of its Prestel pages, I’m stunned that Prestel could get away with the response it chose — to delete Timefame’s pages altogether.

The fight blew up just before Christmas, when Timefame announced that hackers had been playing with its pages (which nobody need doubt) and worse, that these hackers had been given the necessary access codes by a ‘mole’ inside Prestel.

Who can say whether this is, or was, true? Certainly, Prestel couldn’t prove it one way or another, and neither could Timefame. And eventually, Timefame withdrew the claim.

But the rest of us would find that withdrawal just a wee bit more convincing if Prestel hadn’t put such extraordinary pressure on them.

If Prestel feels entitled to censor pages published by users of its service, it is going a lot further than it said it would when it announced the service. And it’s going a lot further than the free press laws (such as they are) would allow it to do if it were a newspaper print works.

But to suspend the Timefame pages because of unflattering remarks is quite another thing.

I know that there are print unions which take similar action (and get away with it, sometimes) when their paper prints things about them which they regard as unfavourable.

But I’d be very surprised to learn that the people running Prestel are the type who...
praise the print workers for that kind of high-handed action.
Apart from the arbitrary damage to Timefame's business, what about the subscribers? Aren't they entitled to the information—which, just possibly, might be important—that they want to look up?
And just suppose—just suppose, that's all—that Timefame was right, after all, and there was a mole, and Prestel was at fault?

It's irresistible
They are rather pleased with themselves at Digital Research, where the company reckons it's beaten IBM to the punch with a 'proper' operating system for the AT. Concurrent DOS 286 launched together with Intel (which makes the 80286 super-chip inside the AT) does something that the AT's own operating systems, DOS 3.1 and Top View, can't do. It extends the memory beyond a megabyte.
The 80286 operates in three modes. At startup, it behaves very like the original 8086 or 8088 inside the IBM PC. It addresses a megabyte, maximum, of internal memory, and it controls it in segments of no larger than 64K bytes. But it can be switched to 'protect' mode. In this mode, it can suddenly control 16M bytes of memory (and the PC AT does have the necessary wires to plug all that memory in) — and can give different programs different 'privilege' levels.
The most privileged level, zero, is reserved for the operating system. It can decide which program runs in which part of the memory, and which bits of memory are not RAM any more, but ROM, or which bits can't even be read because they are secret. No other program can change these protected segmentations.
The result is that computers like the AT, the Acorn Business Computer, Rair, FTs, ICL's 286-based micros and others (still secret) can now run multi-task, multi-user programs, and the users of the AT who stick with Top View and DOS 3.1, can't. When the software is available from Digital Research in April, it will actually run DOS 2.0 programs direct from the disks; at the moment, the company's latest version of Concurrent will read DOS 2.0 files, but not run programs.
Most IBM watchers now agree that Top View is more than just a 'cosmetic overlay' to DOS, and is a genuine multi-tasking operating system. But it doesn't have the multi-user, networking abilities of Concurrent DOS, and, even stranger, all the evidence is that IBM doesn't propose to upgrade it to that level for several months—possibly, not until next year.
And strangest of all, it only gives the AT access to the 640K bytes of memory that the PC has today. It doesn't use protected mode at all.
The only thing that is still far away on Digital Research's travel plan is the networking parts of DOS 3.1. The company says it hopes to incorporate that this year, but not at the release of Concurrent 286. But it will announce DR Net in a version which will work with Concurrent 286 in April.
Working with the already-announced GEM, this new operating system could start the transformation of the AT into a super-Macintosh.
The segmentation and protection abilities of the 286 chip go some way beyond the powers of the 68000 chip as used inside the Macintosh, especially with the current Mac operating software. However, there will be interesting announcements on that level in 1985 too. Concurrent DOS 68k is likely to be announced in the next few months, giving multi-tasking to many systems with the 68000, and then we'll see if anything can stop the transformation of the AT.

The arrival of a Wabash Sony-style diskette is actually something of a breakthrough, because this one is really made by someone else. Most diskette material normally comes from one of three factories in the world, whatever the hype on the advertising box.
Wabash claims that this half-megabyte 3½in system uses a new surface technology. 'It is the first Wabash product,' says the company, 'to use the cobalt-enhanced oxide coating formulation for high density recording.'
Theoretically, this should mean that when disk drives are formatting diskettes to higher densities, these Wabash ones will cope with the new format programs.
Details from 1 Trinity Square, Chelmsford CM3 5JX.

You have never seen Clive Digby-Jones of Websters Software (a distributor) before, have you? But it's all right—he doesn't always snarl like this when entertaining ex-Transport Ministers.
The MP, David Howell, gave Websters a chance of some publicity by inspecting its new premises at Guildford (for where he is the sitting representative).
And what fascinating conversation took place then? Digby-Jones, entertaining little imp that he is, took advantage of the occasion to quip: 'Websters has always taken a firm stance against piracy.'
Keeping them rolling in their seats, he chuckled: 'Organised illicit copying of computer software must be stopped. The loss of revenue for the software houses means there is a shortage of funds for research and development, and in the end, it's the consumer who loses out.'
I think he was trying to encourage Howell to vote in favour of the forthcoming Bill against software piracy. It's hard to be sure, because Howell's only recorded words were: 'I'm very impressed indeed, Websters is obviously in the frontier of computer technology,' and added: 'It is in the nature of things that you cannot prevent ordinary copying any more than you can stop book lending. But you can prevent the actual duplication and then re-sale of software under fraudulent labels.'

Eagle has side-stepped the threat of Chapter XI bankruptcy in the States by rescheduling its debts.
The company's imitation IBM micros have never quite recovered from the blow of a lawsuit from IBM over the
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It's all in the game

At last, I have seen a computer downloading software from a video disk.

It's the new MSX design from JVC, linked into the VHD disk system and likely to hit the market later this year — much later.

The idea is that you can mix the picture from your computer with the picture from the disk player, and decide which film sequences to show under software control.

It looks like a first step, though.

The demonstration games shown at JVC's headquarters in London included the predictable car racing game, where the picture switches from one lane of a motorway to another as you twitch the joystick. The computer makes it more entertaining by dumping oil barrels into your path.

But the loading of software seems to have been designed by a contemplative monk.

Data for the computer is stored on the video disk — how, the executives weren't too sure. But it comes off the video disk at the blinding speed of around 2400 baud.

Ah, well, back to the drawing board. With something like four gigabytes of data possible on the disk, it would take around 5000 hours to read the whole disk at that rate. You can see that this is not a computer peripheral.

The interesting feature of the machine was not its data rate, however, but the games. Apart from the racing game, most of the demo games involved audience participation and an expert bookkeeper.

Executives told me that Japanese players love to sit round the screen, watching a fruit machine rolling. The audience watch the screen until the fruit is just about to settle, and then they have bets among themselves.

Alternatively, they watch a young man with a mischievous disposition walking through the changing rooms of a sauna/swimming pool, and noticing a shapely pair of legs under one of the shower doors. As he opens the door, the action freezes, and the computer makes random jumps — either to an angry young man, or to an embarrassed young lady — after everyone has placed their bets.

My favourite, by far, was the one showing three of those weird aliens from the Star Wars bar, all drinking in a Tokyo hotel. One gets up to visit the toilet, and stops between the two doors.

Which door will it go through — the Gents? Or the Ladies? Place your bets!

Quick off the mark

Commodore has announced approved status for a Plus/4 business program — Company Pac 1*2*3 — saying that it's the first business product to get this approval. Actually, it's the first product I've ever heard of for the Plus/4 at all.

Despite the name, it's not an imitation of Lotus Development's product for the IBM; it includes various ledger packages and management reporting routines, all on one disk.

Normally the thing costs £98.95, but the first 50 applicants were to receive a discount down to £50 by phoning (01) 900 0999. I wouldn't get too worked up about that — the release was sent to us in December, and just possibly someone else has already phoned.

Unix wasting time

If IBM continues to back MS-DOS as its primary operating system, and if that operating system is enhanced to gradually include a sophisticated degree of multitasking, 'then that'll be the end of Unix, at least as far as the PC world is concerned,' commented a pundit in Los Angeles recently.

The pundit is my old friend David Ferris, head of Ferrin, a company which trains corporate users of micros, and advises on selection of hardware and software. And I couldn't have put it better myself.

Ferris and his colleagues do
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The reasons single people join Dateline are often very varied, but come down to one thing—they are simply not meeting the sort of people they would like to meet.

Tim Stagg, a 31-year-old engineer from Pangbourne, found that the break-up of his marriage two years previously and the ending of another relationship since, had left his confidence rather dented. 'So I thought I'd try Dateline because at least that gives you a starting point for meeting people.'

At first Tim could not bring himself to actually telephone any of the girls whose names he received through Dateline, instead he made the initial approach by letter. He was delighted when girls started to telephone him, after receiving his name on their lists. For Tim it made the whole thing a lot easier, and a series of pleasant dates soon saw the return of his confidence. Fortunately, because on his third list from Dateline appeared the name of Christine Terry.

'Many of my colleagues were married'

Tim and Chris agreed to meet at a point halfway between his home and Basingstoke, where Chris worked as a student midwife. Having just moved to Basingstoke, and working unsocial hours, Chris found it very difficult to meet people. 'Many of my colleagues were married and I was getting very low,' said Chris, an articulate 29-year-old. 'I saw Dateline advertised and decided to give it a try.'

Chris had only been a member of Dateline for two weeks when Tim contacted her. Neverthless, she managed to meet four people before that! But she was immediately taken with Tim when he phoned and was delighted when he suggested that they meet.

They agreed to meet in the car park of a pub and swopped car registration numbers as a means of identifying each other. Chris liked Tim immediately. 'Even seeing him sitting in his car, I thought 'We're going to get on!!' Mind you, I thought that when he phoned up first of all. He was quite cheeky on the phone and I liked that.'

'Time just flew by...'

Tim was also very taken with Chris and their first evening was extremely successful. 'The time just flew by. It seemed we had, only just met and then it was time to go again. I can't even remember what we talked about!!'

They decided to meet again a week later ('or sooner if you prefer,' Tim had said, hopefully), and Chris went home to her parents for the weekend. She returned to Basingstoke rather earlier than anticipated on the Sunday and felt like seeing Tim again, so she phoned him and they met again at 'their' pub that evening. They've met nearly every night since!

Within two or three weeks, Chris realised that she was falling in love with Tim and they were beginning to talk about the possibility of a future together. 'We went to London for a few days,' remembered Chris, 'and Tim said, 'Why don't we go to Hatton Garden and get a ring?'' So we did! It was a lovely day.'

Within three months of meeting each other, Chris and Tim were engaged and are planning a wedding in a year's time when Chris has qualified. Their families are very happy for them and Tim has found his friends very supportive. 'I thought they would laugh at me joining Dateline, but they didn't,' he said. 'After a while, especially after I met Chris, it made such a tremendous difference to me — I was so much happier. I would definitely advise anyone to join Dateline. I enjoyed nearly all my dates and even at worst had a pleasant evening out each time. Dateline helped me get my confidence back and I enjoyed my membership.'

Even though Chris was a member for such a short time she met quite a few people before finding Tim. 'Even just getting correspondence and phone calls was nice,' she said. 'And what advice would she give people who join Dateline?

'Give it time and you do meet the right people,' she said, smiling at Tim.

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many schools have both the recommended educational micros — the Research Machines models, and the Acorn model — and that they are about as friendly as chalk and cheese.

A network which lets them link up has been developed by Richmead Micro of Reading, and it sounds like a sensible use of resources as opposed to an ideal solution, which might involve buying new resources.

"Before the Beeb," commented the company in its announcement, "most secondary schools used the RML 380Z. But when the BBC Micro was launched, many switched over because the relative low cost allowed them to use several computers in a classroom where before they could afford only one."

Most schools handed the disk-based 380Z over to the administration side. Then they found that a network of BBC Micros was possible, but they needed a big disk as a file server.

Richmead's solution: connect up to 16 BBC Micros together in Meadnet, and forget about Econet. It costs £275 plus £20 for each BBC station, and is slower than having individual disks 'but faster than tapes,' according to teachers at one school where it is used.

Details of Richmead on (0734) 665771

Rich pickings

Immediately after finishing this issue of Newsprint, I went to Apple's head office to be told about its new local area network.

Apple is making quite a fuss about this deal — air tickets to California wil cost them a bit about this deal - air tickets to California wil cost them a bit

"We give high marks in most areas, especially the announcements about collaboration with software vendors. It will take a long time before most people are able to use Apple Net, but by 1986, we think it will be a serious standard."

I was particularly amused by the number of news media who took the meat of Ferrin's announcement, and reported the Apple network launch without Ferris's comments as if they'd dig it all out of the grapevine themselves . . .

Going down

The Spectrum has been dropped in the UK but the Spectrum Plus lives on, with its price cut to £129.95 from £179.95 (although you now have to pay for the software pack which used to be bundled in).

And you can upgrade your old Spectrum to Plus level for £30. Or indeed, thanks to Acorn, you can take it (or any other micro) to a BBC dealer and get £50 off the price of a Beeb.

Acorn also got in on the post-Christmas price-cutting with the Electron coming down £70 to £129.

Speed, however, isn't what worries my pundit friend David Ferris. He's taken the trouble to issue a condemnation of the apparently high cost of the system — which Apple says will be £50 per micro.

'We have found that when you add up all the hidden expenses of building a network, the costs of the wires are trivial,' Ferris told me. 'We've installed more networks in the San Francisco area than anybody else, I'd say in the world, and really, the costs can be as high as fifty times greater than the cost of the wires, and the wires, and the software all together.'

However, it isn't all bad news: Ferrin as a company has suffered long enough from the software problem — no software works on most networks — to give high praise to Apple's approach to this.

Tactlessly issuing his release a week ahead of Apple's, Ferris commented: 'We give high marks in most areas, especially the announcements about collaboration with software vendors. It will take a long time before most people are able to use Apple Net, but by 1986, we think it will be a serious standard'.

It was particularly amusing to the number of news media who took the meat of Ferrin's announcement, and reported the Apple network launch without Ferris's comments as if they'd dig it all out of the grapevine themselves . . .
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Portable operating system

Microsoft has developed a new operating system, HH-DOS (Hand-Held DOS), for notebook portable computers; it incorporates features of MS-DOS and various integrated software packages.

System calls and the file structure of HH-DOS are the same as MS-DOS, although by no means is it fully IBM PC compatible. Thus, data files and Basic programs can be up and downloaded from HH-DOS, but applications programs will undoubtedly require modification to run.

HH-DOS also integrates several applications software modules including the Microsoft Word word processor, Multiplan spreadsheet, Telecom (similar to the Tandy Model 100 version), File (a file manager), the Basic language, a calculator, calendar/scheduler, and modem dialer. These last three programs may be run from a window without disturbing the primary application in the machine.

The integration of software exists on both a file and functional level; you could pull all or a portion of a spreadsheet into the word processor. A file file can be moved into the spreadsheet, or a Basic program can be edited from either Basic or the full-screen word processor editor.

Data interchange between programs uses the Microsoft Word 'scrap' concept: that is, mark a word (or block), throw it into scrap, go to the other application and recover the scrap. If it's a big or important scrap, you can name it and automatically make it into a file.

The HH-DOS software of 200k bytes is etched onto two CMOS ROM chips which are currently being sold to manufacturers of notebook portables. An early customer was Zenith which has already shown a nifty new machine behind closed doors.

However, I hear that Zenith would prefer to include WordStar in the machine rather than Microsoft Word, and, as a result, has delayed its introduction.

All in the mind

An entrepreneur in self-hypnosis and self-improvement audio tapes is now offering a computer program that seeks to tap the subconscious mind. We're changing the internal tapes inside your head,' proclaims Joel Amkraut of the California-based New Life Institute.

The program flashes messages for a fraction of a second on the computer screen while the user works on primary computer tasks. Over an eight hour day, a user would receive as many as 28,000 subtle copies of the message. He can put in his own message — to lose weight, stop smoking, avoid alcohol, overcome phobias, gain self-confidence, lessen stress, or address a variety of other ills.

Currently there is a great deal of debate as to whether such systems really work. Several university professors voice scepticism and feel that it's difficult to rapidly undo something that nature instilled in a slow and painful way.

Nevertheless, several companies have sprung up to market subliminal software. In addition to New Life, these include GreenTree Publishers, Cabononics, and Fatique, Inc. The latter firm was founded by Timothy Leary, the counterculture hero who championed psychedelic drugs in the 1960's.

Developers of these programs acknowledge the possibility for abuse. For example, an employer could use the program to instill company loyalty and corporate fanaticism, or to send seductive suggestions to an unknowing typist to further sexual ambitions. One developer boasts of using his program to attract people to Christianity — which may or may not be the Christian thing to do.

Better integration needed

Since Lotus' Symphony and Ashton-Tate's Framework were announced, other vendors have been rushing into the integrated software market-place at a ferocious pace. According to one recently published study, the market for integrated packages will increase 20-fold in the next three years.

On the other hand, users who took part in a two-day seminar sponsored by MicroMentor, Inc, a computer training firm, registered dissatisfaction with existing integrated packages and eagerly await a new generation of stand-alone applications packages. Users felt that most integrated packages offer one strong application augmented by several weaker ones.

Symphony was praised for its excellent spreadsheet, but users felt the word processor was lacking. In contrast, the word processor in Framework is very good, but the spreadsheet is weak.

Users also felt that software developers should create common user interfaces and file formats that would allow the use of stand-alone packages from different companies.

In addition, users criticised existing channels of distribution in which sales people push well-known 'safe' brands of software rather than investigating new products that may be superior. Users felt that they would be better served if they had more direct contact with software publishers, and expressed dissatisfaction with software packages that merely reflect fancy technology rather than responding to users' needs.

Random bits

After failing to line up distribution with any major retail chains for its Decision Mate V or later IBM PC compatible computer, NCR is closing its US PC manufacture and transferring production back to Germany . . . Citing delays in software development, Kaypro has cancelled an exclusive agreement with Mitsui to buy its IBM compatible notebook portable machine. Instead, the firm will go with a different design developed in-house . . . Warner Communications has written down the $240 million owed to it by Jack Tramiel for the purchase of Atari to $135 million. Still hoping to recover some of its money, Warner has purchased $10.1 million of receivables from Atari, loaned the company $3 million, and agreed to a further $4.5 million loan.

That's good news for Jack . . . Since the nation's largest retailer, is teaming up with Apple to see if a high-end computer will sell in a department store. For the test, the Apple IIe will be sold at $984.99 side by side with the Commodore 64 and Atari 600XL, both priced at less than $200. Thus far, the greeting card and stationary giant, has acquired Information Technology Design Associates, a firm involved in designing software for children. ITDA's most successful product is Microzone, marketed by Scholastic . . . Meanwhile, the firm is obtaining a large loan and is shifting its retail focus to vertical markets such as banks, doctors, and architects.

The company plans to train dealers in selling to these markets and to set up in retail outlets. Hewlett-Packard is expected to release a 32-bit transportable computer with the Unix operating system. The machine will be aimed at the technical and scientific community, and, at $5000, will be one of the least expensive machines on the market . . . ICL's OPD has some company: over 20 firms are selling new machines that combine the functions of a computer and telephone at prices from $1000 to $6000. Analysts, investors and manufacturers predict the machines will become absolutely essential to anyone in business. One problem: they aren't selling. Of the machines, one consultant said: 'You might as well put a coffee pot on your personal computer.'
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Briefcase portables and a new computer price war dominate the Japanese scene — Shinichiro Kakizawa reports.

**68000 portable**
A Tokyo-based system house, Ampere, has developed a portable computer using a 68000 CPU, which will be marketed shortly. A unique feature of the new machine, called BIG-APL, is the built-in APL interpreter loaded from 128k ROM. The operating system is a unique multi-user, multi-task DOS called BIG-DOS. BIG-APL and BIG-DOS were both developed in the US for the 68000.

The machine features 54k CMOS RAM (max 512k), an 80-character x 16-line bit map, LCD and weighs 4kg. Overseas marketing will be handled by a Hitachi subsidiary, Nissei.

**Full-screen portable**
Fujitsu has announced a 16-bit briefcase computer which weighs 2.7kg. Like the KT portable, it has a full 80-character x 25-line LCD screen, and features an Intel 8086 CPU, and 464k RAM; it runs on Digital Research CP/M-86. The highlight of the machine is its graphic capability — the LCD screen can display 640 x 200 dots. Fujitsu hopes to set the price at around £1000, and the printer will come separately.

**Price wars**
The price war at the lower end of the home computer market is hotting up in Japan. This new price war was triggered by Casio, which began selling its MSX machine model PV-7 last October. The recommended list price is Yen 29800 (approximately £99), but in the space of a month the price has gone down to only £50 at some discount shops around the famous Akihabara electronics bazaar in Tokyo. Other prices have been forced to follow suit. Now the cheapest family computer in the Japanese market is the Nintendo colour game model which costs only £16 (the original list price was £70, only a few months ago).

Because of the recent cutthroat competition in the market, this downward price trend will probably continue for a while. Casio is also selling the PV-7 through Sinclair-type mail order, a new approach to selling computers in Japan. Sony and other MSX suppliers feel threatened by this move. Casio has always played a major role in bringing affordable goods to the general public, and it looks as if the company is extending this virtue into the home computer market.

**Low-cost digitiser**
Oscon Electronics, a Tokyo-based company specialising in digitiser units, has made an extremely cheap digitiser available to MSX users. The new unit, Oscon MSX GP AD, is an electromagnetic induction digitiser. It costs £110, a quarter of the price of the many existing digitisers in the Japanese market. Until now digitisers, although extremely useful, have been highly priced compared with the mouse. One of the advantages of using an electromagnetic board is that you can rest your hand on the board without getting ?QZ!£A on the screen!

The Oscon model can be switched into two other modes, pad mode and joystick mode.

**New floppies**
Hitachi-Maxwell has successfully developed a 5¼in floppy disk which can store as much as 19Mbytes. 1.0 to 1.6Mbytes is the standard for most micros at present, and the expensive hard disk has been the only way to store up to 10Mbytes.

Now this limit seems to have been removed. Hitachi-Maxwell coats the surface of the disk with a special combination of magnetised metal powder, and uses a particular type of metal reading head. The company has also developed a 5Mbyte 3.5in floppy disk.

**Pioneer games**
UK MSX users will be interested in the interactive video games from Pioneer, combining the MSX computer with the Laserdisk system. The result is a series of games played against a videodisk background. Early titles include space games Astron Belt and Strike Mission, and a wild west game, Bad Lands.

However, UK owners will have to wait as Pioneer has hit technical snags when converting the system from MTSC to the UK PAL TV format.

**Toshiba** American-style
Toshiba, a Tokyo software company. The scanner head snaps easily onto the printer ribbon cassette of the Sharp PC4000 printer. Graphic images drawn on paper are fed into the printer, and the scanned, digitised data is transferred to the micro through its RS232C interface.
You'd expect one of the best-selling home computers in Japan to have a specification list as big as its memory. But the Toshiba HX10 doesn't just limit itself to that. It was developed along with other Japanese home computers to operate on one language: MSX. You can swap programs, games, cassettes, even peripherals like disk drives, printers, and joysticks: they're all compatible with every other MSX computer. All of which makes MSX the system of the future.

So if you want a computer that won't be obsolete in a few years, buy an MSX. If you want one of the best-selling MSX computers in Japan, buy a Toshiba HX10.
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Naturally, you can add a second drive (FD-1) to double the on-line storage capacity, speed up copying files and producing back-up discs.

But of course, simply plugging a disc drive into a computer won’t get you very far. That’s why Amsoft have produced a disc based software range of over 30 programs with many more on the way.

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CP/M* is the standard disc operating system for 8-bit microcomputers. We also supply a special version of DR. LOGO* for CPC 464 users.

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Incidentally, you can exchange your Amsoft cassettes for identical Amsoft disc software for a mere £4.95 per cassette (the cost of a blank disc).

The CPC 464 has a typewriter-style keyboard, large ENTRY key, sensibly positioned cursor keys, numeric keypad for fast data entry and a full 8-bit character set.

It provides high resolution graphics, 80 column text display, up to 8 text windows plus a graphics window and a palette of 27 colours.

There’s also a built-in Centronics standard 7-bit parallel printer interface. So you can enjoy high performance word processing with the printer of your choice.

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The IBM AT I ran the Wang PC. After your review of the world's true pace-setter - the As a regular reader of PCW I when I started with my WP example: still some things I miss. For computer systems' users are the real world of personal Dr F Marriott, Enstone, Oxon 'trouble', from the Pall Mall inside and is causing all the insect has secreted itself for solving a difficulty, and discovering a bug in his quotes: 'Mr. Edison, I was Ancient bugs Micro musts Not all the features needed in the real world of personal computer systems' users are among those you see on the usual micro charts. There are still some things I miss. For example: A minimal start-up time — when I started with my WP program, it was taking three minutes to load from cassette. With a succession of upgrades I finally cut that down to seven seconds; Minimal desk imprint — this includes the possibility of moving the keyboard off the desk space altogether when not in use, then there's no spaghetti junction of wires; Maximum user-friendliness — this begins with the keyboard and the screen. It includes a placing of the cursor keys to suit touch-typing, unless cursor movement can be catered for better with voiced commands. Some fancy systems, with cursor keys placed on a far corner of the keyboard, are hopeless in this respect; Internal power back-up — this goes with portability, or at least with not being wholly dependent on mains power in one place. Apricot-style segmentation, if only combined with battery power, might be the best solution; Printer quality with versatility — what is needed is a better way than I have yet seen of combining letter-quality mode with draft speed and print variety. Perhaps we need a combination of 24-wire head printers with personal typesetter programs; Program access to printer capacity — programs (I am thinking especially of word processing programs) should be able to access anything any printer can do: for example, if print commands in ASCII code are provided for. Ideally it should be effective both for screen display and for printout, so that you can see what you'll get.

Parig Digan, Navan, Ireland

Not quite right

I have been reading your journal for quite some time and generally find it quite factual. One exception, however, is David Ahl's comments in the December 1984 issue. Under the heading, 'Eat your words' he states: 'In 1950, a study by Univac indicated that five computers would meet the total worldwide demand for the foreseeable future.' In 1949, one year before his 'study,' there were actually six Univac's already on order, three for the government and three for industry, with additional contracts being actively pursued. When

Remington-Rand purchased the Eckert-Mauchly Computer Corporation in February 1950, the production plan called for an initial run of 10 or 20 systems. At no time did anyone even think that the total demand was as ridiculously low as five. The only problem was one of deciding how much of a production commitment to make in advance of firm orders.

It is true that some studies were later carried out, but none of them ever indicated a number as low as that quoted by Mr. Ahl.

James Weiner, Brussels, Belgium

Spectrum compiler

I was interested in the article on the Acornsoft ISO Pascal compiler in your December 1984 issue, and in particular, the Benchmark programs. I thought 808-based machine owners might be interested in the following timings for the Hisoft Pascal compiler, running on a ZX Spectrum (all times are in seconds):

```
Maginifier  0.9
For loop  16.9
While loop  7.9
Repeat loop  7.7
Literal assign  7.4
Memory access  7.7
Real arithmetic  20.7
Real algebra  21.2
Vector  16.8
Equal  10.7
Unequal if  10.5
No parameters  6.3
Value  7.0
Reference  7.0
Maths  88.6
```

I think the timings speak for themselves, and show the significant difference between true and p-Code compilers. Indeed, it is quite evident to the owner to be able to disassemble the output code and compare it with the source.

The compiler circumvents the problem of lack of memory very well — allowing compilation of source direct from cassette or microdrive, and permitting programs generating up to about 21k of compiled code to be run.

The editor is line based, and printout, so you can see what you'll get. For example, if print commands in ASCII code are provided for. Ideally it should be effective both for screen display and for printout, so that you can see what you'll get.

Parig Digan, Navan, Ireland

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my QX-10 PeachText (previously Magic Wand) certainly rates, in my estimation, as an excellent word processor. But it has some exasperating bugs, the most important being related to page numbering, and starting and stopping at given pages or records. Such functions are vital if you write documents. The print functions are even more defective. For example; it refuses to print any document where page numbering starts at a number other than 1. I am now informed that the errors will not be corrected, there being no further support from Peachtree. Certainly there will not be a version to run under CP/M3. It is quite obvious that Peachtree, probably because of its rush to develop games and educational software for the US market, has utterly failed to support what may well be its best product. Epson’s specific software recommendations also prove to be valueless. The only moral appears to be that even with well-established software and apparently reputable companies, you can never be certain of receiving proper support. Storm Dunlop, East Wittering, Sussex

Do it in one!

I was very disappointed with the publication in January’s issue of the long winded way to put a logo on the Apricot screen: A twenty line program which can be done in one: 10 PRINT CHR$(27) + "i = " 20 PRINT the logo in exactly the same position. John Lyth, Keston, Kent

Disk alternatives

Compared to their ever-increasing performance, computer prices are falling continuously. As for disk drives, price cuts are not and will never be as spectacular. A low-priced home micro costs around £190. The disk drive which goes with it is the memory. Random access would no longer be a time consuming operation. With 512k RAM as memory, it is possible to have two big blocks in the computer for merging and copying of files. Moreover, the DOS could be replaced by a simple and short menu-driven program. It should be possible to build and sell a micro of this type with a fast tape for less than £230. Besides, the potential computer power is much higher than the 64k RAM machines currently available. Corman Eddy, Antwerp, Belgium

Brother brother

Last October I bought a Brother HR25 printer and single sheet feeder from Office International of Euston Road, London NW1, at a price which my computer supplier could not match. Within a day or so of delivery I ran into problems. After contacting Office International by phone I was referred to Brother in Manchester, but still the problems remained. I phoned and wrote and phoned again but with no joy — the printer still gave problems on documents of 40 characters wide while on my other printer, an Epson they printed perfectly. After six weeks of constant problems I asked Office International to take the printer back. In desperation to get one particular document printed, I contacted Tailored Business Systems who supplied the Apricot to see if it could help. What a change in attitude — not only did the company immediately offer to print the document for me, it also said it would find the cause of the problem. One of the directors, Denis Sutch checked out the system and found that the problem was partially due to the Diablo protocol that the Brother is fitted with, and partially due to the program being asked to do too many things at once. Having found the problem, the document was printed successfully. Service is the key to good dealer/customer relations, and my congratulations go to Tailored Business Systems for the quality of service offered.

The problems that arose over page length were largely caused by the instructions, which invite the user to select the page length using a series of DIP switches on the rear of the printer. However, what the instructions do not tell you is that a sheet of A4 measures 11½ inches, the switches should be set to the word processing length of 11 inches. The ambiguity should be cleared up by Brother to halt the confusion. Mike Jones, London NW3

Z80 fast timing

Following your compilation of Benchmark timings printed in PCW January, you may be interested in the following benchmarks run on the Acorn Z80 Second Processor using BBC(Z80) and Mallard-80 Basics. BBC (Z80) MALLARD-80 BM1 0.6 0.4 BM2 2.1 1.5 BM3 7.0 4.3 BM4 7.7 4.5 BM5 8.2 4.8 BM6 11.7 6.3 BM7 16.7 13.5 BM8 21.3 16.2 Average 9.4 6.7

It is interesting to note that the combination of the Z80 Second Processor and the run-only Mallard-80 Basic surpases in speed all the machines listed in your compilation, with the sole exception of the Sage II. D Gay, Barnsley

BLUDNERS

September’s ‘Spectrum Function Keys’ article (page 178) and October’s ‘One Step at a Time’ (page 132) were less a blunder and more a calamity. September’s hex loader program was incorrect — use October’s instead and incorporate the following corrections:

71 PRINT INVERSE 1:’“ADDRESS”’; AT 0,10:’“INPUT”; AT 0,20:’“CONTENTS”; AT 0,0;’“INVERSE 0
80 LET L=4:LET b=ADD:GOSUB 1000
90 LET L=2:LET b=PEEK add:LET x=0:GOSUB 1000
105 LET a$=’”
220 PRINT AT x:a$’”;’”
240 GOTO 50
1080 FOR i=LEN a$+1 TO 1 STEP -1
There were also errors in October’s hex dump. The key to good dealer/customer relations, and my congratulations go to Tailored Business Systems for the quality of service offered.

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80 LET L=4:LET b=ADD:GOSUB 1000
90 LET L=2:LET b=PEEK add:LET x=0:GOSUB 1000
105 LET a$=’”
220 PRINT AT x:a$”
240 GOTO 50
1080 FOR i=LEN a$+1 TO 1 STEP -1
There were also errors in October’s hex dump. The key to good dealer/customer relations, and my congratulations go to Tailored Business Systems for the quality of service offered.

The problems that arose over page length were largely caused by the instructions, which invite the user to select the page length using a series of DIP switches on the rear of the printer. However, what the instructions do not tell you is that a sheet of A4 measures 11½ inches, the switches should be set to the word processing length of 11 inches. The ambiguity should be cleared up by Brother to halt the confusion. Mike Jones, London NW3

Z80 fast timing

Following your compilation of Benchmark timings printed in PCW January, you may be interested in the following benchmarks run on the Acorn Z80 Second Processor using BBC(Z80) and Mallard-80 Basics. BBC (Z80) MALLARD-80 BM1 0.6 0.4 BM2 2.1 1.5 BM3 7.0 4.3 BM4 7.7 4.5 BM5 8.2 4.8 BM6 11.7 6.3 BM7 16.7 13.5 BM8 21.3 16.2 Average 9.4 6.7

It is interesting to note that the combination of the Z80 Second Processor and the run-only Mallard-80 Basic surpases in speed all the machines listed in your compilation, with the sole exception of the Sage II. D Gay, Barnsley
Ever since 1980 there has been a whole boat-load of pundits around, confidently predicting the imminent arrival of the Japanese on the personal computing scene. 'Watch out', the pundits all cried, 'the Japanese are coming and they are going to wipe everyone else off the face of the earth.'

The logic behind this suggestion was quite sound, based on the idea that personal computers, of the home-game-playing variety especially, were high-volume, low-value devices of a domestic nature. This made them the ideal product family for the Japanese to adopt.

That, at least, was the theory. In practice, it didn't work out that way. The Japanese focused most of their attention on the Apple-equivalent market and above, looking to break into the lucrative small business machine area. This required not only good hardware, which they often managed to produce, but good software too. This they failed to come up with. Their operating systems were poor, for one reason or another. It was said, for example, that the OS for the Sharp 3201 machine was truly dreadful except for one thing — it was dreadfully slow. It was a full 'belt and braces' system that never got it wrong, it just took forever to do it.

The Japanese missed out on the small business market, which went first to Commodore, Tandy and Apple, and subsequently to IBM et al, and missed the boat on the home computer boom, which went to the likes of Sinclair and Commodore.

Now the Japanese are having a concerted pitch at the home market again with the MSX machines jointly developed by Microsoft and a whole bunch of Japanese companies. These have generally been well received by reviewers, who have been impressed with the machines but less impressed with the price, considering what you get — essentially an old-fashioned 8-bit machine that the likes of Sinclair has left far behind.

The MSX family does have one thing going for it already, and has some interesting possibilities for the future. Its present advantage is standardisation. There are a whole range of machines coming from different manufacturers that can all use the same software, up to a point. This means that the software authors get a large potential market and become interested in writing for it, which in turn means that the users get programs to play with, plus a choice of machines.

Another advantage of the MSX family is its lineage, which comes from roots buried deep in the dear old CP/M operating system. This means that an MSX system, coupled to a disk drive or two, can become a CP/M machine. Not terribly startling, but the home market is starting to drift upwards in terms of capabilities. People now want to do more than just play 'nuke-the-world' games, and that means two things: bigger systems and better software. It also means that the software has to be available, and that's where CP/M comes in: there's a lot of good, low(ish)-cost applications software waiting to be picked up.

This leads the current MSX machines into a number of alternative routes for the future, stretching from home applications through to real business.

At the home end, it's certain that you will see the machines being applied more and more in association with other systems and equipment. One reason for this is that Japanese manufacturers are now working hard to get the production costs of an MSX machine down to the absolute minimum. The latest versions are said to consist of just seven circuits, which means it will be cheaper to make and smaller to integrate into other things.

Yamaha has already pointed the way with its new computer/organ and there will be plenty of other combination products of this type in the future, especially in the area of interactive video.

Most of these applications will be ideal for the 8-bit Z80 processor used in MSX for several years to come, and the standardisation of the technology and software will make it increasingly easy for manufacturers to 'bury' such a computer in their products. But the MSX family is unlikely to stop there.

An important aspect of the standard is its file structure when working with disk drives. These are directly compatible with the existing Microsoft industry standard for 16-bit personal computers, the MS-DOS operating system. Although it won't run an MS-DOS program, MSX will read data files written under MS-DOS and vice versa.

This compatibility is important for the future of the standard, for Microsoft and the Japanese companies have designs upon a certain market-place. That market-place is the one that will be effectively vacated by IBM as it moves its Personal Computer family upwards technologically, and in performance.

Microsoft founder, Bill Gates, talks quite openly about MSX growing into a 16-bit system at some time. There is little doubt that, from the hardware point of view, it could be done already. The standard is already part way to being MS-DOS, and MS-DOS runs on the 8088/8086 family of processors. An MSX machine based on one of these would not be difficult to engineer.

What is important, therefore, is the market timing. IBM is the key here, for this year will see it move its products inexorably upwards. There is already the PC/AT, which is based on the Intel 80286 chip, and there are strong hints of a replacement for the PC itself in the near future. This could well be based on the 286 chip's close relative, the 80186 processor. Although the company is also expected to introduce a lap-held machine this year, which will probably be based around the new low-power CMOS versions of the 8086 chip, such moves would leave a chink of light in the original PC market which would mark the first openings of a window of opportunity for the MSX range.

As the IBM PC family gets more powerful (though still compatible) it will leave a hole at the bottom of the market. This will be at a time when a new breed of users, the small professional individual and the more advanced domestic user, will want the power and performance of the PC without the expense. For performance it is, of course, important to read the words 'working applications software', and that is just what the MS-DOS environment will offer — a wealth of proven applications software. With its existing compatibility and the upward move towards 16-bit processing, this type of machine can be expected.
Computer shows present an ideal opportunity to get advance information and hands-on experience of the machines which manufacturers would otherwise try to keep under wraps. Escaping from the January freeze in the UK, I went to the Consumer Electronics Show in Las Vegas, and spent four days fighting off the other visitors who also wanted to be first to use the new machines.

It was the Commodore and Atari stands which had the most to offer. The competition between these two companies has always been intense, but it was heightened last year when ex-Commodore boss Jack Tramiel took over the reins at Atari. Now both companies have new machines on their over the reins at Atari. Now both

Commodore's C128 and Atari's ST stands which had the most to offer. The competition between these two companies has always been intense, but it was heightened last year when ex-

Commodore boss Jack Tramiel took over the reins at Atari. Now both companies have new machines on their

books which will bring them into even closer combat, and which will also challenge Sinclair's QL.

Commodore's C128 and Atari's ST micros are similar in one important respect — both are attempts at 'cross-over' machines between the home and business markets.

But while Atari's other new offerings, a range of 8-bit machines based on the 800XL, are aimed more squarely at the home market, Commodore's new products are emphatically upmarket and represent an interesting change of pace for the company.

Commodore

On the Commodore stand were a battery-powered LCD display notebook micro, the much-rumoured C128, and an IBM-compatible business machine.

The Portable Computer

The first thing you notice about the Portable Computer is that it looks good! It comes in a compact off-white 10.5 x 11.7in package with a hard cover which hinges back to allow the LCD display to flip up. This all smacks of careful design. Could this be the same Commodore who gave us the downright ugly 64?

The main processor inside the Portable Computer is a 65C102; this is an enhanced CMOS version of the old 6502 processor with a few extra commands built in. It's similar to (but not exactly the same as) the 65C02 used in the Apple IIc. The processor is clocked at a fairly measly 1MHz.

