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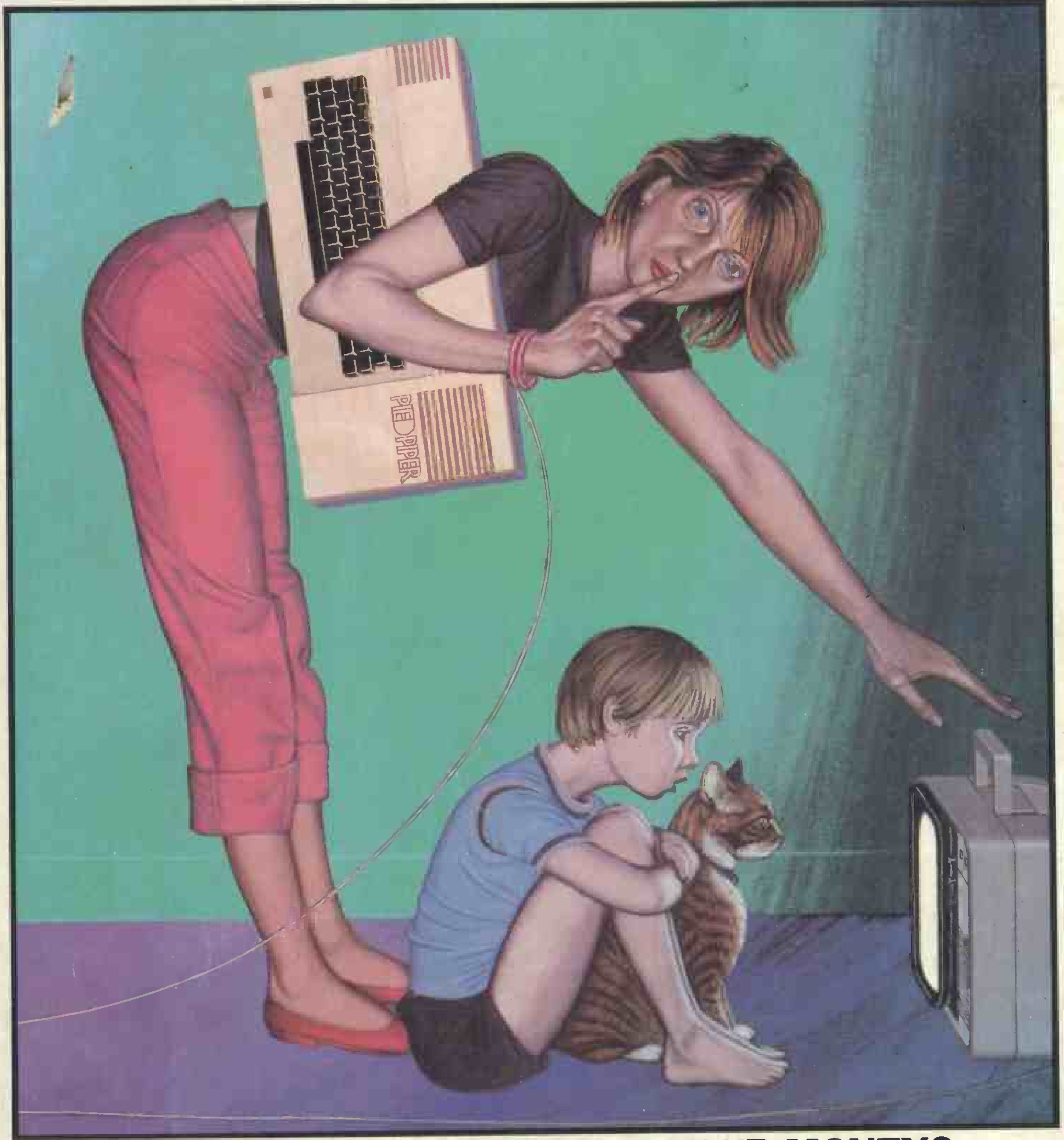

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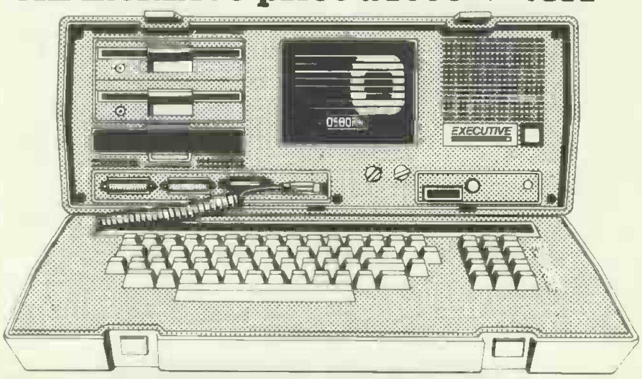

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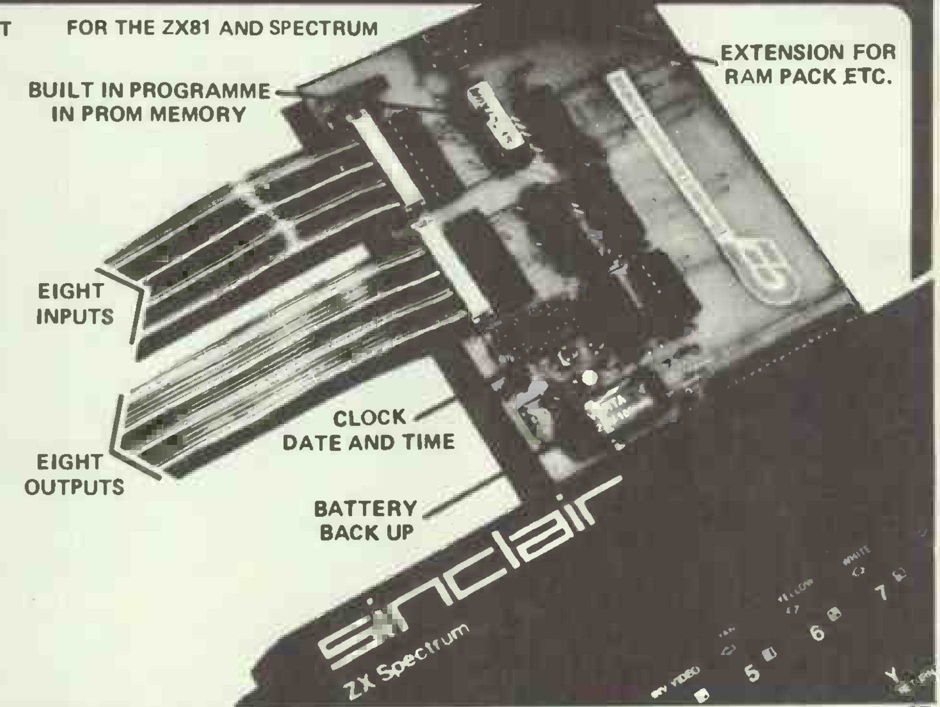

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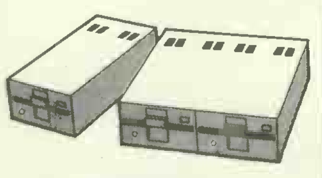

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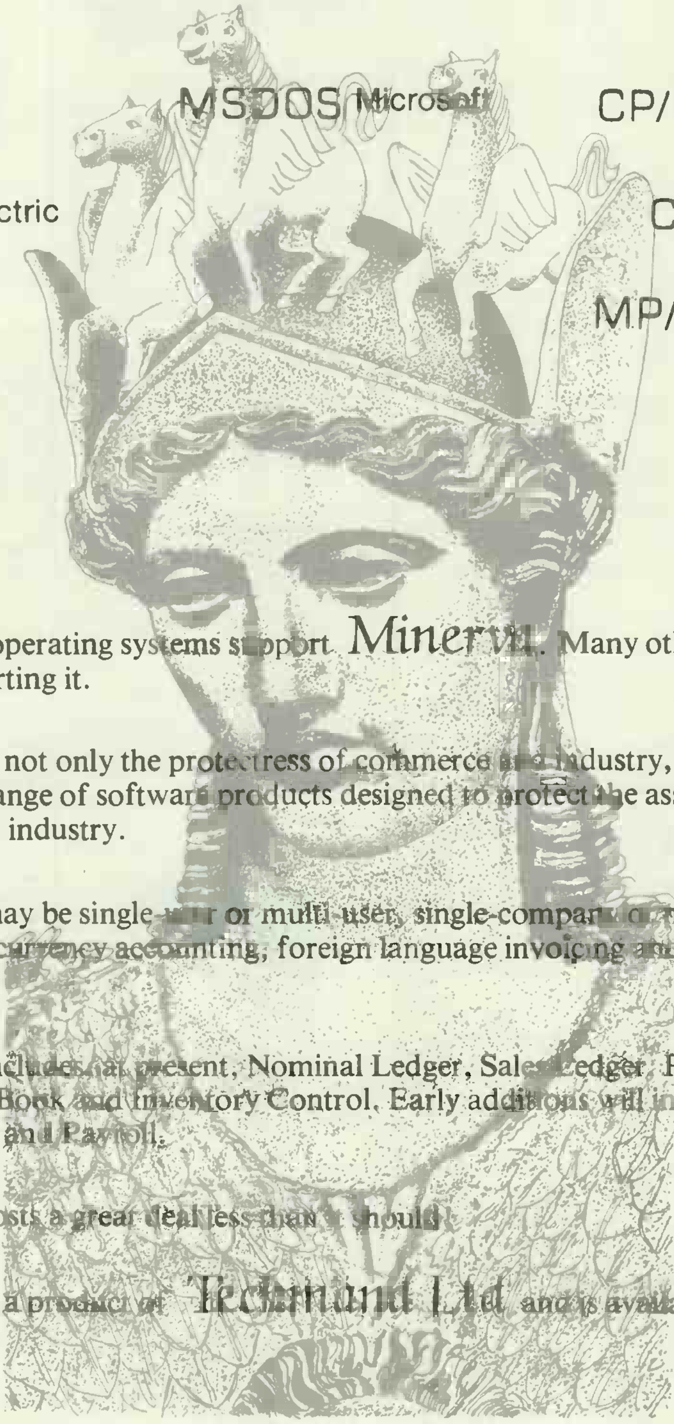

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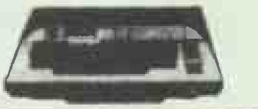

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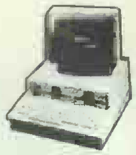

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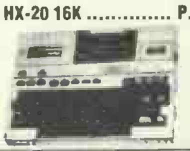

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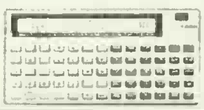

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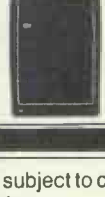