As standard the Portable Computer is supplied with 32k of CMOS RAM, and 96k of CMOS ROM which holds the applications programs. The machine also has a spare ROM slot under the top cover which can take extra ROM-based software.

All the electronics are based on CMOS designs, so you should be able to set about 15 hours use out of the four AA batteries which the machine uses.

One of the good things about the Portable Computer is that it's loaded down with I/O facilities. It has a built-in 300 baud direct connect modem, and unlike most other American machines, this modem can work on British CCITT standards as well as American Bell standards. This means that we should be able to use it in this country as soon as its released, as long as Commodore can get it approved. However, at the moment Commodore UK is being very cagey about launch plans.

As well as the direct connect output, the Portable Computer has provision for acoustic cups so that you can use it with a telephone handset if you don't have access to a jack plug. You can also plug a special handset into the Portable Computer so that your line can be used as a normal telephone without the machine being unplugged.

Other I/O facilities include a Commodore serial port so that you can use any Commodore 64-compatible peripherals such as the disk drive or printer, an RS232 serial port, a Centronics parallel printer port and a bar code reader. Considering that Commodore is infamous for never using standard interfaces, this is a very impressive list.

The machine display is an 80-column by 16-line liquid crystal display (LCD); this is Commodore's own make and it's good. The usual problem with large LCDs like this is that they are difficult to read, but I found the Commodore's LCD excellent in this respect. Even in poor indoor lighting it was easy to read, and it shows what can be done with large LCDs if you try.

When it's released, the Portable Computer will come with a word processor, file manager, spreadsheet, address book, scheduler, calculator, memo pad, terminal emulator, Basic and a machine code monitor built into the ROM.

Only the word processor, spreadsheet and terminal emulator were available on the machine I looked at. All the applications make heavy use of the eight programmable function keys and use the last line of the display to label them. One of the most interesting things about the unfinished applications programs was their speed — considering that the machine only uses a 1MHz 6502, they really were quite fast.

Interestingly, the memo pad and the calculator are available at any time just by hitting a function key from within an application. This means that if you have an idea while you are in an application, you can call up the memo pad and write it down.

At the time of going to press Commodore wouldn't give any specific indication of what the Portable Computer will cost.

The C128

There have been strong rumours about the C128 for quite some time. Most have been proved accurate, although again Commodore UK is keeping quiet about the machine.

Like the Portable Computer, the C128 looks quite attractive. Although it is packaged in a low-profile casing, it's still a large box and takes up more table space than you would expect for a home machine.

The main feature of the C128 is that it's actually three different microprocessors (6510, 8502 and Z80) in one box. This allows it to operate in three different modes: C64 emulation, native C128 and CP/M. The machine can sense if you have plugged in a C64 cartridge or if you have a CP/M boot disk in the drive, and switches itself to the correct mode
automatically. You can also switch modes under software control.

Commodore claims that the C128 is 100 per cent compatible with C64 hardware and software when it’s in C64 emulation mode. One of the engineers on the stand said that he had quite a problem persuading a well designed machine like the C128 to behave like a C64. I can believe it.

In C64 emulation mode, the C128 uses the 6510 CPU running at 1.02 MHz, a 6581 sound chip, 64k of RAM and 16k of ROM. Just like the C64 you get a 320 x 200-pixel display with 16 colours and eight sprites, and you can even plug C64 cartridges into the machine. Commodore says it has tried all the C64 cartridges it can find, and they all work.

In its native C128 mode the machine uses a 8502 processor, 6581 sound chip, 128k of RAM and 64k of ROM. The RAM can be expanded to 512k but 128k is the maximum system RAM: the rest is used as a RAM disk.

The display operates in one of two modes — high-resolution 640 x 200 or medium-resolution 320 x 200. In the latter mode you can have 16 colours and eight sprites which can be accessed via a new super-friendly (for Commodore) Basic version 7.0.

Native C128 mode also allows you to make use of the high data transfer rates on Commodore’s new 1571 disk drive. Although you can use this drive in C64 mode, it only operates at the C64’s (slow) speed.

The CP/M mode uses the built-in Z80 microprocessor. It represents part of a new trend within Commodore towards more standardised systems.

In this mode the C128 is turned into a fairly standard 8-bit CP/M machine. It uses CP/M Plus which allows it to access the C128’s 128k of RAM. You can take the RAM up to 512k as long as you use the extra as a RAM disk.

CP/M mode operates in either 40- or 80-column screen widths and can display up to 16 colours onscreen. It makes use of the new 1571 disk drive which can read Kaypro and Osborne CP/M-80 disks.

Commodore demonstrated the C128 running the Perfect suite (Perfect Filer, Perfect Calc and Perfect Writer) in CP/M mode, and says it will run the most popular CP/M-80 applications software.

As far as I/O is concerned, the C128 is fairly standard Commodore-user port, cassette port, serial port, two game ports and a cartridge port. Its main claim to fame is that it offers composite video, RGB and TV video outputs, so it shouldn’t be difficult to hook up a monitor.

The keyboard on the C128 is interesting because it hints at the multiple modes of the machine. At first sight it looks like a standard full-function keyboard with its separate numeric keypad, programmable function keys and main typing area. However, a closer look reveals two sets of cursor movement keys, one along the top and another at the bottom of the typing area. This makes sure that the keyboard, as well as the electronics, is compatible with the C64.

Although the C128 seems to function well enough in its different modes, it’s difficult to imagine many people wanting the ability to run CP/M programs. It remains to be seen how many software houses will write for the machine’s native C128 mode.

IBM compatible
Also at the CES was Commodore’s IBM PC-compatible business machine. However, unlike the other two machines, this one was hidden away in a private room on the stand to keep it from general view.

Not long ago, the idea of Commodore selling a PC compatible would have been unthinkable. Commodore prides itself on being different from the rest and being able to survive on its own technology, but the failure of recent Commodore business machines has apparently forced a rethink.

Commodore hasn’t given in completely, however. This machine will only be sold in Europe and will not be available in the US. It was also on display at the Which Computer? Show and is expected to be available in the spring at a price of under £2000.

Peripherals
In addition to the new machines, Commodore was also showing a range of new and revamped peripherals. The most interesting of these is its new 1571 disk drive.

The main advantage of the 1571 is that it transfers its data much faster. Unfortunately you only get this extra speed if you use it with a C128.

Essentially the 1571 works in three modes: C64, C128 and CP/M. If you use it with a C64 it works at the same old slow 300cps; if you use it with a C128 the speed goes up to 1500cps. With a C128 using CP/M, the speed goes up to 3500cps. This is fine if you have a C128, but if you use it with a Commodore 64 you’re no better off.

Commodore was also showing a compact Sony 3"in microfloppy unit, but it would say nothing about pricing and availability.

Atari
Ever since its early days of heady success, Atari has been in the doldrums. Until recently Atari was owned by the American entertainments giant Warner Brothers, but during this time it did little but lose money. Warner Brothers decided to sell.

Now enter the portly figure of Jack Tramiel fresh from Commodore. Tramiel and his clan have the reputation of being hard men and their arrival at Atari was accompanied by howls of despair from some quarters within the company, but it’s significant that a large number of staff left Commodore and followed their leader to Atari.

There’s no doubt that Tramiel’s

The Atari ST and the Commodore 128 — battling for personal computer power
The Commodore Portable Computer — it's loaded down with I/O facilities, including a direct connect modem

arrival has transformed Atari: a wide-ranging programme of new product development under the banner 'Power without the price' was begun; the projected new range of machines and peripherals stretches from 8-bit machines right up to a full-blown 32-bit business machine. The one trait that all the machines share is an extremely competitive (some would say suicidal) pricing policy.

Atari chose the January CES to show the first stage of its new products and peripherals. First are four new 8-bit models based on the popular 800XL home micro, and second are two new 16-bit machines based on the powerful Motorola 68000 processor.

65XE/65XEM/65XEP/130XE

The four new models in the '65' range are all broadly the same in that they are based on the successful but long in the tooth 800XL home computer. Atari claims that all the 65 series machines are compatible with the 400/800 series software and peripherals, including the 1050 disk drive.

The base model of the 65 series is the 65XE; this is based around a 6502C central processor linked to 64k of RAM. As you would expect from an Atari home machine its strong features are graphics and sound, both of which are controlled by custom-designed control chips. Programming is achieved via Atari Basic.

The graphics capabilities of the 65XE include a 320 x 192-resolution display, 11 graphics modes and a palette of 256 colours. In addition there are five text modes and the traditional Atari 'Missile' sprite graphics. As far as sound is concerned, the 65XE features four programmable voices.

Externally the 65XE is very different from the old 800XL machine. The casing is the same off-white/grey that seems to be the Atari trademark. It features a full travel keyboard with the traditional 800 series function keys moved along the top of the main typing area. The result is pleasing and is vaguely reminiscent of the Commodore Plus 4. The only disadvantage of the new design is that the cartridge slot has been relegated from the top to the back of the machine where it's far more prone to knocks.

The other machines in the 65 range are similar to the 65XE but offer specialised advantages. The 65XEM offers far more comprehensive sound capabilities than the 65XE. Instead of having four basic voices, the 65XEM offers eight voices and 64 harmonics, and high-quality sound is achieved through a sampling rate in excess of 30KHz.

The 65XEP is a portable version of the 65XE. In addition to the basic electronics of the 65XE, the 65XEP also includes a built-in 5in monochrome monitor and built-in 3½in Sony micro-floppy disk drive. This is all contained in a large portable box.

The final model in the 65 range is the confusingly-named 130XE. Despite its '130' tag, it has the same electronics as the 65XE with the addition of an extra 64k of RAM to bring the total RAM count up to 128k.

Pricing for the 65 range hasn't been fixed yet. All Atari will say is that the new models will start at less than the 800XL costs at the moment, which is £129 at the time of writing.

130ST/520ST

The 130ST and the 520ST are the first of Atari's new generation of powerful personal computers. They are both basically the same machine — the only difference between them is that the 130ST is supplied with 128k of RAM whereas the 520ST comes with 512k.

The styling of the new machines is very similar to that of the 65 series machines — very neat integrated lines in the same off-white/grey colour scheme. The keyboard is a full-function, full-travel unit with separate typing area, cursor control block and numeric keypad. The unit also incorporates 10 function keys integrated into the top of the casing.
The main processor in the ST range is the Motorola 68000 16/32-bit processor; this is the same processor that is used in some of the fastest personal computers on the market today. It's also similar to the processor used in the Sinclair QL, the only difference being that the QL uses a cut-down version while the ST uses the full-blown 68000.

Both machines come with 192k of ROM holding the operating system friendly Macintosh-like environment which makes full use of mice, ikons and pull-down menus to make the system as simple to use as possible.

The basic idea is that the screen looks like a desktop with papers on top of it. The screen has a menu bar running along the top with various options, and has ikons running down the side representing the disk drives. Using the mouse which is supplied with the ST machines, you can move the cursor arrow to select ikons or to invoke a pull-down menu from the menu bar.

Although GEM will run on a wide range of machines, the ST machines are the first personal computers I've come across which have it as standard. During my short time with the machines it certainly did make them much easier to use than traditional operating systems.

Although UK prices hadn't been fixed at the Show, preliminary US prices had been set at $299 for the 130ST and $499 for the 520ST. This represents extremely good value for money. Early indications are that Atari is aiming to sell the machine in the UK from May onwards, at prices starting from about £300.

**Conclusions**

Although they may seem different on paper, the Commodore C128 and the new 16-bit Atari ST machines are similar in some important respects.

Both machines offer facilities which are a combination of home and business micro. Look at the C128: if it's a home machine, why give it CPM? Or if it's a business machine, why give it C64 capabilities?

The same holds true for the ST machines. The processor, Digital Research operating system and RAM all cry out 'business machine'. If this is the case, why give it Logo and a Midi synthesiser interface?

These machines are following the lead of the Sinclair QL in that the companies realise that the home games market can't hold up forever. So they're trying to shift some of their eggs out of the games micro basket without actually going all the way with out-and-out business machines.

Whether this strategy will work or not is open to doubt, and obviously a final opinion will have to wait until we can benchtest the machines thoroughly.
Launching a new business can be risky and costly. Peter Bright looks at Entrepreneur, which is designed to test the viability of any new project. It can help you decide if your business will make it in 1985.

'Now you can do something useful with your home micro.' The number of times I've seen these words and then had my hopes dashed as I look at yet another appalling piece of 'serious' home computer software.

But now it looks as if you may at last be able to do something useful with a home machine. Brentwood-based Triptych Software has released a range of good-looking packages for home machines. Although the Triptych programs run on a range of different home machines, I received them in their most recent versions, running on an Amstrad with the new disk drive unit attached.

Four Triptych packages were supplied with the Amstrad: Entrepreneur, Project Planner, Decision Maker and Star Watcher. I'll concentrate on Entrepreneur here.

**Entrepreneur**

Entrepreneur is best described as a small business modelling tool. Suppose you have an idea for a small business and you want to work out if it could be viable. Using Entrepreneur you can feed in projected sales and costs, and the program will produce cash flow projections, a profit and loss account, balance sheet, and so on. It also provides the information you need to assess the project.

As with the other Triptych packages, Entrepreneur has three main parts: the main program, the tutorial, and the manual. On the Amstrad the tutorial was on side A of the disk and the application program on side B.

**Tutorial and manual**

Both the onscreen tutorial program and the manual are designed so that you must use them both. This curbs the temptation to rush from screen to screen and only read the manual when problems occur, which is a bad way of learning as you could miss important information in the manual.

The Entrepreneur tutorial prevents you doing this by forcing you to use the manual. If you load up the tutorial and try to run through it, you soon come across a message like: 'Please refer to chapter X for instructions on how to proceed.' The only way you can persuade the tutorial program to go any further is to enter the correct code into the machine. The only way to find the code is to read the manual! Clever.

Reading the manual is a very rewarding experience. It begins with lots of good advice on how to analyse whether or not a business will work. It shows you how to produce a business plan and forces you to think about the many difficult aspects of the venture. The last part of the planning section is headed 'Have you been honest?', and finishes in ringing tones with 'Remember; the harder you plan, the luckier you get!'.

The rest of the manual is designed to be used in conjunction with the computer: for example, the manual makes a

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**Cash flow screen**

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<th>December</th>
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<tr>
<td></td>
<td>Cash Out</td>
<td>3884</td>
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<td></td>
<td>Closing Cash</td>
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<table>
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<td>Cash In</td>
<td>4048</td>
</tr>
<tr>
<td></td>
<td>Cash Out</td>
<td>8461</td>
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<tr>
<td></td>
<td>Closing Cash</td>
<td>7536</td>
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<td>Cash In</td>
<td>7077</td>
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<tr>
<td></td>
<td>Cash Out</td>
<td>7077</td>
</tr>
<tr>
<td></td>
<td>Closing Cash</td>
<td>8461</td>
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**Profit and loss screen**

<table>
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<td>Contribution</td>
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<td>Wages</td>
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<td></td>
<td>Depreciation</td>
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<td></td>
<td>Interest</td>
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<tr>
<td>Profit Before Tax</td>
<td>2865</td>
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<tr>
<td>Taxation</td>
<td></td>
<td>1958</td>
</tr>
<tr>
<td>Profit After Tax</td>
<td>908</td>
<td></td>
</tr>
</tbody>
</table>
Finally, Balance Sheet Display allows you to enter your own figures into the balance sheet. I found the combination of the computer tutorial and the manual very impressive. I particularly liked the manual, which is full of information. The planning section at the beginning was very good, and the appendix on sources of assistance for the small business was a nice touch.

The manual includes a book list for those who want to read more on small business planning. One book they recommend which I must read is called The Genghis Khan Guide To Business. If the book is as good as the name, it must be worth looking at.

Applications program
There are actually two versions of the Entrepreneur applications program: Single Product and Multiple Product. As its name suggests, the Single Product program assumes that your business is selling one product; its advantage is that it can deal with more data about the product. Multiple Product allows up to 10 different products to be included in the business.

Before you can do anything useful with Entrepreneur, you have to gather a wide range of information to feed into the program.

If you think about it, this is the first stage of the business analysis. Without performing a single calculation, Entrepreneur forces you to think hard about the costs and revenues of your projected business in order to formulate the first stages of the business plan. It is obvious that the figures you get out of Entrepreneur will only be as good as those you feed in. If you just pull costs out of thin air then the projections will be meaningless, so some thought is required at this stage.

To help you gather the information Entrepreneur needs, the manual explains what the figures mean and provides figures for an example company to show how the package works. The manual also includes pre-printed data entry forms which you can photocopy and fill in so that you have all the necessary data to hand when you run Entrepreneur.

In use
Entrepreneur displays data entry screens with the question on the left-hand side of the screen and a space for the answer on the right. A two-line window at the bottom of the screen gives handy hints on what the right answer should look like.

When you have finished with a screen you can hit Escape. This will give you the option of continuing to the next screen, or calling up the full-screen editor and altering data on the current screen.

The first thing the package needs to know is what your company is to be called and what type of business it is. The program can handle the three main types of business — sole trader, partnership and a limited company. It requires information about any fixed assets (land, buildings, and so on) that you’ll buy, how much they’ll cost and when you’ll pay for them.

This led to my first problem. I couldn’t make the program believe that I paid for my fixed assets by a single cheque rather than multiple payments. It turns out that the package used to have a ‘single payment’ option, but that later versions had this option incorporated under an ‘irregular payments’ heading. Once I was told this everything was straightforward, but perhaps the
You then move onto expenses: for example, rent, heating, lighting, as well as entering how much these will cost. You also have to state whether each item will be paid for by cash or credit, whether VAT is payable, how frequently you will be invoiced and when the first invoice will come in.

The next cost you have to calculate is how many staff you will take on and at what salary; it was here that I came across my second problem. Occasionally the Amstrad got tired of running Entrepreneur and decided that life would be much more exciting if it did a spot of garbage collection. The first time this happened I was convinced that the program had crashed—I was in the middle of inputting data when it locked up. I was just about to reset the machine when the Amstrad finished cleaning itself up and was ready for action.

There was no way of predicting when this would happen and it locked up for 20 to 30 seconds. Once I found out what was happening I didn’t worry too much, but it was very annoying. According to Triptych this doesn’t happen when Entrepreneur is running on any other home micro—it’s just one of the funny quirks about the Amstrad.

The next section allows you to enter projected costs and sales for your product. If you are doing single-product analysis, you can enter costs for the raw materials that go to make up your product. If you are doing multi-product analysis, you just enter the direct costs as a percentage of the selling price. After this you can enter your projected sales figures for your product(s) on a month-by-month basis.

Analysis

When you have entered the projected sales figures, the program has enough data to start producing figures.

If you are doing single-product analysis, the first thing that the system works out is projected year end stock levels for all the raw materials. Ideally you should keep stock levels as low as possible to avoid tying up working capital but without running out. If you will run out of stock during the year, the program will tell you and allow a revision.

The screen then shows a break-even analysis for your business and displays projected sales, so you can see if you will reach your targets.

This display is a good example of one of the things I don’t like about Entrepreneur. Throughout the package, figures are displayed on screen without any heading to tell you what they mean. For example, on this screen, the top few figures represent pounds sterling while the rest relate to product units. It isn’t always obvious which is which.

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The North Star Dimension couples a multi-user, IBM-compatible environment with the capability of running familiar applications programs. Considering its other marked advantages, how will it fare in the same market as the IBM PC/AT? Martin Banks finds out.
There is a growing body of opinion that suggests that small multi-user systems, capable of handling a small number of users, will find an important niche in the market. Such systems will service the needs of small to medium sized companies that want, say, two or three people doing accounting work, two or three writing reports, and a couple working on budgeting and similar spreadsheet activities.

For these users, the traditional options have been to go for a small minicomputer-based multi-user system — and risk bankruptcy trying to pay for it — or to opt for a collection of standalone machines and perhaps networking them.

The new Dimension from North Star Computers cuts this dilemma down to a manageable size by providing a multi-user (or, more accurately, a condensed network) IBM-compatible system that is price-competitive with a collection of standalone machines, and which offers some considerable advantages.

**Hardware**

To the dedicated desktop user, the first impression of the Dimension is its size. The machine comes as a large box which is designed to stand all by itself on the floor. The user workstations, on the other hand, are small and neat affairs which look good on a desk. Between the two elements of the system are strung thick, 25ft-long connector cables. At some 60lbs in weight, the one thing the Dimension isn’t is portable — it’s only transportable by the strongest, but this is not a great drawback.

The system is intended for those users who have a reasonably clear idea of what they want and who feel they can go some way to realising their ambitions.

The machine is this big because of the way it is constructed and operated. With the Dimension, North Star has brought together into the central module of the system a collection of IBM PC clones. Each system user (there can be up to 13 in total but 12 is considered the normal maximum) has his own personal computer within the module.

The key element of the machine is the special internal IBM-compatible bus motherboard; this is controlled by an Intel80186 16-bit processor running at a respectable 6MHz. This processor drives the one or two hard disk drives the system can mount, the IBM-compatible 360k 5½in floppy drive and the optional tape cartridge system. It has its own 256k of cache memory which it uses for such tasks as program loading and print spooling.

Expansion boards are available for the central module cache memory, taking it up to 512k bytes, while there are two options available for the workstation boards, adding either 128k or 384k to the standard 128k bytes with which it is equipped. To gain entry to the module, or to add either these boards or a new user, the machine must be laid on its side and the three screws holding the cover in place removed. This is not something which should be attempted on a regular basis: it involves a DOS routine to lock in place the flying heads of the hard disk being used and the total system should be closed down. The workstation boards slide into place and are located by screws. Expansion memory boards mount over their respective boards on pillars.
The central module comes with a single 15Mbyte hard disk, plus a single floppy drive. Its cabinet is in the classically unobtrusive light fawn colour which most computers are now clothed in, but with a black grille running down the front. A rather noisy cooling fan sits behind this grille.

The workstation cables are connected to the back of the module where the connectors from each user board are exposed as they are added to the system. The user board slots are numbered, so it's the convention to add new boards in number sequence.

From this structure it can be seen why this multi-user system is also defined as a network: in practice each user has his own machine attached to the motherboard rather than all the users accessing a single processor system. The end result, however, is fairly academic until larger numbers of users are attached. Then it’s likely that the Dimension’s construction will allow it to run faster than a more conventional multi-user approach.

The central module is equipped with two serial ports, one an RS232 and one programmable, and one Centronics-compatible parallel port. It can work with any and all of the peripheral devices available for the PC family and its many clones, and is turned on and off by a key switch mounted on the front panel.

The workstations come in four parts. The keyboard is a standard 84-key device which incorporates all the things one would expect of an IBM-compatible unit manufactured by the same company that produced the PC keyboard. It has a good feel and a similar mechanism to the PC on the bottom to bring the back of the unit higher. This is also used to lower the front end of the keyboard so that it complies with West German VDE standards, which specify the height of the front edge of the keyboard from the desk.

The screen is a standard monochrome/green, and the display unit has an on/off and brightness control plus a contrast control. North Star states that a colour unit is expected later this year, but the current 12in monochrome unit is fully capable of running the same level of graphics-based applications as the IBM PC family. Resolutions available are 640x200 and 640x400 pixels.

Both the keyboard and the display plug into the third element of the workstation, the connector cable; this comes equipped with a small connector box into which the two units are plugged. Its most important function, however, is to house a parallel port which allows a local printer to be connected. Using this, an individual user can obtain printouts without having to go into the central printspool or to where the central printer may be located. This port can also be used with a mouse or modem if required.

Also on the workstation is the processor board which sits inside the central module. It uses an 8088-2 processor with a minimum of 128k. This -2 version of the processor runs at a respectable 7MHz clock speed, which contributes significantly to the speed of the system.

The overall feel of the workstation is fine, apart from the lengthy screen decay time. The keyboard feels solid, and has a good action. The screen is easily legible in a variety of lighting conditions, from direct sunlight to pitch-dark and small-table-lamp. The display measures approximately 12ins square, while the keyboard is around 14 x 6ins. With no system box, the desktop footprint is small. In the test system I had two terminals standing easily side by side on a desk measuring 3ft 6in by 2ft, which gives some idea of their size. As with most systems, the keyboard is connected by a 6ft-long coiled cable so it can be ‘lap-mounted’ when required.

System software
Two levels of system software are supplied with the Dimension. There is the operating system itself, which controls both the central module machine and the individual workstation processors, and the system management software through which a designated individual, the system manager, takes care of the system’s housekeeping and performs such tasks as adding new users.

The operating system is North Star DOS which, in the test machine, was version 1.1.0. This is not as intimidating as it sounds: it’s essentially a version of Microsoft’s MS-DOS. The main differences are the inclusion of some additional commands specifically geared to the requirements of the Dimension machine, and the way it is operated.

The main advantage of using MS-DOS as the basis of the machine is obvious, however. As with the main thrust of the hardware design, the key element is to maintain as much compatibility with the IBM PC as possible. This means that the Dimension will run the majority of applications programs available for the PC family, including Lotus 1-2-3, WordStar, dBaseII, and so on. Not all these will run as true multi-user applications, but this will depend on whether they include or can be modified to include 3Com semaphores in the coding, but in many cases this will not be too much of a hardship. Neither will the system run any PC applications which are protected in any way, for example, Prolok.

Typical of the commands which have been added to MS-DOS is the North Star implementation are those that relate to its multi-user orientation and its hard disk basis of working. In everyday use, the average individual user is going to need access to the diskette only rarely, unlike with a standalone machine. All applications programs in common use will be held on the hard disk. Gaining access to the diskette drive is, therefore, a specific task on the Dimension and the DOS provides a couple of ways of achieving this. The first is the command REQUEST, which assigns the diskette drive to the logged-on user making the request. All other users are then barred from it. RELEASE is the command that lets the drive go again. These two are used primarily when a new applications program is to be loaded onto the hard disk by the system manager.

If an application is to be run direct from diskette, DISKBOOT is used which automatically turns that user’s workstation into what is, effectively, a single disk drive PC.
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The system software covers a wide range of systems management tasks which are required to be performed by the system manager. This position will be an appointment from among the users, usually of an individual of suitable status within the user organisation and with sufficient experience to effectively carry out the duties. This should not be taken to mean that a high level of technical competence is required of the system manager, but the tasks are such that the comprehensive experience of using a computer, preferably an IBM PC or clone, will be a useful skill.

The system manager's job involves ensuring that the system runs efficiently, and that the users have sufficient resources for their needs and applications. A major portion of this task is involved with partitioning the available disk space so that every user has what he requires.

The hard disk can be divided up into a maximum of 64 different partitions, each of a minimum 360k capacity. Partition numbers 0 and 63 on the disk are allocated for system software, utilities and electronic mail facilities, and cannot be touched by any user or the system manager. If a second hard disk is installed, its first partition, numbered 64, will also be reserved for these duties.

The system manager's task to define the profile of each user, including his own. Each profile will contain details of the partition(s) available to each user name, and the size of each partition. This will be governed by the demands of a specific application, with a user who's doing long textual reports needing more space than someone doing small financial models on a spreadsheet that rarely need to be saved.

Only the system manager can perform such tasks as deleting or adding applications on the public partition and changing the profiles of users on the system; this also includes being able to add or delete users. These facilities are available in what the DOS refers to as 'manager' mode. To make use of them, the system manager signs on to the system and keys in MANAGER ON to get into manager mode. A key facility available to the manager in this mode is system maintenance, which is called up keying MAINT. This provides the common tasks required of the manager of creating or changing a partition, adding, editing or deleting a user, and adding, editing or deleting a printer. They are called by the function keys, with the tenth key used to exit the maintenance system.

The task of adding a new user, for example, is quite simple and can be done in just a few minutes. The necessity of having a system manager with at least some computing experience will be high-lighted where disk partitioning work is undertaken. At least a general understanding of the concepts of disk storage and the potential capacity requirements of applications programs is a good thing to have when deciding the required size and type.

The one disadvantage of the Dimension system here is that it has to be effectively closed down to all users if any systems management task is to be performed. Unlike many local area network systems, it isn't possible to perform a task such as adding a new user while the machine is being used by other operators. For any systems management task it's necessary to banish all other users for the duration, which may not always be the most popular thing the manager does.

As the machine has to be laid on its side to gain access, there is a possibility of damage to the hard disk as the flying heads move around. To prevent this, North Star has built in a command to the DOS called DISKLOCK. As its name implies, it locks the head away from the disk. Once instigated the system module is turned off, and the head remains locked until it is freed by power on.

Applications software

Apart from DOS and the system management software, the Dimension does not have any software bundled with the machine but it will run the majority of IBM-compatible/MS-DOS applications. Loading a new application is a straightforward affair performed by the manager. The diskette drive is requested, the application disk is loaded in and the application is started. The respective workstations that have requested the data. The algorithm incorporates all personal partitions in the public partition as in the Dimension.

Once the central module is switched on, each user's workstation board is potentially 'live' and ready to run. The user turns on the workstation and sees the sign-on and password entry routines; this will lead into the standard MS-DOS prompt which in this case is the default drive, letter 'C'. Now the user calls up an applications program.

It's here that the power of the machine becomes apparent, especially if two or more terminals are close together. The Dimension uses a specially written algorithm for searching the hard disk which ensures the minimum number of passes over the disk by the read/write head.

Data from the disk is first read into the cache memory under the control of the 80186 processor, and then fed out to the respective workstations that have requested the data. The algorithm allows the head to collect all requested data before it is passing on the disk, rather than complete one full read task then go back and start another. The respective tasks are assembled in the cache memory.

The practical result of this is speed — even in single-user mode it's fast and can load Lotus 1-2-3 in about one second. WordStar takes around 5.5 seconds (including an intermediate RTNR keystroke on the test machine). There was, however, no discernible loss of loading speed when it was asked to load both onto different workstations simultaneously; both were in and ready to run in 5.5.5 seconds. The same speed was achieved when simultaneously loading dBasell and WordStar. Saving a long document file in WordStar can take noticeable amounts of time on some machines, but is completed rapidly on the Dimension.

Dimension applications programs fall into two basic categories — multi-user and single-user. The type of multi-user program that the Dimension can operate with are those that have, or can be modified to accommodate, 3Com semaphores. These allow several people to be active within one file at any time while stopping them working on another single record.

North Star currently has accounting packages from Sky and Omicon available with the 3Com semaphores, ready for full multi-user applications. The Dataflex database system is also available, with Delta and Datamanager expected soon.

But there are many applications for which the company feels that full multi-user capabilities are not essential and where a single-user application package will suffice. This doesn't mean that there is no means of sharing the data between users, and the solution selected will depend to a large extent on the application. For example, the shared data in a word processing application is often going to be of the standard paragraph type, and these can be held in the public partition as read-only files which can be pulled out as required. The finished document can then be saved to a personal partition.

Where there is a need to allow other users access to an individual's files, this can be achieved in one of three different ways. Firstly, the system manager incorporates all personal partitions in

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**BENCHMARK TEST**

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**Benchmark**

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*All timings in seconds. For a full listing of the Benchmark programs, see page 185, January issue.*
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their own manager's partition. It is then possible for the manager, when signed on as such, to copy the file from one user's partition to another and then sign off again.

The second approach depends on the creation of a shared partition between the users needing to swap files. This shared partition will also be assigned a different user name that is used as a sign-on when copying from one user to the other.

The third technique is to simply REQUEST the diskette drive, copy the file to the diskette, and then RELEASE the drive. The recipient then repeats the process and copies from the diskette to a personal partition.

It would be unfair to the machine to describe its facilities and applications without mentioning its electronic mail capability. It's possible to send mail to any user from any terminal by keying in MAIL in response to the prompt. This sends the machine into a routine which displays a neat screen format in which the user can write and address messages, or read the messages that have been received. If there is mail for a user who is not logged on, the message 'You have mail waiting' will appear under the sign-on when copying from one user to the other.

The second and third manuals are more serious, and more comprehensive; both are intended for the system manager. One is the DOS Manual, which is largely the same as the Microsoft equivalent but with coverage of the extensions. The other is the System Manual, which sets out all the facilities available to the system manager for creating profiles, partitions and general system maintenance. The fourth manual is the Technical Manual and is unlikely to appear outside the dealer's door. All are well written and are presented in hard-bound, step-by-step guides; this allows updates to the manuals to be incorporated as they occur. The one drawback of not having bundled software is that users can end up with different styles and sizes of documentation for their system: it would be nice if some coherence could be brought to bear here.

**Prices**

The pricing of the Dimension has been set quite competitively by North Star, given the market-place at which it is aiming the machine. The minimum configuration available, and incidentally the configuration which was supplied for this review, consists of a central module with 256k of memory and a 15Mbyte hard disk, plus two workstations with 128k bytes each. This package, which includes the North Star DOS, costs £5875.

Although this is more expensive than the average desktop standalone machine by a reasonable margin, it is in fact competitive with two IBM PC/XTs (North Star claims you get at least the equivalent performance of two XTs). Additional workstations which come complete with keyboard, display, 25ft connector cable and processor board cost £1395 each.

The 256k RAM expansion board for the central module costs £690, while the two available for workstations, the 128k and 256k boards, are £395 and £645 respectively.

As a guide to its competitiveness, North Star claims that an average installation of five workstations and a central module will cost 40 percent less than four IBM PCs and a PC/XT networked together.

**Conclusion**

The success or failure of the Dimension will, in the end analysis, have little to do with the machine itself. Instead it will be the way and speed with which users in small to medium sized companies take up the idea of a small, competitively priced multi-user machine, and, more importantly, it will depend on IBM.

The arrival of the PC/AT as a potential multi-user engine shows that IBM is aware of the potential of such a market-place and to exploit it, the company will have to maintain some degree of compatibility with the vast base of applications software which already exists. This means that the Dimension is in the right position to reap some of the rewards.

It is a soundly engineered machine that is fast, efficient and tolerably viceless — certainly viceless when not trying to perform tasks like running protected programs that the machine is not designed to run.

If it suffers from any major drawback, it's the temporary lack of available multi-user software with good record locking — this will hinder its market penetration.
With the growing interest in lap-held computers, it seems that an often-forgotten corner of the computer market is that of pocket computers. This is a shame as these machines probably offer a great amount of computing power within the smallest amount of space, providing you can accept the diminutive keyboard and display.

Unlike lap-holds, which are scaled-down versions of business machines, pocket computers are much older and grew out of the programmable calculator market. Originally the battle for the title of programmable calculator king was between Texas Instruments (TI), Hewlett-Packard (HP) and Casio. Then in 1979 Sharp launched the PC-1211, the first hand-held with Basic, and since then it’s been Sharp versus Casio with HP and TI staying in the scientific/programmable calculator field. Both Sharp and Casio have continued to develop in this field and it’s two of the latest machines from these companies that are reviewed here — the Sharp PC-1350 and the Casio FX-820P. Notable predecessors were the FX-702P, Casio’s answer to the PC-1211, and the PC-1500 from Sharp with its comprehensive Basic, graphics and a remarkable printer/plotter.

**Sharp PC-1350**

**Hardware**

The PC-1350 pocket computer is enclosed in the now traditional brushed aluminium ABS case. The machine is considerably smaller than the PC-1500A and more in line with the dimensions of the original PC-1211 — very slim and suitable for, say, an inside jacket pocket. The small size is due to Sharp reverting back to the button-sized lithium battery as a power source. These give approximately 250 hours of life to the machine, and an alternative power source is available.

On the back of the machine is a removable aluminium panel, under which is the edge connector for insertion of the optional 8k and 16k RAM cards. Also under this panel is a small sliding door to the battery compartment.

Pocket computers are not designed to be looked at internally, and I was soon frightened off by the vast number of tiny screws and delicate construction. However, within these tightly packed PCBs I am assured there is an 8-bit processor of Sharp’s own design, a 40k ROM, 5k RAM and all the other necessaries that make a computer. All the chips are CMOS, allowing memory to be retained even when the machine is switched off.

The keyboard consists of a non-staggered qwerty layout of calculator keys, very similar to the PC-1211, with a larger numeric keypad and control keys to the right. The alphabetic keys are just about fingertip size and it’s all too easy to hit up to three keys simultaneously; probably the simplest way round this is to use the blunt end of a pen instead.

The nicest feature of this machine and the reason that the keyboard is so small is the LCD display. Rather than the usual one-line arrangement, this is a four-line by 24-character display, or 32 by 150 pixels if used graphically. Left of the main display but still within it are annunciators for programming mode, lower-case and definable mode.

Other notable hardware features include a contrast thumb wheel (at last). A well documented serial I/O port, which includes configurable baud rate and parity is on the right-hand side — quite remarkable for a pocket machine.

**Software**

Most pocket computers, as a result of their calculator origins, can be used as a calculator. The PC-1350 is no exception: it acts as a very powerful scientific calculator, especially as variables can be used within manual calculations.

Calculation is performed to 10 figures with a dynamic range of 10. A wide range of scientific functions are provided, although these are perhaps a little more cumbersome than their calculator equivalents as they have to be spelled out. The machine breaks no records in terms of speed, and is probably on a par with the slowest of the home machines.

The PC-1350 has three modes of operation: run, program and reserve...
mode. Run and program are toggled by the mode key in the upper right-hand corner of the machine; run mode allows program execution and the use of the machine as a calculator; and program mode is for program entry and editing. Reserve mode is entered by typing SHIFT MODE and allows the bottom two rows of qwerty keys to have a string associated with them. These can then be recalled in both program and run mode, and are useful for commonly used Basic commands and functions.

The bottom two rows of qwerty keys can also be used in conjunction with a DEF key to run a program, or section of program, whose Basic line is labelled with the corresponding letter. The editor can be described as a full-screen editor even though the screen is only four lines long with four-way movement scrolling when necessary, and insertion and deletion control by four cursor keys.

The Basic interpreter is held within an extremely large (for a pocket machine) 40k of ROM, and is Microsoft based with extra commands for graphics, the I/O port, and so on, which adds up to around 120 commands. Unlike some of the previous pocket machines there are no noticeable omissions in the Basic: string handling, one or two dimensional arrays and data statements are all there in their standard Basic form. Variable names can be of any length with the first two characters significant.

The PRINT command stops execution of a program so that the information is not scrolled off the screen, and there's a PAUSE command which enables display for a programmable length of time. Debugging is facilitated by the commands TRON and TROFF, which display line numbers and allow...
The Sharp PC-1350 in use; the Casio FX-820P sitting on its disk interface

single stepping.

Cassette file-handling instructions are included for use with the cassette interface and a suitable recorder. As well as program saving and loading, there are the necessary INPUT# and PRINT# for data files. The serial I/O port can also be accessed from Basic with such commands as OPEN, CLOSE and CONSOLE, which is a sure sign that Sharp intends the machine to be used on site and brought back to base to communicate with a larger machine.

The area where the Sharp really shines out from the competition is in the graphics commands which drive the 32 by 150-pixel screen. Text and numerical data can be displayed anywhere onscreen so that a number of running totals can be displayed at once and figures can be labelled. In addition, the display can drive on a pixel basis with point setting and line drawing commands. Small histograms and line graphs can be drawn with this facility, and it's also used in games.

Overall I was very impressed with the Basic although a little surprised that it took 40k of ROM to implement it. The only thing I can find to complain about is the absence of a real-time clock, something which is useful on portable machines that are used for appointment keeping and is found on the PC-1500. The absence of a block delete and renumber routines is also a disappointment.

After some searching it's surprising what applications software is available for pocket machines, and I suspect that most of it will be converted to the PC-1350. Typically, there is scheduling, tiny databases, sales analysis and other packages for people who need computing power outside the office.

Documentation

It seems that for Sharp the writing of quality documentation is an uphill battle. The earliest attempts at providing a tutorial for the MZ-80K and the
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badly translated PC-1211 manual undoubtedly prove this. But happily, by staying
mainly as a reference manual, the
PC-1350's 269-page instruction manual
is quite comprehensible. By far the
worst chapter is the one that tries to
teach Basic programming; I recommend that this is replaced by a standard
Basic programming book.
Interestingly, with the PC-1500 there
were three commands — PEEK, POKE
and CALL — that were undocumented.
On the PC-1350 these commands are
once again available, and are men-
tioned in the manual for a self-test
routine but are not explained anywhere
else.
I don't know what Sharp has against
people looking around the memory of
its machines — perhaps the fact that
we might find out exactly why it took
40k of ROM to program the Basic.

Casio FX-820P

Hardware
The Casio FX-820P is a larger machine
than the Sharp PC-1350, and is once
again covered by a brushed aluminium
ABS case. It is powered by two lithium
batteries which keep the machine alive
and kicking for approximately 140
hours. The batteries are replaced by
removing the back panel; this requires
the removal of two tiny Philips screws for
which you really need a suitable jewel-
er's screwdriver.
The reason for the extra bulk is the
inclusion of a built-in printer to the left
of the machine, and the NiCad batteries
to drive it. The printer uses special
electrothermal paper of tally roll size,
and produces a good quality print after
it's printed the first four lines or so. A
charger unit is supplied with the com-
puter for recharging the NiCads, and
when fully charged they should work
for well over 3000 lines of printing.
Although the increased bulk is a
result of the inclusion of a printer, by far
the worse casualty is the LCD display.
This is a tiny one-line, 12-character
affair to the right of the printer and can
only be described as just about work-
able.
On the front of the machine is an
opening for the insertion of either 2k or
4k RAM cards (one 2k card is supplied
with the machine). These cards contain
a tiny battery that maintains memory
contents even when the card is re-
moved. As a result, Casio eagerly
pursued the idea that they could be
used in a similar manner to floppy disks,
with frequently used data and pro-
grams stored on a number of RAM cards.
This is very nice, but at £20 a time for
only 2k of storage it's rather expensive.
The Casio's keyboard is a staggered
qwerty arrangement of calculator keys
with a proportioned space bar. There is
sufficient room for most fingertips, and
it all works very effectively as well as
making the machine look neat. To the
right of the keyboard is a numeric
keypad, and the top row of keys
spanning both keypad and qwerty pad
are control keys.
To the left of the machine is a thumb
wheel for adjusting the contrast, and to
the back is the edge connector for
connection to the optional cassette
interface. There's also an all-reset
switch on the back which is activated by
a pen nib: this clears all data and
program memory, and restarts the
machine. The FX-820P is slightly faster
than the Sharp PC-1350, but once again
won't set any records for speed of
operation.
Casio is as shy as Sharp about people
getting into its machines, but if you did
manage to hack your way in there you
would find a custom 8-bit processor, no
RAM (it's all on the plug-in card) and an
undisclosed amount of ROM.

Software
The FX-820P operates in three modes—
run, program and Data Bank entry —
each of which is accessed by pressing
the MODE key followed by a numeral.
Other combinations of MODE and
numerals change the angular mode.
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and setting of the debugging options. Casio has followed in the footsteps of the Sinclair Spectrum by assigning as many as five different functions to one key. Various combinations of shift, function and extended mode are needed to access these, but as with Sinclair a colour scheme eases your way around.

From run mode the machine can be used as a scientific calculator; the one-keystroke entry of functions works very well here alongside the use of variables in immediate calculations. A fine array of functions exist, making the machine an excellent proposition for anyone who would normally consider a top-end programmable scientific calculator.

Also from run mode it's possible to run any one of the 10 programs that can be in memory simultaneously.

Program mode is for insertion of a Basic program. As stated, up to 10 separate programs can exist in memory at the same time, all taking from a central pool of memory. While entering a program, a second, small four-digit display is shown above the main one indicating the amount of program steps remaining.

Like the Sharp, the Basic is very comprehensive by pocket computer standards but no real features shine out as particularly interesting.

An optional cassette interface allows programs and data to be stored on tape, and also the data file-handling capabilities. A trace option is available which displays line numbers and facilitates single stepping — much needed as the error messages consist of a grand total of eight.

The third mode, data entry, is used in conjunction with a feature known as the Data Bank. This is a kind of mini-database on which a primitive number of search criteria can be applied. Each item of data is entered in data entry mode and the separate fields within a record are separated by a comma. It's then possible to do a sequential search through the data, or search via a specified string through any field. Used alone this would allow you to store, say, a number of telephone numbers and perform an intelligent search on either name or number.

The real power of this feature is revealed when it is used in conjunction with a Basic program. The Data Bank can be accessed as a random access file allowing complex search criteria to be constructed from the program.

There seems to be less commercial software available for the Casio than for the Sharp; what does exist once again consists of scheduling programs, data bases, and so on. The absence of the PEEK, POKE and CALL commands means that it isn't possible to write programs with a machine code content or directly access the ROM — two things necessary to produce good quality commercial software.

Documentation

Two books are included with the Casio FX-820P: a 200-page Owner's Reference Manual and a 94-page Database Reference Manual. These are generally well written but do show signs of translation; the most amusing being that the manual constantly refers to the machine as the 'mainframe'. In particular, the phrases that try to make the manual friendly suffer in translation. For example: 'However, unless you activate the computer function you cannot use it.'

Prices

The Sharp PC-1350 retails for £129 with 5k of RAM built in. Additional RAM cards cost £69.95 for an 8k RAM card, and £114.95 for a 16k RAM card. The printer/cassette interface costs £49.95 and £39.95 for the 2k RAM card and £29.95 for the 4k RAM card.

The Casio FX-820P is the top of a range which all feature the Data Bank and are priced as follows: £89.95 for the FX-820P; £49.95 for the FX-720P (same as the FX-820 but without printer); and £49.95 and £39.95 for the lesser PB-410 and PB-110 respectively. Peripherals are £22.95 for the cassette interface, £29.95 for the character printer, £19.95 for the 2k RAM card and £29.95 for the 4k RAM card.

Conclusion

Pocket computers are still a viable proposition for engineers, field service personnel and anyone who needs computing power but is not too concerned about full keyboards and screens. The other market that both Casio and Sharp obviously consider important is as an introduction to computers. Both machines fill that roll very well and would probably still be useful after you'd been introduced, unlike a cheap home machine. What's more, they look rather more impressive than does a Sinclair ZX81 or Spectrum. Both the Sharp and the Casio have features in their favour, but overall I'd plump for the Sharp with its 40k Basic and graphic display. However, if a hard copy of calculations is important then the Casio is the nearest portable method of doing this.
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PCW3
Gareth Jefferson looks at the pitfalls that await the unwary when hooking up a computer to a display unit, and considers three new televisions-cum-monitors.

The vast majority of computers worldwide are used with ordinary domestic television receivers that serve as the computer's video display. However, the domestic compromises that arise when someone wants to use the computer while the rest of the family wants to watch Coronation Street or The A Team is only part of the problem. There are technical compromises too. Ordinary televisions are designed to give an acceptable standard of reproduction of ordinary broadcast television signals. The eye is a fairly forgiving organ when it comes to moving pictures, but more critical when it comes to computer text. TV broadcast standards and TV receiver capabilities are a compromise between cost and picture quality, with cost coming out the winner, and most sets are simply not capable of adequately displaying 80 characters on a line.

Computers, on the other hand, make severe demands of their display units. The signal bandwidth required to display 80 characters across the width of a screen is more than ordinary televisions can manage, so home computer designers and users are forced to compromise: either display 40 columns (characters) on an ordinary television, or use a more expensive high-bandwidth, high-resolution colour monitor.

But a third alternative is emerging: colour television receivers equipped with wider bandwidth circuitry and signal interfaces able to take video signals directly from computers. These 'direct' inputs are either composite video inputs or RGB inputs; using them avoids having to RF (radio frequency) modulate the computer's output signal to make it emulate an aerial input, and excludes unnecessary degradation of the signal.

TV receivers and broadcast standards

The signal emerging from a monochrome television camera consists of an analogue video signal (corresponding to the intensity of the illumination of the picture tube as it is scanned), and horizontal and vertical synchronisation pulses. These sync pulses allow the receiving equipment to know when the end of each horizontal line and each picture field have been reached.

Colour cameras are essentially three monochrome cameras in one, with a separate video output for each of the primary colours — red, green and blue — plus horizontal and vertical sync signals for a total of five signals. These are usually called R, G, B, H-sync and V-sync. The standard signal level for video is one volt peak-to-peak.

Composite video For broadcast purposes, these five separate signals are usually combined into a single video signal called composite video. Although the five original signals are mixed, receiving equipment can separate them using moderately straightforward circuitry. The sync pulses are easily separated from the composite signal using simple time-constant circuits. Composite video signals have the advantage that only a single coaxial cable is needed to connect video...
equipment, and all the sorting into luminance, chrominance and sync signals can be left to the last unit in the chain — the receiver.

**RF signals** Although composite video signals involve relatively high frequencies, they are not suitable for radio transmission as such. For this purpose they must first be RF (radio frequency) modulated for transmission at VHF (very high frequency) or, more commonly, UHF (ultra high frequency). So, it’s an RF modulated composite video signal that is picked up by a TV aerial and fed into the aerial socket at the back of the colour television receiver.

Since the most common type of input signal in the domestic environment is from an ordinary aerial, most domestic sets are equipped with only a single RF (aerial) input socket. A tuner inside the TV set selects only the required signal (each channel is broadcast on a different frequency), and this RF modulated signal is then demodulated to get back to the equivalent of an ordinary composite signal.

**TVs with video inputs** The advent of the VCR (video cassette recorder) and, to a lesser extent, the video disc player, has changed the picture slightly. Since there’s no need for radio transmission between the video recorder under the television and the TV set itself, most VCRs and video disc players provide two outputs: an RF modulated output and a composite or ‘video’ output.

**Computer outputs** Computers that are capable of generating colour outputs invariably do so by generating three separate colour signals (red, green and blue) as well as horizontal and vertical sync. There are three ways of getting this stream of colour data from the computer to a suitable monitor. One is to leave the R, G, B and sync signals as they are and send them individually to the monitor. This involves minimal degradation to the signal, but requires the use of a monitor able to accept these separate signals.

The second approach is to combine the R, G, B and sync signals into a single composite signal, and here a monitor or television receiver able to accept a composite input is necessary. As mentioned, many ordinary TV sets are now able to do this. Signal degradation is greater than when the signals are left separate, but not as great as when RF modulation is involved.

The third approach is first to combine the separate signals internally, then to RF modulate them so that they emulate a broadcast television signal and feed them directly into the aerial socket of the TV set. All ordinary televisions therefore have this type of input. This method involves the greatest loss of quality, and the screen resolution is generally limited to displaying only 40 characters across the screen or the equivalent in computer graphics.

**RGB televisions** A few years ago Sony perceived a niche in the consumer video entertainment market for a ‘unit audio’ approach to domestic television, and produced the Profeel line of TV monitors with RGB inputs and separate TV tuners. Sony was quickly followed by a number of other manufacturers who also offer a unit video approach. The most basic unit is nothing more than a colour CRT (cathode ray tube) with the internal circuitry needed to process separate RGB and sync signals. Other sets offer RGB input and built-in TV tuners to enable broadcasts to be received off-air.

**RGB: TTL and analogue** If you have a computer with an RGB output, you have the choice of either a dedicated computer colour monitor such as the Microvitec Cub, or a television set with an RGB interface such as the three models reviewed in this article. Whether or not this apparent choice is real depends on the type of RGB output your computer provides.

The reason for this unfortunate source of confusion stems from the fundamental difference between computer-generated video and ‘television’ or picture quality video. A colour television receiver, as well as colour computer monitors, provides a large number of phosphor triplets consisting of a triad of phosphor dots, each of which produces either red, green or blue light when irradiated with an electron beam from the electron gun(s) of the CRT. ‘Real’ pictures have varying degrees of brightness at any given point, as well as colour content. To get the full effect of an ordinary colour picture on a colour set, this involves allowing each of the dots in every phosphor triplet to give out varying amounts of light, from no output to full output. An ordinary colour video signal does this by having two components: luminance (brightness) and chrominance (colour value).

Computers work in binary states of on or off. Computer interfaces use TTL (transistor-transistor logic) chips that produce outputs of (approximately) five volts or zero volts. This binary option means that any of the red, green or blue dots can be fully on or fully off. This limits the choice of displayable colours to eight: red (red only), green (green only), blue (blue only), yellow (red + green), magenta (red + blue), cyan (green + blue), white (red + green + blue) or black (nothing). No other colours are displayable.

There are two ways round this problem: either the red, green and blue signals can be made to vary between fully on and fully off; or a separate intensity signal can be supplied. When the R, G and B signals are at TTL levels, there is no question of varying the signal strength because TTL signals are either on or off — there are no intermediate states.

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... or they can act as monitors by bypassing TV demodulation
Broadcast standard colour monitors with RGB inputs have traditionally taken a different approach. They have what is known as analogue RGB inputs. An analogue input is, by definition, infinitely variable between its minimal and maximal values. Video signals are traditionally 1V peak-to-peak, so an analogue RGB signal will vary in intensity between 0V (fully off) to 1V (fully on) and anywhere inbetween. TV monitors for unit video systems, such as the Sony Profeel and the models reviewed here, therefore have RGB inputs that accept analogue signals of between zero and one volts.

Now consider the situation that applies if the R, G and B signals are either on or off, with no intermediate states. The possible signal states and resulting colours are summarised in Fig 1. The righthand columns allow one possible situation where there is a limit in the number of voltages that can be produced. Some monitors use TTL-type voltages, but with a full voltage swing to allow more colours to be displayed. The models looked at here can cope with any voltage likely to be encountered, from half a volt peak up to five volts.

Screen resolution A composite or RGB input to a domestic colour television will result in a cleaner signal getting through, but don’t think that means you can display 80 columns where only 40 could be shown previously. Unless you have a monitor with more phosphor dots on the screen (and more perforations in the tube’s shadow mask) all you’ll get is 40 cleaner characters. Any attempt to display 80 columns will still result in blurred, unreadable characters.

The machines
The Ferguson MC01, the Fidelity CTM1400 and the Hitachi CPT-1444 sets have much in common: all cost under £230, can receive TV signals off-air and accept RGB inputs. The Ferguson and Fidelity sets can also accept composite video inputs.

The Fidelity CTM1400
The TV/monitor version of this set retails for £229, but a monitor only version (with no internal TV tuner) is available for £199. It has the nearest things there is to a standard connector, the so-called SCART or Euroconnector. This is a 21-pin connector feeding into 75-ohm analogue inputs. Three signals catered for include composite video in and out, stereo sound in and out, RGB analogue at 0.7V peak-to-peak, combined sync and fast blanking. A wide range of ready-made leads is available for all the popular micros. Resistors in series with TTL outputs from computers drop the signal (by forming a potential divider with the 75-ohm input impedance) and allow the interface to be used with no significant loss of quality.

The only problems likely to be encountered using this model would be with computers producing separate H and V sync signals since there’s only a compound sync input. The IBM PC, which produces TTL-level RGB and uses a separate intensity line for a fuller colour range, has to use the composite input for sync purposes and only eight colours can be displayed. All in all it’s a very versatile set, although the manual TV tuning was fiddly.

The Ferguson MC01
This model retails for £229 and is provided with separate RGB and composite DIN-style sockets — seven pins and five pins respectively. Neither of these is standard, but the interface is versatile and should work with virtually any machine. Only a BBC lead was available at the time of the review, but this worked with a clear improvement in the quality of the display on switching from RF to RGB. Two sync inputs are available for machines that produce separate sync outputs, but the sync signals must be negative-going (which is normal anyway).

Combined sync is sorted out internally and simply needs to be plugged into one of the sync inputs.

The Hitachi CPT-1444
This is the cheapest of the models under review, retailing at £210. But, unlike the other two models, it has an RF and RGB input only; there is no provision for a composite video input. Only two types of lead are available — a BBC lead with appropriate plugs at both ends, and a general purpose lead with a DIN-style plug at the Hitachi end and nothing at the computer end. Soldering a suitable connector for your computer will be your responsibility. Adjusting the contrast control allows the input sensitivity to be adjusted for either analogue or TTL input levels. The sync input is for combined sync, and the signal must be negative-going.

Conclusion
Television sets with RGB or composite video inputs do give a worthwhile improvement in quality when used with a computer. Particularly noticeable is the freedom from the irritating drifting dot effect, so common when RF inputs are used. They are not, however, really suitable for 80-column displays. They may have the internal bandwidth to handle 80 characters, but do not have the screen resolution owing to the limitations of the shadow masks on domestic receivers.

If you’re in the market for a new colour television and would like some improvement in the computer display, then the few pounds extra these sets cost is well worth considering. This is particularly true if you have a video recorder or disc player with a video output: the lack of a composite input in the Hitachi would then rule it out. The extra £19 spent on either of the other two models gives considerable extra versatility.

In any event, it’s a wise precaution to try out your computer with whatever monitor or television you are contemplating.
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**Programming Down to Basics**

John Locke gets to grips with business programming in Basic.

Despite its reputation, it can produce fast-running and efficient programs with just a touch of 'style'.

Basic doesn't have a wonderful reputation in the programming world, but it is capable of producing fast-running and efficient programs. I have known interpretative Basic programs that ran as fast as a compiled COBOL equivalent from the user point of view.

**Programming style**

One of the surest ways of achieving fast-running programs is to develop an individual programming style—that is, either a personal or a 'house' style. Style implies standardization. Once you have found a good way of performing a particular program function, stick to it until you have a very good reason for changing it. This also applies to the general structure of the program. Writing the code for this function will then become second nature to you, the bugs will have disappeared long since from that section and it can be typed in almost without thinking. Build up a library of generally useful subroutines and try to give them the same and easily remembered start line number in each application. In this way, the address of the subroutines will be remembered and can be referred to in the program almost without thinking. By implication, the subroutines must be developed to have general application. Other aspects of style will appear in the structure of the program and will be described later.

There is a difference between the structure of programs in general and the structure of a particular application. The structure of a particular application arises from an analysis of the requirements. This must be done thoroughly at the start. Making changes to a 'finished' program because an important requirement was forgotten is time-consuming and may even ruin the efficient structure of the program. That is not to say that the customer's requirements will not change (with bespoke programming they assuredly will), but it is your job to anticipate the changes that might be required at a later stage and allow for their insertion when building the original application structure.

After the analysis of the requirements, construct a flow-chart of a program to meet these. Take as an example an accounts suite consisting of sales, purchase nominal ledgers, together with stock control, sales analysis, ordering, invoicing, and so on; this will occupy between 20 and 25 pages of code. Without a flow-chart it is easy to lose track of where you are. Not only that, but flow-charts should be an essential part of the software documentation. As you code the program in accordance with the flow-chart, add to the block on the diagram the line number that commences the function of the block. This makes the task of tracing through the program much easier later on.

**Analysis**

The first step, obviously, is to analyse your program's requirements before constructing a flow-chart to meet them. While constructing the flow-chart, I find it useful to design all the menus for the program (assuming that menus are to be used) because these will determine the major modules of the program and the sections of the flow-chart. Don't be afraid to redraw the flow-charts several times before you are satisfied with them. In this way all the redundant sections can be eliminated, the common subroutines highlighted and the many alternatives of achieving the desired results explored.

Strategic decisions which will affect the whole program should be made when the menus are being designed, and reviewed when the flow-chart has been completed. These decisions will include such things as: whether numerical values are single or double precision; whether values are to be held in core in a large array, or as a random file in permanent storage; whether or not the program is to be machine specific; whether each transaction is to be incorporated in the file to which it refers, or in a separate audit file, and so on.

Applying these to an accounting package example, the totals of each nominal account can be turned into a profit/loss report very quickly if these are held in a core array. The difficulty is that even a modest number of accounts can easily be forgotten when coding. It is essential that they both allow rapid selection of any account and that they both allow rapid selection of any account and easy tracing of each transaction.

When constructing the flow-chart, insert statements, construct a flow-chart of a program to meet these. Take as an example an accounts suite consisting of sales, purchase nominal ledgers, together with stock control, sales analysis, ordering, invoicing, and so on; this will occupy between 20 and 25 pages of code. Without a flow-chart it is easy to lose track of where you are. Not only that, but flow-charts should be an essential part of the software documentation. As you code the program in accordance with the flow-chart, add to the block on the diagram the line number that commences the function of the block. This makes the task of tracing through the program much easier later on.

**Search for match on name**

**Print menu**

1 - Read record
2 - Amend record
3 - Insert record
4 - Delete record
5 - Print file
6 - Return to main menu

**Fig 1 Multiple exit block**

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**Fig 1 Multiple exit block**
useful to preface variables that are to be grouped without clashing with reserved words and for defining as single, double-precision or integers in groups. K and H can be used with care.

Memory space limitations will almost certainly force the chaining of the main program modules. Chaining is an advantage anyway, at least with Mbasic where all or a choice of variables can be transferred and a start line specified (chaining in BASIC is much less flexible). Chaining modules reinforces the structure of the application program and, if properly done, enables each module to be tested separately.

It is essential to have a correctly designed foundation module onto which the other modules overlay. This foundation module has some similarities to the environment division in COBOL but it should go further than that. The foundation module should contain:

(a) A housekeeping section to fulfil such tasks as general definition of variables and dimensioning.
(b) The definition of all the string variables and numeric constants (if any) that will be used throughout the suite of modules. For example, AS$=STRINGS(20), **$ as a useful heading for the line, and perhaps AL$=AS$+A$ as AS$+AS$ to give an across-the-screen division.

All string variable arrays that will be frequently used should also be set up at this time. They are either written into the code, or loaded into the array this time. They are either written into the memory or loaded into the array. They are either written into the array or loaded into the module. This is also set up with the screen control for flash or continual use of long variable names:

```
    10 CLEAR: DIM HS$(120), ST$(10), ST2$(10), SD$(12), FS$(14)\除了TEXT$(14),\除了DAT$(14), T$(10), TR$(10): DEFDBL B: DEFINT J
```

HS$(i) is the array to hold the nominal account headings. ST$(i) and ST2$(i) are the fields in two stock files, one holding stock item data and the other holding stock sales data. SD$(i) is the array of stock descriptors.

Next come the string variables:

```
15 AS$=STRINGS(20), **$*: AS$+AS$+AS$+A$
20 SD$(i)="Ref": SD$(1)="Qty": SD$(2)="Unit": SD$(3)="Item": SD$(4)="Size":
```

The definition of the 12 descriptors in the foundation module will save a lot of space in the overlay modules. For example, to show the first 11 stock details after having selected the stock number and read this record:

```
   FOR X=0 TO 10: PRINT SD$(X); TAB(20)ST$(X): NEXT X
```

The screen control characters are defined in line 25:

```
   25 CL$=CHR$(27)+CHR$(42): BK$=CHR$(27)+CHR$(73):
   DEL$=CHR$(27)+CHR$(82)
```

These are a few of the screen control codes: clear screen, back tab and delete a character. These are set up depending on one of the strategic decisions — whether the program suite is to be general-purpose or specific. Give the control codes meaningful short names like TOFS for top-of-form or CLS for clear screen. You will be using them extensively throughout the program and you won't have to keep referring to your list of variables which you are of course, keeping as coding proceeds) because this is time-consuming. There is no need to waste memory space and typing-in time by continual use of long variable names: reserve these for when they are essential.

Grouping variables by common starting letters is another way of increasing their intelligibility.

```
30 PRINT the program control characteristics.
30 TOFS=CHR$(12)+COMS$=CHR$(15)\除了UON$=CHR$(27)+CHR$(45)+CHR$(1):
   \除了UOFFS=CHR$(27)+CHR$(45)+CHR$(0)
```

These are printer control codes for top-of-the-form, compressed print and underline on and off.

Line 40 is a sample common message:

```
40 TAILS="Please pay this invoice before the 20th of next month."
```

The table of common variables comes in line 80:

```
80 COMMON CLS, DELS$, AS$, AL$, TAILS$, and so on.
```

If memory space permits, it is very much simpler to use the ALL option in the CHAIN command.

Next comes the title and main menu section:

```
100 PRINT CLS; SCLS; PRINT SPCI (23) 'Company Accounting and Stock Control': PRINT ALS$: PRINT SPCI (27) 'Copyright J. D. I. Locke 1984': PRINT
```

This illustrates one simple method of getting a neat screen layout while minimizing the possibility of typing errors in the coding. To obtain the main menu at any time only requires the contents of line 110. KL and KH are controls for the limit of numeric input at the line 520 subroutine. This in its simplest form would be:

```
520 REM **MENU SELECTION**
525 INPUT 'Input the number required': K
```

530 IF INT(K)<>K OR K<KL OR K>KH THEN PRINT BAD$: GOTO 525

535 RETURN
```

The basic interpreter will catch the input of a letter rather than a number. The next program line in this section will print the selected choice in the status line by extracting MID$(TEXT$(K), 3, LEN(TEXT$(K))) and combining it with the necessary control code.

Lines 130-170 are the chaining table. The same line of code will contain: K

```
130 CHAIN MERGE "PURCH", 1000, DELETE 1000-9999
140 CHAIN MERGE "SALES", 1000, DELETE 1000-9999
150 CHAIN MERGE "NOM", PCW 149
```

Fig 2 Foundation module layout

Examining an accounting program in detail should help to clarify the following. The housekeeping is done by line 10:}

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150 CHAIN MERGE "NOM", PCW 149
```
The final section covers file-handling. Generally, the files will be random access, so subroutines will be required to open the file and dimension the fields, to read a record, to write a record and to find a vacant hole in the file for a new record. To give examples of these, the supplier's account file will be used. Twenty records per month have been allocated to each of 150 suppliers, giving 3000 records. At the end of each month, or when all the allocated records have been filled, a statement is printed out and the account cleared to a new record number. The supplier's account file will be used.

It should be noted that the first field contains the record number when it's occupied, otherwise it is blank. The subroutine at 280 may seem longer than is necessary as the section which writes back the record number only into the vacant record. This is a precaution to be taken in a multi-user system to reserve the vacant record as soon as it is found. Another user, or another part of the program, determines its contents. Without this, you could find two users both trying to grab the same record.

This is not the only precaution that has to be taken — other users should be locked out of that file or that record while it is being written to. The use of a single open statement is invaluable during program development, since only a single statement has to be altered should any changes to the file structure be required. The use of common file-handling subroutines does make the adaptation of the program to multi-user systems easier. It is often required, at the beginning of the write routines, to test subroutine to check whether that file is in use and whether that record is in use at the moment. A jump back to the file-sharing routine is made just after the file has been closed to reset the indicators and to release the file again.

As a general principle, it's possible for a small multi-user program to set a single key when any file is open for writing to inhibit all other access to the file. The routine during this time. Even with three files during this time. Even with three single keys when any file is open for writing to inhibit all other access to the file, the resulting delay is negligible. As another example of this, the company name and address, MIS the first month in the financial year, and HS(X) the account headings as described before.

As mentioned, one strategic decision which must be made before program design commences is whether the program is to be machine specific or general. If the latter, then a customising module has to be written. One approach is simply to list the machine specific control codes required, and then let other users insert the codes to match them.

Multiple record search

An exception to the above principle is the multiple record search, an example of which is at subroutine 280; here the file is opened at the start of the search and closed at the end. The speed penalty is small and it does save the loss of all the data files when the system crashes.

As another example of multiple record search, assume that there is a file called SUPPLIER.DAT, £5, containing such details as name, address, telephone number, and so on of 150 suppliers (record 151 is a dummy). The record number is given by SUP% and the file is opened by subroutine 310. To search for a particular supplier's name (contained in field FS(2)) one could use:

1100 TB=0: INPUT"Name":NAS:

Note that as the 'while' condition depends on the contents of a field, the file must be read outside as well as inside the loop. The subroutine at 500 is a standard yes/no routine returning K1=1 for yes, K2=2 for no and K3=3 for error. Each module starts at line 1000 with a menu display. The return must not be to a clear screen command, otherwise the message will not be displayed.

Although the above implies that all the files should be random access, sequential files are useful for reading and writing to an array: for example, the account file headings, if they were set up in a separate program.

In this example, COS(X) includes the company name and address, MIS the first month in the financial year, and HS(X) the account headings as described before.
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COMMUNICATIONS

Spreading the word

Messaging facilities play an important part in the concept of portability. Menno Aartsen takes the weight off his arms to examine exactly what constitutes a portable machine, and looks at the electronic mail systems portables can talk to.

The gap is widening between portables which try to emulate desktop machines and those which aim for true portability. The recent introduction of the Apricot Portable is a perfect example: it's a powerful MS-DOS machine, containing everything the computer user needs. A mini-floppy and a full-size screen make it completely independent, anything from Lotus 1-2-3 to an accounting package will happily run on it, and it can be moved from work location to work location quite easily. Yet it's not a true 'portable' computer, a term better reserved for lap held machines. The Tandy Model 100, in particular, has done much for true portability, although some people still think of it as a toy.

A journalist's toy, I should add — journalists were the first true users of the little 100, which enables stories to be written on the spot, on the train and on the plane, and then transmitted to base either direct or via an electronic mail system such as Telecom Gold. Many more professions have discovered the possibilities of these electronic notepads and found that they are quite powerful in their own right. A Tandy 100 with 23k RAM will yield around 29k of user memory, with Basic, a simple text editor and a communications program in ROM. The Epson PX-8, on the other hand, is even more powerful and sports CP/M (with utilities), WordStar, Portable Calc and a scheduler. It has 24k of user memory (which runs out very quickly once WordStar starts creating backup files), supplemented by 29k on microcassette.

But where Tandy has attempted to create a portable with optimum usability, Epson has tried to emulate a desktop computer. The Tandy 100 is the more useful machine, despite the Epson's 80-column by 8-line display where the 100 only offers 40 columns.

Pocket micros

We'd all like a powerful micro in our pockets, but every extra carries weight. As a journalist I've carried both machines for days on end, covering exhibitions or attending conferences, and started to notice the weight very soon — after all, one usually carries more than just the micro. With acoustic coupler, the usual paperwork, keys and other gubbins, a case can easily weigh in at 10 to 15lbs, which is a lot to carry around all day. In this respect every ounce counts, which is where the Tandy (just over 3lbs) wins easily.

Although Epson has produced a very nice little machine, I can't see the need for PIP and CONFIG in a lap held. Epson does produce a battery-driven floppy, but with four software packages on ROM, built-in microcassette and RS232, I don't really need additional storage space. Once you progress to large files and other software it's surely better to buy a "full" portable, considering that a PX-8 with two floppy drives, diskettes, coupler, cables, spare batteries and charger can hardly be called 'lap held'.

But it all depends on what you expect to do with a portable, of course. Where the Apricot will happily give you an office computer in any location with a convenient AC socket, the true lap held allows the user to access electronic mail systems and remote databases, or even the office computer. The US company Dialcom, now owned by ITT, started the craze with a viewdata system which could be dialled from within the US, and which would accept text output of, what were then, communicating typewriters, or teletypes. You could leave a message for someone else, receive your own and browse through information pages.

Today, the US alone has dozens of these ASCII databases — no graphics, no colour, the simple standard keyboard character set and lots of info. They vary from Compuserve in Columbus, Ohio, where one finds mostly computer enthusiasts, via The Source in McLean, Virginia, where thousands of teenagers make each other's acquaintance, to Dow Jones News/Retrieve, where stockbrokers can find the latest quotes and read The Wall Street Journal.

There are very few 'true' message systems in the States. The latest arrival on the scene is MCI Mail in Washington DC, which offers a gateway to Dow Jones but only provides a mailing service itself. It will allow the user to send surface mail, however, from ordinary two-day post to a four-hour courier delivery in any major popula-
tion centre in the US and Canada.
Which brings us home to Telecom Gold, a British system based on ITT Dialcom software and primarily intended for messaging. Telecom Gold does not run a database, but subscribers do have the facility to make their own available. Gateway facilities are under development, and Roderick Manhattan Associates will shortly start trials, through Telecom Gold, with Manhattan Linq, a European surface mail service with the same possibilities as MCI offers in the States.
The major advantage of a service like Telecom Gold is its link-up with the international packet switching network. From the user's terminal, every ITT Dialcom user in the world can be mailed, and the system can be accessed from any location with a Tymnet node.

Electronic mail
The Tandy 100 is a clever machine: it was designed for use with these electronic mail systems although you can happily use it as a word processor. Tandy's portable version of Scripsit takes only 4k (as compared with Epson's Wordstar, 33k) and has all the basic processor functions. On the road, however, where you're unlikely to be lugging a printer, its own text editor does handsomely. Provided you have an electronic mailbox, you simply dump the contents of your memory (for safekeeping) and continue working. Since all its internal data is, or can be, converted into ASCII code, anything from your diary to utility software can be transmitted via electronic mail and retrieved the same way.
It's unfortunate that neither Tandy nor Epson have found it necessary to provide built-in modems with their portables. Officially they say BABT approval is a problem, but I suspect that preparing a modem card for a small market would make the machines too expensive. Every European PTT has its own standards, and these standards are different in every country; only the USA is a big enough market to warrant the development cost. The American version of the 100 thus comes with built-in Bell modem and software for auto-dialling, automatic log-on and automatic data retrieval. All you have to do to read and download your mail or stock market quote is program it, plug it into the telephone socket, press one button and hey presto! — it goes away and does it.
But Britain can't have it, and that's final. Even ACT doesn't bundle terminal software or a modem for its portable; it's all optional, meaning extra pounds and pence. And even if you do get your coupler, modem and terminal emulator, you're not always home free. European buyers of Epson's PX-8 soon noticed that when they started using dial-up services, the terminal program either 'throws' you or simply doesn't work. Why? Epson isn't saying, but I suspect the software contains a modified American terminal package. This was originally intended to work with a
The major advantage of .... Telecom Gold is its link-up with the international packet switching network. From the user's terminal, every ITT Dialcom user in the world can be mailed, and the system can be accessed from every location . . .

and European telephone network. Epson users who have experienced these difficulties might like to know that PCW offers a (free) solution (see box).

The use of portables and dial-up services is really tied to professions — private use is simply too expensive. The Epson is a splendid little machine if you happen to have another CP/M computer, so file and software transfer become useful. The PX-8 is specifically configured to talk to Epson's own HX-10 desktop micro, but it wouldn't talk to my Rank Xerox 820-II although the latter would work as a terminal on the Epson. Other than that, you really need the memory expansion pack and/or floppy disks, both of which make the thing highly unwieldy. The Tandy 100, made by Kyocera which also supplies Olivetti and NEC, does have a limited memory (for some reason the 24k plug-in RAM isn't sold here) but will work as an intelligent terminal and has nice, big, readable letters with true descenders, which is useful if you're writing on a train at night. It's virtually impossible to crash and will take a fall or a bucket of water without complaint (yes, both happened to me).

Don't go for a portable unless you really want a portable, and if you do, use it with a mail system. And don't get on electronic mail unless you've got someone to talk to, and if you do, be prepared to pay for it. Telecom Gold is supposed to charge 10.5p per minute during working hours, but if you add the cost of the telephone, you pay between 13 and 15p. Once you're outside of London and have to use PSS the situation gets even worse: a five minute datacall can add another 12p exclusive of VAT. With foreign (American) databases, apart from the dollar exchange rate, the cost of PSS is horrendous: six minutes on The Source cost £1.05 just for the transatlantic connection. Because of the timeshift, you normally end up in either PSS's prime time or in that of The Source, so beware.

Conclusion
Portable computing is good fun, and useful for some, but has a long way to go. You can't make a keyboard smaller and a larger screen does away with portability, so lap-holds will always be a compromise. Not until a portable with a large internal memory and a real fold-under screen is introduced will we really be able to carry our office around with us.

The Data General One is a step in the right direction, but we'll have to wait for cheaper technology and make do in the meantime.

PCW readers who own or use an Epson PX-8 may have run into the terminal problems mentioned in this article. Gerrit Slot, who runs the Dutch Epson Users' Club bulletin board, has written a terminal program which is in the public domain, and Epson UK has offered to copy it onto your empty microcassette. If you send it to PCW, along with a suitable sae, it will be returned with a copy of the program. Written in C, it contains an Xmodem option and will take up 11k of RAM.
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*The Portable is data-compatible with the IBM P.C.

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Perfect power

The Perfect suite of programs is familiar as the bundled software with a selection of machines. John Vogler presents various procedures that he's implemented with the package on an upgraded BBC Micro.

Perfect software (in an improved version 2) is shortly to be marketed in the UK by Thorn EMI Software, initially for the IBM PC, with releases for the Apple and Apricot following close behind. The company is already known to CP/M users: for example, the estimated 12,000 users of the Torch and Torch upgrades of the BBC Micro. Recently, a number of other popular and low-cost business micros have been bundling Perfect software with the initial computer purchase: for example, WH Smith's bargain the Ferranti Advance, and the Prism Wren.

As more and more small businesses discover that home micros with single processors are not sufficiently powerful for their needs, it is likely that an enormous number of people will be cutting their teeth on Perfect software. Hence this article written by a business user (small-business computing consultant, and management consultant) for business users.

Perfect software (version 1) comes from the States. As bundled in this country it comprises: Perfect Writer word processor, which includes the spelling checker Perfect Speller; Perfect Filer database; and Perfect Calc spreadsheet.

These procedures are for a BBC fitted with a Torch ZEP100 Z80 processor and any dual disk drive. This is the least powerful hardware that will run them. Users of the Torch business machine will find only minimal changes are needed from descriptions given here. If they refer to the keyboard diagrams in the Programmers' Guide, they will find that the left-hand pad keys bear a number whose final digit is the same as the function key number given in this article (f0, f1, and so on). Those with more sophisticated systems will no doubt build on these ideas.

Perfect Writer

I work in three separate phases: text input, performed at high speed with accuracy secondary, either by myself or by a secretary or typist; editing, to produce a word perfect manuscript with all necessary formatting commands in place; and finally, format and print.

With text input only slight improvements are possible, of which the most important is a slick loading sequence. I do not have a winchester disk, so text files go onto different floppies according to the client. Originally these were listed on paper in the drawer beneath the computer. Now I find it's quicker to type D RETURN, which loads command file D.SUB (a display of which disk contains what) that ends with the system prompt onscreen ready for the next stage. For this I use a writer's command file, W.SUB, which resides on each of my Writer/Filer program disks (always placed in top drive 'A') (Fig 1). The user enters:

```
W <filename> <keyword> RETURN
```

The file name needs neither the drive prefix 'B:', nor the file name extension .MSS; both are added automatically by argument substitution, using the rules for preparing command files. The keyword is any single phrase which may be frequently repeated during the text, but a shortcoming is that only

```
B 2
VDU 12

Fig 1 Command file W.SUB to load Perfect Writer
```
upper case words can be used. It's very handy for environment commands or for writing 'Perfect' innumerable times!

Planning ahead, you would need to do the above immediately you sit down to the machine, then, while the disk drives are whirring, you can organise dictaphone, earphones, text being copied, flask of coffee and all the other essentials. By the time attention returns to the screen the disks are silent, ready for a single-letter selection from the menu (such as 'E' to Edit) followed by function key (a red, user-definable key at the top of the keyboard) f0.

An alternative sequence T.SUB is for typists only. It is even quicker to load, requiring only two keystrokes plus the file name, but occupies f# with an EXEC command that prevents its use for other things.

W.SUB speeds up the auto-repeat and shortens the delay; each user and secretary must tune these to suit their touch. I like a rather fast auto-repeat so that I can zoom the cursor around the screen when editing, but need a longer auto-delay. When writing, I make frequent use of three or four environment commands, particularly: ITEMISE, ENUMERATE and SUB-HEADING. These are programmed into function keys with the vital final bracket (to terminate the environment) in position, but with the cursor pulled back to its correct position before the final bracket.

Editing provides the major gains. To the ordinary user it may seem to place too much importance on tiny time-savings and speed gains. However, to the professional user editing thousands of words a day, be it book, report, news article or broadcasting script, these represent huge increases in productivity and a detailed, complex system is justified. In discussing it I'll refer to command keys, by which I mean the use of a key to perform some task (for example, delete the next word) rather than type a character. Perfect software gives some keys (in different combinations with others) as many as three or four different tasks.