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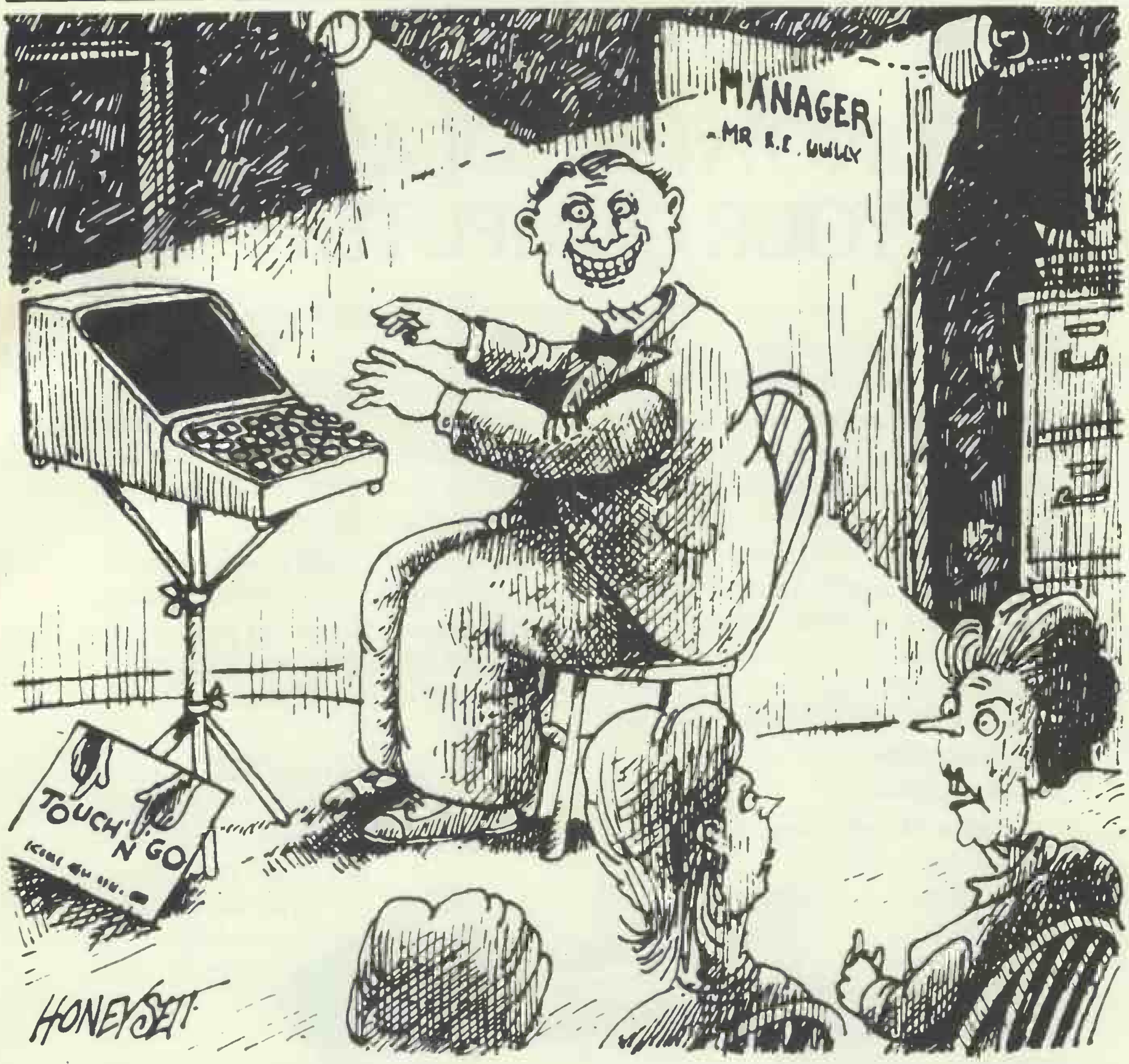

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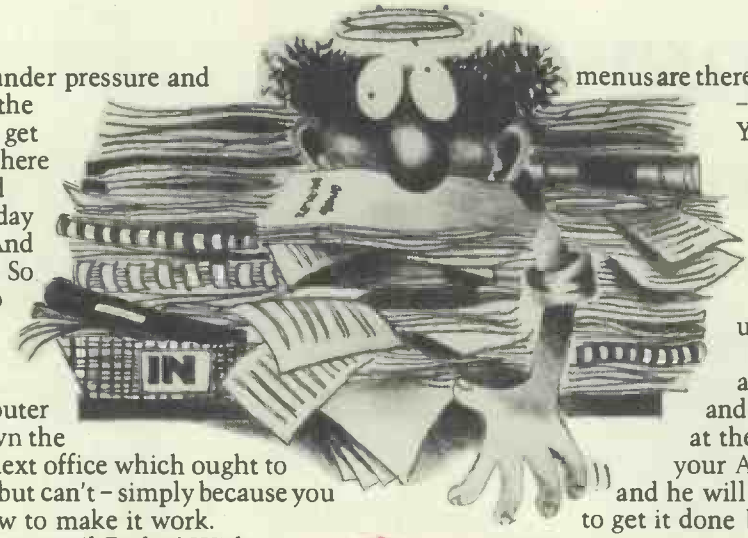

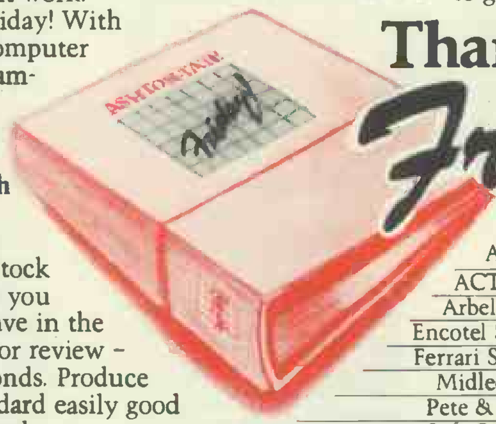

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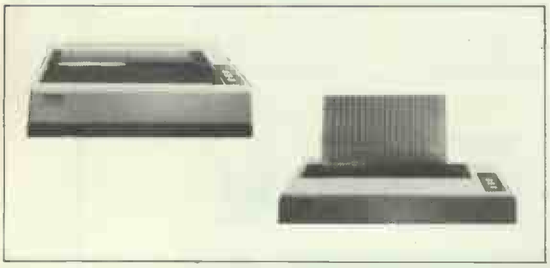

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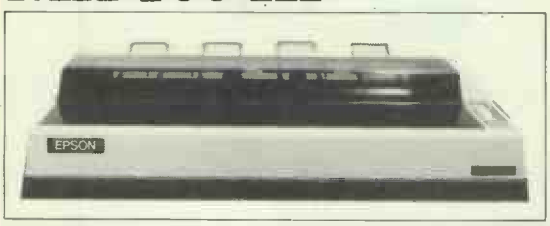

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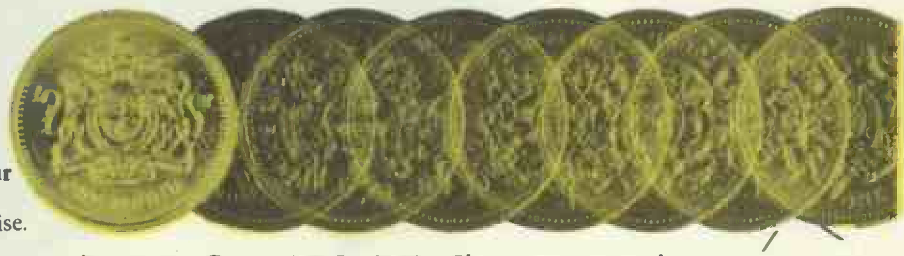

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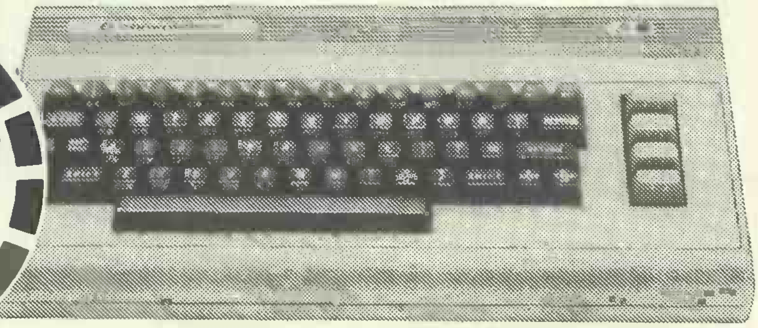

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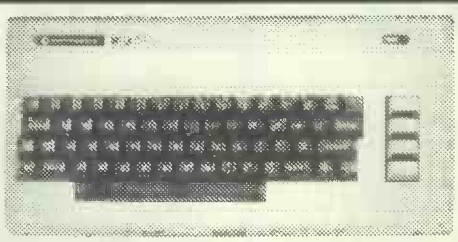

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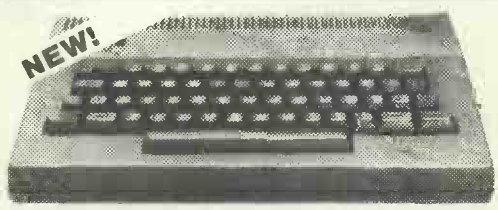

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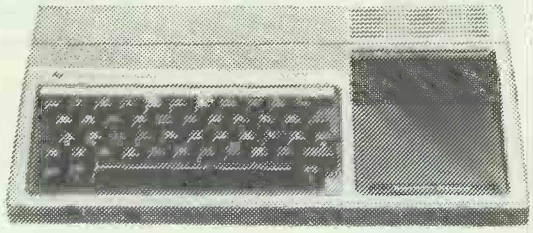

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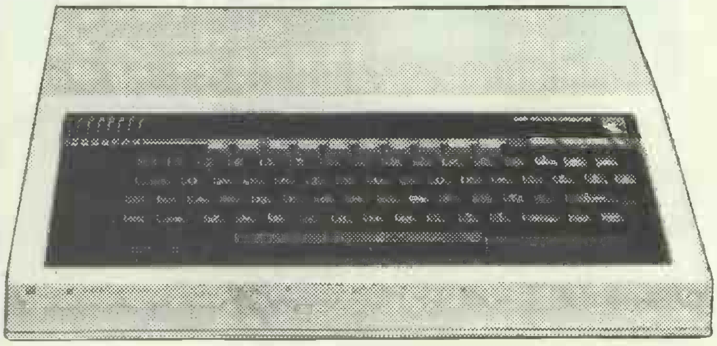
BBC Model 'B' MICRO



Yes, this **top selling Micro system** is now available from your local **SPECTRUM** dealer -the **BBC Model'B'** offering **32K RAM** plus a **full back-up** of **peripherals** & **software** too! It's an **infinitely expandable** machine, ideal for the **home or business** and is already widely used for **educational purposes in schools** - so the chances are your children may already be **well familiar with its operation,** which must make it the ideal **choice** for the **home** too!

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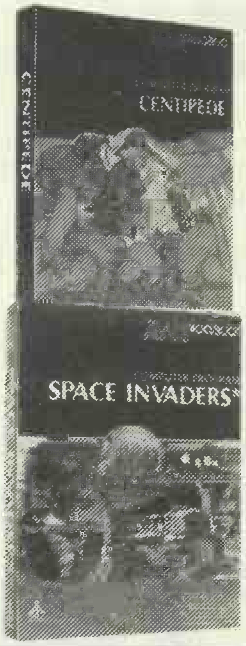

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spectrum

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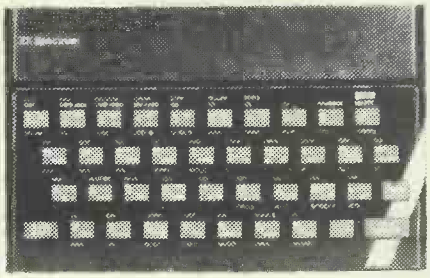

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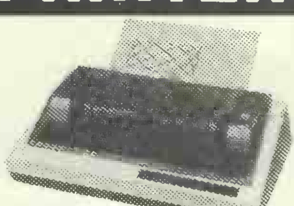

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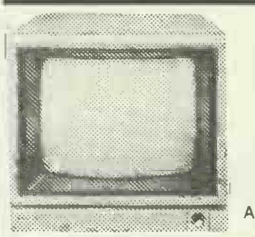

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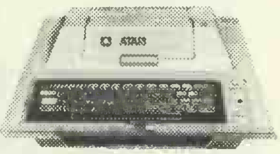

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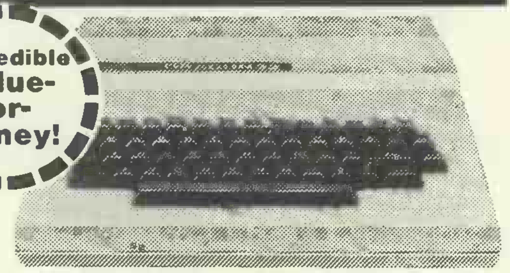

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LINCOLN MKO Computers, 24 Newlands. TEL: (0522) 25907

LONDON

E6 Percivals, 85 High St. North, East Ham. TEL: (01) 472 8941
E8 McGowans, 244 Graham Rd., Hackney. TEL: (01) 533 0935
EC2 Devron Computer Centre, 155 Moorgate. TEL: (01) 638 3339/1830
N14 Logic Sales, 19 The Broadway, The Bourne, Southgate. TEL: TBA
N20 Castlehurst Ltd., 1291 High Rd. TEL: (01) 446 2280
NW4 DA Vinci Computer Store, 112 Brent St., Hendon. TEL: (01) 202 2272/3/4 (Just Opening)
NW9 Moviescope, 459 Kingsbury Rd. TEL: (01) 204 6352
SE1 Vic Odden's, 6 London Bdg Walk. TEL: (01) 403 1988
SE9 Square-Deal, 375 Footscray Rd., New Eltham. TEL: (01) 859 1516
SE15 Castlehurst Ltd., 152 Rye Lane, Peckham. TEL: (01) 639 2205
SW6 Chelsea Micros Ltd., 14 Jerdan Place. TEL: (01) 385 8494
W1 Devron 4 Edgware Rd. TEL: (01) 724 2373
W1 Computers of Wigmore Street, 87 Wigmore St. TEL: (01) 486 0373
W1 Sonic Foto & Micro Center, 256 Tottenham Court Rd. TEL: (01) 580 5826
W3 Colormatic Computers, 44 High St., Acton. TEL: (01) 992 7611
W11 Electroleisure, 120 Notting Hill Gate. TEL: (01) 221 7029