One of Perfect's shortcomings is that you cannot function key definitions while in the program: all have to be pre-defined. W.SUB, therefore, contains an elaborate key definition sequence. Unshifted function keys have been defined by Torch. The handbook omits to mention that the COPY key alone performs the sequence ESCAPE CONTROL W — the CONTINUE SAVING command which is used for gathering isolated fragments of text and indicated by the appearance of a '+' at the right-hand end of the echo line. Use of this makes text gathering much slicker. After gathering text, or just deleting, it may be necessary to discontinue the gathering (denoted by the disappearance of the +). This can be done by either CONTROL G or the DELETE key.

Controlled function keys (depressed while CONTROL is held down) have also been defined by Torch. Because this has been done for the Torch business machine, it appears rather illogical on the BBC keyboard. They can be redefined using *FX227, but I disagree. Any definition the user imposes is eradicated when the Perfect program is loaded. Again the handbook does not mention that the left arrow cursor key plus CONTROL deletes the word in front of it to the right, which is utterly illogical but quicker than ESCAPE — F.

Using *FX4,2 enables the five grey (ARROW and COPY) keys to be defined, in addition to the 10 red. However, SHIFT and SHIFT + CONTROL function keys cannot be freely defined simultaneously. Define one group (using *FX226,1 or *FX228,1) and the other can only be set in a combination dictated by the list (Appendix C, Changing the Command Keys) in the handbook. This appendix has been included for use with a program named WRTBIND.COM, which can be used to alter the command function of any key but which is unfortunately not available. Without it, the user's best hope is to select whichever block of 15 sequential code numbers gives the most useful set of key definitions. My preference is for codes 193 to 208 inclusive. The BREAK key, which is also function key f10, cannot be used in practice but its place can be taken by the TAB key by use of the code *FX219,136.

These codes (imposed by
*FX226,193) form a coherent set of editing controls which, if the SHIFT LOCK is on, can be used single-handed to move the cursor one word, sentence or paragraph in either direction, change to upper or lower case, delete the next word or sentence, or mark the current paragraph for deletion or moving. There is also a command, ignored in the handbook, to indent successive lines by as much as a VERTICALLY scalable environment but is far more flexible than the INDENT environment command, which will only indent by a fixed half-inch.

Perfect Writer's range of commands for moving rapidly through a text, when editing, is already wider than almost any other word processor. You can move by letter, by word, by line, by sentence, by paragraph, by screen or by the whole text. However, some of these are achieved with clumsy 'one-two' commands, such as ESCAPE followed by a key, or by a CONTROLled key; or CONTROL -X followed by a key, or by a CONTROLLed key. The arrangements described aim at least to reduce these to simultaneous keystrokes. The benefit becomes most evident when repeating the task; for example, moving the cursor three words forward, which can now be done with one finger static on SHIFT while the other taps £5 three times or holds it down momentarily.

This leaves the user to fully define all the function keys with SHIFT + CONTROL, and each user will have his or her own favourites. For many the most important need will be the command to delete a word backwards. This is an essential facility for rapid editing, yet even its laborious one-two form, ESCAPE CONTROL-H, is not mentioned in the handbook. To have it ready to hand, I put it on f11, the COPY key. Still in search of rapid cursor movement, I have defined the left and right arrow keystomove five words either way. The up and down arrow keys find the extreme start and finish of the text, replacing the clumsy ESCAPE SHIFT <and >.

Other SHIFT + CONTROL definitions include f0 and f1, and f2 which contains the key phrase described above. Because I do a great deal of split-screen editing, f4 is used to flip from one window to the other. f4 to f6 contain the environment commands mentioned above, while f7 and f8 automatically insert bold-face and underline commands. f7 sets up the BOLD command for use while inputting text (the command is typed before the word), with the final bracket of the environment 'fence' moving ahead of the text. If the word has already been typed, a rapid two-part operation is used. Pressing f7 places the command, complete with closing fence, before the word and f9 then moves the closing fence, one word at a time, through as many as are to be emboldened. Similarly with underlining. Finally, the TAB key (acting as f10) is used to hyphenate any pair of words.

Alternatively Torch advises that customers buying the MCP Plus-100 upgrade pack will get a utility program, Softkey, which, run on its own will display the function key settings, and run with a filename will create the relevant key definitions Environment.

Perfect Speller automatically counts the words, but is not accessible during editing. However, f8 not only lists the buffers in current memory but also tabulates their length in characters. The trick therefore is to count the words in a typical piece of text using Perfect Speller, then divide this by the number of characters to find your average word length. There will be surprisingly little variation between different texts, so the character count, divided by this figure, will give a rapid and surprisingly accurate word count.

Perfect Writer has an extensive and imaginative range of commands for document design. They are invoked by instructions that use full key words, such as DESCRIPTION. As well as defining function keys, this can be avoided by creating standard document headers. For example, HEAD4AR where 4 stands for A4 and AR for article. The header not only defines the page margins: it prepares the environments for the article heading, sub-heading and page headings, and gives the option of turning off page numbers.

For letters (but only to correspondents who are not included on the database) there is L4E4W.M and L5E5W.M (Fig 3) for A4 or A5 paper and envelope. These are loaded using L.SUB, which automatically loads the heading and has slightly different key definitions. Once the address has been typed for the letterhead, pressing f0 automatically copies it onto the envelope which is printed immediately following the letter.

W.SUB speeds up loading and reloading the text file on which you are working. Typing drive letter, colon, file name, extension and RETURN every time is irritating. W.SUB avoids it elegantly: provided the file name is included as the argument when loading, the whole sequence is contained in f0 thereafter while, to initiate printing, f1 contains the name of the formatted file (with the extension, FIN).

To preview the exact page layout before printing, the handbook instructs that it should be formatted with the console or screen as output, configured identically to the printer. However, viewing a formatted text as it scrolls rapidly past is difficult.

There are helpful error messages generated by the formatting program but they are limited, particularly in respect of one irritating problem. This is the disastrous consequence of omitting the final fence of an environment command, namely that the entire remainder of the document is itemised or enumerated. Whereas most single-character errors can be altered even after printing, this one must be corrected before.

For this I use CON.SUB (Fig 2) which imposes paged mode instead of scrolling so that text can be examined meticulously. Secondly, it defines keys f8 and f9 to search for the left and right square brackets I use as the fences for environment commands. Thirdly, like W.SUB, it speeds up loading and reloading.

Perfect Filer

The Filer database is the weakest

<table>
<thead>
<tr>
<th>B 2</th>
<th>VDU 12</th>
<th>VDU 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>*FX226.1</td>
<td>EXC 0 . PW B$1.MSS</td>
<td>KEY 1 VDU 14</td>
</tr>
<tr>
<td>KEY 5 VDU 15</td>
<td>M</td>
<td>KEY 8</td>
</tr>
</tbody>
</table>

To display formatted file: press f1
; To show next screen, press SHIFT
; For continuous scrolling press ESCAPE
; To restore scrolling afterwards press f5

; To load file on PERFECT WRITER: press f0
; To search for missing environment brackets, press f8, f9 alternately.

Fig 2 Command file CON.SUB for viewing formatted text
element of the Perfect suite. One defect is that it only permits one data file to be open at a time and allows only one database file on a whole double-sided data disk. The handbook urges creation of two separate correspondence data files, one for organisations and one for individuals. My correspondents are such a mixture of organisations and individuals that I ignored Filer's templates and merged the two as a single, multi-purpose record.

One difficulty with Filer that can be overcome is the small size of the cursor. This can be changed by VDU 23,0,10,64 which produces a large, flashing cursor. For smaller cursor size, select other values (between 64 and 71) for the final argument.

Another shortcoming is the absence of a browse facility. I have failed to overcome this and shall be indebted to any reader who can help.

I have learned one or two lessons about designing database records. I incorporated a switch — a status field that switches any individual member into or out of a given subset — using yet another command file, S.SUB, which defines user keysto switch members on or off. To economise on keystrokes when defining fields, form letters, and so on, my fields use only a two-character field tag, such as sn. This undoubtedly saves time, but does not provide meaningful subsection headings.

In the light of this experience perhaps full-word tag names, such as 'surname', are justified. Include two or three defined fields so that the standard database can be used for special functions. Spare fields should be alphabetic.

Perhaps the most important lesson when designing a Filer correspondence database concerns addresses. To avoid shuffling program disks in and out of the top drive by hand, I designated three fields for ADDRESS, the fourth for CITY, COUNTY or STATE, the fifth for POSTCODE, the sixth for COUNTRY and the seventh for world REGION. This was a mistake which cannot be altered by MOVE, only by changing each member individually.

My database is mainly used for correspondence, so I avoid shuffling program disks in and out of the top drive by holding both Writer (plus its entourage of command files and headers) and Filer on a single program disk, generously protected and backed up. This has been achieved by scouring away all surplus programs. Correspondence that plucks names, addresses, producers, prices and other comments off the database is initiated by a completely different command file, M.SUB. Editing facilities on function keys have been replaced with sequences that pick their way through Filer's menu choices. It is loaded by M letter-format ID of correspondent. The ID is Filer's recommended four-digit member identity tag.

Letter formats are of two types: form letters, whose text will be written using

This is for A4 letters that do not use the database.
LE55W.M for A5 letters is similar.

- MESSAGE: INSERT INTERNET WASTE A4 LETTERHEAD - Top of paper to top of rollers
- PAGESETTING()
- STYLE(paperwidth 8 inches)
- STYLE(paperlength 11 inches)
- STYLE(topmargin 0 lines) COMMENT=So second sheet is full to top(1)
- STYLE(headerspacing 0 lines)
- STYLE(bottommargin 3 lines)
- STYLE(leftmargin 5 chars)
- BLANKSPACE(5 lines) COMMENT=Space for letterhead
- BEGIN(VERBATIM) COMMENT=Address starts next line

- COMMENT=To address envelope, now press RED KEY f1 + SH + CTRL
- COMMENT=Next line: write the date

Dear

Yours sincerely

J A Vogler

BEGIN(ADDRESS)

MESSAGE={insert A4 envelope - Top of envelope to top of rollers}

FIRST CLASS @ COMMENT=Delete for second class or airmail

@ BLANKSPACE(3 lines)

@ BEGIN(ADDRESS)

@ COMMENT=Address starts next line

@ END(ADDRESS)

NEWPAGE

NOTE: There should be no space after the @ sign: the space has been inserted to disable the command while printing this Figure.

Fig 3 Perfect Writer letter header L4E4W.M

Writer but whose variables and printing are controlled by Filer, are distinguished by a final F in the file name and take Filer's special, formatting commands; and individual letters, for which standard headers are fed into Filer to gather date, name, address and salutations, then printed to file. The file B:LMSS is automatically erased as the first task when M.SUB is run, then recreated for the new batch of letters and loaded automatically into Writer for insertion of text and any editing of the information that came from the database.

Solitary envelopes for bills or parcel labels are addressed using E.SUB. This takes, on average, 43 seconds to address an envelope from a cold start; a second envelope takes only 10 seconds more. For a single envelope the computer is thus much slower than addressing by hand, the only way to improve this would be to buy a Winchester disk drive. Finally, such a plethora of command files and headers needs its own index, both on paper and on yet another quick-to-load command file, O.SUB.

Perfect Calc

I loaded Perfect Calc with S.SUB, which

switches on the printer and defines the function keys with a number of commonly used processes. The normal and CONTROLled keys are already defined by Torch. Once again, each user will find certain functions are either inconvenient or commonly used and define his own. To demonstrate the scope, my SHIFTed keys are: f0 starts the first task after loading; to alter the width of the current column; ready for the new number. f1 moves to the top of the sheet and f2 to the bottom. f3 splits the screen, horizontally, at the centre line; saves failed commands due to an unsuitably placed cursor. f4 prepares for creation of a sum formula. f6 converts all numerical entries to integers. f8 puts the current cell into edit mode, with the cursor positioned at the right-hand end of the text. Arrow keys all jump the cursor five lines or columns. The COPY key switches from one window to another. Users of the Torch business machine may have already discovered that despite the handbook's statement to the contrary, the left-hand keypad and EXACT SPACE key have already been configured for Perfect Calc.

The PCCONFIG.COM program that redefines all Perfect Calc keys is provided, so it is unnecessary to use SHIFTed and CONTROLled function keys. However, to change them sacrifices the enormous benefit of Calc and Writer using identical codes: for example, to save the current file, CONTROL-X CONTROL-S or F5 on both. This elegant simplicity evaporates if Calc keys change when Writer's cannot.
It is an interesting paradox in business, that those who achieve the greatest success, appear to do so with the least amount of work.

This illusion of relaxed inactivity is considerably heightened by the Wang PC.

Like its human counterpart, the Wang works faster than its rivals. Put another way, that’s twice as fast as an IBM PC.

It also plays its part in making the work appear easy.

There’s no referring back to manuals, all instructions appear on the screen. And should there be a moment’s uncertainty,
Invariably, the man with most on his mind has least on his desk.

our unruffled executive merely touches
the key marked 'help'.

It's no accident either that the Wang PC
looks neater than others. Not only is it
physically smaller, but as you can see, the
screen uses no desk space at all.

But then a busy man ought to have

somewhere to put his feet up.

For further information on the Wang PC
phone Teledata on 01-200 0200.

WANG

The office automation computer people.
If you think that every important aspect of programming arises somewhere in the context of sorting and searching, then you're in full agreement with master programmer Donald Knuth. Mike Liardet looks at Sorting and Searching, the third volume of his book, The Art of Computing Programming.
original order would be quite useless!
In some actual applications the keys may be an integral part of the record or they may be textual, and so on. Once you understand the algorithms it is relatively easy to tailor them to fit the specific sorting problem.

The program is structured as shown in Fig 2.

Line 10000 — Initialisation and menu control Line 20000 — Insertion sorting routine Line 21000 — Shell’s sorting routine Line 22000 — Quicksort routine Line 23000 — Distribution counting routine Line 30000 — Routine to initialise data to be sorted Line 31000 — Routine to print and check sorted data

Fig 2 Sorting program structure

The simplest sorting algorithm is called ‘insertion sorting’. Imagine a situation where the list of keys is partitioned in two, with a sequence of keys in order up to a given point, and thereafter out of order. For example:

By scanning the values to the left of the marked key, we can gradually move these values one place right until we arrive at the right place to insert the marked key. This increases the size of the sorted partition by one. The above example would become:

By repeatedly applying this method, the sorted partition grows until all the keys are sorted. To get it started, only the first key is deemed to be sorted since any single value must be ‘sorted’, no matter what it is. Initially all keys, bar the first, are in the unsorted partition. In the Basic routine (Fig 1, line 20000) the variable J marks the boundary between the two partitions, and K is used to hold

In effect the 4-sort does an insertion sort on four independent sequences of keys, where in each sequence the keys are four apart. The first of these sequences (marked with asterisks) comprises the keys 5, 3 and 8. The second comprises the keys 7 and 1, and so on. Note that all four of these sequences are correctly sorted following the 4-sort. The 2-sort does the same thing for just two sequences, with keys two apart. Finally, the 1-sort sorts a single sequence of adjacent keys and gets everything in the right order. In fact, the 1-sort is identical to the insertion sort.

Any sequence ending with 1 will work. (Insertion sorting is a special case of the method with a single increment of 1 being used.) In fact powers of 2 provide a fairly poor performance, and after extensive analysis Knuth suggests some better alternatives. One of these is the sequence used in the routine here (Fig 1, line 21000). The increments are produced from the expression \((3^K - 1)/2\), with values of \(K\) decreasing from some initial value down to 0. (The code given does calculate these values but without recourse to exponentiation, and the increments are held in the array \(H()\).) The initial value used is the largest possible, not exceeding one third of the number of items to be sorted. For example, to sort 1000 keys the increments would be 121, 40, 13, 4 and 1.

Quicksort

The Quicksort method was devised by C A R Hoare in 1962. This is one of the more complex methods to code (Fig 1, line 22000) particularly if the implementation language is not recursive — as is the case with Basic. In its basic form, a list of keys is sorted by choosing the first key as a ‘pivot’ and then dividing the remaining keys into two partitions: keys to the left being less than, or equal to, the pivot; and to the right being greater than, or equal to, the pivot. To obtain these two partitions we scan right from the first key after the pivot until we find a ‘rogue’ key (greater than the pivot) and scan left from the end until we find another rogue key (less than the pivot). These keys can then be swapped, and this continues until the right scan crosses the left; this is the correct position for the pivot element. For example, quicksorting the following numbers:

```
579431268
312457968
213456879
```

1-sort:
```
123456789
```

4-sort:
```
312457968
```

2-sort:
```
213456879
```
Place pivot (exchange 5 and 3)...
3 2 1 4 5 9 7 6 8
At this point the 5 is correctly placed; all the values to the left of it are less than it, and all those to the right are greater.
Sorting these two partitions can be seen as two separate independent problems, so we can continue by quicksorting 3, 2, 1 and 4, and then quicksorting 9, 7, 6 and 8, and so on.
There are various refinements to this method. As insertion sorting is generally regarded as the most efficient method for small lists, we can invoke insertion sorting instead of quicksorting when the lists get below a particular size (the value M in Fig 1 at line 22000). There's nothing to lose by abandoning the sorting when a list gets below size M, and then calling insertion sorting just once for the whole list, right at the end. Note that if M is 1, then pure quicksorting is used.
A major problem with quicksorting is that it's at its worst when the list is already sorted. Unlike most methods, it's at its best when the keys are scrambled. This seems very unsatisfactory, and can be corrected to some degree by arranging for a more careful choice of pivot. The method recommended by Knuth is to first interchange the second and middle keys in the list, then sort just the first, second and last keys, pivoting on the middle one. For the aforementioned sequence:
5 7 9 4 3 1 2 6 8
Swap second and middle...
5 3 9 4 7 1 2 6 8
Sort first, second and last only...
3 5 9 4 7 1 2 6 8
Now partition the third to last keys using 5 the pivot...
3 5 2 4 1 7 9 6 8
Insert pivot in the right position...
3 5 2 4 1 7 9 6 8
This procedure makes little difference to randomly ordered keys, and considerably improves the situation if the keys are already ordered.
Both these enhancements are incorporated in the routine at line 22000. The routine prompts for a suitable value of M before starting: Knuth recommends 9 as optimum, although the best value depends on the characteristics of the programming language you are using. Lines 22031 to 22039 make a careful selection of the pivot. Simple pivot selection is obtained by deleting the REM at line 22030.
In circumstances where the keys are numeric and have a restricted range of values, a very efficient sorting procedure can be applied by noting the frequency of occurrence of each key. This is the strategy adopted by 'distribution counting' sorting. The first phase of the algorithm obtains the number of occurrences for each key. In Fig 1 at 23000, if the lowest key value is U and the highest is V, then COUNT (O)
holds the number of occurrences of U, and COUNT (V-U) holds the number of occurrences of V. For example, the counts for the 2 3 1 1 2 3 2 2 would be:
1-count: 1
2-count: 3
3-count: 2
Once sorted, we will see 3 '1's followed by 4 '2's, followed by 2 '3's. If each of the counts is now accumulated, for example, the 2-count becomes 3+4 and the 3-count becomes 3+4+2, then the last position for each of the corresponding keys:
1-count: 3
2-count: 7
3-count: 9
So the '1's will appear in position 1 to 3, the '2's in 4 to 7, and the '3's in 8 to 9. Now, scanning the numbers from right to left, we search for a key which is too far to the left:
*
2 3 1 1 2 3 2 2
The totals in the counts make this test relatively easy, and the found key can be inserted at the position indicated by its count (position 9):
2 3 1 1 2 3 2 2
By adjusting the counts and repeating this process, it is then possible to get all the keys into the correct order. Fig 1 (at line 23000) contains extra sophistications which further minimise the amount of scanning and moving needed to sort the keys.
In order to assess how effective these different algorithms are, Fig 3 outlines the results of running each of them under various conditions. The times are in minutes and seconds (obtained in interpreted Microsoft Basic on an ACT Apricot - some appreciation of the performances can be gained by noting that it takes all of 12 seconds just to initialise the data for 500 keys). £ signs indicate times definitely in excess of 10 minutes and estimated to be about one hour, demonstrating the appalling behaviour of standard Quicksort if the keys are ordered. The following conclusions can be drawn.
Insertion sorting is good for short-lists but hopeless for long ones, unless the list is already, or very nearly, in order. (All methods appear equal for short lists in Fig 3, but this is due to inadequacies in my reflexes.) This is the only method considered here that maintains equal keys in their original order — this can be important for some applications.
Shell sorting performed well on all tests, with consistent response times no matter what the state of the input. Quicksorting is excellent for random lists, but no use for ordered lists. Pure Quicksorting (when M=1) is slightly slower than Quicksort combined with insertion sorting. More careful selection of a pivot value mitigates the ordered list problem.
Distribution counting was best all round, but is not universally applicable. If asked to nominate a good, general-purpose, workhorse sort routine I would choose Shell sorting. In fact it would not be difficult to write a super-sort procedure which, from a preliminary scan of the data, could choose the most appropriate routine. Knuth covers another 20 or so possible algorithms.

Searching

Of the two topics, Knuth gives far more prominence and material to sorting. Searching is concerned with retrieving data that has been stored with a given identification. The identification is the 'key', and the data is the associated 'record'.

Sequential searching is the most obvious technique for searching a list: start at the front, and keep going until either you find the key you want or reach the end. On average half the keys are scanned for a successful search, and all of them are scanned for an unsuccessful one.

A more efficient technique, which is almost as simple to implement, is called binary search (Fig 4); this only works if the list is in order. Given an ordered list of keys, examine the middle one, which will either be greater, less, or equal to the key we are seeking.
If it's equal then we have successfully found the key. If it's less than the given key, then we can continue searching for the key in the right half of the list, otherwise continue on the left. The search terminates unsuccessfully...
As it's a more efficient technique, binary search can be blindingly fast even for very long lists. A maximum of 20 comparisons would be made to search a million keys — quite an improvement on straight sequential search. Marginal improvements have been suggested — not examining the middle element every time, but making a more careful choice determined by the key we are seeking. In practice, the increase in complexity offsets any other gains.

**Binary trees**

Frequently, following an unsuccessful search, we may wish to insert the unknown key. If we are using binary search, then this can be computationally expensive for long lists of keys. Instead of storing the keys sequentially, a 'binary tree' structure can be used, then binary search and easy insertion can coexist (Fig 5). The price for this is that the tree requires slightly more storage and is more complex to scan. A binary tree is built up of 'nodes'. Each node contains the text of one key, and pointers to the before and after nodes. (In real applications there may be other information as well.) These pointers reference the other nodes from which all the words before or after the current node can be accessed. If there are no other nodes, the pointers are simply 'null'.

A binary tree is searched, starting at the root node. If this node contains the key we are seeking, then we have found the place we want. Otherwise we have the key must be before or after the current node, and we move to the next node accordingly and repeat the process. If there is no next node then the key is not in the tree, and we can insert it at this point if necessary.

This method works best with storage management routines to allocate and de-allocate storage as nodes (that is, keys) are added and deleted. In the routine given here only minimal storage management is attempted to keep things simple.

In some cases a binary tree can become unbalanced. The worst case occurs if the keys are inserted in order, when the algorithm just performs an unnecessarily complex sequential search. If the keys are presented in a suitably random order, then all the branches will be at roughly the same depth. Knuth also presents techniques for keeping trees well balanced.

Throughout this analysis we have assumed that it is readily possible to identify two keys as being equal. But when working on an interactive system, it can sometimes be a problem to recall the precise spelling of a word, such as a surname. Knuth presents a technique, called soundexing, which can convert similar sounding words into the same key (Fig 6). The technique was developed by Margaret Odell in 1918, predating computers by a good many years. Essentially the method converts any word into a key, consisting of a letter followed by three digits. Similar sounding letters are assigned the same digit; vowels and a few other letters are ignored altogether, as are repeated letters.

**Conclusion**

This concludes my presentation of Knuth's three volumes on *The Art of Computer Programming*. It should be remembered that these volumes run to over two thousand pages in total, so I have had to be highly selective as to which material I have featured.

Unfortunately many interesting and pertinent algorithms have fallen by the wayside, and if my writings have whetted your appetite for more information then you will have to buy the volumes to find out more.

**References**

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*Volume 2 Seminumerical Algorithms*  
*Volume 3 Sorting and Searching*
Functions in C are comparable with the procedures of Pascal, or with the built-in functions of Basic like mids$, sin, and inkey$, except that you can write your own of any complexity to add to those provided. The most used functions, for example for file and display access, are supplied in a library with the compiler.

A simple function called 'spaces' to blank part of a line on a display is illustrated in Fig 1. Once this has been defined, it can be used anywhere in a program simply by calling it by name with the number of spaces required: for example, spaces(10).

Only one value is passed to this function, but others might accept none or a list of arguments. One function can call others which can call others, and so on; the example calls a standard library function, putchar, to display each space. A function can also return a value which can then be assigned to a variable or used in any other way. The standard library function, getchar, returns a character entered at the keyboard: for example, c=getchar().

Of course, a returned value can be ignored if it suits your purpose, and you might use the statement getchar(); so that the user presses a key before a program continues.

Advising on how large functions should be might seem like discussing the length of pieces of string, since clearly they can be as short, or long, as the job requires. But a rule which works well in practice is that functions should be less than 60 lines. This arbitrary limit means that each function will fit a sheet of print-out and read as a whole. In fact, many functions will be short enough to fit on a display screen. If you produce a program with a massive main function, then you should probably reconsider how it is structured. It's perfectly reasonable to have a main function of only a few lines which just controls the principle parts of a program.

**Basic pattern**

The basic pattern for a function is:

```
type function-name (list-of-argument-names)
  argument-declarations
  local-data-declarations
  statements
  return value
```

The only restriction is that one function cannot be defined inside another, so local procedures cannot be used. The only essentials are the name, the following brackets and the braces, giving something which would do nothing. For example:

```
myfun()
{
}
```

A rather artificial function with all the components is shown in Fig 2.

The type of a function is the type of the value returned and can be left out if it does not return anything. The type can be int, long, double, and so on, although int can be omitted as it's the default.

The name of the function is followed by a list of names which will be used internally to refer to the arguments passed to it. The types of these arguments are declared followed by the body of the function, which is enclosed in braces. Local data is declared before any statements and, unless this is specified as static, it disappears on finally leaving the function. After executing the statements, a function is exited either by reaching the final brace, or by a return statement which can be followed by a value to send back.

**Data**

A function is called by name with a list of values to be passed in brackets; these can be variables or constants. For example:

```
square (2);
sqrt (3.6);
```

A function can read, for example, a character (c=getchar()); and write things like:

```
puts ("Your message could go here");
```

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```

As well as its type, every variable has an associated storage class which determines how it will be kept in memory. Local data is available within the function in which it is defined and

---

**Fig 1 Function to display spaces**

```
spaces(number)
int number:
{
  while(number-- %0)
    putchar(' ');
}
```

**Fig 2 Specimen function**

```
square(x)
{
double result;
result=x*x;
return result;
}
```

**Fig 3 Returning values**

```
range(x)
unsigned x:
{
  int rval=2; /* for values>32768 */
  if(x<256) rval=0;
  else if(x<32768) rval=1;
  return rval;
}
```
nowhere else — not even in other functions called from it. The default for local data is auto, which means that the memory is released and the value lost when the function is finally left. When you need to retain a value for the next time a function is called, this can be done by using the specifier static. You might also use this to retain a count of how many times a function has been called.

Another alternative is to specify a local variable as a register to indicate that it will be very frequently used, perhaps as a loop counter. Many micro versions of C ignore this hint to store it in one of the registers because of the limited number available.

A single value can be sent back to the calling function by a return statement. This can use a variable or constant, or can involve an expression which is first evaluated. For example:

```c
return 0;
return x;
return (x>y)? x:0 ;
```

Return statements can occur anywhere in the body of a function. Since they disrupt the logical structure, it's best to use a local variable called, say, rval, which is sent back by a single statement as in Fig 3.

A function call 'leaves behind' its returned value, just as an expression does when evaluated. This means that a function call can be used anywhere a value is acceptable: in an assignment, as part of a complex expression or comparison, or as an argument for another function call. Consequently, it is inevitable that only one value can be returned. You could use:

```c
x=sqrt(3.6);
x=sqrt(sin(3.6));
if(getchar()==a')
x=rand();
```

If a function returns a type other than int, then this must be specifically declared before it is used. This is done in a similar way to a data declaration, except that the function name is given with empty brackets. The declaration must correspond to the type specified in the function definition. It is usually convenient to declare all the functions which return non-integers at the start of a source file, so that they are known throughout. For example, the standard maths functions return a double, so must be declared before use:

```c
double sqrt(); /*square root function*/
double y,x=0.7;
y=sqrt(x);
```

Since the type char is converted to int in expressions and all floating point operations are in double precision, the types used for function declarations need only be int, long, double, or a pointer. The default is int so does not have to be declared and often isn't, although it's good practice to do so.

There must be the expected number of arguments passed to a function and these must be of the expected type and in the correct order, for library functions the requirements will be described in the reference manual. Sometimes we want to use an 'incorrect' type and so must massage the value of our data into the required type using a cast, which is simply a type name in brackets:

```c
int x=8;
double sqrt(int y);
y=sqrt((double)x); /*force value of x to double*/
```

If a function requires a long argument and you want to use a constant, use the L suffix as in:

```c
lseek(myfile,256L,0);
```

The function lseek is in most libraries and adjusts the position in a file, where the next data will be accessed to give random access. The second argument needs to be a long because it determines the position, and files can be bigger than allowed by an unsigned value.

The C compiler will give no protection against errors involving data types. The program will usually carry on regardless, so if a function expects a double then it assumes one has been provided and will grab what it can from the expected place in memory. If you used sqrt(x), in the example above, then the answer would be meaningless.

### The stack

It is useful to have some insight into the mechanics of calling a function, especially how the stack is used. This is simply an expandable area of memory, where values can be added to the top and taken off as required; the size goes up and down as the stack is used. A good analogy is a pile of paper on a spike. When a function is called, the normal process is for the arguments to be placed on the stack, right-most first. Then information on how to return, and finally, any space required for local auto variables is allocated. All of this section of the stack is moved on, leaving the function to restore the initial condition. Special arrangements are sometimes made for floating point arguments.

```c
PCW 167
```
Static variables are not held on the stack but in an area of the memory reserved for permanent data. The compiler ensures that these variables are only accessible from within their functions and that there is no conflict over names.

When values are returned, they are placed in a consistent way according to their type: for example, in one or more registers. The returned type must be declared so that the value can be correctly accessed.

Any function can call itself without conflict of argument or local variables. All that happens is that a new section of the stack is allocated for each call. If this continues, then eventually there will be no memory available and the program must abort. Recursion can lead to very succinct programs, especially when using data structures like linked lists.

There is a standard library function, (printf), to display all kinds of formatted output, but as an example we can write a recursive function to display a decimal number. This can’t be done directly, since the first character to display is the last available as we repeatedly divide by 10:

```c
numsho (num)  
unsigned num;  
{  
    unsigned quot,rem;  
    quotum/10;  
    rem=num%10;  
    if(quot==0) numsho (quot);  
    /*recursion until no remainder*/  
    putchar (rem + '0');  
}  
```

The function putchar accepts an argument which is the ASCII value of a character to be displayed. So to use it to display a digit, we need to add the value of rem to ‘0’.

**Changing variables**

Any function can make changes to global data items since these are accessible by name. Some global data, needed by many functions, will be used in most programs and this is preferable to long lists of arguments. However, in general, values should be passed between functions using arguments and a returned value, and local variables used. In most versions of Basic, all variables are global; a common problem is that a change to a variable in one part of a program has unexpected side effects on another.

A function cannot directly change local variables in another function, including the one which called it, nor can it return several values. However, we often want to do just that. For example, you might want a function to exchange the values in two integers but cannot use exchange (x,y) /*this does nothing*/

```c
int x,y;
```
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TEACH YOURSELF C

```c
nib=15;
putchar((nib >= 10) ? nib-10+'A': nib+'0');

/* Sample output */
0000 0D 0A 2F */ 2A */ 0D 0A 5E P 52 R
0008 4F 47 52 41 A 4D M 20 74 t 6F o
0010 6D m 78 x 20 20 20 20
0018 6F o 66 f 20 69 i 65 e
0020 69 i 6C 1 65 e 20
0028 68 h 65 e 78 x 20 20 20 20

Library functions used
fopen open a file for reading or writing
getc get next character from a file
putchar display a character
puts display a string
exit exit program

/* open file for reading */
```

```c
int temp;
temp=x;
x=y;
y=temp;
```

This will have no effect on the original variables because only their values are passed as arguments. What is needed is to pass values which enable the required variables to be accessed, specifically their addresses in memory. This leads us into the use of pointers which will be considered next month.

**Main function**

Every program must have a function called main where execution begins. This can have arguments which are provided, not by another function, but by the call to the program. For example, if a program is invoked by entering `myprog arg1 arg2`, then the two arguments, and in Unix the program name, are available to main. By convention the arguments are declared as follows:

```c
main (argc, argv)
```

```c
int argc; /*the number of arguments*/
char *argv[]; /*array of pointers to strings*/
```

You will be able to access the command line arguments after getting to grips with pointers. Since they are local to main, they have to be made available to other functions by passing their values or copying to global variables.

As well as learning C by writing simple programs and trying them out, it is also useful to see examples from other programmers. The program in Fig 4 illustrates some of the features of C which have been described and it might even be useful. The file name is passed to the program as an argument and is available as argv[1].

This is part three of a five-part Teach Yourself C series. Back issues can be obtained from our office at 53 Frith Street, London W1A 2HG, tel: (01) 439 4242.

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DISCOUNT VOUCHER
Trundle along

There must be tens of thousands of ZX81's gathering dust on shelves, as their owners have graduated to bigger machines. Robin Moorshead and Eddie Forrester give new life to the ZX81 — reborn as Trundle.

We set out to make a simple 'robot' that would solve a problem; to find its way through a twisted passage-way with blind alleys, reach an end goal, and know it was there. The programming is not too difficult, it can all be done in Basic (2k of RAM has been fitted to allow even poorly structured programs to fit in). Undoubtedly you could write a machine code program in the ZX81's original 500 bytes, but it wasn't built for experts, it was built for beginners. To see the 'robot' in action tune into 4 Computer Buffs on Channel 4. (See 'Light Fantastic' page 184 for further details.)

The Trundle package consists of an interface and memory expansion board for the ZX81 and the extra pieces necessary to make a ZX81 based 'Trundle' robot. The system is supplied in kit form with a comprehensive set of instructions.

The package itself breaks down into four main sections: the interface, the memory expansion, the sensor board, the motor/chassis unit.

The interface

This provides eight input lines and eight output lines, the latter being buffered by relays to enable the direct control of small motors, buzzers and so on (Fig 1).

Data is latched onto the output lines by the command: POKE 9000, data.

The data is presented on the output lines in its binary form for example: If data = 1 then only the relay for bit 1 is energised. If data = 5 then the relays for bits 1 and 4 are energised.

The interface is memory mapped and may be addressed between 8-16k or 40-48k although address 9000 is usually used for convenience. This area was chosen since it is unused by the ZX81 operating system. The area is not however clear, containing a ROM shadow. If this shadow were to be left, the operation of the interface would be corrupted. For this reason, ROMCS is connected to A13 through a diode D9 so that it is pulled high, if any address containing A13 appears on the address bus (as at any address in the 8-16k ROM shadow). This disables the ROM when necessary without affecting the normal operation of the ZX81.

The output of IC3a will only go high if the computer is writing to memory (MREQ and WR low) in ROM or ROM shadow areas (A14 low). This signal is then 'ANDed' with A13 to ensure that the computer is not trying to communicate with ROM and this output (from IC4b) used to take the 'E' pin of IC6 high. This prepares IC6, an octal latch, for data transfer. When MREQ goes high again, the 'E' pin is taken low, the new data being latched onto the output lines on the falling edge. These lines are then used to drive the relays through TR's 1 to 7. The diodes across the relay coils protect the transistors from the back EMF spikes that occur when the relays are de-energised.

The select circuitry for the input port is essentially the same as for the output port differing only in that it provides an active LOW output when the computer wants to READ data. This output is used to enable IC5 (an octal buffer) which effectively connects the input lines directly to the ZX81's data bus.

IC's 7 and 8 are Schmitt inverters and serve to square up the input signal.

Memory expansion

Although the standard 1k ZX81 does not provide enough memory for any but the simplest of interfacing programs, the extra cost and power consumption of a 16k RAM pack are not worth while. Instead, this package contains a CMOS memory board which provides extra memory whilst actually lowering the power consumption of the ZX81. The memory board also serves to connect the ZX81 to the interface board.

IC2 is a 6116, 2k x 8 CMOS RAM. It is selected when both A14 and MREQ are low simultaneously. This decoding is essentially the same as that performed in the ZX81's ULA which normally selects the RAM when required. However, the RAMCS line cannot be used as it must be pulled high permanently to disable the internal RAM.

The design of the sensor board is simplicity itself, Fig 4. When Infra-red from one of the TIL38 IR transmitting diodes is reflected into one of the photo-transistors, its collector/emitter resistance falls dramatically, pulling the appropriate input line to 0V. When no IR is detected the resistance of the collector/emitter junction becomes extremely large and the input of the port is effectively left floating high. As the signals are inverted by the Schmitt triggers in the interface, a high will appear on the appropriate data line when IR is detected and a low when none is perceived.

The photo-transistors are arranged so that they may provide an indication of Trundle's orientation in a passage-way, where there are walls. Fig 6.

The chassis and motors are also supplied in kit form but the instructions make assembly an easy task. The motors are switched by the relays in the interface. See Fig. 7.

Construction

Provided you take care and obey a few simple rules, your circuits will work first time. Too much haste or carelessness inevitably leads to disappointment.

1. It is critical which way round most components are connected. With semiconductors, if you switch them on connected the wrong way round, you will not get a second chance; they are destroyed in a few millionths of a second. The legend on the printed circuit board will tell you the way the components should be connected.
The microchips have a ‘U’ shaped slot in the plastic package. This aligns with the ‘V’ shaped slot in the socket. The transistors have a tag on the case. The diodes D1 to D4, and D9, have a thick band at one end. The diodes D10 to D12 have the anode lead longer, and D13 to D17 have the anode (collector) lead shorter. The capacitor has a + sign by one lead.

2. Use a miniature soldering iron. When it has heated up, wipe the hot tip on a piece of wet sponge to clean it. Do this regularly to remove excess solder and flux. Hold the soldering iron so that it touches both the copper track and the component lead and after a few seconds apply solder to produce a ‘volcano’ shaped joint.

Sensor Board

Solder the 10Ω resistor in position (Fig 5). The infra-red detector transistors can be identified as they are transparent and smaller than the emitters.

Insert the transistor into its holes, making sure the emitter and collector are the right way round. Hold the transistor so that it stands 9mm proud of the board and solder it in place (Fig 8). Repeat the process for the other four transistors. Do not clip off these leads.

Now solder in the emitter diodes, noting that the longer lead goes to the 'A' sign. Position them so they are level
with the transistors, (Fig 9). Again, do not clip off the leads.
Cut a 22cm length of ribbon cable and strip off the white, grey and violet leads, leaving a 7-way cable. With a sharp knife, separate the leads from one another for a length of about 1cm at both ends. Remove the insulation from each wire for a length of about 2mm. Make sure the wire strands are tightly bunched together and solder one end to the 'minicon' terminals. You can then push the terminals into the 10-way housing (Fig 10). Do take great care when doing this work as odd straggling wires will cause shorts.

Take the 10µF tantalum capacitor and note that the longer lead is marked +. Offer the capacitor into position C4 with the + mark on the capacitor adjacent to the + mark on the board, and solder into place. Trim off surplus leads. The two 0.1µF capacitors, C2 and C3, can be put in either way round. Solder into place and trim off the surplus leads.