MANCHESTER GREATER

MANCHESTER Lomax Ltd., 8 Exchange St., St. Ann's Sq. TEL: (061) 832 6167
SWINTON Mr. Micro Ltd., 69 Partington Lane. TEL: (061) 7282282 Open Friday until 8 p.m.
HYDE Pase, 213-215 Market St. TEL: (061) 366 5935
BOLTON Wilding Ltd., 23 Deansgate. TEL: (0204) 33512
WIGAN Wilding Ltd., 11 Mesnes St. TEL: (0942) 44382

MERSEYSIDE

HESWALL Thornguard Computer Systems, 46 Pensby Rd. TEL: (051) 342 7516
LIVERPOOL Beaver Radio, 20-22 Whitechapple. TEL: (051) 709 9898
LIVERPOOL (Aintree) Hargreaves, 31/37 Warbreck Moor. TEL: (051) 525 1782
SOUTHPORT Central Computers, 575 Lord St. TEL: (0704) 31881

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EDGWARE Breaker 1-4, 130 High St. TEL: (01) 952 7488/8860
HARROW Camera Arts (Micro Computer Division, 24 St. Ann's Rd. TEL: (01) 427 5469
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TEDDINGTON Teddington Camera Centre, Broad St. TEL: (01) 977 4716

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NORWICH Sound Marketing, 52 St. Benedicts St. TEL: (0603) 667725
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NORTHAMPTON Basic Computers & Systems Ltd., 72 Kingsthorpe Hollow. TEL: (0604) 710740

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NEW MALDEN Surrey Micro Systems, 31 High St. TEL: (01) 942 0478
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NEWPORT (Gwent) Randall Cox, 118 Commercial St. TEL: (0633) 67378
PEMBROKE Randall Cox, 19 Main St. TEL: (064) 668 2876
PORT TALBOT Micro Gen, 6 Royal Buildings, Talbot Rd. TEL: (0639) 887730
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WORCESTER David Waring Ltd., 1 Marmion House, High St. TEL: (0905) 27551

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HUDDERSFIELD Richards (formally Lawries) 12 Queen St. TEL: TBA
HULL The Computer Centre (Humberside) Ltd., 26 Anlaby Rd. TEL: (0482) 26297
LEEDS Bass & Bligh, 4 Lower Briggate. TEL: (0532) 454451
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Perhaps we could just add that the BBC Micro is the machine which was chosen to be at the heart of the BBC's massive Computer Literacy Project.

It is also the machine which, having won the Department of Industry's blessing, will account for over 80% of the computers bought by British schools this year.

And now for some facts about the machine itself.

The BBC Micro is light, compact and, with a conventional electric typewriter keyboard, easy to get the feel of.

It can be loaded from virtually any cassette recorder. And there is a wealth of ready-made programs available covering games, education and business subjects.

The BBC Micro uses BBC BASIC, a sophisticated version of the most popular computer language.

However, as your confidence and fluency grow, it can be adapted to switch to other languages.

It can also become a word processor, with the facility to link with a second processor for high-powered business use.

A disc drive unit can also be added. And with an adaptor, the BBC Micro is the first micro to be able to pick up programs from the Micronet–Prestel system. Another adaptor converts your TV into a Teletext receiver, with further ability to download programs.

All this for only £399.

The most sophisticated version of the BBC Micro, the Model B, is only £399. The basic Model A is £299. (Both come with a "Welcome cassette" and comprehensive introductory manual.)

They are both available from John Lewis, selected branches of Boots or local stockists.

Alternatively, if you would like to order a BBC Micro B with your credit card, or if you want the address of your nearest stockist, just phone 01-200 0200.

Or, you can buy a Model B by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants.

Your order will be despatched by fully insured courier.

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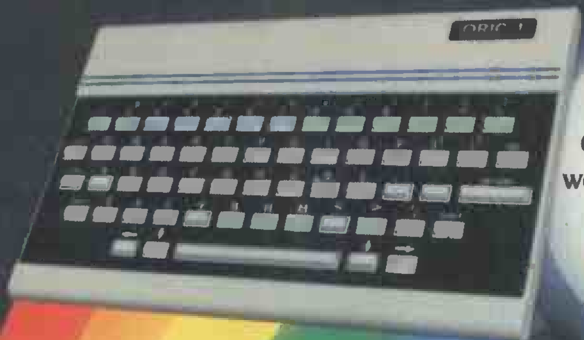

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To be launched within the next few weeks - the revolutionary ORIC 3" MICRO FLOPPY DISK DRIVES, with incredible access time and data storage capacity.

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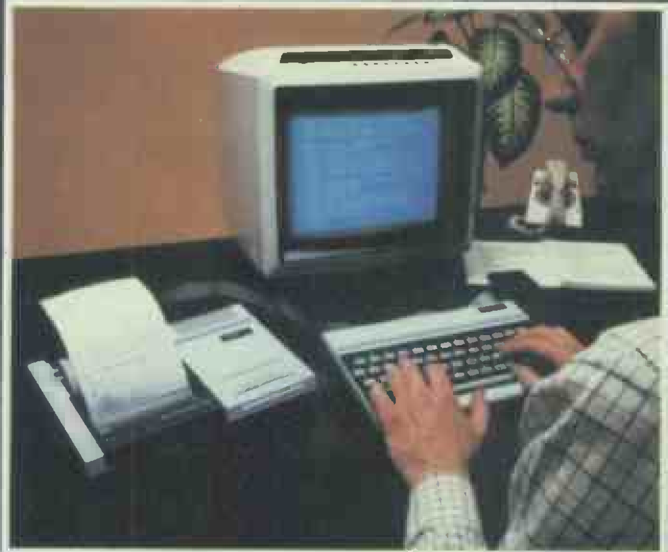
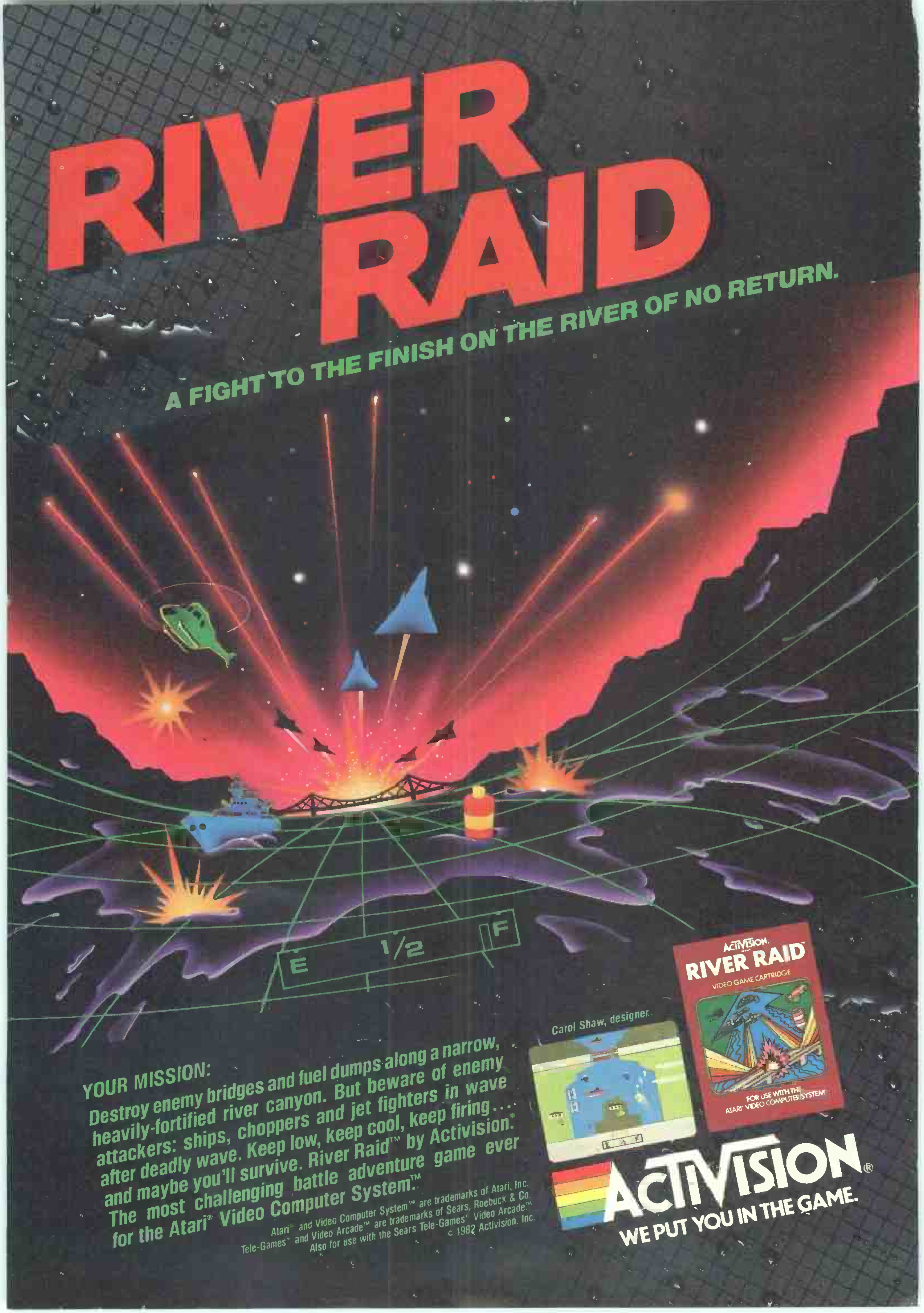
It is Oric's policy to continue to expand our product range, in order to offer our customers a comprehensive, professional, Micro Computer system, at a realistic price.

We believe that with the launch of our MCP 40 colour printer, and our combined computer/software value packs, we will continue to lead the small micro market in both quality and value.

*Titles may vary subject to availability but the approximate value will not.





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Destroy enemy bridges and fuel dumps along a narrow, heavily-fortified river canyon. But beware of enemy attackers: ships, choppers and jet fighters in wave after deadly wave. Keep low, keep cool, keep firing… and maybe you'll survive. River Raid™ by Activision.® The most challenging battle adventure game ever for the Atari® Video Computer System.™
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sinclair special 3

Inside...
The New ZX Microdrive!
Latest software...
Latest prices...

The ZX Microdrive-and more!

For some time now, the new ZX Microdrive has been the subject of much discussion. Which is only to be expected, when the object of everyone's anticipation is *completely* new to the world of computing.

Microdrive provides high-speed access to truly massive storage. With just one Microdrive, you'll have at least 85K bytes of storage, and the ability to LOAD and SAVE in mere seconds. Yet the ZX Microdrive is about the size of a Spectrum mains adaptor, and costs less than £50!

First stocks are now in. Microdrives will be released on an order of priority basis. Spectrum owners who purchased by mail order, direct from us, will be sent full details including how to order, in a series of mailings that begins with the earliest names on our list.

And if you didn't buy by mail order?

Don't worry – for a colour brochure with full information on Microdrives, including how to order, just send us your name and address (use the coupon at the back of this issue of Sinclair Special). But remember, the sooner you send us your name, the sooner you'll get on the list.

Of course, there's much more to Sinclair than Microdrives, as you'll see on these pages. The latest releases of Spectrum and ZX81 software have been amongst the most successful ever. Prices of most established Sinclair products are at their lowest ever. To buy what you want, just use the Order Form.

Until the next issue of Sinclair Special, and more good news ...

Nigel Searle

Nigel Searle, Managing Director, Sinclair Research Ltd.

PS: Come and see us – and all that's new at Sinclair – at the PCW Show, Barbican Centre, from Sept 28th to Oct. 2nd. We'll be pleased to see you!

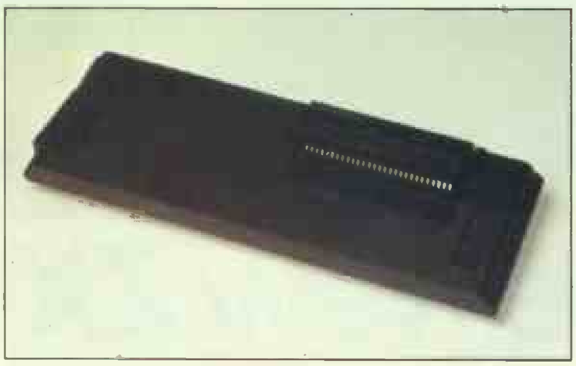
ZX Microdrive System preview!

ZX MICRODRIVE

At least 85K bytes storage, loads a typical 48K program in as little as 9 seconds: £49.95.

ZX MICRODRIVE CARTRIDGE

Compact, erasable, revolutionary. Complete with its own storage sleeve. Contains up to 50 files, with a typical access time of 3.5 seconds: £4.95.



ZX INTERFACE 1

Necessary for sending and receiving data from ZX Microdrive. Includes RS232 interface, enables creation of local area network of 2 to 64 Spectrums. Attaches to the underside of your Spectrum. Purchased with ZX Microdrive, just £29.95. As separate item, £49.95.

Six new ways to make more of your Spectrum

Take a look at these brand-new titles. Each is an outstanding new program using the full potential of the Spectrum, for games with stunningly animated graphics, for strategies of fiendish cunning, for masterly applications of computing capability...

Cyrus-IS-Chess Based on the Cyrus Program, which won the 2nd European Microcomputer Chess Championship *and* trounced the previously unbeaten Cray Blitz machine. With 8 playing levels, cursor piece-movement, replay and 'take-back' facilities, plus two-player option. The 48K version has many additional features including an extensive library of chess openings. For 16K or 48K RAM Spectrum.

Horace and the Spiders Make your way with Horace to the House of Spiders, armed only with a limited supply of anti-spider-bite serum. In the house, destroy the webs before the spiders can repair them. Then destroy the spiders, before *they* destroy Horace! Undoubtedly the creepiest Horace program ever produced! For 16K or 48K RAM Spectrum.

Computer Scrabble The famous board game, on-screen – with the whole board on view! A huge vocabulary of over 11,000 words. Full-size letter tiles, four skill levels – the highest of which is virtually unbeatable. For 1 to 4 players. For 48K RAM Spectrum.
(SCRABBLE trademark and copyright licensed by Scrabble Schutzrechte und Handels GmbH – a J.W. Spear and Sons PLC subsidiary.)

Backgammon A fast, exciting program, with traditional board display, rolling dice and doubling cube. Four skill levels. For experts – or beginners. (Rules are included – it's the quickest way to learn the game.) For 16K or 48K RAM Spectrum.

FORTH Learn a new programming language, as simple as BASIC, but with the speed of machine code. Complete with Editor and User manual. For 48K RAM Spectrum.

Small Business Accounts Speeds and simplifies accounting work, produces Balance Sheets, Profit and Loss information *and* VAT returns. Complete with User manual. For 48K RAM Spectrum.

Overleaf – your Sinclair order form.

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The HX-20 is different. Because it is designed and built to be different.

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Uses full extended version of Microsoft BASIC with 16k RAM optionally expandable to 32k, and 32k ROM expandable to 64k, RS-232C and Serial interfaces.

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24 column dot matrix impact micro-printer offering 42LPM for hard copies.

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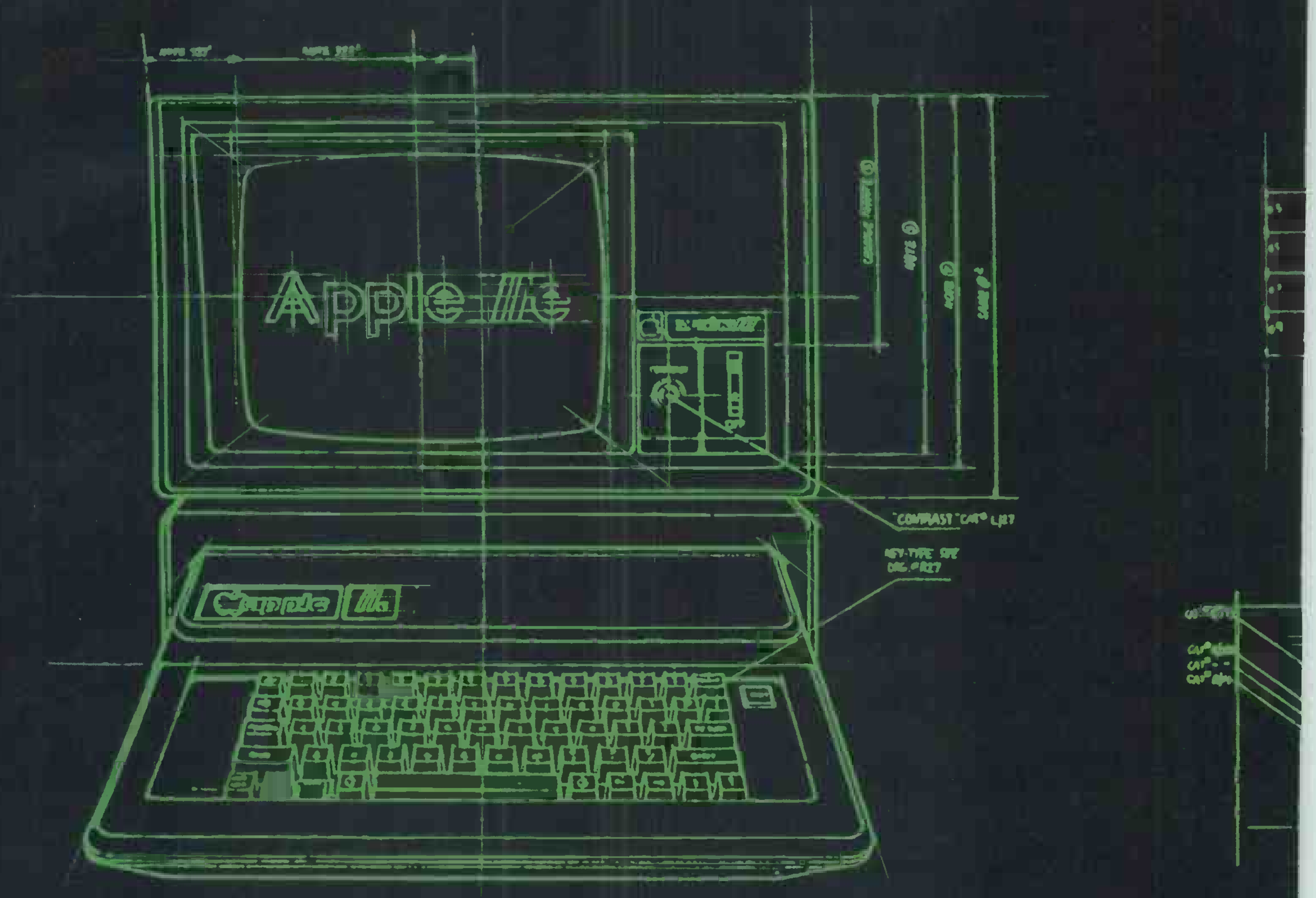
PCW/9/20

It's the same old Apple II.



For years, people have been trying to build a better Apple® II.

It finally happened.

Meet the Apple IIe, an impressive new version of a most impressive machine.

The "e" means enhanced.

Which means a bundle of new features:

A standard memory of 64K (versus 48K) that's easily expandable. So you can create fatter files and crunch larger numbers of numbers.

A new, improved keyboard, with a complete set of ASCII standard characters. Plus full cursor controls, programmable function keys, and a rapid auto-repeat feature built into every key on the board.

Both upper and lower case characters. (And if you want to see more of them on the screen at one time, a low cost 80-column text card is available.)

Improved peripheral ports. Which make it a lot easier to connect and disconnect game controllers, printers and all those other wonderful things that go with an Apple Personal Computer.

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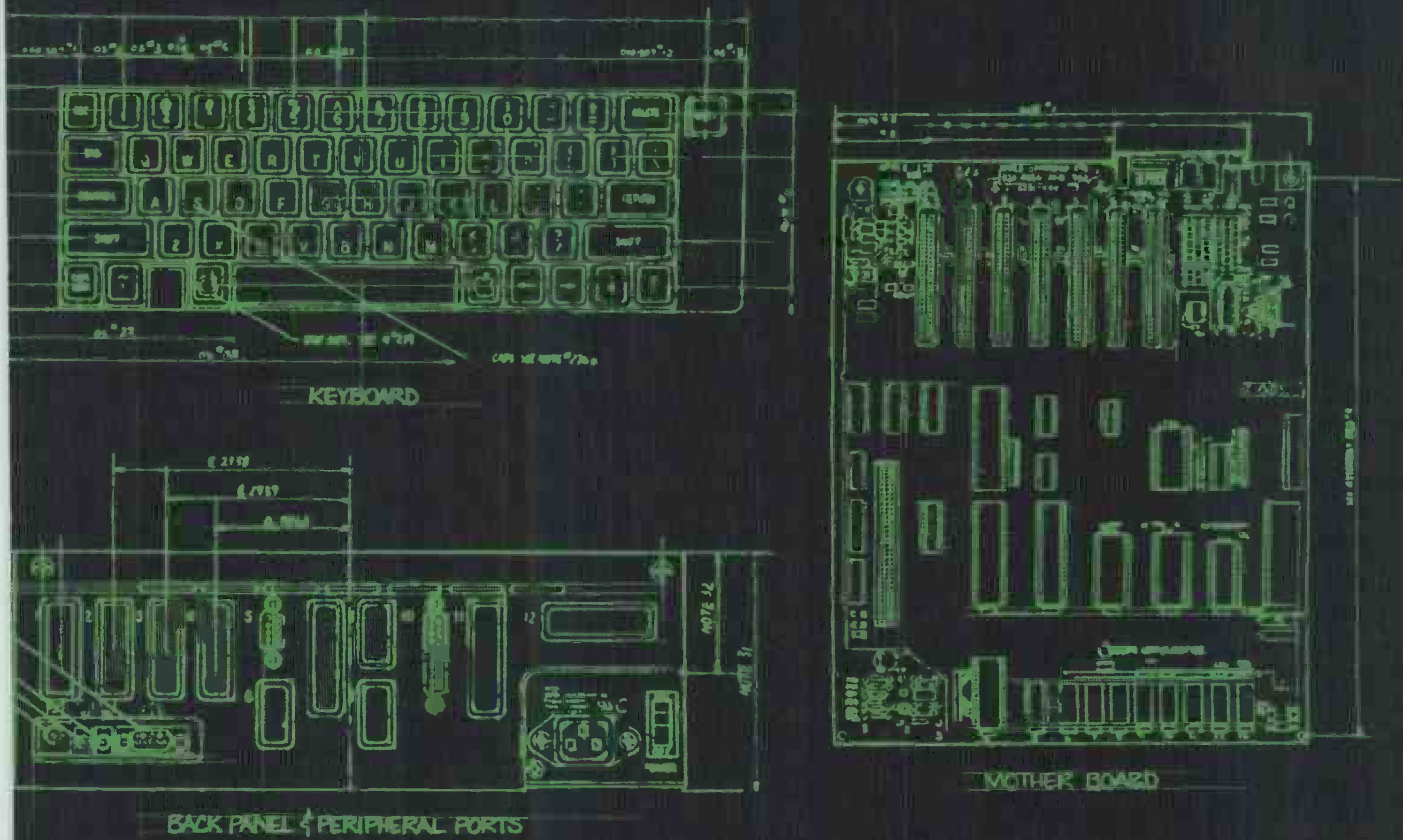
Except for the front, back and inside.



And bear in mind, the IIe still has all those other virtues that made the Apple II so very popular. Including access to more accessories, peripheral devices and software than any other personal computer you can buy.

Like the original, it's rather extraordinary. But then some things never change.

So either visit one of our many authorised dealers, and see the newest Apple for yourself.

Or return the coupon for further details.