Take 13 of the Vero-pins and push them firmly through the holes P1 to P4, P9 to P12, P17 to P20, and P25 from the copper track side of the board until the collar touches the track. Solder them firmly through the holes P1 to P4, and solder into place. Trim off surplus leads. The two 0.1/AF capacitors, C2 and C3, can be put in either way round. Clip off the leads. The two 0.1/AF capacitors, C2 and C3, can be put in either way round. Clip off the legs. The two 0.1/AF capacitors, C2 and C3, can be put in either way round. Clip off the leads.

Solder in the multi-way edge connectors. Solder in the 0.1µF capacitor C1; this which will form the chassis (Fig 12). You should take particular care when drilling the holes for mounting the motors and sensor board as misalignment here could cause the device to perform poorly.

Assemble the motors and gearboxes following the instructions enclosed in the motor kit. Use four of the black gears and four space washers. You will find the motor will enter its housing more easily if the plastic label is peeled off first. Be careful not to apply excessive pressure when assembling as this may crack the casing. Ensure that the gears all move freely and oil all the moving parts.

Place the main output shaft of the motor onto a vice or similarly hard object (Fig 13). Place the wheel in position and tap into place. Do not use excessive force or this may bend the output shaft or break the plastic casing.

Bolt the motors into place with 6BA nuts and bolts, making sure there is a washer on top of the plastic mounting flange. This will avoid the flange cracking when the bolts are tightened up. Do not use excessive pressure when tightening up as this could break the plastic casing.

Fix the 4BA bolts into place. These act as skids, stopping the chassis rocking backwards and forwards. Bolt the battery box to the chassis using four 6BA nuts, countersunk 1in screws, spacers and washers. The spacers fit between the battery box and chassis to allow cable access and room for the skid nut. Take the free end of the cable from the interface board and peel the green and black wires away from the other wires for a distance of 6cm. Peel the red and brown pair from the orange and yellow pair for a distance of 4cm. Separate the yellow from the orange and the red from the brown for a distance of 2cm. Solder the yellow wire to the negative (spring end) of the battery box and the black wire to the other end (positive). Solder a 0.4µF capacitor across the terminals of each motor; it doesn't matter which way round they are fitted. Solder the yellow wire to the positive of the right hand motor; orange to the motor's negative tag; the brown wire to positive of the left hand motor and the red to the negative tag of same. (The positive is identified by a small + sign cast into the plastic.) Mount a U2 or HP2 battery in the battery holder with the positive pointing towards the left motor.

Attach the two brackets to the holes in the front with 6BA nuts and bolts. Bolt the sensor board onto the brackets with the track side up, with the cable leaving from the front of the board, and the bracket underneath the board (that is not on the track side Fig 15). Make sure the sensor board is level with the base of the box.

With the set of screws provided, screw the box together. The motor/chassis unit is now complete. Do not try pushing the unit forwards without power running through the motors or you may strip the teeth from the gears in the gearboxes.

The board is now finished. Check it carefully for solder joining tracks together. Also check that the components are inserted the right way round. The diodes and transistors have been left with long leads for final adjustments.

Chassis and Motors

Drill and cut the two parts of the box which will form the chassis (Fig 12). You should take particular care when drilling the holes for mounting the motors and sensor board as misalignment here could cause the device to perform poorly.

Assemble the motors and gearboxes following the instructions enclosed in the motor kit. Use four of the black gears and four space washers. You will find the motor will enter its housing more easily if the plastic label is peeled off first. Be careful not to apply excessive pressure when assembling as this may crack the casing. Ensure that the gears all move freely and oil all the moving parts.

Place the main output shaft of the motor onto a vice or similarly hard object (Fig 13). Place the wheel in position and tap into place. Do not use excessive force or this may bend the output shaft or break the plastic casing.

Bolt the motors into place with 6BA nuts and bolts, making sure there is a washer on top of the plastic mounting flange. This will avoid the flange cracking when the bolts are tightened up. Do not use excessive pressure when tightening up as this could break the plastic casing.

Fix the 4BA bolts into place. These act as skids, stopping the chassis rocking backwards and forwards. Bolt the battery box to the chassis using four 6BA nuts, countersunk 1in screws, spacers and washers. The spacers fit between the battery box and chassis to allow cable access and room for the skid nut. Take the free end of the cable from the interface board and peel the green and black wires away from the other wires for a distance of 6cm. Peel the red and brown pair from the orange and yellow pair for a distance of 4cm. Separate the yellow from the orange and the red from the brown for a distance of 2cm. Solder the yellow wire to the negative (spring end) of the battery box and the black wire to the other end (positive). Solder a 0.4µF capacitor across the terminals of each motor; it doesn't matter which way round they are fitted. Solder the yellow wire to the positive of the right hand motor; orange to the motor's negative tag; the brown wire to positive of the left hand motor and the red to the negative tag of same. (The positive is identified by a small + sign cast into the plastic.) Mount a U2 or HP2 battery in the battery holder with the positive pointing towards the left motor.

Attach the two brackets to the holes in the front with 6BA nuts and bolts. Bolt the sensor board onto the brackets with the track side up, with the cable leaving from the front of the board, and the bracket underneath the board (that is not on the track side Fig 15). Make sure the sensor board is level with the base of the box.

With the set of screws provided, screw the box together. The motor/chassis unit is now complete. Do not try pushing the unit forwards without power running through the motors or you may strip the teeth from the gears in the gearboxes.

The board is now finished. Check it carefully for solder joining tracks together. Also check that the components are inserted the right way round. The diodes and transistors have been left with long leads for final adjustments.

Memory Board

Solder in the six link wires and clip off the surplus leads. Solder in the IC sockets as before, ensuring they are pressed firmly home and the notch faces the same way as on the legend. Solder in the multi-way edge connectors so that the bar on the legend lines up with the locating peg in the socket. Solder in the 0.1µF capacitor C1; this may fit in either way around. Clip off the surplus leads.

Push the 74LS00 into its socket. The 6116 memory chip is sensitive to static electricity so precautions should be taken when fitting it. Always leave it in its box until required. Touch an earth if possible; then touching the pins as little as possible, plug the IC into its socket.
Cut off all excess leads. Inspect the copper tracks carefully to make sure you have not joined any tracks together with solder; if you have, remove it with the soldering iron.

You can now test the board. Plug it into the back of the ZX81 pushing it home firmly. Switch the computer on; you should see a 'K' in the bottom left-hand corner of the TV screen. Now type in: `PRINT PEEK 16388 + 256*PEEK 16389 'new line'`.

You should see the number 18432 in the top left-hand side of the screen. You can use the ZX81 with this board only, plugged in like this as the available memory is now nearly doubled.

**Main Interface Board**

Note that there are no components for relays RLE-RLH, transistors TR5-TR8, resistors RS-R8 or diodes D5-D8. This is because the interface board has been designed to be able to cope with future developments.

First install the link wires. Cut each wire about 8mm longer than the distance between the holes (marked with a bar on the board). Bend the bare ends at right angles to the length of the wire; offer these ends through the holes and solder into place. Trim off any surplus wire above the solder.

Solder in the six sockets. Note that they have a 'V' shaped notch at one end. This is to help orientate the chips the right way around. Solder in the 10-way 'minicron' plug assembly with the long shafts pointing out from the board. Take one of the BC109 transistors and note the tag which identifies the emitter. Push the transistor TR1 into its holes and solder into place. Trim off the surplus leads. Repeat the process for TR2 to TR4.

Take one of the 1N4001 diodes and note the silver band which identifies the cathode. Repeat the process for the other 1N4001's. Now fit D9 with the thick band on the diode lining up with the thick band on the legend. Solder in place and trim off the surplus leads.

Solder the resistors into positions R1 to R4, and trim off the surplus leads. These may fit either way round, but it looks neater if they are all the same way. Carefully offer the relay into position RLA pushing it firmly home, and solder it into place. Repeat the process for RLB to RLD.

**Assembly and Testing**

Take a piece of wood 10mm thick (approximately) by 4cm by 10cm. Push the main interface board into the memory board and the memory board into the back of the computer. Support the interface board by putting four sticky pads along the long narrow edge of the piece of wood, two on the bottom and two on the top. Place them, either by loosening the bolts holding the brackets to the box or if necessary, by melting the soldering joints and moving the components.

If it still does not read 31 on white paper you can tell which sensors are not receiving (Fig 17). If for example it reads 27, bit 4 needs adjusting. Bend the transistor gently towards the transmitter, this will increase its sensitivity. If it reads 28, both bits 1 and 2 need adjusting, and so on. Now check it by putting the sensors over a strip of black PVC tape. It should read zero; if it does not, the sensors are too sensitive. Move the appropriate receiver away from its transmitter a little. Re-check it over white paper again.

To use Trundle, you will need a problem for it to solve. The passage it travels along should be made of black 3/16 inch PVC tape on a white surface. We used an 8 x 4ft sheet of melamine covered chip board, but white-coated or painted hardboard would do. If you could find a large sheet of paper, even that would do but make sure it lays absolutely flat. Mark out your passage carefully in pencil first so the inside edges are 16cm apart. When you stick down the tape, don't stretch it or it will creep out of place. You should include left and right turns and dead ends as well as the end goal. An approximate diagram of our original passage-way is shown in Fig 18.

In the test procedure 'POKE 9000,10' turned on the motors, both going forwards, and 'POKE 9000,0' turned them both off. The rest of the POKE commands are:

<table>
<thead>
<tr>
<th>Number Poked</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Stop</td>
</tr>
<tr>
<td>1</td>
<td>Reverse</td>
</tr>
<tr>
<td>2</td>
<td>Correct left drift</td>
</tr>
<tr>
<td>3</td>
<td>Correct right drift</td>
</tr>
<tr>
<td>4</td>
<td>Left turn</td>
</tr>
<tr>
<td>5</td>
<td>Right turn</td>
</tr>
<tr>
<td>6 &amp; 9 also</td>
<td>perform about turns</td>
</tr>
<tr>
<td>10</td>
<td>Forward</td>
</tr>
<tr>
<td>20</td>
<td>10 PRINT PEEK 9000</td>
</tr>
<tr>
<td>30</td>
<td>20 SCROLL</td>
</tr>
<tr>
<td>40</td>
<td>30 GOTO 10</td>
</tr>
<tr>
<td>50</td>
<td>'NEW LINE'</td>
</tr>
</tbody>
</table>

(Any other number poked to 9000 may activate the motors but not necessarily producing a useful movement.)

Place Trundle on a piece of white paper onto which two strips of black PVC tape have been placed 16cm apart. Type in:

```
10 PRINT PEEK 9000
20 SCROLL
30 GOTO 10
'NEW LINE'
```

With the outer sensors directly over the black lines, you should see a series of 4s moving up the left-hand side of the screen. If not, move it gently from side to side until you do see 4s. If you cannot achieve a 4, go back to the adjustment section and adjust the diodes for bits 1,
2, 8 and 16. The number 4 appears because only the middle sensor sees white.

If there was only a tape on the right (from Trundle’s point of view) Bits 4, 2 and 1 would be activated, so you should read 7. Likewise, if there was only tape on the left, you would read 28 (16 + 8 + 4). Move Trundle about gently and try these.

You will need to know what the readings are if it drifts off the straight path. Since these will vary from one Trandle to another, you will have to find these out for yourself. Place Trundle between the two lines so it is reading 4. Now gently push it to the left; the 4 will change (to either 5 or 12). Now push it further, recording all the new numbers until it reaches 31. Repeat the procedure for right drifting and record your results. Make all your readings into a chart, thus:

**Reading**  | **Meaning**  
--- | --- 
4 | Going straight between two lines 
31 | No lines (coming out of a ‘T’ junction) 
0 | Line under all sensors (at the end of a dead end) 
7 | Only line to the left 
6 | Line to the left and Trundle drifting to the left 
5 | Line to the left and Trundle drifting to the right and so on . . .

Trundle has achieved its goal if it reads 27, since this is the only time 4 would be de-activated while the others are active. With lists of all the possible PEEKS and POKES in front of you, you can now . . .
### Hardware Components

**Capacitors**
- C5,6: 470nF Minidisc (2 pcs.)

**Miscellaneous**
- Case AC64: 1
- Trundle Motor Assembly: 2
- Trundle Wheels: 2
- Trundle Bracket: 2
- Battery Box HP2 Single: 1
- 6BA Bolt × 1/2in: 1 Pkt
- 6BA C/S Screws 1in: 1 Pkt
- 6BA Spacer × 1/2in: 1 Pkt
- 6BA Nut: 2 Pkts
- 6BA Washer: 2 Pkts
- 6BA Bolt x 1/2in: 1 Pkt
- 6BA C’S Screws lin: 1 Pkt
- Spacer 1/2in: 1 Pkt
- 6BA x 6BA Nut: 2 Pkts
- 6BA Shankwasher: 1 Pkt
- Quickstick Pads: 1

**Optional**
- B1: D Cell Battery (1 pc.)

### Interface Board Components

**Resistors:** All 0.4W 1% Metal Film
- R1-4 inc.: 4k7 (4 pcs.)

**Capacitors**
- C2,3: 100nF Minidisc (2 pcs.)
- C4: 10µF 16V Tantalum (1 pc.)

**Semiconductors**
- IC3: 74LS27 (1 pc.)
- IC4: 74LS00 (1 pc.)
- IC6: 74LS373 (1 pc.)
- IC5: 74LS244 (1 pc.)
- IC7,8: 74LS14 (2 pcs.)
- D1-4 inc.: 1N4001 (4 pcs.)
- D9: IN4148 (1 pc.)
- TR1-4 inc.: BC109C (4 pcs.)

**Miscellaneous**
- Ultra-min Relay 6V DPDT: 1 Pkt
- RA Latch Minicon Plug 10-way: 1
- 14-pin DIL Skt: 4
- 20-pin DIL Skt: 2
- Veropin 2145: 1 Pkt
- Bell Wire Blue: 1 Mtre
- Trundle Interface PCB: 1

**Optional items**
- R5-8 inc.: 4K7 (4 pcs.)
- D5-8 inc.: 1N4001 (4 pcs.)
- TR5-8 inc.: BC109C (4 pcs.)
- RLE,F,G,H: Ultra-min Relay 6V DPDT (4 pcs.)

### Sensor Board Components

**Resistors:** All 0.4W 1% Metal Film
- R2: 10R (1 pc.)

**Miscellaneous**
- Infra-red Emitter TIL 38: 3
- Infra-red Sensor TIL 78: 5
- 10-way Ribbon Cable: 1 Mtre
- 10-way Minicon Housing: 1
- Minicon Terminal: 10
- Trundle Sensor PCB: 1
- Veropin 2145: 1 Pkt
write a program! I would suggest the first thing you do is write a short routine to make Trundle run along a straight, correcting for drifts.

No, I'm not going to write it for you; that's your problem! Now do the same for dealing with bends. It is useful to know here that as you approach a corner, you can maintain a straight line on one wall. Also, if you stop when all the sensors see the black line at the top of a bend, Trundle is exactly in line to turn into the next passage.

Consider all the situations Trundle can get into and write routines for them. One of the most challenging will be to correctly get out of a dead end. Unless you are careful, you will find that on coming out of the dead end, Trundle will go back to the beginning again. To avoid this, you will have to arrange a 'flag' in the program to indicate that a choice between two possible pathways was made and if you do hit a dead end, you take the alternative pathway on coming out of it.

Uses of Trundle
Firstly note that you can install another four relays if you wish. Space has been left on the board for this. You will of course also have to put in the extra transistors, diodes and resistors.

The input port will also accept a total of eight lines. The relays can be used to switch any piece of equipment up to a maximum of 24 volts at 1 amp. Note that they are not suitable for switching mains electricity. To attempt this would be very dangerous. The input port will respond to any system that can produce a suitable voltage transition (Fig 19a).

In the dark, this will produce a logical high on the computer port at any derived temperature (Fig 19b). When the switch is open, the port will read a high (Fig 19c). When closed, it will read a low or if it is more convenient, the circuit can be reversed to give the opposite logic (Fig 19d).

You could monitor the doors and windows of a house with reed switches held closed with magnets. If somebody enters the house, the computer could be preprogrammed to recognise where the intruder had entered. Then switch on an alarm or tape recorder with a warning message. If you were to set this up permanently, it would be advisable to cut ventilating holes in the ZX81 case and preferably increase the size of the heatsink since the computer does get very hot when it is left on for long periods.

Use one of the original Trundle motors to move a conveyor belt made from an old bicycle inner tube. Objects moving along the belt could be monitored by placing light sensitive sensors along the belt.

For example, count total bottles passing along the belt with one sensor. Check that each bottle is upright. If one is on its side, stop the belt and use another relay to switch on a relay to turn off the computer and possibly alert the police.
The Complete Manager comes in four flavours, ranging from a menu system used to drive packages, to a full applications development system based upon a powerful database manager. (The terminology is confusing, because the name 'The Complete Manager' is used both for the whole suite of packages, and for the applications development system itself.) At the simplest level is the Executive Manager, which is essentially a shell providing the ability to construct menus which give access to other packages, both those written in The Complete Manager itself (for which it provides a run-time system) and third party application packages such as word processors, spreadsheets. A version which includes electronic mail and a diary is available for Unix-based systems. The Executive Manager can thus be likened to the kind of 'electronic office' environment provided by many of the suppliers of major office systems, but with the 'building blocks' constructed from a much wider variety of sources if the user requires that flexibility.

The second level of The Complete Manager is The Enquiring Manager, which is essentially a simple, single-file data management system providing basic facilities in the same part of the market as DMS++, Friday! and Trendisk. The Enquiring Manager is constructed from Complete Manager commands, but is itself menu-driven and reasonably simple to use. I understand that it was originally intended primarily as a demonstration of what The Complete Manager can achieve for ordinary users, and as a simple way in to The Complete Manager.

A number of users have, however, found The Enquiring Manager to be of considerable value in its own right, and it is being developed to provide additional facilities. These are functions which are available within The Complete Manager, but which can at present be accessed by users of The Enquiring Manager only by executing modules which they have constructed in The Complete Manager.

The Complete Manager is a powerful and flexible applications development system, which has at its core a database manager called MKFS. This database manager is also accessible to programs written in high-level languages where additional database handling functions are needed, or where programs need access to files created in Complete Manager applications. In this review, I'll concentrate on The Complete Manager as an applications development system, since the other parts of the package are generated by it or provide a subset of its facilities.

The Complete Manager is essentially a command-driven package which includes within it a command for creating menus, so that sets of Complete Manager commands may be grouped together and invoked from menus. Commands are of two types: immediate commands, which are executed as soon as they are entered (like statements without line numbers in Basic); and stored commands, which are executed when an EXECUTE or RUN command is issued. Any command can be made immediately simply by prefacing it with EX (for EXECUTE). The term 'stored' is a trifle misleading — it refers to the set of commands currently in memory, which may in turn include references to sets of commands stored on disk as macros.

The Complete Manager comes with a set of commands, called internal commands, which developers may use but may not change. They may, however, set up commands of their own, known as external commands in The Complete Manager, which consist of sets of internal and external commands: that is, any external command may include calls upon other external commands. This ability to nest commands — comparable with the use of true subroutines (more powerful than the despised Basic GOSUB) and with the DO command in Relational (which allows the passing of parameters) — is an extremely powerful feature, and one which gives developers' packages (such as The Complete Manager) control of facilities comparable with those of good high-level languages.

The Complete Manager stores records as fixed length strings of characters, or combinations of character and binary data. The structure of each record is fixed in the sense that each record must be identical in length, and in order and length of sets of data items of the same type (real numbers, characters, whole numbers). On the other hand, the structure is more flexible than such a description would suggest in the sense that field definitions and the information about how these describe the records are held separately from the records themselves, and any set of records may be described in several different ways.

This is an unusual approach for a microcomputer package. The Complete Manager allows up to ten data files to be open at once, and provides commands to facilitate their linkage. The Complete Manager is also unusual among microcomputer packages in being truly multi-user. It provides facilities for record locking and unlocking to prevent updating by more than one user at a time. This feature in part reflects its history as a package initially written for a large minicomputer — the Prime — and
then implemented on other minis running Unix and similar operating systems, as well as onto networked micros. The Complete Manager is a British product, written by Alternative Business Systems, and supplied and supported by Pipeline (part of the Tamsys Group) through its network of dealers.

Constraints
Size constraints are unlikely to worry people using The Complete Manager, but the absence of a special date format will be a problem for some, modified, to some degree by special functions for handling both dates and times. The requirement to have a unique primary key may also cause difficulty in some applications.

File creation and indexing
In order to be able to enter data into records, to amend them, and to analyse them to produce reports, The Complete Manager must be told the format of those records. There is, however, no permanent association between the description of a record format and the data file containing the records. Required definitions are set up using one of two Complete Manager commands, the main differences being in the amount of prompting available and whether amendment is available. When setting up a record definition, you specify for each field its name, type (which includes lists — that is, single dimension arrays), length in the record, and in reports, position in the record (which may be 'immediately following the field I defined last'), and, if you wish, other attributes such as whether the field should be restricted to viewing only. You also assign to each field a unit number, which is used within the Complete Manager's facilities for direct cursor addressing to design more carefully tailored formats with an appropriate file of data, for when you open a file you must specify the unit number used to reference it. (This has some parallels with the approach used by Basic for handling random access files.)

Every data file may have up to ten keys; these keys may be individual fields or they may be any section of the record which is contiguous, so a key may span more than one field or cover only part of a field. The keys are specified in the file is opened through the CREATE command; the first key specified is the primary key, whose value must be unique to each record. If you subsequently need to define extra key fields, you must copy the data file to a new file created with the required key specifications.

Within the Enquiring Manager, menu options are provided to enable you to set up record formats and create files without having to use commands and remember their method of use. This facility is implemented using The Complete Manager's ability to take information from the screen, and use it to create files and field definitions.

Data input and updating
When updating files, the first essential is to provide a set of field definitions for the file(s) you intend to update, and to open the data file(s) on unit numbers which match those in the appropriate field definitions; this allows The Complete Manager to relate each data file to its record definition.

The Complete Manager then provides a variety of ways in which to add and amend data. Probably the simplest is the BUILD command, which takes a file number as its parameter. The Complete Manager then presents a default screen format showing all the fields defined for that file number, and allows you to enter values into the fields. If you enter a new value into the primary key field, BUILD will add the record to the file. If you enter an existing value, The Complete Manager requests confirmation before overwriting the existing record.

More sophisticated entry and editing is provided by the ADD and CHANGE commands. Using ADD, you can set up a set of new values for the record in memory, and then save them as a new record. This allows you to accept data via your own screen formats, carry out any validation that may be needed, and calculate field values which depend on the contents of other fields.

The CHANGE command allows similar flexibility: it is prefaced by either the FIND or the NEXT command, to retrieve a specific record or to get the next record in the current key order. It is thus possible to work through a file in order by any key, and you can change the key used for this process.

The Enquiring Manager uses these commands to provide interactive entry and editing for one file at a time, using simple menus and lists of options. You can, of course, develop more complex systems in which several files are amended in one operation.

Screen display
When entering, amending or viewing data, you can either rely on the simple default format used by the BUILD command, or exploit The Complete Manager's facilities for direct cursor addressing to design more carefully tailored formats. This means that, using the DISPLAY command, you can place prompts anywhere on the screen, and using the ACCEPT command you can take data from any position. This involves specifying the row and column positions of the displayed information, either as absolute coordinates or relative to the most recent cursor positioning.

The Complete Manager does not, however, allow you to 'read' the current position of the cursor if it is moved by the user in an unpredictable way. As a result, the facility which The Enquiring Manager provides to allow you to construct your own simple screen formats must, since it uses The Complete Manager facilities, ask you for the column and row coordinates of each prompt and field — no paint-a-screen approach is possible.

In addition to the formatted screen formats using cursor addressing, The Complete Manager provides two view-only formats. The LIST command is immediate, and shows the values for every field for each record in a file using a default display format. The WRITE command works in a similar way to the DISPLAY command, but is intended for showing information which is only to be viewed, and not printed. Any report designed with the WRITE command can be displayed or printed, but its primary purpose is to give formatted reports for listing on the printer.

Printed reports
Any report which can be displayed can be sent to the printer, either by echoing screen input using operating system facilities (for example, CTRL/P in CP/M and MS-DOS) or by directing output to the system list device. System commands control the default dimensions of items such as page length, relating to the formatting control options in the

<table>
<thead>
<tr>
<th>Fig 1 Features and constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum file size</strong></td>
</tr>
<tr>
<td><strong>Max record size (ch)</strong></td>
</tr>
<tr>
<td><strong>Max no fields</strong></td>
</tr>
<tr>
<td><strong>Max field size</strong></td>
</tr>
<tr>
<td><strong>Max digits</strong></td>
</tr>
<tr>
<td><strong>Max prime key length</strong></td>
</tr>
<tr>
<td><strong>Special disk format?</strong></td>
</tr>
<tr>
<td><strong>File size fixed?</strong></td>
</tr>
<tr>
<td><strong>Link to ASCII files?</strong></td>
</tr>
<tr>
<td><strong>Data types</strong></td>
</tr>
<tr>
<td><strong>Fixed rec structure?</strong></td>
</tr>
<tr>
<td><strong>Fixed record length stored?</strong></td>
</tr>
<tr>
<td><strong>Amend rec structure?</strong></td>
</tr>
<tr>
<td><strong>Link data files?</strong></td>
</tr>
<tr>
<td><strong>No. data files open</strong></td>
</tr>
<tr>
<td><strong>No. sort fields</strong></td>
</tr>
<tr>
<td><strong>No. keys</strong></td>
</tr>
<tr>
<td><strong>Max key length</strong></td>
</tr>
<tr>
<td><strong>Subsidiary indexes kept up-to-date?</strong></td>
</tr>
<tr>
<td><strong>Data validation</strong></td>
</tr>
<tr>
<td><strong>Screen formatting</strong></td>
</tr>
<tr>
<td><strong>Unique keys</strong></td>
</tr>
<tr>
<td><strong>Report formatting</strong></td>
</tr>
<tr>
<td><strong>Store calculated data</strong></td>
</tr>
<tr>
<td><strong>Totals and Statistics</strong></td>
</tr>
<tr>
<td><strong>Store selection criteria</strong></td>
</tr>
<tr>
<td><strong>&gt;1 criterion/field?</strong></td>
</tr>
<tr>
<td><strong>Wild code selection?</strong></td>
</tr>
<tr>
<td><strong>Browsing methods</strong></td>
</tr>
<tr>
<td><strong>Interaction methods</strong></td>
</tr>
<tr>
<td><strong>Reference Manual+</strong></td>
</tr>
<tr>
<td><strong>Tutorial Guide+</strong></td>
</tr>
<tr>
<td><strong>Reference Card+</strong></td>
</tr>
<tr>
<td><strong>Online Help+</strong></td>
</tr>
<tr>
<td><strong>Hot-line?</strong></td>
</tr>
</tbody>
</table>
WRITE command. This command also allows the inclusion of headers and footers, and of system variables such as the date and the current page number of the report. When used with the ON command, it can output sub-totals (using keys as break fields) and performs various other formatting tasks subsequent to a new page.

The Enquiring Manager uses the facilities of The Complete Manager to allow the production of simple columnar reports.

Selection and sorting

In addition to the facilities already described for selecting individual records, there are two main ways in which you can select sets of records for inclusion in a report, or list using The Complete Manager's two methods of cycling through records in a file.

The EXECUTE command carries out the specified procedure once. If you want to carry out parts of the procedure on many records, you include them in one of The Complete Manager's repeat loops (see Tailoring) and then make any selection tests using the IF...THEN...ELSE...ENDIF commands. The condition used with the FIND command to include the usual comparison operators (equals, less than, and so on) together with string comparisons allowing you to test for whether a character field starts with, ends with or contains the test string. Where more than one criterion is used, you can ask for them all to be met, or any combination, using AND, OR and brackets to determine the correct order of evaluation. Where you simply want to carry out one set of commands once for each record on the file, you can use the RUN command. This cycles through the data file, executing each command in the named procedure once for each record.

You can attach selection criteria to the RUN command, so that the procedure is executed only for those records which meet the criteria. These criteria can be set up using the same tests and combinations as those described for the IF command.

Within The Enquiring Manager, you can attach conditions to the production of a report, and again these may include any or all of the tests and combinations described for the IF command. Sorting is achieved by using the index keys as sort fields. The Complete Manager allows the use of any or all of the keys for ordering purposes when producing reports. Within The Enquiring Manager, you are restricted to a single key for ordering reports. If you wish to change the way the file is indexed, you must copy the data to a new file which has been created using the new key definitions. The field definitions can be re-used, since they form a template laid over the physical data in whatever file it is stored.

Calculation

Calculations can be carried out on any numeric fields from data files, or on temporary variables defined as being held in 'file zero'. Arithmetic operators and brackets are available. There is also a 'scale' function, which allows you to have all numeric values scaled by 10 to a given power on input and rescaled on output, thereby maintaining values to a higher precision than would be possible if they were stored at their displayed precision.

Multiple files

Within The Complete Manager, files are referred to by number (which may be a constant or a variable); the connection between numbers and names is made by an Open Statement for each file. When processing two or more files, you can link them by reference to any key field in the subsidiary files and any field in the main file. Procedures carried out using RUN will use this process implicitly: that is, linkages are always attempted. Procedures executed using the RUN command work by reading in one record at a time from the main file in use with an appropriate set of file definitions.

If we suppose that such a set of definitions includes a field called 'dept', whose value is to be used to extract a corresponding record from another file, then the FIND command could accomplish such a linkage. The command 'find 1,2,dept' would take the value of 'dept' from the main file and use it to match the second key of the file opened on unit 1. This matching would be attempted once for each record in the main file.

Where procedures are carried out using the EXECUTE command, the same approach can be used but it may be conditional if you wish: that is, the FIND command may be included in IF loops. It is, of course, possible to check whether a FIND command has been successful. It is also possible to use any variable as the match for FIND, including values read in from the keyboard or calculated from other field values.

Tailoring

Many of The Complete Manager's basic facilities come within the range of features which are needed to enable you to tailor a system for your own or others' use. Among those not yet mentioned are the ability to include commands within a WHILE...ENDDW loop, to branch anywhere in the current procedure using GOTO (and I mean anywhere, including into IF and WHILE loops), and the ability to construct menus. These may include hidden options which are available only to the cognoscenti. For example, on the main menu, you can choose to press a single key then press 'esc' at any point, and to react in predictable ways to this key. It is also possible to provide screens of Help text through a 'short-cut' screen display command called MASK, which simply takes the file of text given and displays it on the screen in a sensible layout, replacing temporarily the previous screen image.

| BM1 | Time to add one new record | Inst |
| BM2 | Time to select record by primary key | Inst |
| BM3 | Time to select record by secondary key | Inst |
| BM4 | Time to select 20 records from 1000 sequentially on three-character field (same field as in BM2 key) | 4mins 15secs |
| BM5 | Time to access record using wild code | 37mins 40secs |
| BM6 | Time to index 1000 records on three-character field | 4mins 15secs |
| BM7 | Time to sort 1000 records on five-character field | N/A |
| BM8 | Time to calculate on one field per record and store result in record | 4mins 40secs |
| BM9 | Time to total three fields over 1000 records | 32mins |
| BM10 | Time to add one new field to each of 1000 records | 40secs |

Time to import a file of 1000 records: 20mins 6secs

Notes: NT = Not tested; NP = Not possible; + = including scrolling

Where two times are given, first is access to first record, second is access to each subsequent record.

Fig 2 Benchmarks recorded on IBM PC/XT, H
Any set of The Complete Manager commands may be grouped together to form a macro, and stored in a file in the local or system macro directory. Where this is done, you can call such macros with parameters which are substituted by the appropriate values when the macro is invoked. When the macro finishes, any variables altered within the macro will retain those values. In most respects, including the facility for immediate execution provided by prefacing the name with the EXECUTE command, macros are equivalent to internal commands. The main difference is that macro names cannot, as internal command names can, be abbreviated to their minimum recognisable length.

Creating and editing The Complete Manager macros is achieved by using an appropriate editor. If the editor is named ED.COM it can be called from within The Complete Manager, and can be used either to edit the source of commands currently within memory, or to edit a named file of commands and/or file descriptions. Such editing is facilitated by the RESET command, which clears the memory of all commands but leaves file definitions in place. This allows you to test several macros in succession without resetting file definitions as well.

Security & housekeeping

In a multi-user system, the commands LOCK and UNLOCK allow the system developer to protect records against more than one user attempting to change them at a time.

The Complete Manager includes facilities for copying and deleting files. It also has the ability to ATTACH to any directory, so that files may be located in any directory where the operating system provides these facilities. You can also execute operating system commands from within The Complete Manager, again if the operating system permits it: for example, on versions 2.0 and above of MS-DOS and PC-DOS.

Links with outside

An unkeyed MKFS file containing only character data is simply a fixed-format ASCII sequential file. To import data, therefore, one must ensure that the file contains fixed-length fields in the appropriate order, create a file in The Complete Manager specifying the appropriate key field positions, and then copy the external file into it. As you would expect, the implication is that ASCII sequential files can be used directly within The Complete Manager, but none of the direct access commands would then be available.

User image

It is always hard to judge the user image of a package which can be so completely tuned to the user’s requirements as can the two simple elements of The Complete Manager, namely The Executive Manager and The Enquiring Manager. In a sense it is unfair to try, since what any user will see will depend on what the system developer has made of the system. Probably the most it is fair to say is that The Complete Manager shouls be reasonably straightforward for most people to use, if rather pedestrian and limited in its function.

About the underlying development system, however, there need be no such hesitation. As someone who is used to command-driven systems, I found The Complete Manager easy to use. Online help is available, although most floppy systems could not accommodate The Enquiring Manager menus and macros, as well as The Complete Manager itself and all the Help files, on a single floppy disk. For this and other reasons the system is better suited to a hard disk system.

I would expect a novice user, however, to fare badly, although this is probably more the fault of the documentation than of the basic user image of The Complete Manager. On the whole, I would say that the difficulties a novice would experience are inherent within the nature of command-driven systems, where such Help as is provided is only in the form of text screens which can be summoned up by request. This means that, even at the beginning, the user must have a reasonable picture of the way the package functions to get anything out of it.

Summary

Supplier Pipeline Software
Tel (07535) 56747
Cost (£) £530/130
Systems 86, MS, PC, Unix, MU
Version reviewed 1.1
Type F, E
Features Three-level system: underlying package is command-driven, with up to 10 files in use at once, multi-user features, parameter-driven macros, all indexes kept up-to-date. Top-level Executive Manager is run-time system (£130).
Drawbacks Short fields, no date type (although functions provided), primary key must be unique.
Ease of use Acceptable for experienced users, although documentation poor. Levels 1 & 2 OK for novices, command level very hard.

Documentation

Such a verdict on the user image puts a premium on the quality of the documentation.

The introduction to The Complete Manager is in fact a discussion of all its features at a relatively simple level. I felt it to be lacking in two ways: there is little in the way of an explanation of the whole approach of the system (i.e. an introduction to commands, but no explanation of how they are actually used in conjunction with file definitions), and there are far too few examples. I found it quite hard going. I suspect that a novice user, who had mastered The Enquiring Manager and wanted to progress further, would find it very difficult indeed.

The reference list of commands also lacks sufficient examples. In addition, it suffers from an even more serious disadvantage: it is neither rigorous nor comprehensive. In some cases, the command description only gives the current usage of the command and describes how it is shipped should be reasonably straightforward for most people to use, if rather pedestrian and limited in its function.

Included with the software are two simple demonstration The Complete Manager systems; the commands used by these systems are listed at the front of the manual. Although not quite uncommented, there are insufficient comments to make it easy to follow what is going on, so what could have been the most helpful part of the manual is much less than it could be. A final criticism — the manual is A5, in typed format, right justified, an approach which does not make for the easiest of reading.

Conclusion

Novices wishing to use The Enquiring Manager should be able to get going without too much trouble, and that system can be used in a simple way. It is not, however, intended for people who will never need the full power of The Complete Manager, nor would it be cost-effective to buy the complete package just for that part. I do not believe that an inexperienced computer user, aided only by the current documentation and with a reasonable expenditure of effort, could come to grips with The Complete Manager at the command level.

For system developers, however, and for experienced users wanting a powerful and flexible data management system with multiple files, parameterised procedures and true multi-user capability, The Complete Manager would be well worth investigating. But even for such users, some improvements in the documentation would be highly desirable.
Light fantastic

Participate in an experiment with PCW and Channel 4 — it involves a new method of software transmission. The circuit has been conceived and implemented by Mike Daley and Richard Theodossiades, and the programs by David Atkins; all three are from University College, Cardiff.

The new Channel 4 computer news and current affairs programme for serious computer users currently being broadcast (Monday 5.30-6.00pm from 11 February) offers its viewers a unique opportunity to participate in an experiment. We're all used to transmitting software by making electrons run up and down a wire, but now it's the turn of the photons.

During the broadcast of 4 Computer Buffs, a flashing white square will appear on the screen roughly where the TV AM clock usually sits. If you make a receiver by following the instructions below, you'll be able to pick up free software for the Commodore 64, BBC or Spectrum 48k micros, transmitted via the flashing white square.

Sounds crazy? At least one company we know of, Firstquad Ltd, has applied for a patent for a system which offers commercial data transfer rates and data security levels. If you're interested the

![Circuit diagram for the BBC Micro and Commodore 64](image)

![Circuit diagram for the Spectrum 48k](image)
Having constructed a receiver, you need to calibrate it for your particular TV set using the calibration program for your micro. Picking up software is then easy. Tune into 4 Computer Buffs, connect the receiver, load and run the receiver software, and press the space bar when told to. By the end of that edition of 4 Computer Buffs you’ll have a program in memory which you can save to tape or disk and run in the normal way. Note that the receiver board will only work with the 48k version of the Spectrum. Unfortunately the 16k Spectrum doesn’t allow the necessary control over timing.

The actual light detection is done by a phototransistor mounted in a sucker, which is fixed to the screen over the flashing white square.

**Construction**

To construct the circuit you’ll need a piece of veroboard, approximately 60mm x 40mm. The 74LS123 chip is mounted in a 16-pin DIL socket, rather than soldering it in directly. Care should be exercised when soldering the transistors to ensure that excess heat is not applied. Ensure also that the capacitor is put in the right way round, as it is of the electrolytic type and will blow up if connected backwards. The rest of the components are inserted as shown on the circuit diagrams (Figs 1, 2).

The phototransistor is mounted in the centre of the rubber sucker. The best type of sucker is that sold with hooks for the cups (Fig 3).

Try to make as small a hole as possible to achieve an air-tight fit. If necessary a blob of silicon rubber can be put over the hole to seal it (Fig 3).

The input to the BBC Micro is via the user port and is a 20-way (female) IDC connector. The user guide is misleading about the orientation of this plug.

**Procedure for receiving a program transmitted during 4 Computer Buffs**

The following steps should be carried out in a room with low lighting — definitely no direct light on the television screen.

Before 4 Computer Buffs is due to start, set up your computer as you would do normally, with the receiver board plugged into the port.

Load and run the receiving program:

**BBC**

- `RUN BBCREC`
- `CHAIN 'REC'`
- `CALL 900`

**Spectrum**

- `NEW`
- `LOAD 'REC'`
- `RUN`
- `LOAD 'TUNE'`
- `RUN`
- `SYS 49152`

Your computer is now ready to receive the software.

Switch on the television and tune into 4 Computer Buffs. When it starts, place the receiver sucker over the solid white block in the corner of the screen. Make sure that it is firmly stuck to the screen.

Just before the software is transmitted, you will be told to press the space bar on your computer. After this, the computer will start downloading the program. When the transmission has finished, save the program onto tape or disk using the usual instructions for saving a Basic program.

Before you try to run the software, it is advisable to switch the computer off and on again so that it is completely reset. Load the program back into your —computer using the normal instructions for loading a Basic program, and run it.