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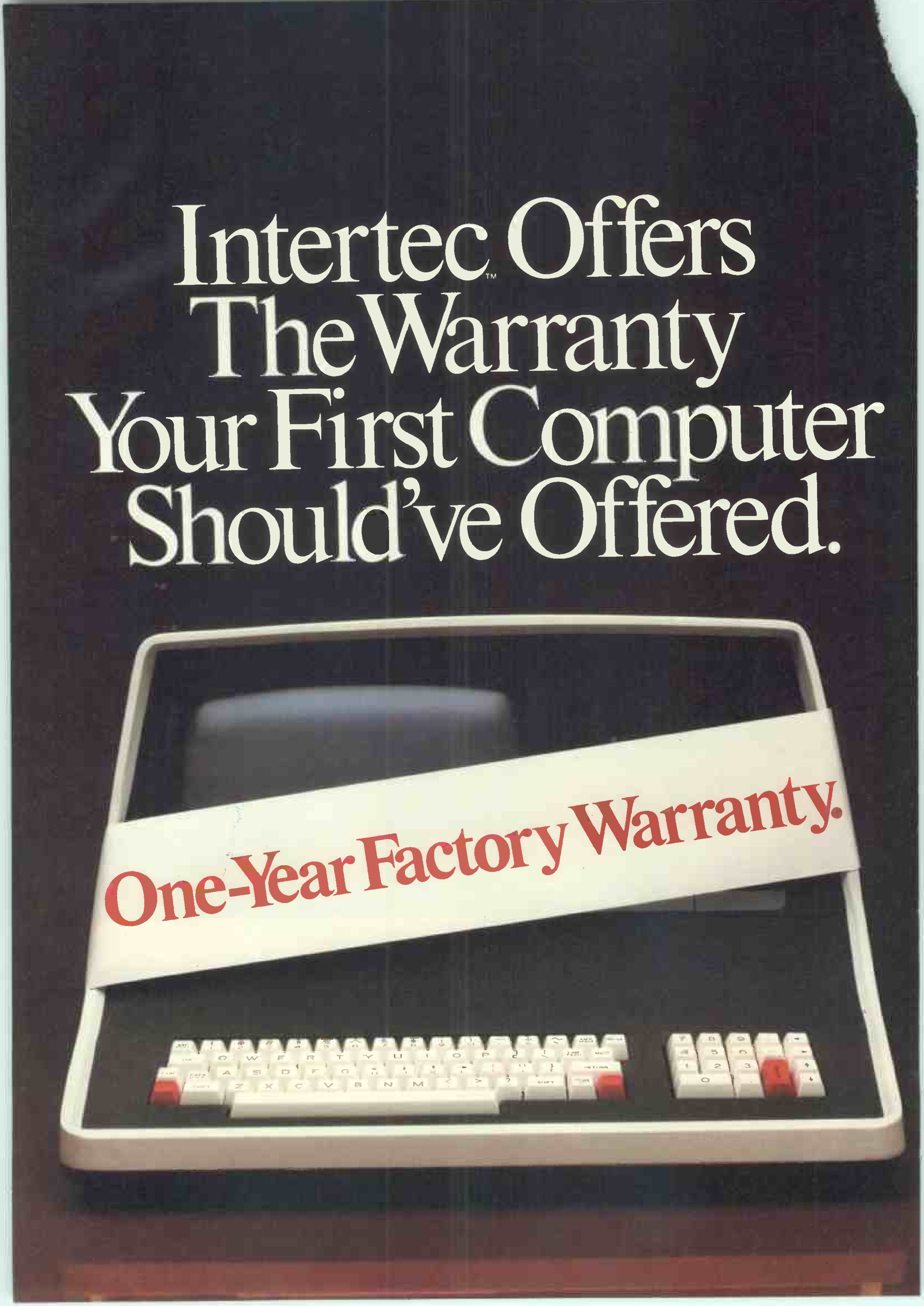
PCW/9/83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CompuStar can network up to 255 intelligent terminals and give each of them access to common or restricted databases.

Ah, but now it's 5 months down the road, the honeymoon is over, your equipment has finally begun to justify its cost, and that's the afternoon your processor's fan succumbs to fatigue.

Or maybe the malfunction is more gradual, like a disk-head drifting increasingly out of alignment.

Or more elusive, like an intermittent failure due to borderline components.

When You Build Them Stronger, You Can Back Them Longer.

And that's why all Intertec terminals, computer networks and disk storage systems come with a full year of coverage. Not because you'll need it, but to assure you that you won't.

See—unlike other makers, we know what we're standing behind.

We don't slap Intertec nameplates on other people's parts. We build virtually all our equipment ourselves.

And we assemble it ourselves.

And we test and re-test it ourselves.

More Bytes For Your Buck.

That's also why we can offer you flatly superior dollar-values.

In single-user desk tops, for example, our SuperBrain offers twin Z80s, standard; 64 kbytes of dynamic ram, standard; up to 1.5 mbytes of disk storage, standard; CP/M 2.2* and MBasic,+ standard.

And compared to conventional multi-user systems, our CompuStar systems can give you many more hours of productive labor every day—because, instead of depending on a central processor for data manipulation, each workstation in a CompuStar network has its own processor and its own 64 kbytes of ram.

As a result, you can have anywhere from 2 to 255 workstations working simultaneously without suffering noticeable declines in execution-time.

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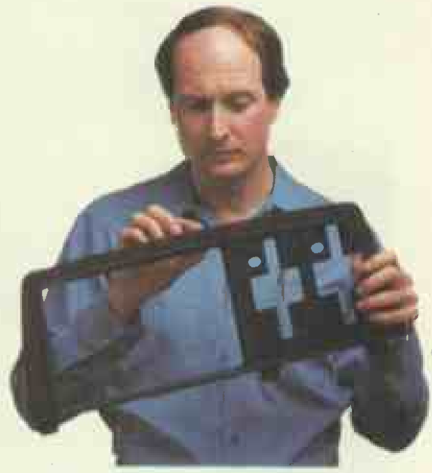
Dollar for dollar, the Intertec system is apt to be not only faster, more powerful and more versatile, but more reliable and better supported.



Since we build our equipment from scratch, we can afford to do it right and still hold down our prices.

For the name and address of your nearest Intertec dealer, or for more information about any of our products and services, please contact our Regional Manager at P.O. Box 367, London W13-9QQ, or telex 297066.

You're welcome as well to direct your enquiries to our corporate headquarters in the USA. Telex 8106662115, or write to Intertec Data Systems Corporation, 2300 Broad River Road, Columbia, South Carolina 29210.

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For just £1,495 the Galaxy 2 provides the basic requirements for a small business system:

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It has a CP/M operating system which gives access to the largest range of software available for any machine. In particular, Gemini can offer QUIBS; a small-business package developed especially for the Galaxy.

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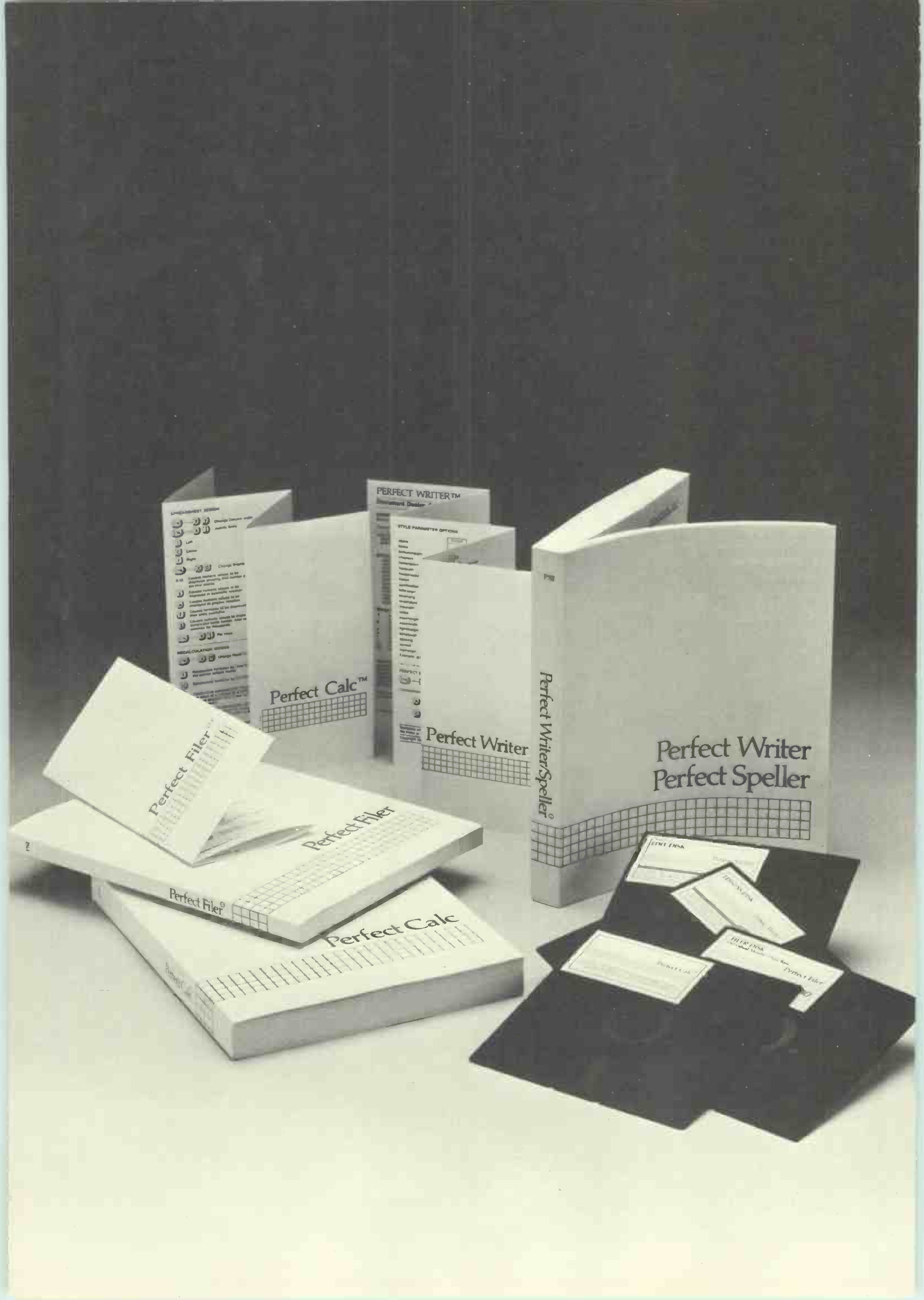
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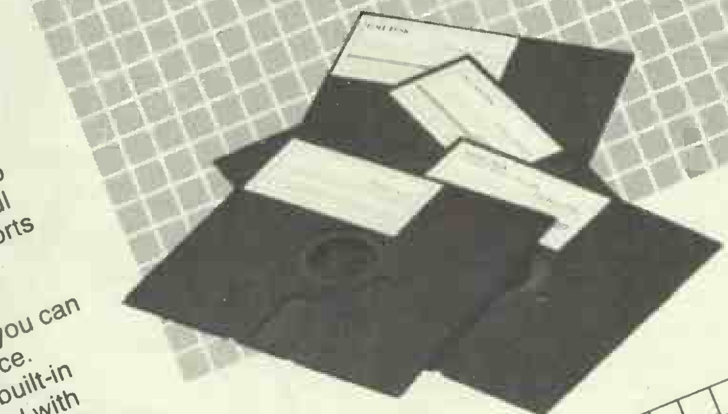

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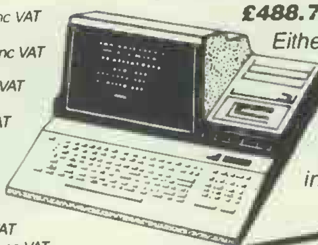

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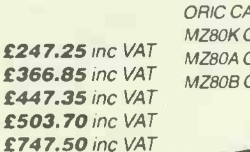

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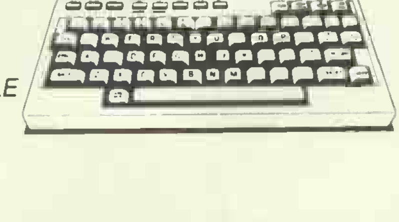