If you are using the same television set for your computer and for watching the television program, take care that you don’t accidentally knock any of the leads when connecting, or disconnecting, the television.

**Procedure for tuning the receiver board ready for the software broadcast**

The following steps should be carried out in a room with low lighting and definitely no direct light on the television screen.

The Basic programs should be typed in and saved onto tape or disk before carrying out the tuning or receiving procedures. The instructions for these procedures assume that the tuning program has been saved with the name TUNE. And that the receiving program has been saved with the name REC.

First set up your computer as normal, using the television set that will be used for the broadcast. Make sure the receiver board is plugged into the computer’s port correctly before you switch on.

Then load and run the tuning program:

**BBC**

- `CHAIN 'TUNE'`
- `CALL & 900`

**Spectrum**

- `NEW`
- `LOAD 'TUNE'`
- `RUN`
- `SYS 49152`

Adjust brightness and contrast, so that the writing on the screen is a clear white on a steady dark background. Make sure there are no streaks of light across the screen.

Place the sucker over the solid white block in the bottom right-hand corner of the screen. Make sure that it is firmly stuck to the screen.

If there is not also a '*' on the display in between the two pointers $\Rightarrow$ and $\Leftarrow$, adjust the variable resistor’s value so that one appears. Each time you change the value of the variable resistor, press the space bar afterwards. *This is very important.*

Now adjust the resistor in small steps, so that the '*' just disappears. Again, remember to press the space bar after every adjustment of the variable resistor. Before you can be sure that you have correctly tuned in the board, the tuning program should be left to run for as long as possible after you have made the star disappear. A time of 15 minutes should be adequate. If the '*-' reappears during this time then repeat this step again.

Once the board has been tuned in, you are ready to receive the broadcast of software. Now read the procedure for doing so.

Once you have tuned in the receiver board, do not alter the value of the resistor on the board, or the brightness, or contrast controls on the television.

**Check with a volt meter if you have one — look for GND and +5v. One wire must go from ground on the receiver board to one of the ground pins; another from the battery sealant**

*Fig 3 Mounting the phototransistor*
PROJECTS

Fig 4 Component mounting for the Spectrum 48k

Component list

Spectrum

Resistors

1 of 150k R1 1/4-watt carbon
1 of 100k R2 1/4-watt carbon
1 of 2.7k R3 1/4-watt carbon
1 of 1.8k R4 1/4-watt carbon
1 of 3.9k R5 1/4-watt carbon
1 of 22k Preset R6 1/4-watt carbon

Capacitors

1 of 6.8μF Tant bead C1
2 of 0.1μF Disc ceramic C2,C3

Semiconductors

1 of 7805
1 of 74LS123 1C1
1 of 74LS244 1C2
1 of 74LS138 1C3
1 of 74LS30 1C4
1 of BC108 TR1
1 of FPT100 From Tandy stores: Cat No 276-130 or 2N5777 (Phototransistor)

Miscellaneous

Rubber sucker from any ironmonger or DIY shop
28-way double-sided edge connector 1.90
Pair PP3 snap battery connectors
1-14 pin DIL socket, 2-16 pin DIL socket, 1-20 pin DIL socket

PIN 16 of the 74LS123 on the receiver board to five volts on the user port. The third and final connection is the OUT-PUT from PIN 13 of the 74LS123 to the user port pin B7.

The Spectrum does not have a user port as such. The edge connector at the rear of the keyboard has the entire address/databases and control signals on it. Therefore, to use the Spectrum, an address decoder and input port has to be constructed. The decoder consists of a 74LS138 three-line to eight-line decoder and input port has to be constructed. The chip is enabled from state non-inverting chip. For this experiment only data line seven needs to be connected; the chip is enabled from the address decoder (Fig 2). The power supply is derived from the nine volts at the edge connector, which is regulated, via a 7805 regulator, to give five volts to the board.

The edge connector can be a problem. Wafford Electronics can supply one for the Spectrum (28-way double-sided 0.1in pitch), or you can buy a 43-way, double-sided, 0.1in pitch con-
that there are 23 connectors edge on pin 2 will cause the output on opposite effect, so pin 2 goes low. pin 2 of the 74LS123. Darkness has the voltage at the base of Tr1 low, thus causing conduction which pulls the transistor switches the transistor on, Light falling on the base of the photo-transistor via the user port, which is a 12-way edge key. The input to the Commodore 64 is to the connector diagrams by sending an SAE sucker

Circuit operation Light falling on the base of the phototransistor switches the transistor on, causing conduction which pulls the voltage at the base of Tr1 low, thus switching it off and putting five volts on pin 2 of the 74LS123. Darkness has the opposite effect, so pin 2 goes low. The 74LS123 is a retriggerable monostable. With pin 1 tied low, a rising edge on pin 2 will cause the output on pin 13 to go high. It will revert to low after a time determined by the RC network (R5, R6 and C1), and is adjustable by means of R6. If the pulses arrive at such a rate that the next pulse arrives before the output goes low, the monostable retrigger so that it simply stays high the whole time. Readers can obtain a photocopy of connector diagrams by sending an SAE to the PCW offices.

Component list

Commodore 64 and BBC Micro Resistors

1 of 100KΩ R1 ¼-watt carbon
1 of 270KΩ R2 ¼-watt carbon
1 of 2.2KΩ* R3 ¼-watt carbon
1 of 3.9KΩ R4 ¼-watt carbon
1 of 2.7KΩ R5 ¼-watt carbon
1 of 22KΩ† PresetR6 ¼-watt carbon

*2.7KΩ for Commodore 64

1470KΩ for Commodore 64

Capacitors

1 of 6.8μF Tant bead C1

Semiconductors

1 of 74LS123 1C1
1 of BC108 TR1
1 of 2N5777 (Phototransistor) or

FPT100 from Tandy stores: Cat No 276-130

Miscellaneous

Rubber sucker from any ironmonger or DIY shop
20-pin IDC connector (for user port) (female) (BBC micro)
12-way edge connector (0.15in pitch) double-sided (Commodore 64)
Pair PP3 snap battery connectors 1-16 pin DIL socket

Fig 5 Component mounting for the Commodore 64 and BBC Micro
Following the first wave of integrated software packages such as Symphony, Framework and Open Access, which combine a spreadsheet, a word processor and a database, Mike Liardet looks at another trend — the so-called 'desktop' applications.

The idea behind desktop managers is to remove that clutter of address books, diaries and calculators from the top of the desk and embed them in the computer instead.

Some readers may consider a desktop manager to be of dubious value, replacing a few portable and accessible notebooks with an intimidating computer system. In one sense this is right. If the sole reason for getting computerised were to run a desktop manager, then this would be a bit like buying a Ferrari just to listen to its stereo. But anyone who is already computerised may consider a desktop manager a valuable asset.

Whereas integrated spreadsheet/word processor/database systems provide an environment for doing just about anything you could conceivably want, the desktop managers are more limited in scope but considerably easier to use. This article will take a broad look at three of them, all of which are for the IBM PC: Sidekick, QED+, and Spotlight.

The most striking thing about these systems is their similarity, in their core facilities at least. It is probable that they were all designed and implemented in ignorance of the others, yet there is an uncanny resemblance between them.

**Sidekick**

Sidekick was written by Borland International and is distributed in the UK by Altair Computer Software. Sidekick is by far the cheapest of the three systems, but that is no expense spared with respect to quality. It is supplied as a slim paperback manual with a copy-protected disk. The files on the disk can be freely copied, to a hard disk for example, but the original disk must always be present when Sidekick is first loaded. If this arrangement is too cumbersome then Borland will supply an unprotected version for 'a small extra charge'.

To load Sidekick simply type 'SK', then, following a brief message, control is returned to the operating system. If you are unfamiliar with desktop managers you can easily assume that something is wrong because nothing seems to have happened. Actually all the software has been loaded into memory, protected from being overwritten by anything else, and the operating system modified to respond to a special keystroke. The consequence of this is that, having loaded Sidekick, you can forget about it and use your normal software packages as if it weren't there. But press the CONTROL and ALT keys together, and up pops a Sidekick menu in the middle of your screen; you can use any of its functions from then on.

Once you are finished, the screen is completely restored to its original state and the original application continues as if there had been no intervention at all. The only overhead for Sidekick arises from the extra memory needed. If one of your applications already consumes all available RAM, it will not be possible to have Sidekick loaded simultaneously. The complete Sidekick program requires about 60k of RAM, and if this is only just too much, then the supplied disk offers some alternative incomplete versions which lack one or other of the facilities.

After pressing the magic key, an eight-option menu is displayed. Five of the options are for the five Sidekick applications, and there are also help, exit and setup options. Menu selection can be made in a variety of ways: by pressing a function key (F1 to F8 for each of the eight options); by pressing a single letter, usually the initial letter of the option; or by moving a horizontal bar which illuminates the current option. This may sound complicated, but it's very easy — the chances are that you are already familiar with at least one of these methods and can use that.

Sidekick has fairly extensive help facilities which are supposedly 'context-sensitive', but are actually only sensitive to the main menu and each of the applications. These are presented as pages of text which you can flick through using the arrow keys, and constitute a useful supplement to the manual.

**Sidekick's calculator**

WordStar behind the calendar/diary
The notepad facility is the first of the five Sidekick applications. When it is selected a notepad window appears at the bottom of the screen with the rest unchanged. This window can be moved, enlarged or shrunk using the function and arrow keys clearly outlined at the bottom of the screen. Text can be entered and edited into the notepad window in a fairly standard word processor fashion — in fact, Borland has unashamedly copied WordStar's keystrokes. It does not, however, implement all the WordStar facilities and is limited in capacity too, at least in the standard configuration. (You have the capability of modifying a present parameter — this is at the expense of extra memory consumption.)

Notepad does offer the chance to 'capture' text from the original screen into your notes. To do this, you press a function key which redisplay the original screen. You then mark the beginning and end of the text to be captured (using WordStar block beginnin and end keystrokes) followed by the block-copy command. The contents of the Notepad can always be saved on file.

The ability to write a note you need to do some calculating, then you can call up Sidekick's calculator. The notepad window is retained onscreen, and a picture of a calculator appears in the top right-hand corner. It has all the functions you would expect from a sophisticated business calculator, plus the ability to work in binary or hexadecimal arithmetic. This is a useful feature for programmers, and could be sufficient justification alone for buying Sidekick since real hexadecimal calculators are comparatively pricey.

As with all Sidekick facilities the calculator can be instantly accessed from any other software, so the hexadecimal facility is very useful when working with some of the standard debuggers. With the calculator it's possible to program one of the keys with the current numeric result, so if that key is ever subsequently used then it reproduces the number. This is an easy way of transferring numbers out of the calculator. When you have finished calculating, a touch of the EXIT key causes the calculator to be replaced by the original display and you return to whatever you were doing previously.

Sidekick also provides a calendar/diary facility. The workings of this option are certainly elegant and sophisticated, but I found it the least useful facility. I can see no reason to abandon my eminently portable old-fashioned pocket diary.

A more useful facility is the autodialer which can automatically dial, through your modem, any number in your telephone directory file. It can also recognise and capture telephone numbers off the screen left by previous applications — like a database system, for example.

Sidekick's final facility is simply an ASCII table — it displays all 256 characters together with their codes and other information. This may seem something of a make-weight facility, but it would be useful for anyone involved in software development.

**Spotlight**

Spotlight is produced by Software Arts, creator of the world-famous VisiCalc spreadsheet system. It offers slightly more facilities than Sidekick, and also costs rather more. The package is supplied as a spiral-bound manual plus disk, housed in a matt black box together with some extra leaflets. One of these leaflets is a Customer Support Plan, with a hotline telephone number in case you have any problems. My version has a US number, but I'm told the UK number is given now.

The supplied disk is copy-protected and must be loaded in the beginning and end of the text to be captured (using WordStar block beginning and end keystrokes) followed by the block-copy command. The contents of the Notepad can always be saved on file.

The Spotlight calculator is functionally similar to Sidekick's but does not have a hexadecimal or binary arithmetic option.

**Spotlight's calculator**

Spotlight offers six facilities. It does not have the ASCII code chart, but otherwise covers all the Sidekick options. Two facilities not offered by Sidekick are the filer and the index card file.

The index card file can be called up by pressing the SHIFT, ALT and I keys. In general all Spotlight's facilities are brought up by a SHIFT-ALT combination, plus the initial letter of the task. The initial loading operation for Spotlight only loaded the minimal control software to intercept special keystrokes, and so on. This means that in every case, following the keystroke, the code for the required task must first be read from the disk before the task can start. There is an irritating delay before you can use it which completely destroys the feeling of spontaneity which you quickly appreciate with Sidekick.

When the index card file is ready you are presented with a simple facility for compiling, viewing and searching index cards on the screen. The information on any given index card can be entered in a free format, and the cards are sorted on the contents of their first line. There are two display modes — one displaying a single card, the other displaying the card 'index': that is, all the first lines. Up to 500 cards are allowed in any one list and up to 36 lists can be accommodated, assuming your machine has the capacity. These lists are stored in separate files and are completely unconnected with one another. Unfortunately each list is only identified by a single letter or digit rather than a more meaningful name, so it may be difficult to recall which index list you want.

Spotlight's filer facility is used for manipulating disk files. At first sight this may seem an even stranger inclusion than Sidekick's ASCII table, as it does not provide much that isn't already available through ordinary DOS commands. However, as Spotlight can be invoked in the middle of another activity, this feature provides the option of controlling disk files from within other software. This can occasionally be useful, but can also totally confuse the original program if you're not careful — for example, you might delete a file it assumes is present.

The other advantage of Spotlight's filer is that it might be considered more user-friendly. Inexperienced users, in particular, may prefer to manipulate files through menu control rather than typed commands at the keyboard.

The notepad facility does not conform to the WordStar keystroke conventions which can be seen as either an advantage or disadvantage depending on your opinion of WordStar. Like Sidekick the notepad has limited capacity (eight pages) but unlike Sidekick this cannot be increased.

The calculator facility is functionally similar to Sidekick's but does not have a hexadecimal or binary arithmetic option.

**Spotlight's calculator**

Spotlight's phone book is really an alternative presentation of the index card filing. If name and number are placed on the first line of a card, the information will be sorted, and numbers rapidly looked up by viewing the cards in index (first line only) mode. Spotlight does not have an auto-dial facility.

Spotlight's appointments book stands a slightly better chance of prising me away from my trusty diary. It
has special facilities for setting up weekly meetings and offers an optional alarm— not to wake you up at the end of a meeting, but to alert you to the fact that one is about to start! The alarm sounds whatever you're doing even if you're not using Spotlight at the time, as long as the computer is switched on.

**QED+**

QED+ is the only British product of the three. The name is a mnemonic for Quantec Executive Desk. Quantec being the author of the system. Quantec aimed to produce a software package to perform all the personal management tasks that have hitherto been carried out manually, and accordingly it offers a few more facilities than Sidekick and Spotlight. It has rather more substantial manual and, yet again, a copy-protected disk.

The operation of QED+ is rather more conventional than the other two. When the system is first loaded, it does not simply disappear but displays a menu of the main options. One of these options allows you to set up to 10 different program names, and then run one of them. It's possible to return to QED+ from that program at any time with just a single keystroke, ALT, and function key 10. The original program can be resumed where you left off by repeating the keystroke. This facility is clearly less flexible than the others and would not be favoured by software developers, for example. However, the system is clearly aimed at business managers who might very well prefer this type of menu control.

Quantec also supplies QED, which is identical to QED+, but without any facility to run other software.

Many of the areas covered by QED+ will be familiar: diary, calculator, address book, and so on. But one of the most surprising inclusions is that of a critical path analysis facility, or project planner as it is sometimes known.

Critical path analysis (CPA) is an invaluable management tool that can be used for scheduling and progress-chasing projects. Unlike most of the desktop applications I have seen, CPA is generally available as a standalone product from a wide variety of suppliers. Most of the other desktop applications are too trivial to enjoy that status.

QED+ provides facilities for building up critical path networks on 'task pages'. A task page specifies a task (for example, recruitment) in terms of its duration, and in terms of the other tasks that must be completed before it (for example, rent new offices). QED+ imposes various limitations on network size (a maximum of 150 tasks) and the number of tasks that can precede a task is six. Each task uses the points of interest are when it can start and finish, and if there is any slack time (because it is waiting for some other preceding task). QED+ displays all this information on a task page and also provides a bar chart display, which gives the same information graphically.

QED+'s desk filing system is considerably more complex and powerful than Spotlight's index card filer, and Sidekick has no equivalent at all. It hinges on the idea of a 'form', which you can design to your own specification. Quantec used this facility itself to create some of the other applications for QED+, such as the address book. A form is built up with boxes on the screen, where information is destined to be entered. The type of information for each box can be specified for validation purposes.

Like its rivals, QED+ offers a calculator, diary, address book and telephone facilities. It has a day book and event file which automatically update the diary, and a number of other sophistications. Like Sidekick it has an auto-dialling facility, but as QED+ is a British product users should not anticipate any problems dealing with our telephone system. Among other things you can setup the auto-dialling to cope with a local PABX: that is, it will precede the number with a 9.

QED+'s Notepad facility is weaker than the other two products, being confined to free-form notes entered in a box on a form. Quantec excuses this on the grounds that a manager would prefer to use a word processor for notes.

**Conclusion**

Of the three systems, Sidekick emerges as excellent value for money. If you hold the view that many of the applications covered by desktop managers are tending towards the trivial, then Sidekick's price seems about right. It was also much the easiest to use, and only in part because it offers fewer facilities. Quite simply it's just very well engineered.

Sidekick may also have a special appeal for programmers with its hexadecimal calculator, ASCII table and excellent text editor - which is almost identical to the text editor released with Borland's Turbo-Pascal.

QED+ takes a much more serious view of desktop management. It has a heavyweight feel about it which makes it more difficult to use, but it does attempt to address itself squarely at the manager looking for software to help with his daily work.

The critical path analysis alone makes it worth the price, and the other multiple features could be considered a bonus.

Spotlight falls between two stools. It's certainly no better than Sidekick, but costs rather more.

**Summary**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Sidekick</th>
<th>Spotlight</th>
<th>QED+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment book/diary</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>ASCII table</td>
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<td>Calculator</td>
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<td>Critical Path Analysis</td>
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<td>DOS Filer</td>
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<tr>
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<td>£125</td>
<td>£295</td>
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</tbody>
</table>

The QED+ menu

The QED+ filing system menu
Most leading low cost Micros, eg BBC, Dragon and Sinclair QL love the MT-80 printer from Mannesmann Tally. It is fully hardware compatible and with a range of cable options, gives trouble-free straight through plug-in facilities.

You'll love it too, for its sophisticated looks, and its range of standard features, which include 80 col, 80 cps optimised bi-directional printing with dot addressable and line graphs, quick tear-off facility, friction and tractor feed, and easy change cassette ribbon. And all for an ex-VAT price of around £200.

Options include <55dBA sound reduction kit and 2K buffered serial interface.

The dealer who supplies you is supported by Mannesmann Tally, Europe's leading printer manufacturer. Your guarantee of continued support and assistance throughout the life of the printer.

Ask your nearest dealer for a demonstration, or phone us today for full details. Either Annie, Sall, Terry or Geoff will be only too pleased to help you.

MANNESMANN TALLY
THE FIRST NAME IN PRINTING
Mannesmann Tally, Molly Millar’s Lane, Wokingham, Berkshire RG11 2QT
Telephone (0734) 791619/791533 Direct Lines or (0734) 788711 Switchboard
There's more than one way to play chess in this month's pick of the best, and either way the pieces aren't friendly. But Tony Hetherington survives to review games for the Commodore 64, Apple Macintosh and Spectrum.

One night in Archon
Title: Archon
Computer: Commodore 64
Supplier: Ariolasoft
Format: Disk/cassette
Price: £14.95/£11.95

Ariolasoft is a company set up to import software under its own name. The US company providing the goods is Electronics Art, and Archon is one of its best. It's loosely based on chess, but each of the pieces is a magical creature in a fight between the forces of good and evil. Each creature has its own strengths and abilities, and becoming familiar with these is the key to success. They range from the lowly goblins and knights, which are slow and weak, to dragons and a phoenix.

The most important pieces on the board are the wizard (light) and the sorceress (dark). These characters cast a selection of spells which range from summoning the elements to healing injured creatures or shifting time.

The time-shifting spell alters the cycle that controls the colour of a symmetrical pattern of 33 delta squares. These go through a sequence of six colours from black to white, affecting fortunes in the battle which, in Archon, you have to fight if you want to take a piece.

When this happens, play shifts to a battle area where the two pieces face each other. Their strengths are represented by a coloured bar on either side of the screen which decreases as they are hit.

During the battle the pieces are controlled by joysticks, but they attack in different ways. The goblins and knights attack with clubs and swords, whereas the dragon breathes fire. The unicorn fires energy bolts from a distance, and the phoenix mobilises into a ball of fire which burns everything in its path. The most interesting piece is the dark side's Shapeshifter, which mimics whatever creature it is fighting.

You can either enjoy playing Archon against another player or be slaughtered by a computer opponent.

The prize is right
Title: Hedron
Computer: 48k Spectrum
Supplier: Firebird
Format: Cassette
Price: £9.99

Hedron is described by Firebird as 'the most challenging computer game ever written.' It is also a competition; those skilful enough to complete it will qualify for a tournament, with a Porsche 924 as the prize. But I wouldn't sell the old banger yet as it's a difficult game to play.

In essence it's a maze game in which you are a hedroid dropped into the
maze to destroy an enemy computer. This is not an easy task. The computer is defended by laser-shooting towers and 56 menacing white spheres that are reminiscent of the guardians in The Prisoner.

The spheres trundle around the maze, and are both deadly and impervious to your attack. They also impose a time limit on your efforts for, after a while, they will move into positions that make some routes impossible.

The towers, however, provide a more immediate danger as they shoot to kill on sight. They can be killed but only from behind. Unfortunately the chances are that when you kill one it will reappear elsewhere, as well as changing the direction of a few others.

To help you find your way around the maze, a 3D image is to the right of the main display. Below this map is a helix-shaped damage display, with the number of lines illustrating your current state of health.

Below that is a timer which is synchronised with the sphere movement, and finally, my favourite — a rotating hedroid which is colour coded to show the region of the maze that you are in. There are 12 regions and consequently 12 colours, which is quite an achievement on the eight-colour Spectrum. It is attained by mixing the existing colours to create shades of salmon, turquoise, gold and lilac. These additional colours are just an example of the technical expertise that created this game. Add to that smooth scrolling, and not only have you got an enjoyable game, but a serious contender for the Game of the Year award.

---

Wonderland chess

**Title:** Alice Through the Looking Glass  
**Computer:** Apple Macintosh  
**Supplier:** Apple  
**Format:** Disk  
**Price:** Approx £30

Alice is the first games program I've seen for the Macintosh. It's a chess variant in which you play Alice against a Wonderland chess set.

You start the game by selecting the piecethat you wish Alice to mimic. Most people will head straight for a queen but for a real challenge you should try one of the lesser pieces. To move your piece, you move a mouse-driven cursor to the required square and press. The game isn't played in set turns, so if you stop and think you'll be clobbered.

Luckily you are quickly resurrected and the action continues. The best strategy I have found is to click in several moves in advance, but you must have the mouse ready for when things go wrong. For example, avoid the hole that moves around the board swallowing pieces.

Your performance is rated by a score which is increased when pieces are taken, but points are deducted for a hammering. The theoretical maximum is 999 but to achieve this you must take all the opposing pieces, including the pawns once they have been promoted to queens, without being hit. But the prospect of nine queens is somewhat daunting.

Alice is an extremely professional, well presented game. Although the review copy was described as being pre-production, the game was supplied in mock book cover complete with velvet-like inlay and ribbon.

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The great space hype

**Title:** The Great Space Race  
**Computer:** 48k Spectrum, Commodore 64  
**Supplier:** Legend  
**Format:** Cassette  
**Price:** £14.95

The policy behind Screenplay is to review only the best games. However, The Great Space Race has been hyped so much that we had to look at it. According to the hype, it was to feature movie-style graphics in a game that was to follow BMA award winner Valhalla.

Unfortunately the game falls sadly short of the hype, and the movie-style graphics are a nuisance: they interrupt the flow of the game. You deal in a particularly potent brew called Natof which is coveted throughout the galaxy. Unfortunately you can’t deliver the stuff yourself, so you have to hire traders from a motley bunch of drunks, psychopaths and crooks. These characters are more likely to drink the stuff themselves than deliver it.

Your problems increase with the intervention of pirates and the galactic police who want their share, not to mention the other racers. The fight sequences are particularly disappointing. They merely consist of drawings leaping unrealistically around the screen with the occasional line drawn between them. Also, the use of Basic makes the game slow.

The Great Space Race has an interesting plot, but is badly let down by its implementation.
Symphonic key

Title: Mastering Symphony
Author: Douglas Cobb
Publisher: Sybex
Price: Not available

It’s not as if purchasers of Symphony are short of something to read. This whopping packages (six floppies, needing no fewer than 320k or RAM just to boot) comes in a small plastic suitcase containing a 438-page Reference Manual, a 308-page How-To Manual, a further fat Introduction Manual, a separate Glossary and a Quick Reference Guide. To this manual mountain, and to America’s massive range of Symphony manual re-writes, Mr Cobb now adds another 760 pages and, if you weaken, will sign you up for his monthly Symphony User’s Journal, too. 'Patience is one of the keys to learning Symphony,' he asserts. You might need a good optician, too.

Symphony is at heart a spreadsheet, points out Mr Cobb, but not just any old spreadsheet. The act it has to follow is Lotus 1-2-3 with its half a million devotees. Once, way back in 1983, that was the IBM PC’s most powerful piece of figure-crunching software and an instant bestseller worldwide. Symphony has to surpass it and, moreover, has to compete with such robust rivals as Framework and Open Access. All combine awesome spreadsheet power with the current fashion for integrated graphics, word processing, database management and (all-American) communications. All take ages to get to know inside-out.

No question but that Cobb, author of a similar big-selling tome on Lotus 1-2-3, knows the score on Symphony, or that he believes it to be the bee’s knees. His text is commendably lucid, if wide-eyed at the wonder of it all. Not a whisper of any Symphonic shortcomings (such as the fact that the comms package supports only two modems, neither usable in Britain) and lots of praise for the word processor which is OK but scarcely any match for the best wp-only packages like Microsoft’s Word or Samna.

Still, Mastering Symphony is as thorough-going as it is uncritical and as such is a useful adjunct to the Lotus texts, good as they are. Cobb’s next job, presumably, will be to set about another brick-sized book for Symphony customers planning to use the extra speed and memory of a PC-AT. I feel for Mrs Cobb who, as is acknowledged at the start of this book, wondered if she
would ever see her husband again.

All graphics and gloss
Title: Creative Computer Graphics
Authors: Annabel Jankel and Rocky Morton
Publisher: Cambridge University Press
Price: Not available

Acapivating book, this, of the kind to be savoured over a pot of strong coffee and a box of thin mints. It’s a picture book, as opposed to as they come, with a bit of text attached to outline the history, the techniques and the applications of computer graphics at their most visually (and expensively) stunning. The disjointed text isn’t that wonderful, but the pictures are.

Jankel and Morton met at art school ten years ago and now run a video outfit called Cucumber — TV commercials are a specialty. It’s a pity, they say, that while inspired computer graphics are now accepted as an everyday tool for ads, for TV station identity sequences like the tumbling coloured bricks of Channel 4, or for animated titling like the opening sequence of Weekend World, no enterprise TV producer has yet risked a programme to exploit the entertainment value of sophisticated yet risked a programme to exploit the capabilities of text attached to outline the history, the techniques and the applications of computer graphics at their most visually (and expensively) stunning. The disjointed text isn’t that wonderful, but the pictures are.

Nevertheless, it is suggested that we get a sense of how to go about the idea of AI with typical reserve, thinking machines don’t seem to strike us as quite respectable.

Masoud Yazdani and Ajit Narayanan are lecturers at Exeter University (the former familiar to Electron users who get their guide to programming in the Acorn box). They are thus academics and no doubt thoroughly respectable. There’s no mistaking their studiousness as here they assemble a collection of learned, and at times stupefyingly impenetrable papers by more academics, (many from Exeter), on the discipline in question. The subject of what exactly Artificial Intelligence is and where it might or might not be taking us. Their purpose, they stoutly maintain, is not to draw conclusions — merely to encourage lively debate.

Debate we do get but lively it’s not. We get discussion of the computer in medical diagnosis or legal counsel. We get a discussion on the social and philosophical implications of AI. AI methodology is examined, AI in education looked at. It sounds interesting enough, but it would take a computer with a brain the match of Einstein’s to tie the threads together — the contributors’ lead-weighted style: ‘We consider that one of the biggest blocks to a healthy interaction between psychology and AI is what Pettitt has called AI-centricty. A common conceptual error of the AI-centric is the naive belief in a simple dichotomy between what Miller calls theory development and theory demonstration.’

There is a tremendous amount of thought-provoking, not to say brain-twisting argument and counter-argument in this book, but it is strictly for those who have some knowledge of its Basic, enjoy writing their own programs and have £7.95 to spend on Commodore 64 Subroutine, colour peeper, games routines, or small-time business and financial add-ons that will calculate interest rates or simply tidy up display formats. There are some 70 such ‘recipes’ — some trivial, some patching up the gaps in Pet 2.0 Basic, a few providing useful comms support, but it’s all rather Heath Robinson when set alongside more modern machines. Commodore 64 users generally have my sympathy, but as I was reminded the last time I was a bit snippy about this machine, there are an awful lot out there and thousands who spend our money researching into it. The cynic may well have a valid point.

Second best
Title: Inside Apple’s ProDOS
Author: John Campbell
Publisher: Reston (Prentice-Hall)
Price: £18.40 (paperback)

ProDOS, bubbles Mr Campbell, is Apple’s exciting new disk operating system with new commands, expanded and improved old commands, file management utilities, assembly data types, file types and new procedures — everything anyone could ask for the Apple II family.

True enough, I suppose, but what is undoubtedly a damn sight more exciting is Apple’s new family of Macintosh computers.

Still, this book is only for those who are stuck with early Apples and looking for an improvement on their DOS 3.3 capability. They should like it. Campbell describes in patient detail all that ProDOS is and does, and attaches examples and listings. I couldn’t fault it but I can’t pretend I found it an absorbing read. I dare say the same would go for any Apple user who’s laid hands on the incomparable Mac.

Suggested recipe for Commodore 64
Title: Commodore 64 Subroutine Cookbook
Author: David D Busch
Publisher: Prentice-Hall
Price: £7.95

If you have a Commodore 64, a sound knowledge of its Basic, enjoy writing your own programs and have £7.95 to hand, you shouldn’t hesitate. This little book spells fun.

What Busch does is provide a set of machine-specific subroutines for you to merge into your own listings (some will run on their own) and thus provide instant tricks like sound effects (gunfire, klaxons) an elapsed timer, joystick subroutine, colour peeper, games routines, or small-time business and financial add-ons that will calculate interest rates or simply tidy up display formats.

There are some 70 such ‘recipes’ — some trivial, some patching up the gaps in Pet 2.0 Basic, a few providing useful comms support, but it’s all rather Heath Robinson when set alongside more modern machines. Commodore 64 users generally have my sympathy, but as I was reminded the last time I was a bit snippy about this machine, there are an awful lot out there and thousands who spend our money researching into it. The cynic may well have a valid point.'
SPECTRUM BASIC REMOVER

This program will remove all, or least part of, a Basic program, but will leave the variables unharmed; thus it becomes possible to change Basic programs but retain the same variables. This is most useful if you use programs which run off the same data. It's not always possible to merge such programs directly, but with one program removed the second can be merged with the first's variables. This machine code can go anywhere in RAM — I find it best above RAM top. Users who don't have an Interface One should be able to convert it using the PRINT USR system. If you have a hundred-line Basic program, and you wish line 50 onwards to be removed, then all you do is load the HL register pair at USR #R to hold the value 50. If you wish all the program to be removed, then load the HL register with one. The USR function has been selected to act as the adapted calling command. The USR command, and all commands which immediately follow it, should be located on one multi-statement line; this should be the first line in the program. If you don't have an Interface One, then remove lines 10 to 240, and lines 280,290,540 and 550. Change the DEFWs' at lines 300 and 280,290,540 and 550. Change multi-statement line; this should be located on one which immediately follow it, command, and all commands calling command. The USR register with one.

This program is designed to allow the user to place the program above RAM top, then save it to tape. The data contains the code for the full listing of the machine code program.

Nigel Mossman

```
00010: basic removal routine
00020: using extended basic via
00030: INTERFACE ONE
00040: rst sarom i select ma
00050: in rom
00060: defw get# i collect
00070: next char
00080: actor
00090: cp usmr is it usr
00100: jr z,usr# jump if
00110: it is
00120: jp syer i else synt
00130: !
00140: user# rst sarom i select ma
00150: in rom
00160: defw next# i get next character
00170: !
00180: call syin i advance
to end &
00190: exit if
00200: checking synt:
00210: !
00220: !
00230: the above is not needed when not
00240: using interface one
00250: usrn# ld hi,100 i 1st line
00260: to be del
00270: eted
00280: rst sarom i select ma
00290: in rom
00300: defw addsea i call main
00310: rom this fi
00320: nd start
of line
00330: push hl i save a co
00340: py
```

QL WILD CARD FILE SPECIFICATION

A surprising omission from the QL QDOS operating system is the means to refer to files collectively by the use of wild card characters. For example, all microdrive operations (for example, DELETE or COPY) involve specifying filenames individually, which may be fine for a few files on cartridge, but what happens when the promised hard disk arrives? Trying to back up all or part of a hard disk one file at a time would be virtually impossible.

Users of most other operating systems are much more fortunate. Those who are accustomed to CP/M will be familiar with the following conventions: the symbol '?' is taken to match any single character, while the symbol '*' is taken to match any
Michael Bryant

**AMSTRAD DISPLAY TIPS**

**TAG** — extremely useful for printing literally anywhere on the screen. However, the printing is done with the graphic pen, and what the Manual doesn’t make clear is that if you want to PLOT or DRAW in one colour, then TAG and PRINT in another. If you need to PLOT x,y,new col (where x & y are offscreen), then PRINT. This also means that you might have to restore your previous coordinates and colour to continue with PLOT or DRAW. COLOURS — there are 32 available (see chapter nine page four of Manual). As numbers 27-31 duplicate five existing colours, only 27 are mentioned elsewhere. Nevertheless, commands such as BORDER 29 are valid. CONTROLS — characters 0-31 (except 0 & 13) can be embedded in PRINT statements, saving quite a bit of space. For example, try PRINT "CTRLL TEXT" instead of CLS: PRINT "TEXT", or PRINT "CTRL L" to produce BEEP.

**NOTE:** INK & BORDER (chrs 11 & 12) can be used. However bear in mind what was said previously about the PEN result of bit combination in each mode, remember that overlapping pixel colours arise from a logical combination of PEN colours. Try this:

1 MODE 1
2 MODE 2
3 MODE 3

**COLOUR MASKING** — use of CHR$(22) with text and CHR$(23) with graphics is one of the most powerful and difficult, perhaps, for beginners to understand in terms of the results achieved. Bearing in mind what was previously said about the PEN result of bit combination in each mode, remember that overlapping pixel colours arise from a logical combination of PEN colours. Try this:

1 XOR 3 = 3 (XOR &X00000001 XOR &X00000000)
Mixing your own paint

Is there any way I can use more than 16 colours on my Commodore 64? I can use extra colours, for example in sprites, but these must be chosen from the 16 available for background displays. I would like to be able to produce shading and graduated hues, as on an Atari or some of the new arcade machines.

Dave Waller, Canning Circus, Nottingham.

You’re stuck with just 16 colours on a Commodore 64, although the new Commodore machines (the Plus/4 and the C16) allow the shading you describe. On an Atari every point displayed can have an intensity (brightness) as well as a hue (colour), this means that shades of the same colour can be produced, giving the attractive results you mention.

The electronics of the Commodore 64 can generate only 16 different hue signals for the TV—these correspond to the standard poster colours you are used to. On a Spectrum there are only eight colours available but each can appear in bright or normal intensity, giving 15 possibilities (bright black looks exactly the same, however, as normal black; in fact the difference between bright and normal in most colours can be hard to distinguish).

On an Atari there are 16 colours, but each can be shown in a range of intensities—either eight or 16 different brightnesses, depending on which books you believe. Luckily there is a ‘trick’ which can enable you to produce the effect of extra colours. Imagine a block of colour on a TV screen, 20 dots wide by 20 dots high. 400 dots would be glowing, producing a solid block of colour, say, green. Now imagine that alternate rows in the block are set to black. You should have a grid of horizontal lines, but in fact what you see is a darker shade of green—the lines merge, spilling dimly into the black areas. The effect is destroyed if you look closely at the picture, but from a distance it looks as if you have produced a new colour. The effect may be better if you scatter the contrast ing dots (which can be in any colour) throughout the area to be shaded in a chequeboard pattern. A red and yellow check will look like red and yellow, a blue will look purple, and so on. This effect—a kind of computer tartan—can be used on any computer with a high-resolution display. It doesn’t work on a low-resolution display or a video monitor since the dots don’t merge. It’s called ‘stipple’ or ‘rule’ after the process used by some artists.

The Sinclair QL has built-in commands to generate stippled mixtures of its eight standard colour signals. Most IBM machines can produce stippled shades on a variety of machines to generate shading and 3D effects.

Connection conventions

I recently bought a Dragon 32 computer but I can’t save or load programs. The problem is that the cable which comes with the computer has small jack plugs at the cassette end, but my tape recorder, a Philips 3302A, expects DIN plugs. Is there any way I can use the tape recorder with the computer, or will I have to buy a new recorder?

Andrea Husbands, Wrexham, Clwyd.

In theory it’s possible to use the tape recorder just by changing the plugs at the end of the lead from the computer. You’ll need a two-pin DIN loudspeaker plug in place of the EAR jack, and a three-pin DIN plug instead of the MIC jack. These go into the sockets marked with a picture of a loudspeaker and a digit (1), respectively. You’ll need to experiment to find the correct way to wire up the two MIC wires to the three-pin DIN plug—one wire should go to the middle pin, and the other to one of the side pins.

In practice it may be more sensible to spend £10 or so on a low-cost, modern, cassette player with jack sockets already fitted. You don’t need to buy a special ‘computer compatible’ model—most of these accept just last year’s floats tared up with a tape counter and a few flashing lights. Some of them don’t even work reliably with common computers. You’ll get just as good service from a cheaper, general-purpose model.

Some hi-fi recorders are useless with computers because they incorporate clever circuitry to ‘process’ the sound. This makes it sound better to the human ear but confuses a computer, for which raucous beeps and buzzes have a special meaning.

The most common cause of unreliable loading is incorrectly set up tape heads. This is easily identified, since you experience problems loading other people’s tapes (or pre-recorded ones) but your own tapes load perfectly. The misalignment corrects itself on your own tapes—you record them as raw and read them back the same way.

Incorrect tape head alignment is a common fault on old machines. With heavy use or rough handling, the head, used to read a cassette, can move out of line, making music sound dull and data unintelligible to a computer. The more ‘tinty’ a recorder sounds, the better it’s likely to work with most computer models. It is possible to re-align the heads on a tape recorder, but it’s easy to make things worse rather than better unless you know exactly what you are doing.

Of course, it helps to clean and de-magnetise your tape heads regularly, using one of the kits available from most electrical shops, but this doesn’t usually make a great deal of difference—computers are quite tolerant of dirty tape heads (except on a microdrive system). Incorrect alignment gives much greater problems.

Some hi-fi shops or electricians will re-align tape heads for you but prices vary widely, from about £2 to as much as £20.