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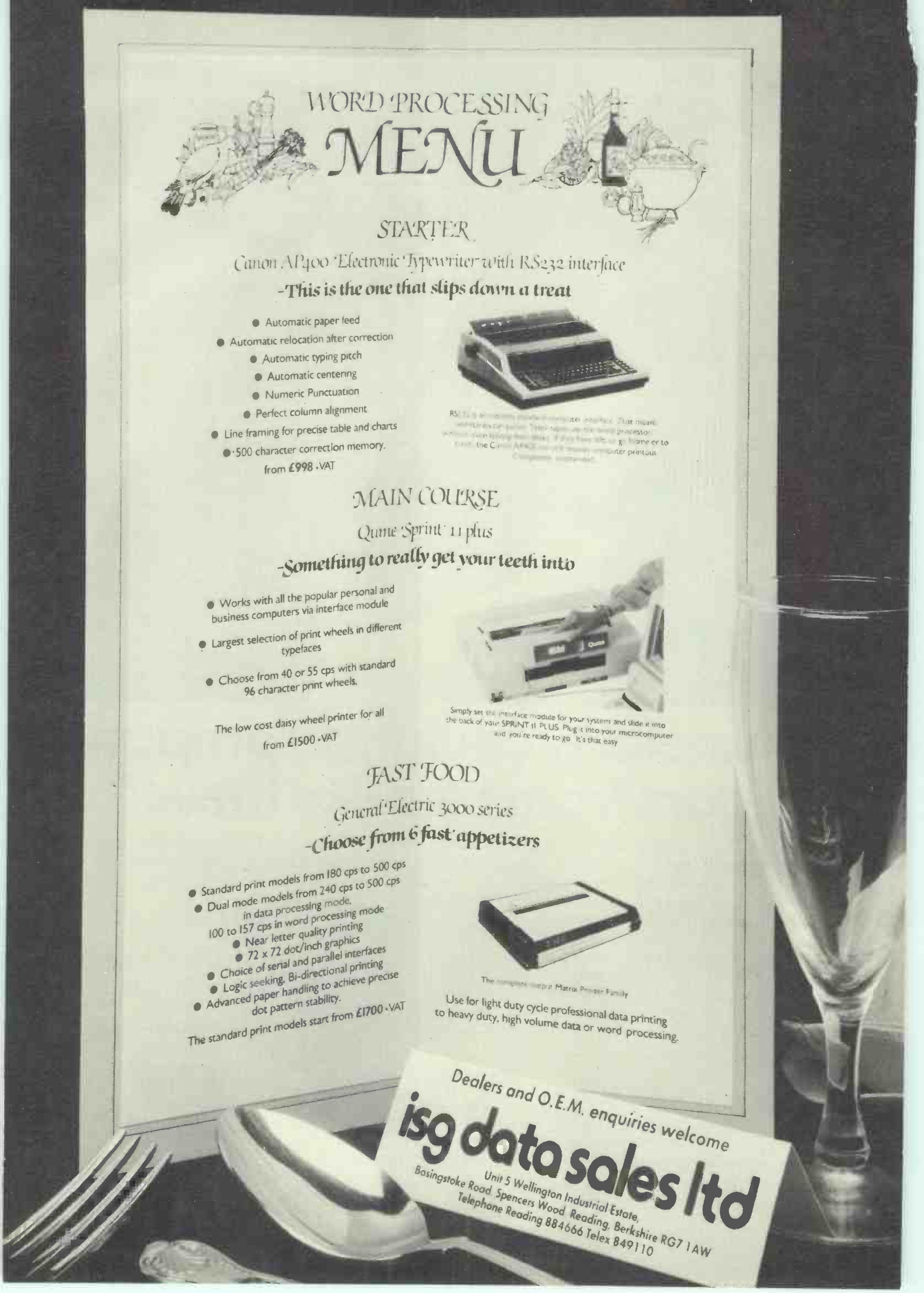
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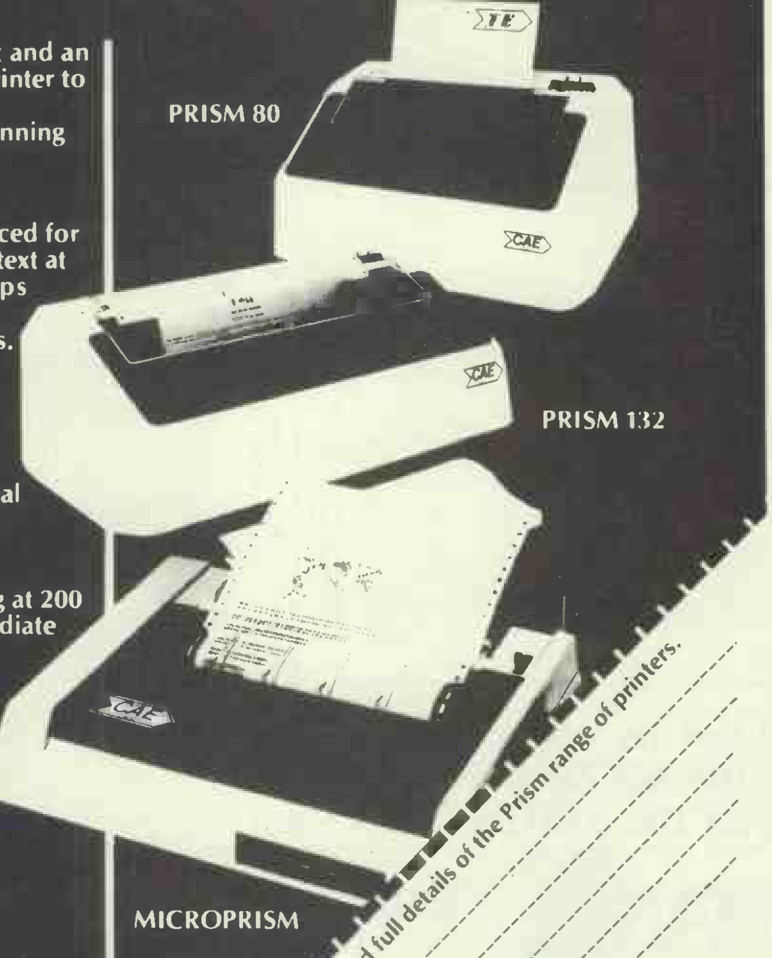

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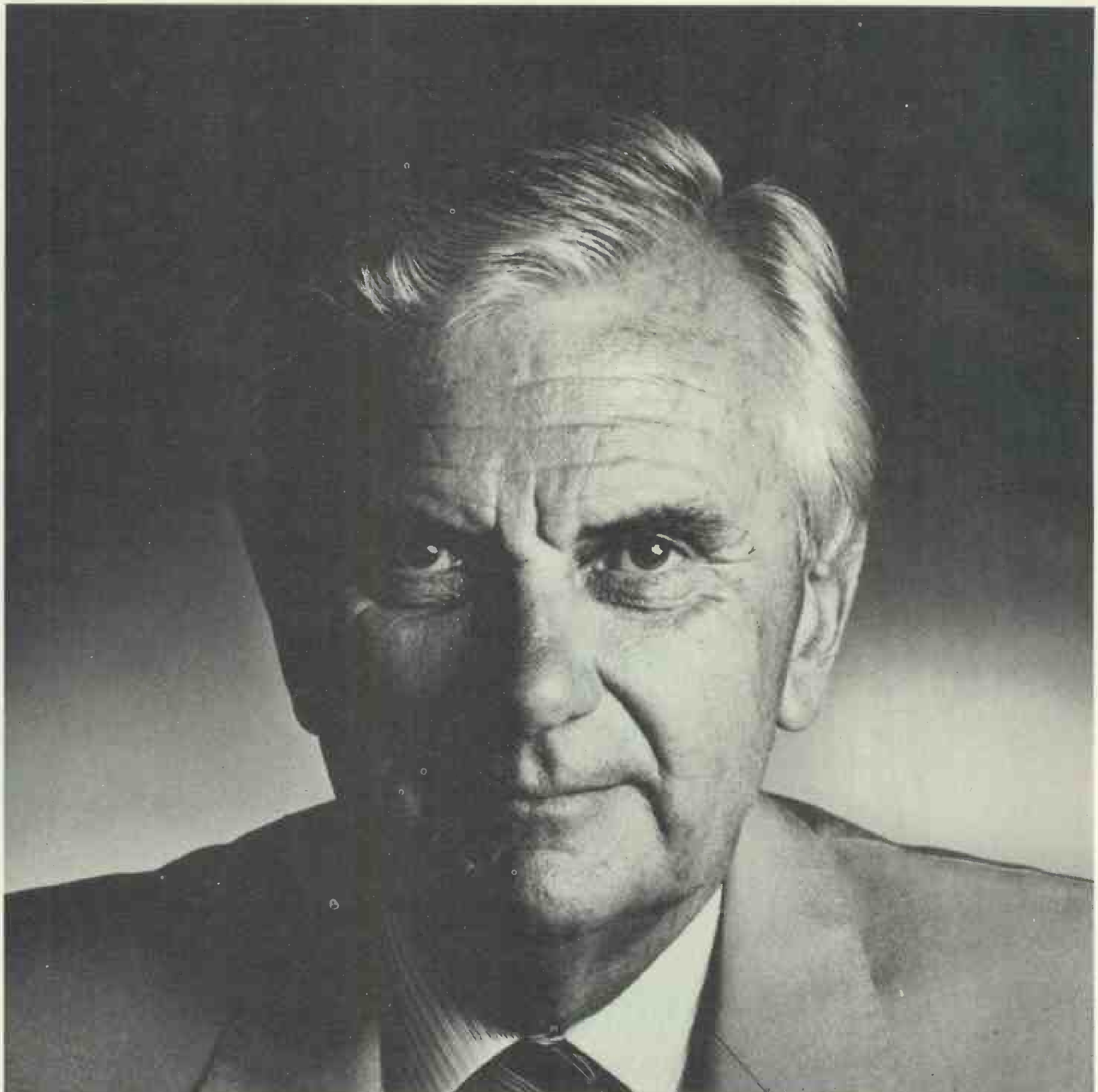

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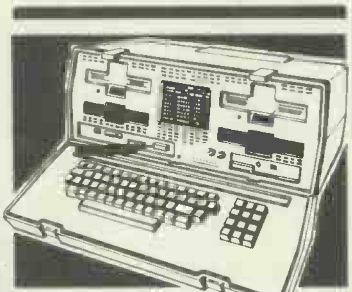

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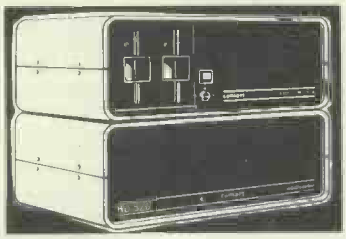

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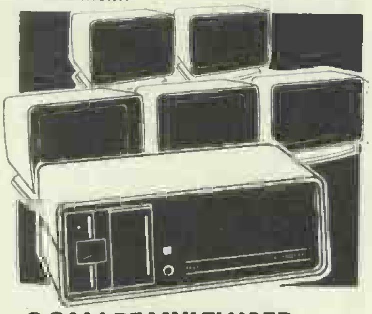

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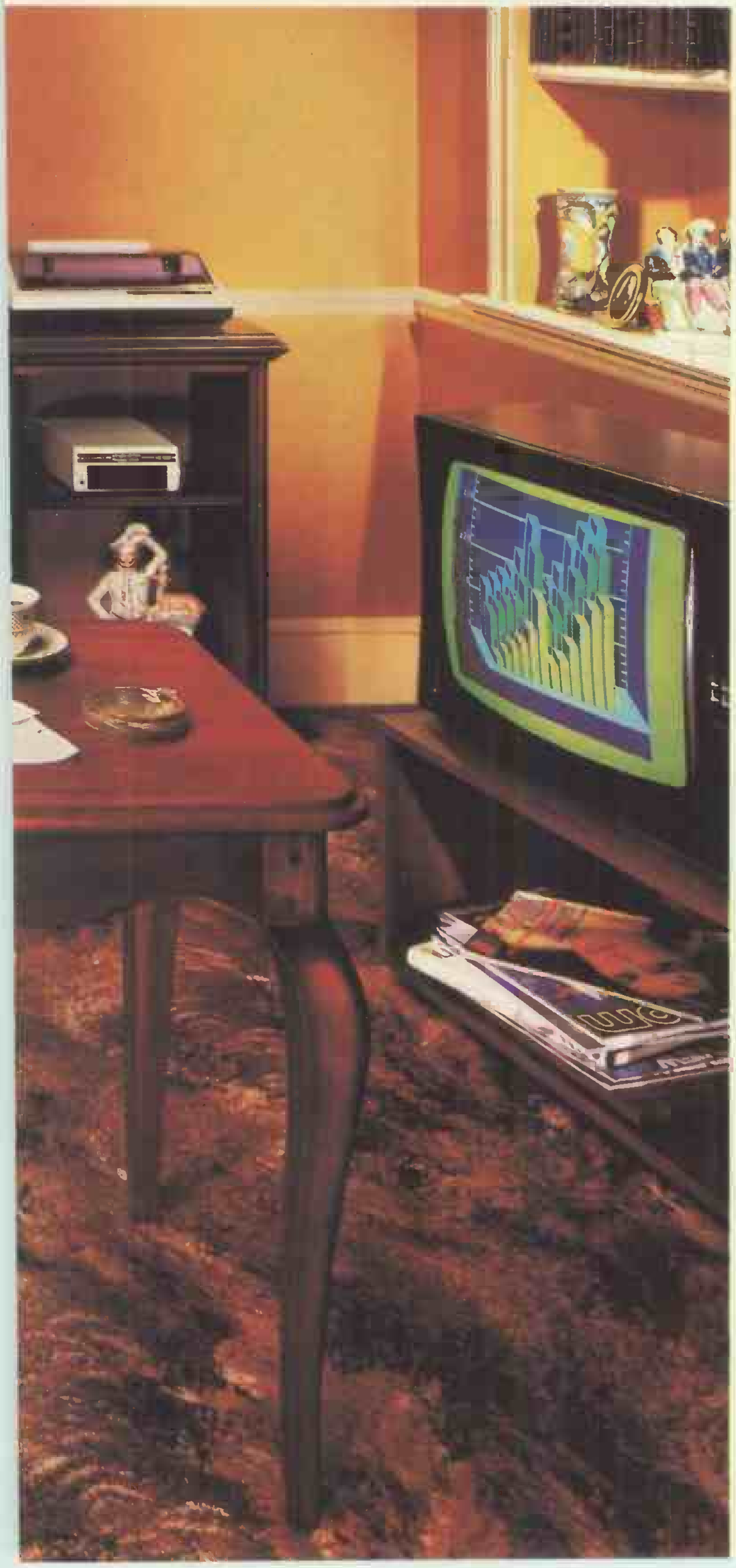

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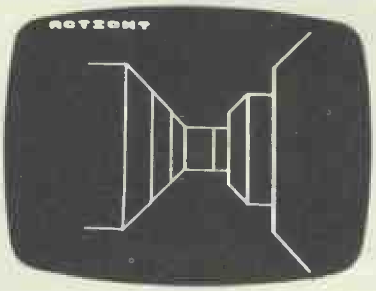

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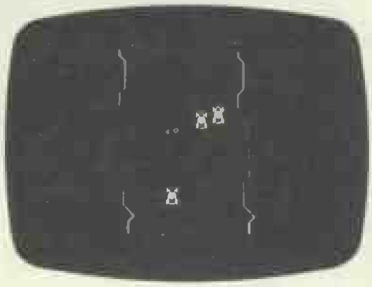

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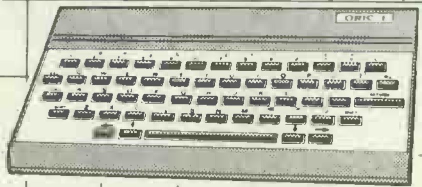

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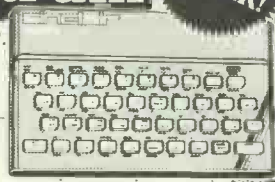

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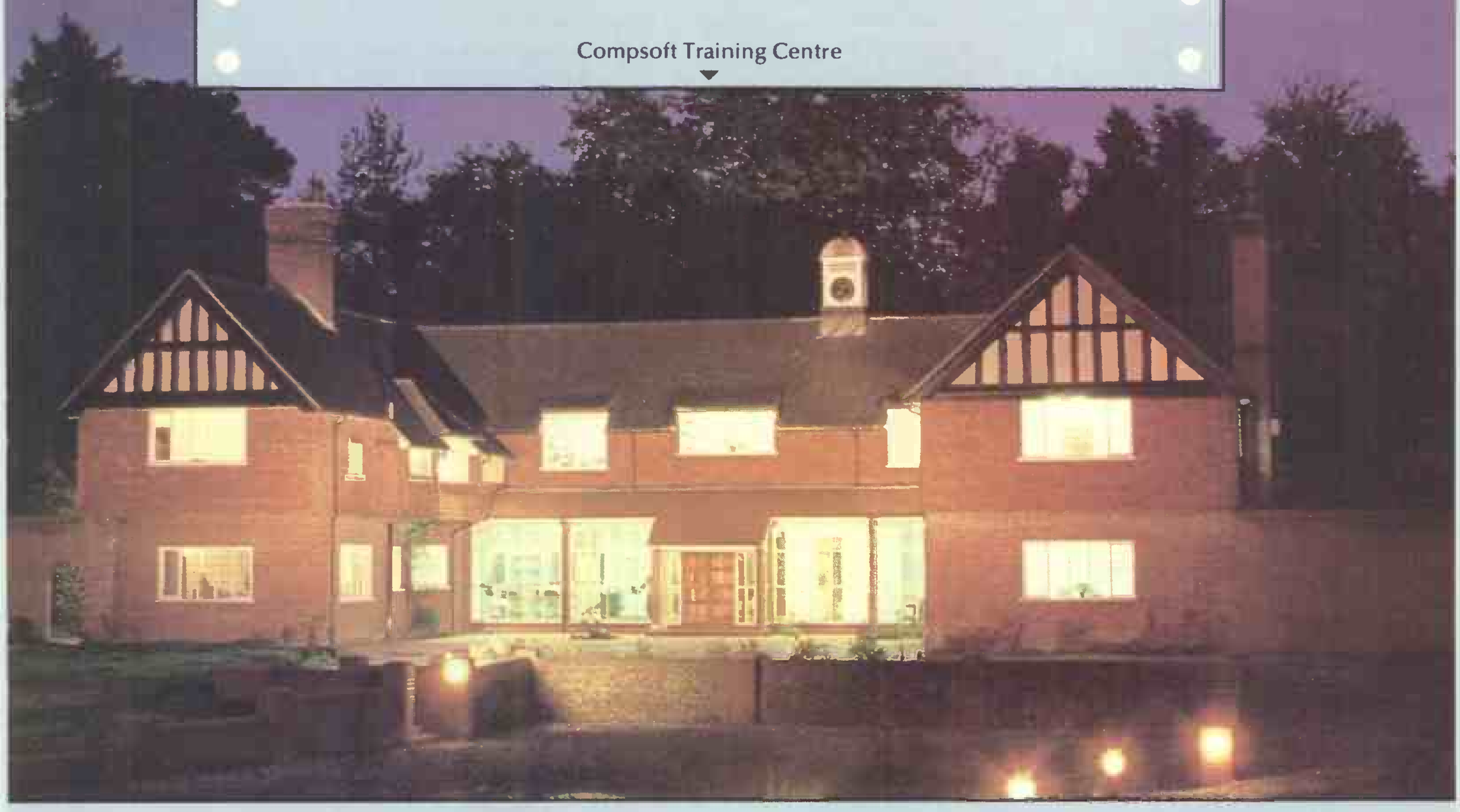

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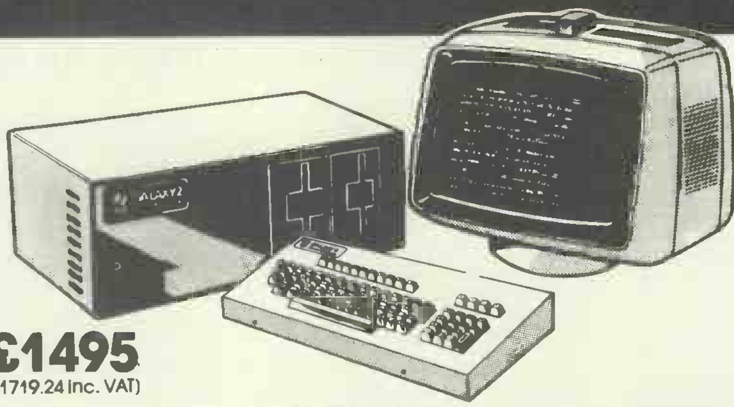

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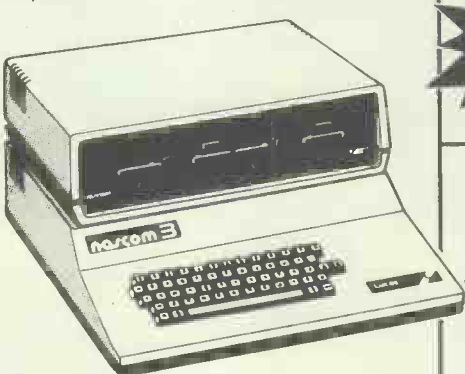

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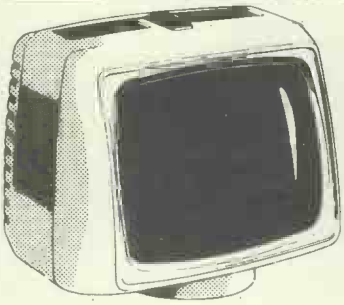

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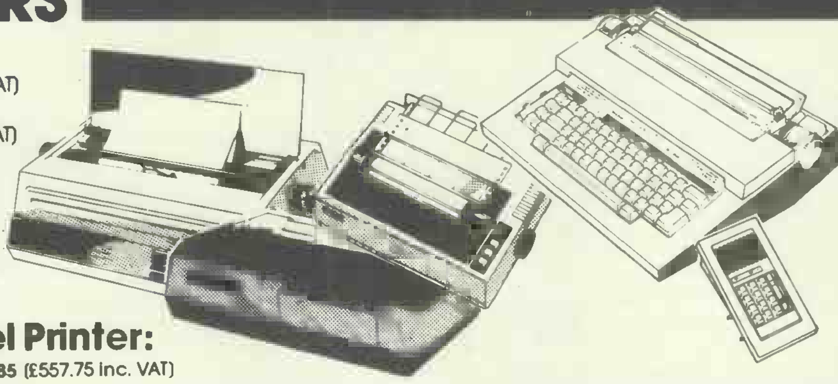

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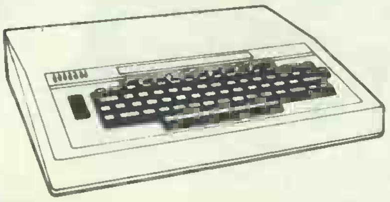

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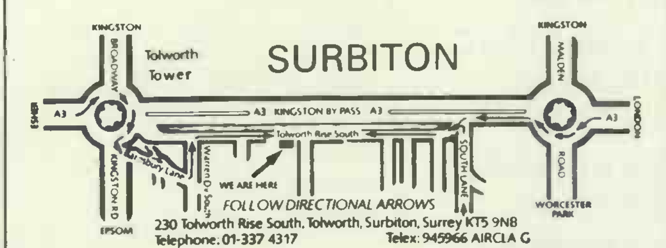

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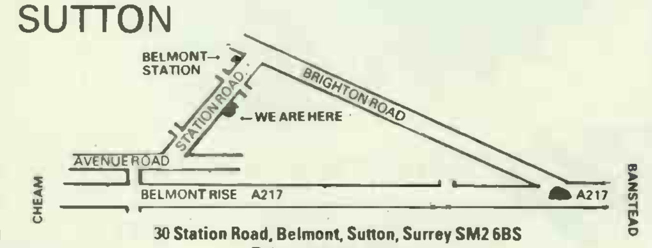