Translation frustration

I have recently changed from a Sharp MZ-80A to a BBC Model B. This has meant that all the data I had on cassette for the Sharp’s data-base is now incompatible with the BBC. As there is so much data on the cassettes it’s impractical to type it out again if there is an alternative. What I would like to be able to do is make the data compatible with a BBC data base.

Edward Wilding, Blaby, Leicestershire.

This is a very common problem, in business data processing as well as personal computing. Often companies use the same system for years rather than upgrade to a more useful or efficient one—they simply can’t afford the cost of converting all their data from one format to another.

Curiously enough, the essence of the problem is the low cost of computers: it does not last long before the data on a system is worth far more than the machine which processes it.

In your case there’s no easy solution. Both computers use special-purpose hardware to generate or detect a cassette signal, and they each use a different approach to the storage of data. Your Sharp cassettes will make no more sense to the BBC micro than a tape of Culture Club or Beethoven.

Data on a cassette is recorded as a series of clicks or tones. One pitch might correspond to a ‘1’, and another to a ‘0’, so that a stream of beeps or clicks can correspond to a program, or a list of data items. The actual pitches or timings used will vary from one computer to another, influencing the reliability of the recording and the speed at which it can be read.

Your BBC Micro uses different tones and a different speed to the Sharp, so you can’t just load the data as you would information recorded from another BBC. In fact, the Sharp data would be too fast.

Even if the tones were the same, the format might be different. This is the sequence in which data is recorded, the way file names and locations are handled, and so on. Every file contains extra information besides the data—its name, size, total value (for checking), and so on. These are recorded in micros that are different to various machines. There’s no standard format since each choice has advantages and disadvantages in terms of complexity, flexibility and speed.

Some computers encode cassette cassettes using software; a program might use simple
Commodore 64. I don't have very much money, so £20 is about the most I am prepared to pay. Could you recommend a suitable assembler, bearing in mind my price limit and the fact that I am still using tapes?

Daniel Procida, De La Salle College, Malta.

There are a large number of assemblers available for the Commodore 64 on tape, disk and cartridge. Most of them allow all the standard features of assembly language—mnemonics, labels, and so on. It's worth making sure, before you buy an assembler, that it conforms to a few basic criteria: it should be written in machine code (Basic assemblers are irritatingly slow); and it should be at least 'two-pass'—this means that you can refer to any labeled address in your program. Other useful features are macros (facilities to refer to a group of instructions with one name) and built-in debugging commands (to allow you to adjust memory values, start and stop machine code programs, and so on).

There is a big problem associated with learning machine code on a cassette-based computer. When you make a mistake in a Basic program, the most common result is an error message. You can then adjust the program and run it again. But the same cannot be said for machine code programs. The majority of mistakes in machine code cause the computer to stop dead or crash completely, losing all the contents of its memory. In other cases you can't find the mistake until you have re-loaded your assembler program, instructions, debugger (if any) and re-assembled the code. This will take several minutes on a cassette system.

It's much more convenient to have your assembler on a cartridge, so that you don't have to re-load it from tape every time something goes wrong. This may cost a little more than you planned (Commodore's own assembler/editor cartridge costs £24.95 at the time of writing) but the extra money will be well spent—you'll save hours in the first week of serious use. Almost all professional Commodore 64 programmers use cartridge-based assemblers.

If you just want to get some idea of what assembly language is all about, you might as well start with a cheap and cheerful program on tape. Mushroom Software, 193 Rommany Road, London SE27 sells a two-three-pass assembler on cassette for just £5.50, plus £1 for overseas orders.

More Ace space

Last year I bought a 3k Jupiter Ace. I would like to expand the memory, but I understand that the manufacturer of the computer, Jupiter Cantab, has gone out of business. None of the shops near my home stocks accessories for the Ace. Is there anywhere I can still get a RAM pack for my computer? Could I plug in the 16k RAM pack from my ZX81?

John Dewhurst, Middlesbrough, Cleveland

The expansion port on a Jupiter Ace carries the same signals as a ZX81 RAM pack. However, the signals are wired on the port in a different order, so you'll need an adaptor to enable the two devices to work together.

Despite the death of Jupiter Cantab there are still a few firms supplying Ace enthusiasts. The stocks of the Jupiter Ace, and add-ons, are now owned by a company called Boldfield Limited Computing. It sells most of the original add-ons including RAM packs (£23 for 16k), joystick interfaces, keyboard adaptors, and so on. They also stock a motherboard which has an Ace expansion plug on one side and a ZX81 socket on the other; you could use this to connect your Sinclair RAM pack to the Jupiter Ace. It costs £13.80.

For further details you should contact Boldfield at Sussex House, Hobson Street, Cambridge CB1 1NJ.

Dragon key mystery

I have a strange problem with my Dragon 32 computer sometimes it ignores keys when I'm typing quickly. For example, if I type LIST, the screen shows 'LST and I get a syntax error when I press ENTER. The problem occurs with some words but not others.

Is there something mechanically wrong with the computer? Why does it work properly when I type slowly?

Graeme Newman, Crown East, Worcester

Your problem stems from some sloppy system programming—there's nothing wrong with the keyboard of your computer. The Basic interpreter in the Dragon, and in the Tandy Color Computer, contains a bug which affects the way multiple key presses are detected. The computer is meant to have 'roll-over', which means that you can press the next key of any sequence before you release the first. Of course, this is only useful for fast typists—when you type slowly you press the keys one by one. Hold down the L key on your keyboard, then press E. The second letter appears even though L is still depressed. Now hold down L and press I; this time the second key is ignored.

The Dragon keyboard is wired up in groups of eight keys. The computer reads each group of keys and then works out which key is pressed by examining the resultant pattern. It keeps a record of the last key pressed, so that it can determine which is the 'next key' as your fingers 'roll' from one to the next. The snag is that this is not properly done on the Dragon—it ignores the second key if two in the same group are depressed, L and S are in different groups, but L and I are in the same group.

There's no easy solution to the problem—you have a choice of typing more slowly or writing your own keyboard routine. The bug is not confined to program entry: INPUT AND INKEY$ use the same code, and therefore also suffer from the bug. It has, however, been fixed on the Dragon 64.
The ZX Spectrum Expansion System. Only £99.95

Sinclair's complete alternative to floppy discs...

The ZX Spectrum Expansion System contains:
- One ZX Microdrive
- One ZX Interface 1
- One wallet containing four programs on Microdrive cartridge
- Microdrive demonstration cartridge
- One blank Microdrive cartridge
- Full documentation
- Connecting lead for Microdrive/Interface 1
- ZX Net Lead

The new ZX Spectrum +
Fully compatible with all Spectrum software and peripherals, including this Expansion System
Tasword Two word processor
Turns your ZX Spectrum into a high-quality word processor!
Tasword Two has all the essential features of professional word processing packages - move and copy, insert, margin settings, help pages, find and replace, and much more.
Written by Tasman Software Ltd.
Usual price (RRP): £13.90.

Masterfile filing system
Address lists... personal files... stock inventories... stamp or album collections... club records... recipes... if you can file it, you can Masterfile it!
Masterfile is a menu-driven filing and retrieval system of immense power. Display formats are user-defined, so the range of applications is enormous.
Written by Campbell Systems Ltd.
Usual price (RRP): £16.95.

Games Designer
Now, all you need to create original games are original ideas - and Games Designer! It has eight, very different, pre-programmed games for you to play as they are - or modify out of all recognition!
There's never before been an easier, more enjoyable, way into games design.
Written by Quicksilva Ltd.
Usual price (RRP): £14.95.

Ant Attack
The all-time classic 3D strategy game. Ant Attack combines stunning Escher-like graphics with fast-moving action and a real tactical challenge.
your task is to enter the walled city, seek out your captured partner, and escape. At all times you can choose from four angles of view. But beware: the city is patrolled by giant ants.
Written by Quicksilva Ltd.
Usual price (RRP): £6.95.

...includes this great set of Microdrive programs!
The unique ZX Microdrive system sets the Spectrum apart from all other home computers.
It gives you all the advantages of floppy disc drives - at a fraction of the cost. And tests show the Microdrives are faster than some disc drives.
Now, the complete Microdrive system comes in one package - together with four of the best-ever Spectrum programs, on Microdrive cartridges. This software alone would normally cost you over £50. Yet the Sinclair price for the complete ZX Spectrum Expansion Pack is just £99.95!
You'll find full details of its contents in the panel opposite.

ZX Microdrives—another Sinclair first! The ZX Microdrive is a revolutionary fast access/mass storage device. And it's the only truly affordable alternative to disc drives...
• Loads or saves up to 85K of program or data from Microdrive cartridges.
• Just 3.5 seconds to access a typical file.
• Only 9 seconds to load a typical 48K program.

The ZX Microdrive cartridge - a unique storage medium.
Smaller than a matchbox, the ZX Microdrive cartridge packs in a massive amount of data and programs. Each Microdrive cartridge holds at least 85K bytes of data or programs (that's 30 pages of A4 text). And you can store up to 50 different data files per cartridge, identified by titles of your choice.
Every cartridge comes in its own protective case. Simply remove the cartridge, slot it into the Microdrive, and it's ready to use.

ZX Interface 1—adds powerful new capabilities to your Spectrum.
ZX Interface 1 connects to the back of your Spectrum and controls up to 8 Microdrives. (Additional Microdrives are available for £49.95 each.)
It also gives you:
• An RS 232 interface - to link your Spectrum with full-size printers, other computers using RS 232 (the industry-standard interface) and provide data transmission over telephone lines, via modems.
• ZX Net - lets you set up a local area network of up to 64 Spectrums, for high-speed data communications between you and Spectrum-owning friends.

At your local Sinclair stockist—today! The ZX Spectrum Expansion System adds an exciting new dimension to Spectrum and Spectrum + computing. At £99.95 it's superb value too.
To find out more, call in at your local Sinclair stockist now!

Sinclair Research Ltd,
Camberley (0276) 685311.
sinclair, ZX, ZX Spectrum, ZX Microdrive, ZX Net and ZX Interface are Trade Marks of Sinclair Research Ltd.
Most bulletin boards that provide high-speed access in addition to the normal 300 bits/sec V.21 facility use the Prestel-type V.23 standard. This is fine as long as the BBS is talking to you, but when the roles are reversed, 75 bits/sec can become tedious: this is especially true if you want to upload software or a prepared message. The high-speed standard used in North America is Bell 212, which is equivalent to the CCITT’s V.22 and runs at 1200 bits/sec in both directions (full duplex). But the problem with V.22 in the UK is that modems are still expensive (around £500) as miracle chip technology hasn’t achieved this standard yet. This is a little surprising as Bell 212 is very popular in the US and Canada, and it’s compatible with V.22 at 1200 bits/sec.

As an experiment, Liverpool Mailbox will be providing a V.22 service, in addition to the normal V.21 (300 bits/sec) service, which should be operating now. It will be interesting to see how many V.22 users there are out there, and if this results in any calls from people in the US using Bell 212.

The ICL OPD
The new ICL computer, the One Per Desk, is an interesting development. The concept of combining the busy executive’s telephone-answering machine, micro, calculator and mainframe terminal in one unit looks like becoming the way of the future. It would also make a nice addition to any online computer user’s equipment.

I have been using a null modem made by Peter Inglis, and it performs very well. It’s very small, being hardly any bigger than two 25-way connectors. An added bonus is that it has two LEDs, one on each of the data lines, which flicker on and off as data passes; this can be a very useful feature when troubleshooting. The best news is the price — a remarkably low £9.50 plus 50p p&p. Mr Inglis can supply gender changers at the same price. Contact him at: 14 Arbour Lane, Chelmsford, Essex CM1 5RG. Tel: (0245) 267482.

RS232 troubleshooting
If you’re having problems using online systems, there are a number of common symptoms which will give you a clue as to where to look for the cause and cure. Here are the most common cases:

Nothing seems to happen: check that your modem and the one you have called have locked together. Has your modem’s carrier detect (CD) light come on? If not, you are probably calling a system that has incompatible modem standards — Prestel with a 300 bits/sec modem, for example. Try a different system, or change the settings on your modem if it’s a multi-standard type. Most systems operating in the UK are V.21 (300 bits/sec) or V.23 (1200/75 bits/sec). Most bulletin boards use V.21, Prestel uses V.23. Some systems provide both, either on separate numbers or by automatically detecting your mode when you call.

If the CD light comes on but nothing appears on your screen, try sending a few carriage returns (for PSS send two carriage returns followed by the characters ‘D1’, and another return). If you’re still not getting anything on your screen, then it’s possible that your computer is not sending (or receiving) data. If your modem has transmit and receive data (TD and RD) indicators, check that the TD one flickers when you type at the keyboard. Is the RD indicator flickering?

If you don’t have TD and RD indicators, the easiest way to check that your computer is transmitting and receiving properly is to set your modem to test mode (sometimes called ‘analogue loop’) if it has this facility. If it doesn’t, you can test the computer and RS232 interface by connecting the transmit and receive pins together (pins 2 and 3 on a standard 25-way connector).

In both these cases, with a terminal program running and set to full duplex, whatever you type on the keyboard should be echoed back to the screen. If not, it could be connection problems — are pins 2 and 3 the right way round? Alternatively, perhaps the lack of a control signal is stopping the computer from transmitting. Some software needs to see CD go high before it will start to send.

Try different software or investigate the state of the various pins with a voltmeter. A 6- or 9-volt battery can be used to set the various control lines high or low.

Garbled data: if you are receiving badly, or completely, garbled data when online, the most likely cause is incompatible word length and/or parity settings. The most common settings are 8-bit word, no parity, one or two stop bits, and 7-bit word, even parity, one or two stop bits. The number of stop bits is not as critical as the word length. Another cause of garbled data is a poor phone line. In this case, you will often get letters appearing when nothing is actually being sent; this is caused by noise on the line.

Missing characters at the start of a line: this is most likely to be caused by your
system needing nulls after carriage returns. The solution, for BBSs at least, is to look for the command that enables you to change your terminal configuration. It is often called FORMAT.

**Missing chunks of text:** this is probably caused by flow control problems. When information is being sent to you from an online system, there may be times when your computer needs time to catch up. This is especially true at higher speeds, such as 1200 bits/sec.

The usual way to pause output is to use a couple of ASCII control characters called X-on and X-off (the 'X' stands for 'transmission'). If you lose chunks of data, it's probably because your system is overloaded with incoming data and isn't sending an X-off character to request the sender to pause. Alternatively, it may be sending X-off and the sender doesn't recognise it, but this is unlikely as most online systems support X-on/X-off flow control. X-off is control-S (ASCII decimal 19), X-on is control-Q (ASCII decimal 17).

**UK free networks**

<table>
<thead>
<tr>
<th>Bulletin Board</th>
<th>Phone Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BABB5-Bath</td>
<td>(0225) 23276</td>
<td>300/300 baud rate; 9pm-8am weekdays, 9am-noon weekends; Atari-based system</td>
</tr>
<tr>
<td>BABB5-Felixstowe</td>
<td>(0394) 276306</td>
<td>300/300 baud rate; 24 hours daily; Apple users' group</td>
</tr>
<tr>
<td>BABB5 TWO-Basildon</td>
<td>(0268) 778956</td>
<td>300/300 baud rate; 24 hours daily; Apple users' group with special area for queries to Apple UK</td>
</tr>
<tr>
<td>Basug</td>
<td>(0742) 667983</td>
<td>300/300 baud rate; 24 hours daily</td>
</tr>
<tr>
<td>Bettisfield</td>
<td>(094875) 378</td>
<td>300/300 baud rate; 9pm-9am daily; remote CP/M system</td>
</tr>
<tr>
<td>Blandford Board</td>
<td>(0258) 54494</td>
<td>300/300 baud rate; 24 hours daily</td>
</tr>
<tr>
<td>CABB</td>
<td>(01) 631 3076</td>
<td>300/300 baud rate; 24 hours daily</td>
</tr>
<tr>
<td>CBBS SW</td>
<td>(0392) 53116</td>
<td>300/300 baud rate; 24 hours daily</td>
</tr>
<tr>
<td>CBBS Woking</td>
<td>(0626) 890014</td>
<td>1200/75 and 300/300 baud rates; 24 hours daily; jokes, jobs, reviews, news</td>
</tr>
<tr>
<td>CNOL Lancaster</td>
<td>(0524) 63099</td>
<td>300/300 baud rate; 24 hours daily; Clinical Notes Online service, mainly for medical users; works in conjunction with a database on the Datastar network</td>
</tr>
<tr>
<td>Computers Incorporated Newcastle</td>
<td>(0207) 543555</td>
<td>300/300 baud rate; 24 hours daily; primarily business-oriented</td>
</tr>
<tr>
<td>Forum 80 Hull</td>
<td>(0482) 859169</td>
<td>300/300 baud rate; 5-11.30pm weekdays, noon-11.30pm weekdays; Bell 103 standard, midnight-8am daily; international electronic mail, library for up/downloading</td>
</tr>
<tr>
<td>Forum 80 SPA</td>
<td>(0926) 39871</td>
<td>300/300 baud rate; 11pm-midnightdaily; TRS-80 and Genie users' group</td>
</tr>
<tr>
<td>Forum 80 Wembley</td>
<td>(01) 902 2546</td>
<td>300/300 baud rate; 7-10pm weekdays, midday-10pm weekdays; electronic mail, library for downloading; ring and ask for Forum 80</td>
</tr>
<tr>
<td>Hamnet Hull</td>
<td>(0482) 497150</td>
<td>300/300 baud rate; 6pm-8am daily</td>
</tr>
<tr>
<td>Liverpool Mailbox</td>
<td>(051) 428924</td>
<td>300/300 baud rate; 24 hours daily; electronic mail, program downloading, TRS-80 information; messages for PCW can be left on the board and will normally be read by us within 24 hours</td>
</tr>
<tr>
<td>Mailbox-80 Stourport</td>
<td>(0384) 635336</td>
<td>300/300 baud rate; 6pm-8am daily</td>
</tr>
<tr>
<td>Manchester Open Bulletin Board</td>
<td>(061) 7368449</td>
<td>300/300 baud rate; 24 hours daily</td>
</tr>
<tr>
<td>MBBS-Mitcham</td>
<td>(01) 640 2617</td>
<td>300/300 baud rate; 7am-9pm Thursday and Sunday; BBC-based system with jokes, graffiti, electronic mail, and Atari and BBC sections</td>
</tr>
<tr>
<td>MG-Net CBBS London</td>
<td>(01) 399 2136</td>
<td>300/300 baud rate; 5-10pm Sunday; electronic mail, program downloading</td>
</tr>
<tr>
<td>Microweb Manchester</td>
<td>(061) 4564157</td>
<td>300/300 baud rate; 24 hours daily; Micro User magazine, mainly for BBC users</td>
</tr>
<tr>
<td>NBBBS-North Birmingham</td>
<td>(0827) 288810</td>
<td>300/300 baud rate; 24 hours daily; program downloading, TRS-80 information; messages for PCW can be left on the board and will normally be read by us within 24 hours</td>
</tr>
<tr>
<td>OBBS Manchester</td>
<td>(061) 4271596</td>
<td>300/300 baud rate; 24 hours daily</td>
</tr>
<tr>
<td>PIP-Sheffield</td>
<td>(0742) 667983</td>
<td>300/300 baud rate; 8pm-2am daily; ring-back system (dial the number, let phone ring once, and then ring back); messages, downloading</td>
</tr>
<tr>
<td>Southern BBS</td>
<td>(0243) 511077</td>
<td>300/300 baud rate; 24 hours daily; remote CP/M system</td>
</tr>
<tr>
<td>Stoke ITEC</td>
<td>(0782) 265078</td>
<td>300/300 baud rate; 7am-9am daily</td>
</tr>
<tr>
<td>TBBS London</td>
<td>(01) 348 9400</td>
<td>300/300 and 1200/75 baud rate (including Prestel compatibility); 24 hours daily; temporary number for the TBBS Nottingham system</td>
</tr>
<tr>
<td>TBBS London Metro</td>
<td>(01) 341 7840</td>
<td>300/300 baud rate; 24 hours daily; ring-back system (dial the number, let phone ring once, and then ring back); Atari-based</td>
</tr>
<tr>
<td>WABBS-Worthing</td>
<td>(0903) 42013</td>
<td>300/300 baud rate; 24 hours daily; remote CP/M system</td>
</tr>
</tbody>
</table>

Every system has a facility to provide line feeds. The system won't accept your password: if it won't, even though it has been done so before, check that you are sending the correct case. Many systems see upper and lower case as different, and it's easy to get it wrong when the system doesn't echo it back to you.
David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for.

Send your contributions to Sub Set, PCW, 62 Oxford Street, London W1A 2HG.

Z80 floating point

As a somewhat delayed follow-up to its conversion of a 32-bit integer arithmetic suite from 280 to 6502 code (February 1982, PCW), Dennis May of London provides Subset with a Z80 suite to perform floating point binary arithmetic.

The suite acts on arguments anywhere in memory, indexed by the Z80's two 16-bit index registers, IX and IY. It returns the result in the six registers BCDEHL, ready for storage anywhere. The zero and carry flags are used to convey division by zero and overflow error information.

Each number in the format required by the suite is contained in six bytes. The first byte is the exponent and the second is the sign byte of which only bit 7 is actually used. The remaining four bytes form the mantissa, or fraction. The 32-bit precision is about the equivalent of 9.5 decimal digits. The range of the zero exponent to indicate that for a non-zero number, the mantissa is normalised so that for a non-zero number, bit 31 is always set. (Anyone wishing to try and improve upon the suite might like to utilise this fact — the sign bit can be stored in the high order bit of the mantissa, cutting variable storage by 1/6.)

The exponent is held as an 'excess 128' value; this is similar to the Z80's complement notation with which you should be familiar but has 128 (30H) as the zero exponent value with lower values negative and higher ones positive. The advantage of excess 128 over the familiar scheme of indicating signed numbers is that zero — the easiest value to test — signifies either overflow or underflow. Dennis also uses a zero exponent to indicate that the number is zero, making it unnecessary to clear the mantissa and reset the sign.

33-bit subtraction

One elegant feature of the suite worth commenting upon is the implementation of 33-bit arithmetic in the division routine FPDIV. If, in any iteration, the 32-bit subtraction of divisor from dividend fails then a borrow is generated. However, the previous iteration shifts the highest dividend bit out to carry and the subtraction would be possible if this bit were set. In fact the borrow in 33-bit arithmetic will be the inverse of the shifted out bit, and the algorithm used by Dennis simply replaces the 32-bit borrow by the complement of the shifted bit.

DATASHEET 1

CPU Z80

- HARDWARE
  - FETCH: arguments in RAM, MOPUP: none.
  - SOFTWARE
    - FETCH: none, MOPUP: 'NORMAL' and 'ROUND'.

INPUT

- FPDIV: Result in 8 bytes on stack addressed by IX.
  - FPDIVH: bits 15-17.
  - FPDIVL: bits 0-14.

OUTPUT

- FPDIVH: bits 15-17.
  - FPDIVL: bits 0-14.

- MOPUP: Result in 8 bytes on stack indexed by IX. All flags cleared.
  - MOPUPH: bits 15-17.
  - MOPUPL: bits 0-14.

ERRORS

- None

DATASHEET 2

- FPDIV: Result in 32-bit floating point number.
  - MOPUP: Result in 32-bit floating point number.

- MOPUPH: bits 31-32.
  - MOPUPL: bits 0-30.
### DataSheet 3

<table>
<thead>
<tr>
<th>CPU</th>
<th>HARDWARE</th>
<th>RAM indexed by IX (Stack workspace within suite).</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM</td>
<td>SOFTWARE</td>
<td>None.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INPUT</th>
<th>1</th>
<th>C = rounding byte. D = byte above mantissa.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT</td>
<td>1</td>
<td>C = bit count for RESWRT.</td>
</tr>
</tbody>
</table>

| ADDM | + | Add mantissa of two floating point numbers. |
| Prev. | 2 | SUBM | Subtract mantissa of two floating point numbers. |

| NEMG | + | Negate mantissa of a floating point number. |
| Prev. | 2 | NEMG | Negate mantissa of a floating point number. |

**JOB**  
Set of three arithmetic utility routines acting on the 4-byte mantissas of floating point numbers.

**ACTION**  
Move numbers to stack workspace. Input mantissa set in BCDEHL.

**ERRORS**  
None.

**RES USE**  
A, B, C, D | stack workspace |

**STACK USE**  
None.

**LENTH**  

### Datasheet 4

<table>
<thead>
<tr>
<th>CPU</th>
<th>HARDWARE</th>
<th>Memory containing the two numbers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM</td>
<td>SOFTWARE</td>
<td>None.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INPUT</th>
<th>IX, IY and indexed numbers unchanged. 2. A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY</td>
<td>Result in DECB, CY = 1 (Overflow).</td>
</tr>
</tbody>
</table>

**ERRORS**  
None.

**RES USE**  
F, BD, DE, HL, IX, IY | stack workspace |

**STACK USE**  
22.

**LENTH**  
None.

**CYCLES**  
Not given.

### CLASS 2  2 | Discrete | Interruptable | xprovable |

### Memory Location Table

<table>
<thead>
<tr>
<th>Memory Location</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B, C, D</td>
<td>Floating point mantissa</td>
<td></td>
</tr>
<tr>
<td>IX, IY</td>
<td>Floating point mantissa</td>
<td></td>
</tr>
</tbody>
</table>

**NEMG**  2 | Complement negative mantissa stored in first number. |

### SUBM

Subtract mantissas of two floating point numbers.

### ADDM

Add mantissas of two floating point numbers.

### NEMG

Negate mantissa of a floating point number.

**JOB**  
To perform addition or subtraction on two floating point numbers, set input mantissa in BCDEHL, return a valid result in registers or error information in flags.

### ACTION

Move numbers to stack workspace. Input mantissa set in BCDEHL.

| IF | Neither number = B THEN: Return other number. |

### EQUAL

Evaluate mantissas, adjusting input, combine mantissas, set carry on overflow.

### ADD/MULT

Add or subtract mantissas with any necessary negation, equalise exponents, justify mantissa, store result in BCDEHL.

| Exit, result to registers, setting correct flags. |

**CPU**  
808 | HARDWARE | Memory containing the two numbers. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM</td>
<td>SOFTWARE</td>
<td>None.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INPUT</th>
<th>IX, IY and indexed numbers unchanged. 2. A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY</td>
<td>Result in DECB, CY = 1 (Overflow).</td>
</tr>
</tbody>
</table>

**ERRORS**  
None.

**RES USE**  
F, BD, DE, HL, IX | stack workspace |

**STACK USE**  
22.

**LENTH**  
None.

**CYCLES**  
Not given.
Our versatile Model 4 is a truly portable unit, and will run all Model 4 disk software and also Model III TRSDOS and LDOS disk programs (in Model III mode) without change - so a huge library is already available. Model 4P is compatible with the CP/M Plus* operating system which opens the door to literally thousands of applications! The TRSDOS 6 operating system lets you use extra memory as a superfast disk drive.

Unlike some transportables, it's big on features, such as a full 80-character by 24-line 9" green display that can be upgraded to provide optional 640 x 240 high resolution graphics. Its full-size keyboard features CONTROL, CAPS and three function keys. A 64K memory as standard and a 128K option means it is ideal for larger tasks.

The Model 4P is ready to go to work in any small business - you can prepare accurate balance sheets and income statements for a fast analysis of your company's profits, improve your cash flow by monitoring your receivables to speed up collections and identify bad debts, and optimize your payment schedule for maximum efficiency.

Thoroughly documented, the Model 4P comes with Microsoft** Disk BASIC and TRSDOS 6 operating system, owner and programming manuals, reference card, and an introduction to your computer that gets you started immediately. Housed in a hi-impact ABS case with built-in carry handle.

Specifications:
- Microprocessor: 4 MHz Z-80' A (2 MHz in Model III mode).
- Memory: 64K RAM, expandable to 128K. Provides for disk drive emulation in RAM, only 64K addressable from BASIC. Keyboard: 70-key typewriter-style with datapad, plus CONTROL, CAPS and 3 programmable function keys (F1, F2, F3). Video Display: 80 x 24 (Model 4 mode), 64 x 16 (Model III mode), or double-width 40 or 32 characters per line. Upper and lower case. Reverse video (Model 4 mode), 96 text, 64 graphics and 96 "special" characters. Language: Microsoft 5.0 BASIC. Sound: Obtainable from BASIC. Toggled "keyclick". Disk Drives: Two built-in double-density 184K 5¼" drives. External Connections: Parallel printer port, RS-232C serial port. Dimensions: 16⅞ x 13⅛ x 9¾". Power: 240 VAC, 50 Hz.

Send For Further Information to:
Computer Marketing, Tandy Corporation (Branch UK), Tameway Tower, Bridge Street, Walsall, West Midlands. WS1 1LA.

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- **SHARP MZ-80A, 48k** integral monitor and cassette, Sharp Basic and machine language books and tapes. Tel: Newcastle (0911) 255260.

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- **TRON 200 Modular II Level II,** 48k, expansion interface, green screen monitor, lots of software, Forth, Pascal assembler, word processor, adventures, etc. Books and 80 micro maps. £150. Tel: Metheringham (Lincoln) 22109.
WRITING FOR PCW

Your chance to contribute to the magazine.

We’re offering readers a chance to get rich (well, at least richer) and to influence what’s published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It’s often users with practical experience who have the most interesting things to say, so don’t worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature write, with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing with ample margins top and bottom and on each side.

Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

We’ll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well.

Bear in mind that it’s worth taking a look at the Back Issues advertisement to see what sort of things we have already published — after all there’s no point in reinventing the wheel. And please be sure to tell us if you’ve contacted another magazine (perish the thought!); it would be very awkward if the same article appeared elsewhere. Frankly, we’re more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is £65 per 1000 words, and payment usually follows about four-six weeks after publication.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printer’s errors, etc.

<table>
<thead>
<tr>
<th>Location</th>
<th>Event</th>
<th>Contact Information</th>
<th>Dates</th>
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<tr>
<td>London (Barbican)</td>
<td>Int Computer Graphics User Show &amp; Conference</td>
<td>Montbuild Ltd, (01)4861951</td>
<td>19-21 Feb</td>
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<tr>
<td>Blackpool</td>
<td>Northern Amusement Equipment &amp; Coin Operated Machines Exbn.</td>
<td>Jack Rose Exbsns Ltd, (01)8559201</td>
<td>19-21 Feb</td>
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<tr>
<td>London (Barbican)</td>
<td>PC Trade Show</td>
<td>EMAP Int Exbsns Ltd, (01)8373699</td>
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<td>London (Olympia)</td>
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<td>CGP Ltd, (01)5829256</td>
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<td>Glasgow (Anderston Centre)</td>
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<td>USA (Anaheim)</td>
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<td>Contact Interface Group Inc, 300 First Ave, Needham, MA 02194</td>
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<tr>
<td>London (Olympia)</td>
<td>INF0 85 (Information Technology &amp; Office Automation Exbn.)</td>
<td>BED Exbsns Ltd, (01)6471001</td>
<td>26-28 March</td>
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LEISURE LINES

Quickie

This month’s quickie has an educational slant. In a mixed class of a certain school, each girl student can see as many girl students as she can boy students. But each boy student can see twice as many girl students as he can boy students.

How many boy and girl students are there in the class?

Prize Puzzle

I have a box full of equal sized ball bearings. The total number of ball bearings happens to be a perfect square greater than 4. It is possible to construct a triangular pyramid using every ball bearing.

What is the least number of ball bearings that I could have. Note — in a triangular pyramid, the layers contain 1, 3, 6, 10 ball bearings and so on.

Answers please, on postcards only (letters will be disqualified), to PCW Prize Puzzle, March 1985, Leisure Lines, 62 Oxford Street, London W1. Entries to arrive not later than 31 March 1985.

November Prize Puzzle

We had exactly 100 entries for this competition. Program running times to solve the problem ranged from five and a half days on a Spectrum to two minutes on an HP9816. But, since one HP9816 owner said it took 26 hours, I suppose the timings reflect the quality of the programming rather than of the hardware.

Some readers said it couldn’t be done, but, to show they are wrong, the required answer is 2199978, which divides with 8799912 exactly, giving a
Definitions A Prime number is a positive whole number which is exactly divisible by itself and unity only. Thus the sequence of primes begins 2, 3, 5, 7, 11, 13, 17, 19, ... A truncatable prime number is a prime which yields a sequence of primes when successive digits are removed: always from the left (for a left-truncatable prime), always from the right (for a right-truncatable prime), or simultaneously from the left and right (for a shrinking prime). For example: 629137 is left truncatable since it is prime and so are 29137, 9137, 137, 37, & 7. 939133 is right-truncatable since it is prime and so are 939133, 933, 33, & 3.

The State of the Art Angell 10 and Godwin HJ 1977 Mathematics of Computation, vol 31 page 265, have tabulated, to base ten, the largest primes when successive digits removed: always from the left (for a right-truncatable prime), or simultaneously from the left and right (for a shrinking prime). For example: 629137 is left truncatable since it is prime and so are 29137, 9137, 137, 37, & 7. 939133 is right-truncatable since it is prime and so are 939133, 933, 33, & 3.

The winning entry comes from Mr. Clauses Malcolm from Sweden. Congratulations Clauses (or is it Malcolm?), your prize is on its way.

Prize winner

(Factorial n) + 1 is prime for the following n less than 231: 1,2,3,11, 27,37,41,73,77,116, & 154.

(A horrible decision to have to make, but against anything else Black simply removes the pawn on c6 and then builds up his central power-house.)

Kevin O’Connell bets on Chaos in the North American computer chess championship.

The game which follows was played in the last round of the 15th North American Computer chess championship, held in San Francisco last October. The game is proof of grandmother’s old saying that one should never bet on a proposition.


<table>
<thead>
<tr>
<th>Move</th>
<th>White</th>
<th>Black</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>d2-d4</td>
<td>c7-c5</td>
</tr>
<tr>
<td>2</td>
<td>d4-d5</td>
<td>e7-e5</td>
</tr>
<tr>
<td>3</td>
<td>e2-e4</td>
<td>d7-d6</td>
</tr>
<tr>
<td>4</td>
<td>c2-c4</td>
<td>g7-g6</td>
</tr>
<tr>
<td>5</td>
<td>Nb1-c3</td>
<td>Bb8-g7</td>
</tr>
<tr>
<td>6</td>
<td>Bf1-d3</td>
<td>Ng8-e7</td>
</tr>
<tr>
<td>7</td>
<td>Ng1-e2</td>
<td>O-O</td>
</tr>
</tbody>
</table>
| 8    | Bc1-d2| A typical position out of the Old Benoni Defence, which shows the great progress made by programs in the last few years. It is very important here to retain freedom of movement for the f-pawns and both programs seem to understand this.)
| 9    | f2-f3 | Nb8-a6 |
| 10   | Bd2-g5| Na6-b4 |
| 11   | Bd3-b1| h7-h6 |
| 12   | Bb4-h4| g6-g5 |
| 13   | Bb4-f2| f5xe4 |
| 14   | Bb4xe4|       |

(Having e4 for his pieces promises White some advantage.)

14 | Bc1-f5 |
15 | O-O    | Qd8-d7 |
16 | a2-a3  | Na4-b4 |
17 | Qd1-b3 | Na6-c7 |
18 | Bc1xf5 |

(The start of an interesting but very risky plan. This makes the c6 square available to White’s queen. However, the net result of the whole manoeuvre is merely a very weak white pawn on c6.)

18 | Ne7xf5 |
19 | Qb3xb7 |
20 | Qb7-c6 |
21 | d5xc6 |
22 | Rb8xb2 |
23 | Ne2-g3 |
24 | Rf1xb1 |
25 | Nc3xb1 |
26 | Ng3-e4 |
27 | Ne4xb6 |

(A horrible decision to have to make, but against anything else Black simply removes the pawn on c6 and then builds up his central power-house.)

27 | Ne8xd6 |
28 | Bf2xc5 |
29 | Nb1-d2 |

Kg8-f7
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The Association of Computer Clubs (ACC), is the national representative and liaison body for computer clubs around the UK. It is a democratic, non-profit making association run by and for its members through a council consisting of representatives of the computer clubs that are paid up affiliates of the ACC.

The ACC runs a number of services for clubs and for computer enthusiasts interested in the computer club movement.

We offer a free, public liability, insurance scheme and a low cost, equipment insurance scheme for affiliated club meetings. A network of regional contact points is being set up (anybody interested in being a regional contact, please contact me), and we are active on the Prestel database with a network of public domain programs for the CP/M BIOS. Not to mention a variety of public domain programs for the expanded and unexpanded NewBrains, a version of Basicode and a large listing, controller module, the paged Basic and the paged operating system, disk controller module, the paged Basic and the CP/M BIOS. Not to mention a variety of public domain programs for the expanded and unexpanded New-Brains, a version of Basicode and a large number of languages. The club is affiliated to NewBrain user groups in Holland, Denmark and Italy; and is planning to hold meetings in Central London (possibly also Manchester and Scotland).

There has been a change of secretary at the Forth Interest Group (UK). The new man is Douglas Neale, 58 Woodland Way, Morden, Surrey. The group continues to meet on the first Thursday of the month in room 307 of the Polytechnic of the South Bank, London, at 7pm. The membership is now around 700 in total and it is proposed to organise local chapters of FIG outside London.

Serious business users might take note of the Sirius and Apricot User Club, Electron House, 27 Cardiff Road, Luton, LU1 1PP, or on 0582 4212214. Not exactly an amateur club, this outfit is run as a business — but if you are using Apricot or Sirius professionally you would do well to take a look. They run a telephone hotline, seminars, newsletters, disk count schemes, hardware and software exchange schemes, training schemes and much more.

BBC disk system users — have you joined the Format 4080 Club? It is run by Peter Hughes of 5 Marsh Street, Bristol BS1 4AA. The club operates by distributing a disk six times a year, containing both a newsletter and software for members to run. Both 5.25 and 3 inch disks are available. Other products are offered on special offers with each issue of the 'Club Disk'.

Memotech users may be interested in GENPAT, said to be the official user club for Memotech MTX and FDX systems. I understand that this club is recognised by the manufacturer. The annual subscription is £16, which covers 12 editions of the club magazine, 'Memo-pad', and 'all the usual benefits of membership of a user group'. Write to Mr K Hook, 3 Bulcock Street, Burnley, BB10 1UH, for details.

Orientally speaking, are you interested in the Sord-Pips Users Club? If so, contact Peter Kuhn, 134 Marlow Drive, North Cheam, Surrey SM3 9AS.

Texas Instrument TI 99/4A users may be interested in the TI 99/4A Exchange, which is the UK user group for this, now discontinued, machine. There is a quarterly newsletter called T1*MES featuring a wide variety of material included.

The annual subscription is £6, and the group (which is a non-profit organisation), is supported only by its members. For full details, contact T1994 Exchange, 40 Behall, Patcham, Brighton BN1 8UF.

REMEMBER: If you are interested in the ACC's services, or would like to find out about a computer club near you (or for your machine), or would like information for your club in this column, please write to me: Rupert Steele, 17 Lawrie Park Crescent, London, SE26 6HH, or call 01-370 0601.
BRITAIN'S BEST S/W PRICES?

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<tr>
<td>Price</td>
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<tr>
<td>WordStar</td>
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<td>Framework</td>
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- We will endeavour to better any other advertised price in this issue, please call.
- Please call for anything not listed above.
- All goods will normally be delivered within two working days.
- Please state micro type, operating system and disc format when ordering.
- Please enclose cheque with order where possible including £1.50 VAT.
- We supply government, local authorities etc...
- We will endeavour to better any other advertised price in this issue.
- WordStar professional — now only £275!

The most common objection to the Commodore 64 is its abysmal Basic — anything remotely clever ends up as an encrypted tangle of POKEs. The program of the month turns the 64 into something usable, and gives a Basic programmer simple access to the sprites and music capabilities. In total 29 new commands are added to the Basic, all of which can be used in the normal way. As the program is in machine code, it can be POKEd in with the top of memory lower and the original Basic deleted. This way it occupies only a few hundred bytes, leaving plenty of room for a Basic program, and the commands operate faster than their equivalent POKEs.

Following the NewBrain assembler published last month, there's a machine code monitor of truly exceptional quality. Some of its more outstanding features that place it on a par with commercial products are: a program relocator that updates all the addresses so that the program still runs in its new location; a block move; intelligent search and replace; and a disassembler.

BBC owners can produce professional smooth scrolling of text and graphics with the smooth scroll routine published this month. Text on a graphics screen has always been a problem for Atari owners, but is elegantly solved with the Multi-Mode Text program. Although short it's very powerful when offering text in any graphics screen, and features numerous other niceties.

On the games side there's a Pengo-like arcade game for the Research Machines 380Z and 480Z, and multiplayer puzzle game for the Beeb with a clever computer opponent.

Finally, a few loose ends to tidy up. My apologies go to Jeff Aughton who wasn't credited in the intro to Simon Biggs' Golf program (November 1984). This was in fact a conversion of the original Pet Golf program written by Jeff and published over two years ago.

If N Thomas, author of the Commodore assembler program which was printed in the September 1984 issue would contact me, he may discover something to his advantage.

Although the first programs for the Amstrad, OL and MSX are drifting in, they are nothing compared with the demand for quality programs to be published. So, if you have written anything substantial or clever, then do send it to me.

---

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Other systems available — please ring for details. Apple systems in stock.

Program of the Month
Commmodore 64 Scroffs Basic
by David Gristwood

I like this program — not just because it's an excellent program that adds 29 new commands to Commodore Basic, but also because all the commands are fully described within the REM statements of the listing. Here's a brief description of the commands:

CLS — clears the screen.
PAPER X — changes the colour of the main screen(paper), X between 0 and 15.

EDGE X — changes the colour of the border, X between 0 and 15.

AT X,Y — is used in conjunction with PRINT to position text anywhere on the text screen.

JUMP X — calculated GOTO, jumps to the line number in X.

KEY — waits for any key to be pressed.

YNKEY — waits for either the Y or N keys to be pressed.

PAUSE X — pauses X seconds.
**PROGRAM FILE**

EXIT — switches off Scroffs Basic.
CFILL X — fills colour matrix and hence printed colour.
SFILL X — fills the screen with the ASCII character corresponding to X.
REPEAT UNTIL (cond) — normal REPEAT UNTIL loop.
FPOP — allows GOTO exit from a FOR loop without confusing the next FOR loop.
GPON — allows GOTO exit from a GOSUB without confusing the next GOSUB.
RVS — reverses everything on the screen.
VOL X — sets the volume and selects the envelope to apply to a subsequent sound command.
VX X — selects the voice (0 to 3) for subsequent sound commands.
PLAY X — POKEs the control register for current voice.
XSP X — is the x coordinate of the selected sprite.
YSP X — is the y coordinate of the selected sprite.
COLSP X — changes the colour of the selected sprite.
MOBCTRL X — turns on or off any combination of the three filters.
FILTFQ X — defines the cut-off frequency for a filter.
FILTER X — switches on any combinations of the three filters.
SPRITE X — selects the sprite for further sprite commands to act on, X between 0 and 7.

**MAKE YOUR OWN PROGRAMS**

After typing in and running the program, typing SYS 36864 will enable the extra to be used. After that it is possible to get rid of the program and use the commands for your own programs. LOADING and SAVEING programs will not effect Scroffs Basic—the only way to disable the commands is to switch off the machine or use the EXIT command.

---

**Data Buffers**

Don’t wait for printing to finish — no matter how fast your printer, your computer works faster.
Release that micro for more processing, seconds after giving the command to print out.
Save time by using a data buffer. And remember, computer time saved means operator time saved.

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**PROGRAM FILE**

- **2520 DDE=2:GOSUB 1400**
- **2540 IF A2="I2" THEN 2000:REM END OF ONE ROUTINE**
- **2580 PIKE ADDR,A21=ADDR+ADDR+1**
- **2600 GOTO 2500**
- **2980 REM**
- **3000 DATA 9000, WEDGE**
- **3020 REM # WEDGE**
- **3040 REM **
- **3060 REM**
- **3100 REM THIS IS NOT A NEW COMMAND FOR**
- **3110 REM BASIC. THIS IS THE MACHINE CODE**
- **3120 REM COMMANDS TO BASIC. IT IS CALLED**
- **3140 REM BY A 'SYS' CALL1**
- **3150 REM SYS 944099**
- **3160 REM OR**
- **3165 REM SYS 3824**
- **3180 REM THIS MUST BE USED BEFORE ANY**
- **3200 REM OF THE NEW COMMANDS WILL WORK.**
- **3240 REM**
- **3260 DATA A9,50,80,08,03,99,90,80**
- **3280 DATA 09,05,49,50,80,90,20,18**
- **3300 DATA A2,BD,00,9F,9D,ED,90,9F**
- **3320 DATA EE,81,02,E8,BD,00,9C,C9**
- **3340 DATA 00,50,8D,08,06,C5,AE,00**
- **3360 DATA 00,50,8D,08,06,80,9F,68**
- **3380 DATA 26,A0,00,4C,C3,90,A0,00**
- **3400 REM **
- **3430 REM **
- **3450 REM **
- **3480 REM **
- **3500 REM**
- **3520 REM THIS MUST BE USED BEFORE ANY**
- **3540 REM OF THE NEW COMMANDS WILL WORK.**
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- **4000 REM**
- **4020 REM**
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- **4120 REM**
- **4140 REM**
- **4160 REM**
- **4180 REM**
- **4200 REM**
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- **4940 REM**
- **4960 REM**
- **4980 REM**
- **5000 REM**

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16100 REM CURRENT SPRITE UN
16040 REM *SPRITE
15620 REM !HE FILTER.
15500 REM FILTERS TO SWITCH ON OR OFF.
15460 REM ****************************
15400 DATA 9440, FILTER
15240 DATA 80, 15, 04, 4A, 4A, 4A, 85, 14
15180 REM
15080 REM
15020 REM ****** ****** *******************
14880 REM
14820 DATA 02, C8, C8, C8, C8, A5, 14, 99
14720 REM
14660 REM CAN BE USED FOR RING MOD ETC.
14600 REM NEW 'PLAY' COMMAND. 'PLAY' POKES
14520 REM ****************************
14460 REM ****************************
14560 REM
14320 DATA ZZ
14260 DATA 20, 8A, A0, 20, F7, B7, AC, B0
14220 REM (0 UR 4095
14160 REM ****** ******* ***** ***********
14000 REM
14020 REM FREQUENCY IS IN RANGE
14000 OHIO 9460, SPRITE
13920 REM (OF MUST RECENT 'VX' COMMAND)
13880 REM CUTOFF FREQUENCY
13840 REM ****************************
13800 REM *
13760 DATA 93F0, PLAY
13720 DATA C8, A5, 15, 99, 00, 04, 60
13680 DATA 02, A5, 14, 99, 00, D4
13640 REM WAVE.) E.G.
13600 REM OUTPUT, 2048 PRODUCES A SQUARE
13560 REM MUST BE IN RANGE
13520 REM SQUARE WAVE IS TO BE SELECTED
13480 REM WIDTH
13440 REM *
13400 DATA 93D0, PULSE
13360 DATA ZZ
13320 DATA 15, 99, 00, 04, 60
13280 DATA 02, CB, CB, A5, 14, 99, 00, D4
13240 DATA CB, A5, 15, 99, 00, D4, 60
13200 DATA ZZ
13160 DATA ZZ
13120 REM
13080 DATA 9460, SPRITE
13040 REM ************
13000 REM
12960 REM REQUIRES ONE PARAMETER - THE
12920 REM CUTOFF FREQUENCY OF THE 'VX'
12880 REM FILTER (SEE 'VOL' & 'FILTER')
12840 REM ****************************
12800 REM *
12760 DATA 9410, FILTFQ
12720 DATA ZZ
12680 DATA 00, 04, 60
12640 DATA 20, 8A, AD, 20, F7, B7, AC, B0
12600 REM
12560 REM 2048. E.G.
12520 REM CURRENT VOICE, SO OTHER VALUES
12480 REM SHOULD
12440 REM WAVE FORM OF THE CURRENT 'VX'
12400 REM *
12360 DATA 94F0, FILTFQ
12320 DATA ZZ
12280 DATA 00, 04, 60
12240 DATA 20, 8A, AD, 20, F7, B7, AC, B0
12200 REM
12160 REM REQUIRES ONE PARAMETER - THE
12120 REM WAVE FORM OF THE CURRENT 'VX'
12080 REM ****************************
12040 REM *
12000 DATA ZZ
12000 REM
11960 DATA ZZ
11920 DATA 20, 8A, AD, 20, F7, B7, AC, B0
11880 DATA 20, 8A, AD, 20, F7, B7, AC, B0
11840 REM
11800 REM 2048. E.G.
11760 REM CURRENT VOICE, SO OTHER VALUES
11720 REM SHOULD
11680 REM WAVE FORM OF THE CURRENT 'VX'
11640 REM *
11600 DATA ZZ
11560 DATA ZZ
11520 REM
11480 DATA ZZ
11440 DATA ZZ
11400 DATA ZZ
11360 DATA ZZ
11320 REM
11280 DATA ZZ
11240 DATA ZZ
11200 REM
11160 REM *SPRITE
11120 REM ************
11080 REM
11040 REM REQUIRES ONE PARAMETER - THE
11000 REM CURRENT SPRITE ON WHICH TO
10960 REM PRINT SPRITE CUPWAX ACT IE:
10920 REM "COLSP", "ISP" & "VSP", USE A
10880 REM XXX OR YSP TO DESIGNATE EACH SPRITE
10840 REM IN TURN. E.G.
10800 REM 10 FOR T=0 TO 7

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-:0 SPRITE I:LULSP

R LM

.30 NEX1

18..40 REM

1

t

16260 REM SPRITES ARE NUMBERED 0 TU 7.
16280 REM
18.300 DATA 20,8A,AD,20,F7,87,A5,14
16320 DATA 29,07,8D,82,02,60
16340 DATA 22
16360 REM
16400 pArA 9480, MOBCIRL
16420 REM ************************ ****
*
1108CTRL
16440 REM *
16460 REM *****************************
16480 REM REQUIRES ONE PARAMETER - THE
16500 REM SPRITES THAT ARE TO BE TURNED
INDEPENDANT
16520 REM UN. 'MOBCIRL' IS
16540 HEM OF THE 'SPRITE' COMMAND. E.G.
ALL SPRITES OFF
u
16560 REM
ALL SPRITES UN
255
16580 REM
SPRITE u ON
1
16600 REM
SPRITE I UN
16620 REM
2
ETC.
SPRITE 2 UN
4
16640 HEM
16680 REM
16/00 [MIA 20,8A,AD,20,F7,87045,14
16/20 DATA 81415,00,60
16/40 DATA il.
REM

16800
16820
16840
16860
16880
16900
16920

16160

DATA 9490, COLSP
REM *****************************
*
COLSP
REM *
REM *****************************
REM REQUIRES ONE PARAMETER - THE
OF
THE
0 TO 15
REM COLOUR
REM CURRENT SPRITE. SEE 'SPRITE'
REM FOR AN EXAMPLE.
16960 REM
17000 DATA 20,8A,AD,20,F7,87,A5,14
17020 DATA AC,82,02,99,27,00,60
1704u DATA Li
17060 REM
17100 DATA 9480, XSP
17120 REM *****************************
XSP
*
REM *
17160 REM *****************************
17180 REM REQUIRES ONE PARAMETER - IHE
17200. REM X- COORDINATE OF 1HE
CURRENT
17220 REM SPRITE. II
MUST BE BETWEEN
1724u REM 0 AND 511.
ALTHOUGH NOT ALL
17260 REM WILL GE UN IHE SCREEN 1. SEE
17280 REM 'YSP' FOR AN EXAMPLE.
17300 REM
17320 DATA 20,8A,AD,20,F7,87,A9,00
17340 DATA AC,B2,02,F0,07,18,69,02
17360 DATA 88,4C,B8,94,A8,045,14,99
17380 DATA 00,00,A5,15,29,01,85,15
DATA AC,82,02,C8,89,F4,94,85
17420 DATA 14,AD,10,D0,25,14,8D,10
17440 DATA D0,A5,15,D0,01,60,89,FD
17460 DATA 94,85,14,AD,10,00,05,14
17480 DATA 8D,10,00,60,EA,FE,FD:::
17500 DATA FB,F7,EF,DF,BF,7F,EA,01
17520 DATA 02,04,08,10,20,40,80
17540 DATA Z2
REM
17600 DATA 9510, YSP
17620 REM *****************************
17640 REM *
YSP
*
17660 REM *****************************
17680 REM REQUIRES ONE PARAMETER - THE
17700 REM Y
COORDINATE OF IRE CURRENT
17720 REM SPRITE. IT MUST
BE
BETWEEN
REM 0 AND 255.
ALTHOUGH NUI ALL
17760 REM WILL BE ON THE SCREEN ).
ED
11/80 REM
10 SPRITE 0:COLSP 0
17800 REM
20 XSP 300:YSP 100
17820 REM
17840 DATA 20,8A,AD,20,F7,87,A9,01
17860 DATA AC,82,02,F0,07,18,69,02
1/880 DATA 88,4C,18,95,A8,A5,14,99
17900 DATA 00,00,60
17920 DATA Li
17940 REM
50000 DATA 2Z-22:REM END OF PROGRAM DATA MARKER
)

(

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I've yet to beat the computer opponent!

```
10REM***********************
20REM*
30REM D I Z Z Y  D O T S *
40REM*
50REM R.N.Arrowsmith 1984*
60REM*
70REM FOR BBC Micro or *
80REM Acorn Electron*
90REM*
100REM***********************
110*KEY10"OLDIMRUNIM"
120*FX200,1.
130MODE1:PROCinstruct
140REPEAT
150PROCsetup
160PROCstartgame
170REPEATPROCmove
190UNTILboxesleft%=0
190PROCendgame:UNTILFALSE
200END
210:
220DEFPROCinstruct
230PROCtitle
240PRINT"Each player takes turns to join the""dots to form squares."
250PRINT"Whenever a player completes a square they get one point and another turn."
260PRINT"You can play against the computer, or""""just use the computer as a playing board."
270DIMdots%(maxx%,maxy%),boxs%(maxx%-1,maxy%-1),player$(maxplayer%),score%(maxplayer%)
280DIMcoll%(maxplayer%),col12%(maxplayer%)
290FORA%=0TOmaxplayer%-1:READcol12%(A%):NEXT
300DATA1,1,2,2,3,3,1,2,1,3,2,3
310VDU4
320ENVELOPE1,4,20,-15,-15,6,3,3,127,33,-4,-10,126,126
330ENVELOPE2,4,-10,-2,0,3,0,127,100,-1,-10,120,122
340ENVELOPE3,1,4,8,4,30,30,5,5,-10,-30,12,10
350COLOR2
360PRINT"DO YOU WANT THE NOISES? (Y/N)"
370REPEATA=GET OR32:UNTIL A=121 OR A=11
380IFA=10THEN#FX210,1
390IFA=11THEN#FX210,0
400COLOR1
410PRINTTAB(10,20)"PRESS THE SPACE BAR"REPEATUNTILSET=32
420ENDPROC
430:
440DEFPROCsetup
450FORX%=0TOmaxx%-1:FORY%=0TOmaxy%-1:dots%=(X%,Y%)=0:1FX%<maxx%ANDY%<maxy%boxes%(X%
```

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```
PROGRAM FILE

920 Y2% = FNvcoord(maxy%+1)
930 FOR XX = O TO maxx7.: MOVE FNxcoord(X%), Y1%
940 MOVE FNxcoord(X7), Y2%: VDUX%+65
950 NEXT: VDU4
960 boxesleft% = maxx% * maxy%
970 thisplayer% = 0
980 ENDPROC

1000 DEF PROC dot(X%, Y%)
1010 X% = FNxcoord(X%)  
1020 Y% = FNvcoord(Y%)  
1030 MOVE X%, Y%: DRAW X%, Y%+4: DRAW X%+8, Y%+4
1040 ENDPROC

1050:  
1060 DEFINPROC move
1070:  
1080 REPEAT  
1090 PROC cetmove
1100 PROC makemove
1110 UNTIL NOT scored% OR boxesleft% = 0
1120 thisplayer% = thisplayer% + 1: IF thisplayer% = max% thisplayer% = 0
1130 ENDPROC

1140 DEFPROC cetmove
1150 REPEAT  
1160 IF playerS(thisplayer%) = "Dizzy" PROC move ELSE PROC theirmove
1170 UNTIL FNmoveok
1180 ENDPROC

1190:  
1200 DEF PROC guessmove
1210 X1% = RND(maxx%+1) - 1: Y1% = RND(maxy%+1) - 1
1220 X2% = X1%: Y2% = Y1%
1230 IF RND > 0.1 THEN X2% = X2% + 1 ELSE Y2% = Y2% + 1
1240 ENDPROC

1250 DEF PROC makeMove
1260 dots%(X1%, Y1%) = dots%(X1%, Y1%) OR dir
```

---

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PROGRAM FILE

```
1% 1470dots%(X2%,Y2%)=dots%(X2%,Y2%) ORdir
2% 1480MOVFXncoord(X1%),FNycoord(Y1%):GCO
L1,2:DRAWFNxcoord(X2%),YNycoord(Y2%)
1490scored%=FALSE
1500IFdir1%=1:PROCcheckv(X1%,Y1%)
1510IFdir1%=2:PROCcheckh(X2%,Y2%)
1520IFdir1%=4:PROCcheckh(X1%,Y1%)
1530IFdir1%=8:PROCcheckh(X2%,Y2%)
1540ENDPROC
1550:
1560DEFPROCcheckv(XX,Y%),
1570IFXX<max%PROCcheckbox(XX,Y%),Y+=2)
1580IFXX>PROCcheckbox(XX,Y-%,1)
1590ENDPROC
1600:
1610DEFPROCcheckh(XX,Y%),
1620IFXX<max%PROCcheckbox(XX,Y%,4)
1630IFXX>PROCcheckbox(XX,Y%-1,1)
1640ENDPROC
1650:
1660DEFPROCcheckbox(XX,Y%,side%)
1670IFXX<0 OR XX>max% OR YY<0 OR YY>max
1680 THENENDPROC
1690IFbox%(XX,Y%)=box%(XX,Y%) ORside%
1700IFbox%(XX,Y%)<15THENENDPROC
1710score%(thisplayer%)=score%(thisplay
1720boxesleft%=boxesleft%-1
1730scored%=TRUE
1740ENDPROC
1750:
1760DEFPROCtheirmove
1770PRINTTAB(0,27);SPC(20):TAD(0,27);"I
1780t's your move ":player$(thisplayer%)
1790PRINTTAB(0,28);SPC(20):TAB(0,28);
1800REPEATX17=(GETOR32)-97:UNTILX17>=0
1810ANDX17<max%+1:VDUX1%+65
1820AND
1830Doctrine():player$(thisplayer%)
1840ENDPROC
1850:
1860DEFPROCmymove
1870X17=max%+1
1880FORX%=0TOmax%-1:FORY%=0TOmax%+1
1890IFbox%(XX,Y%)=box%(XX,Y%) ORside%
1900THENPROClastside
1910NEXTX.:NEXTYX.
1920IFX17>max%THENREPEATPROCquessermove:
1930UNTILFNmoveok
1940ENDPROC
1950:
1960DEFPROClastside
1970IFbox%(XX,Y%)=box%(XX,Y%) ORside%
1980THENX17=XX+:Y1%=YY+1
1990ELSEX17=X7.:Y27.=Y%+1
2000ENDPROC
```

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NewBrain Newmon
by Niels Larsen

This program is a machine code monitor for the NewBrain. The program is written in two parts, a loader and the data; this gives an enormous gain in speed when you load it at the expense of a little more complication when typing.

If you do things in the following order there shouldn't be any problems:

1. NEW the machine code and make sure TOP>30000.
2. Enter the loader program.
3. SAVE it at the start of a blank tape, leaving the tape where it is.
4. NEW the machine again.
5. Enter the data program. This is best done in several sessions, saving to a separate tape until finished.
6. RUN it and correct any errors displayed.
7. Repeat step 6 until the program reports 'Press NEWLINE when tape-recorder ready.'
8. Press the RECORD button on the tape recorder, and press NEWLINE.
9. NEWMON is now saved. When you want to use it, just load the loader program and RUN it.

Having done that, you're left with a very professional monitor capable of the following commands:

A Lists an area of memory in ASCII.
Example: A1000 2000 lists from 1000 to 2000 in ASCII.

B Returns to Basic with program and variables intact. NEWMON may be called again by entering 'CALL 27500'.

C Calls a machine code program. The program must end with a RET (C9) command. On return to NEWMON, the Z80 registers will be displayed. Example: C6000 calls a program at 6000.

D Disassembles an area of memory. Example: D5734 5926 disassembles from 5734 to 5926.

E Edits an area of memory. The current

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**PROGRAM FILE**

**NEWMON LOADER**

10 IF TOPI 27300 RESERVE TOP-27300
20 CLEAR1 OPEN1:1
30 IF I=27300 TO 32560 STEP 16
40 NEXT I
50 END

**NEWMON DATA**

5 IF TOPI 27300 RESERVE TOP-27300
10 FOR I=27300 TO 32560 STEP 16
15 =0
20 FOR J TO I+1
30 REM
35 ON=I
40 NEXT J
45 REM C
50 IF C ) THEN 'ERROR IN LINE"+1100+(I-27300)+100END
55 NEXT I
60 LPRINT"(PLEASE READ THE DATA ENCODING)”
65
g-1210",1CHR$(13)+CHR$(28)+".Please wait

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### Data

| Address | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | Data | 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Jungle is a high-resolution graphics arcade game for the Research Machines 480Z of the push-the-blocks-and-trap-the-bad-guys kind. Although written on a 480Z, the program should run on a 380Z fitted with an HRG board. Level II graphics is also needed - the sign-on message will state what level is supported.

On running the program and selecting the instructions option, it's possible to configure the keyboard control. The cursor cluster is used as the default movement key on the 480Z; 380Z owners will have to use the redefine option. Also from the instructions option it's possible to select black and white or colour displays.

The object of the game is to survive. You are the running figure who is being pursued by a number of hungry beasts (two initially). The jungle clearing is strewn with boulders which you can slide along to manoeuvre the beasts. When all the beasts have been trapped and are unable to move, you continue to a higher level.

On the other hand, should the player continue to a higher level.
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252PCW
Atari Multi-Mode Text
by Garry Whittaker

Much has been written about the problems of getting text onto a graphics screen with Atari home computers, but most of the solutions have relied on large amounts of data statements to define the character set in terms of plot positions, and virtually all have offered text in only one graphics mode. This short utility allows you to print text in any graphics mode.

The first listing is the actual machine code routine and should be saved before running. There is a checksum, so if upon running you receive the message 'You have a data error', correct the error in the data statements and re-run.

The second listing is a demonstration of how the program can be used to obtain the following effects:

1. Printing text at any pixel on the screen.
2. Smooth pixel scrolling of a single character (good for animation).
3. Different sizes and textures of text. Produced by varying the internal graphics registers.
4. Large text can be produced in graphics 0 by treating each character position as a pixel.
5. Multiple character sets can be displayed onscreen at the same time. After correctly typing in and running listing one, type in the necessary lines of listing two for the demo.

As well as printing text on a graphics screen, the second listing also shows how the program can be used to obtain the following effects:

1. Printing text at any pixel on the screen.
2. Smooth pixel scrolling of a single character (good for animation).
3. Different sizes and textures of text. Produced by varying the internal graphics registers.
4. Large text can be produced in graphics 0 by treating each character position as a pixel.
5. Multiple character sets can be displayed onscreen at the same time. After correctly typing in and running listing one, type in the necessary lines of listing two for the demo.

**180 REM NOTE THE REMARKS IN THIS PROGRAM. MAKE IT LOOK LONG & DIFFICULT, IT IS NOT! THE ACTUAL ROUTINE**

**110 REM IS SHORT AND EASY TO USE IN YOUR OWN PROGRAMS - WHILE AT THE SAME TIME BEING A VERY FLEXIBLE WAY OF DISPLAYING TEXT ON ANY ATARI GRAPHICS SCREEN - DO NOT BE AFRAID TO EXPERIMENT**

**200 REM BY GARRY J. WHITTAKER**

**210 REM ALE GRAPHIC MODES - TEXT DISPLAY - DEMONSTRATION**

**220 REM 230 GOSUB 520:REM INITIALISE MCS - MAGIC ROUTINE**

**240 CHSET=PEEK(7563)*256:REM **

**250 REM GRAPHICS SET POSITION DOES NOT ***
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---

**PROGRAM FILE**

**NEED TO START ON EVEN BOUNDARY**

**250 CHWIDTH=8:REM CHARACTER WIDTH IN BITS**

**260 X=0:Y=0:REM X Y POSITION ONLY**

**270 GRMODE=7:REM GRAPHICS MODE**

- **NOTE TEXT IS ONLY INCLUDED AS A REMINDER THAT GR. MODE NEEDS TO BE SET**

**280 INK=0:REM FOREGROUND COLOUR USE THE SAME PARAMETER AS**

**COLOR IN BASIC**

**290 PAPER=9:REM BACKGROUND COLOUR**

**300 TEXTS="Hello readers of "REM**

**NOTE THAT AS THE FIRST CALL IS TO THE WHOLE ROUTINE TEXTS DOES NOT END IN a**

**310 REM**

**320 REM ALL GRAPHIC MODE****

**330 REM THE FOLLOWING ROUTINE DISPLAYS THE MAGIC TITLE PAGE. NOTE USE**

**OF INK,PAPER,TEXTS,X,Y,CHWIDTH**

**340 REM ALSO NOTE THE USE OF POKE 87,9 TO FOOL THE OPERATING SYSTEM**

**350 REM THE PATTERNED EFFECT IS DUE TO GR. 9 ACCEPTING DATA FOR**

**EACH POINT RATHER THAN JUST A**

**360 REM COLOUR FROM INK AND PAPER TRY**

**CHANGING THESE PARAMETERS.....**

**370 GOSUB 690:X=A:INK=2:TEXTS="PCW":G**

**OSUB 710:X=A:TEXTS="This is a":GOSUB 7 10**

**380 X=A:INK=2:PAPER=3:TEXTS="20":GOSUB**

**8 710:X=A:INK=2:PAPER=1:TEXTS="Char/L ine":GOSUB 710**

**390 Y=8:FOR X=25 TO 80 STEP 1:Y=Y+1:PA**

**PER-X-19:INK=PAPER-2:TEXTS="Magic":GOSUB**

**710:NEXT X**

**400 FOR Y=64 TO 58 STEP -1:PAPER=255**

**INK=PAPER-2:X=X+1:GOSUB 710:NEXT Y**

**410 Y=8:FOR X=80 TO 25 STEP -1:Y=Y+1:P**

**APER-X-19:INK=PAPER-2:TEXTS="Magic":GOSUB**

**710:NEXT X**

**420 X=171:Y=35:POKE 87,9:GOSUB 710:REM**

**YOU CAN STILL FOOL THE OPERATING SYSTEM**

**M WITH POKE 87, GRAPHC MODE**

**430 ? "PRESS ANY KEY TO CONTINUE"**

**440 POKE 764,255**

**450 IF PEEK(764)=255 THEN 450**

**460 GRAPHICS 8:X=8:Y=8:INK=255:PAPER=3**

**2:TEXTS="Multimode Atari Graphics Independent"**

**470 FOR CHWIDTH=3 TO 8:GOSUB 710:NEXT**

**CHWIDTH=REM YOU CAN VARY THE WIDTH IN**

**BITS OF THE CHARACTERS**

**480 CHWIDTH=7:TEXTS="Characters":X=8:**

**Y=Y+10:GOSUB 710:POKE 87,7:X=4:GOSUB 7 10**

**490 END**

**500 REM THE FOLLOWING CODE IS WHAT**

**ACTUALLY DOES THE WORK I WOULD**

**SUGGEST YOU LIST IT TO CASSTTE**

**510 REM OR DISK FOR INCLUSION IN YOUR**

**OWN PROGRAMS**

**520 REM ALL GRAPHIC MODE****

**530 REM**

**540 DIM MCS(210),TEXTS(256)**

**550 MCS="h,uh,thb,th,thb,th,thb,thb,**

---
You may have seen, in some of the commercial software available for the BBC Model B, text scrolling across the screen. One way to do this is to use the commands MIDS and LEFTS, but the text scrolls at a jerky eight pixels or one character at a time. This short utility moves text or graphics across the screen in mode two at a much smoother rate. One way to do this is to use the commands MID$ and LEFTS, but the technicalities, lines 180 to 270 do the actual scrolling. It works by getting an address in &78,&79, adding on eight and then storing in &84,&85. The character block in &84,&85 is then shifted left into &70,&71, and the two addresses are incremented by eight until the end of the line is reached.

If you have OS 0.10 you will have to remove line 300. This is the equivalent of the Basic command *FX 19, which waits until the start of the sync to produce smoother graphics and scrolling.

Bbc Smooth Scroller
by Andrew Thomas
MICROMART

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• "... Final verdict, good value for money, good looking and impressive machine."

* JUST ARRIVED two programmes Pas - call.

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<thead>
<tr>
<th>Line</th>
<th>Description</th>
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<tbody>
<tr>
<td>100</td>
<td>REM **** Model B</td>
</tr>
<tr>
<td>90</td>
<td>REM **** 1.00 O.S. or above</td>
</tr>
<tr>
<td>100</td>
<td>REM **** Smooth Scrolling text, in Mode 2 ****</td>
</tr>
<tr>
<td>110</td>
<td>REM **** (C) Copyright A.J. Thomas 1984 ****</td>
</tr>
<tr>
<td>120</td>
<td>MODE2</td>
</tr>
<tr>
<td>130</td>
<td>VDU23;10,32,0;0;0;23,224,66,36,255,153,189,231,90,195</td>
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<tr>
<td>140</td>
<td>DIM TEXT 255</td>
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<tr>
<td>150</td>
<td>TEXT=&quot;This is an example of smooth scrolling in mode 2. It could be used for titles in games, or for scrolling little characters &quot;+CHR$224+CHR$224+CHR$224+&quot; What ever you wish! &quot;+CHR$224+&quot; &quot;+CHR$224+&quot; 160</td>
</tr>
<tr>
<td>170</td>
<td>PROC ASS:COLOUR2:PRINTTAB(0,4);</td>
</tr>
</tbody>
</table>
| 180 | "You may use the 'scroll' routine in your programs."
| 190 | COLOUR1 |
| 200 | CALL main |
| 210 | END |
| 220 | DEFPROCASS |
| 230 | DIM CODE 200 |
| 240 | FOR i=0 TO 2STEP2 |
| 250 | P%=CODE |
| 260 | OPTI1% |
| 270 | scroll LDA i:STA &78:STA &7C:STA &70:STA &7D: |
| 280 | STA &71:STA &7C:CLC:ADC &8:STA &74:STA &7D: |
| 290 | ADC &0:STA &75:LDY &0 |
| 300 | scroll LDA &0 :STA &78 :STA &7C :STA &70 :LDA &7D : |
| 310 | STA &71 :LDA &7C :CLC :ADC &8 :STA &74 :LDA &7D : |
| 320 | ADC &0 :STA &75 :LDY &0 |

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by Daniel Greenspan

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5 List your program.

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- Long and short term rentals

Call for our full price list.
### Apple Compatible Peripherals

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Price</th>
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<tr>
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### Printers – Daisy Wheel

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### Computer Accessories

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<td>EPSON LQ-2000</td>
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### Computers

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<tr>
<td>EPSON LQ-2000</td>
<td>£155</td>
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</tbody>
</table>

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Position
Address
Tel. No.
Date

Sponsored by: Personal Computer

4-8 September 1985 Olympia London
### COMPUTERS

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
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<tbody>
<tr>
<td>D BASE III</td>
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<tr>
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<td>£250.00</td>
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<td>LOTUS 123</td>
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<td>SYMPHONY</td>
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<td>D RACER</td>
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<td>DMS DELTA</td>
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<td>£350.00</td>
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### MATRIX PRINTERS

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### DAISYWHEEL PRINTERS

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### PRINTERS

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<td>HP 9500</td>
<td>£2225.00</td>
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**UNBELIEVABLE SAVINGS**

<table>
<thead>
<tr>
<th>Software</th>
<th>Price</th>
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<tbody>
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<td>£350.00</td>
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<tr>
<td>FRAMEWORK</td>
<td>£345.00</td>
</tr>
</tbody>
</table>

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or Dept. PCW 480 Groveley Lane, Rednal,
BIRMINGHAM Tel: 021 445 1039

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**DOT MATRIX**

<table>
<thead>
<tr>
<th>Printer</th>
<th>EPSON</th>
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**COLOUR MONITORS**

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**MONOPRINTER**

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**MONITORS**

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**PROCESSORS**

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<td>DEC ISC with 32MB</td>
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</table>

**ACCESSORIES**

- **Dr. Dr.**
- **Dr. Dr.**
- **Dr. Dr.**
- **Dr. Dr.**
- **Dr. Dr.**
- **Dr. Dr.**
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<th>Price</th>
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<td>Silver Reed EXP770/P</td>
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<td>Smith Corona TP1</td>
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<td>Ricoh RP1200</td>
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<td>Diablo 620</td>
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<td>Sanyo MBC550 (with free word processing and database software)</td>
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MONITORS

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<td>Sanyo DM8112 Green</td>
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<td>Sanyo DMX7500 (IBM-PC)/Aparicot-Colour)</td>
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<td>Zenith ZM122 (Amber or Green 12&quot;)</td>
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<td>Zenith 13&quot; High Res (IBM-PC)</td>
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DAISY WHEEL PRINTERS

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<td>Ricoh 1300 Flowriter</td>
<td>£995.00</td>
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<td>Ricoh 1600 Flowriter</td>
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<tr>
<td>Silver Reed EXP400/P</td>
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MODEMS (Multi-Standard)

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<td>Brother TC600 Typewriter or Printer)</td>
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DISK DRIVES (All half height)

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<tr>
<td>Single sided, 40 Track</td>
<td>£99.00</td>
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<td>Double sided, 80 Track</td>
<td>£131.50</td>
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<tr>
<td>Double sided, 4080 Track</td>
<td>£153.00</td>
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WINCHESTER 5.25 HARD DISK DRIVES (SUPPLIED WITH CABLE, HOST ADAPTOR BOARD, MANUAL AND SUPPORT DISKETTE), COMPATIBLE WITH IBM-PC AND COMPATIBLES, SANYO 550/555 AND ACT APRICOT (UNFORMATTED MEMORY).

<table>
<thead>
<tr>
<th>Size</th>
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<tr>
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<tr>
<td>44 MByte Hard Disk Drive</td>
<td>£1,595.00</td>
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<table>
<thead>
<tr>
<th>Size</th>
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<tr>
<td>11 MByte Drive Plus Tape Streamer</td>
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<td>22 MByte Drive Plus Tape Streamer</td>
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<td>33 MByte Drive Plus Tape Streamer</td>
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<tr>
<td>44 MByte Drive Plus Tape Streamer</td>
<td>£2,420.00</td>
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<th>MAXELL</th>
<th>FUJI</th>
<th>BABASH</th>
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<td>SS/DD 40/48</td>
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<td>SS/DD 40/48</td>
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<td>DS/DD 40/48</td>
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<td>SS/DD 80/96</td>
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<td>DS/DD 80/96</td>
<td>18.70</td>
<td>32.25</td>
<td>25.00</td>
<td>25.00</td>
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<tr>
<td>Microvitec 14&quot; colour</td>
<td>Epson RX80 F/T</td>
<td>£585</td>
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<td>1451DQ3</td>
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<td>Epson JX80 colour</td>
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<td>Canon PJ1080A colour</td>
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<tr>
<td></td>
<td><strong>Brother HR5 plus mains adaptor</strong></td>
<td>£425</td>
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<th>Tractor feeders</th>
<th>Monochrome</th>
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<td>RX80F/T</td>
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<td>£250 1431 MZ Spectrum £235</td>
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<td>£250 Monochrome</td>
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<td>Daisy Wheel</td>
<td>£495 HR25/35</td>
<td>£250 Philips</td>
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<td>£250 BM7502 green £92</td>
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<td>£65 Novex 12/800 £120</td>
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It's a man's life in micro manufacturing: Chris Curry's birthday celebrations are likely to be quieter this year than last when guests at the Curry mansion had an eventful time. Their meal was eaten to the accompaniment of various ghost noises, slime seeping through the floorboards and collapsing curtains. Those who made it through to the last course were relieved to find that the 'ghosts' had in fact been hired for the evening. All this was mild stuff compared to the Acorn boss's original idea - he wanted a squad of SAS-style troopers to come bursting in through the windows.

Many happy returns: Clive Sinclair got into the spirit of Christmas by pursuing Chris Curry round various Cambridge pubs. Tempers, newspapers - and in some reports even fists - were raised in anger as the two disagreed about their respective machines' reliability. An irate Sir Clive is the last person we want to meet in our local - but we have to point out that the blurb on one game we received recently says, 'to achieve reliable microdrive operation, please format each new microdrive cartridge at least 20 times before use.'

Trigger happy: not to be outdone, Commodore made its own contribution to capturing the true spirit of Christmas. It sent out a card depicting the three wise men and the Star of David. To add a touch of spice, one of the wise men was shown zapping the Star.

Frosty: Atari's gesture of goodwill was similarly in tune with the spirit of the times. The company reportedly laid off more than 200 people at its Irish video games factory before Christmas. Jack the knife in action. Still on the subject of Jack Tramiel, the new Atari machine previewed in this issue is seen as a rival to Apple's Macintosh - and has already been dubbed the 'Jacintosh'.

Three wheels on my wagon: the best aside we've heard about Sinclair's new car runs as follows: 'Guaranteed to get you there in less than 28 days'.

No hairs on them: Electronic Data Systems likes to get the important details right - such as insisting that its staff be clean-shaven. No details are available of what happens to staff who prefer to stick to their beards, although if you see any male faces covered with cotton wool sympathy might be in order.

It never rains, but it pours: a consoling thought for those who suffered through the cold January. The story goes that the plumbing in Clive Sinclair's London house burst, resulting in inappropriate waterfalls in all the wrong places. At least Sir Clive kept his sense of humour. He blamed the problem on low technology.

Acronym-happy: others with a sense of humour include software houses Quicksilva and Bug-Byte, who joined forces to announce their awards for the computer industry. The award for the 'Biggest United Liaison of Leading Suppliers of Hardware Innovative Technology' went to the MSX manufacturers.

Black marks: Amstrad's move into micros hasn't all been plain sailing. In fact the company keeps a black book with the names of all the people who haven't been helpful along the way, Micropro included. And Amstrad says that it has got WordStar running on its drives - with a little bit of tweaking of the software.

Enterprise: being privatised has obviously gone to British Telecom's head. It's selling its own version of ICL's OPD - called Tonto. If BT really thinks that Red Indians are the market of the future or that all businessmen see themselves as Lone Rangers in search of an assistant, now might be a wise time to sell those shares.

Time's up: the questionnaire in our January issue didn't impress one of our readers. He wrote to the market research company concerned to point out that if he answered all the questions he wouldn't have time to use his micro, make money, or read magazines - let alone breathe. As money was going to charity for all the questionnaires returned he decided to send in 10p instead.

Maureen the elephant's days as a TV star are over. Commodore came up with the bright idea of using Maureen to represent the 64's giant memory, but animal-lovers weren't impressed. Commodore insists that the RSPCA knew about the ad and let it go through - and that the campaign had run its course anyway. Either way it's back to the big top for Maureen.

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