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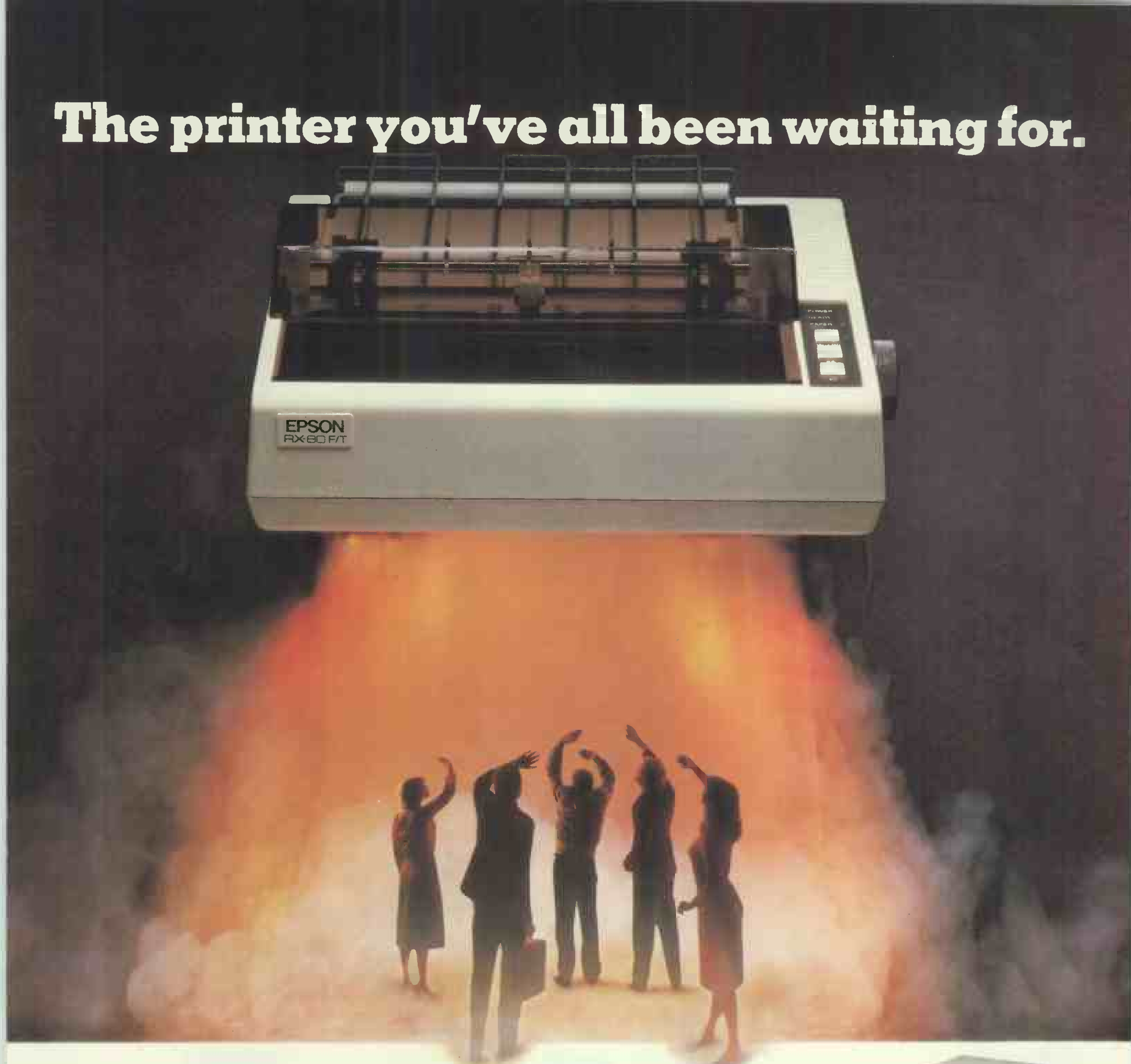

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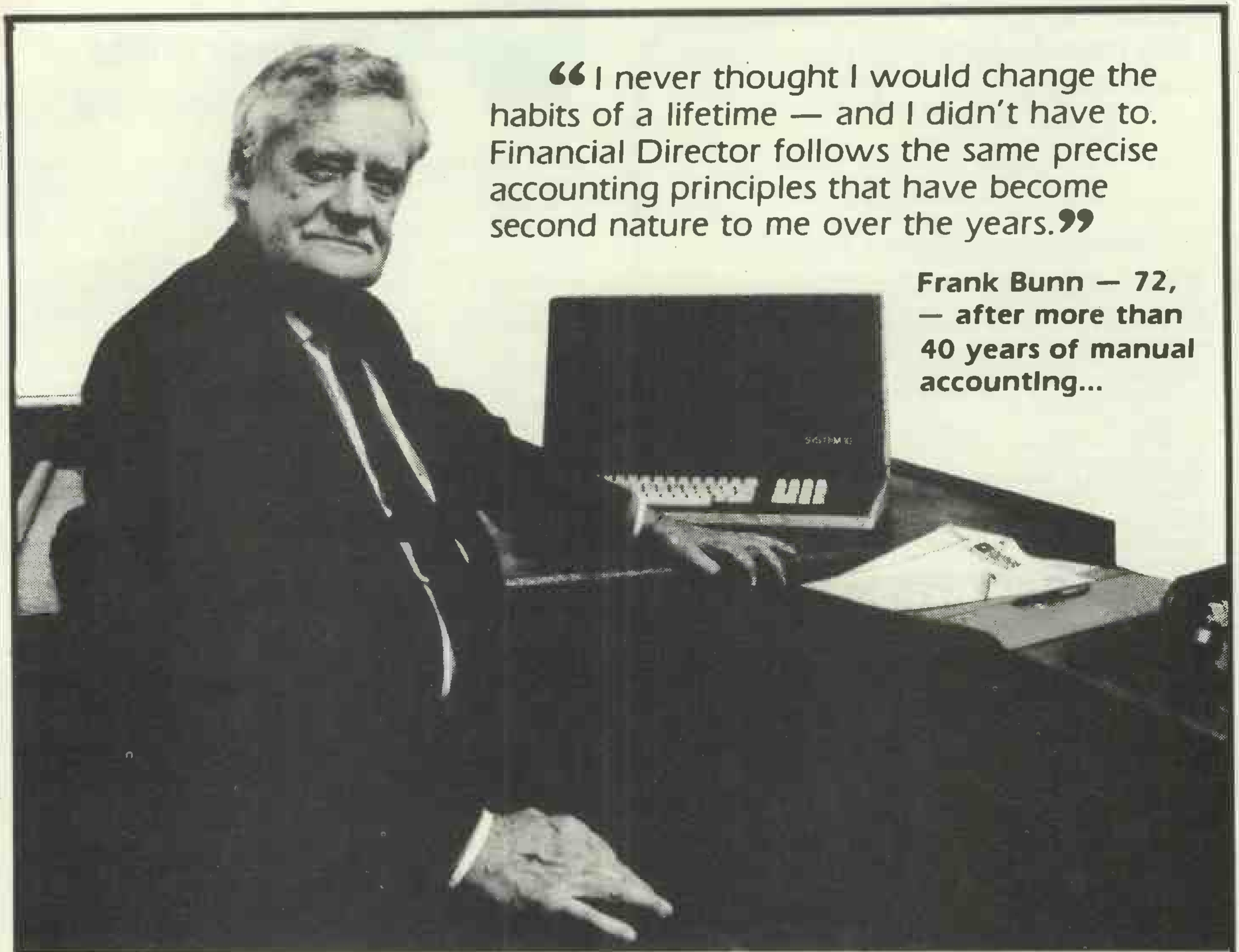

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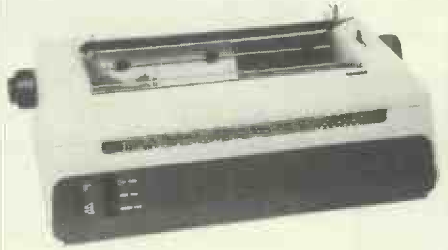

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Announcing more exciting programs for the BBC.

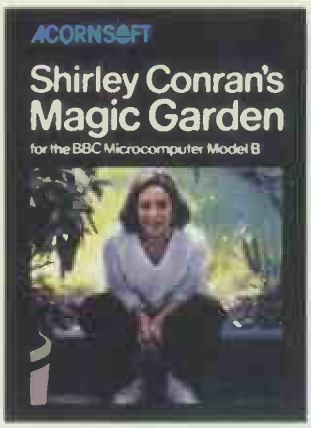
Acornsoft is the software division of Acorn Computers, the company that designed and built the BBC Microcomputer. Here are four more exciting programs, all designed to get the most from your BBC Micro.

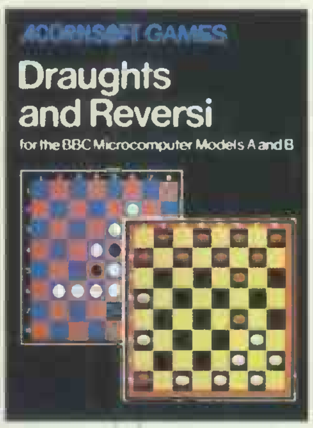
Magic Garden (£9.95) is a cassette based on Shirley Conran's successful book. It's a problem-solving program which provides the complete beginner with instant answers to the questions of what to plant and where. Simply tell the computer whether you prefer a shrub or a flower, the type of soil, light and shade conditions and required flowering time and the computer will come up with a selection of possible plants.

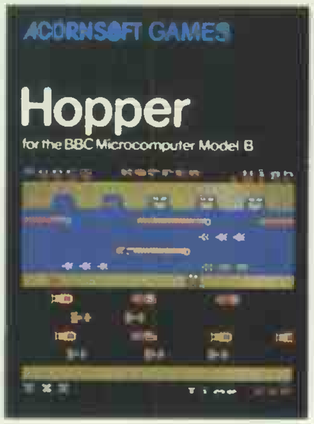
Draughts & Reversi (£9.95) is a cassette containing two traditional board games for you to play against the computer. Both give a graphic display of the board on the screen and you can enter your moves with either keyboard or joystick. The games can be played at varying levels of difficulty and on the higher levels you will find the computer to be a very worthy adversary.

Hopper (£9.95) is a game on cassette which can be played with either keyboard or joysticks. Hop the frog across the busy motorway trying to avoid four lanes of fast-moving traffic. To get across the river to the frog's lair you must leap on to the logs and turtles' backs, but beware of the diving turtles, the crocodile and the snake.

BCPL (£99.65) is a flexible modern structured language that's very easy to learn. The package consists of a BCPL language ROM, a 40/80 disc and a 450 page User Guide. The disc contains the BCPL Compiler, a Screen Editor and a 6502 Assembler. BCPL is particularly good at handling Input and Output and is ideal for writing utility programs and to develop games and commercial packages.







How to get Acornsoft programs.

If you're a credit card holder and would like to buy the programs shown in this advertisement, or if you would like to know the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy the programs directly by sending off the order form below to:
Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

Also use this form if you would like to receive the current free Acornsoft catalogue.

Please allow 28 days for delivery.

☎ Credit Card Holders. Telephone 01-200 0200.

To: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.
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Draughts & Reversi	£9.95			SBG20
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★ ★ PLUS ★ ★

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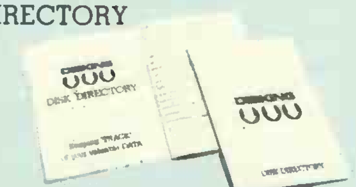

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The 20 page PVC bound DISKING Disk Directory, offering two pages per diskette for keeping 'Track' of what's on each diskette. Also inside this directory, you will find a self adhesive index label for the spine of your Library Box.
You may purchase these separately at £9.90 for ten.

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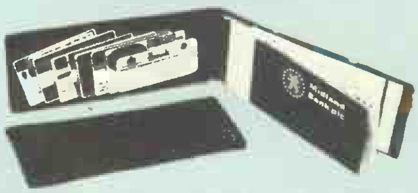

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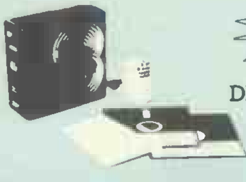

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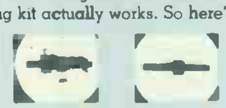
BEFORE  AFTER

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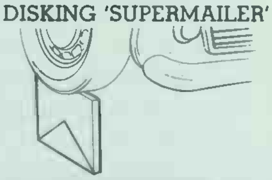

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* CAVERNOUS CAPACITY - will take, one, two, three or even four diskettes WITH envelopes.

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Although the NewBrain is conceived as a total system, the unexpanded Processor itself has a great deal to offer. It is available in two forms: Model AD, shown below, with a built-in line display; and Model A, without the line display. Both models can operate with a monitor or a television set.

MEMORY

□ 24K bytes of ROM;
□ 32K bytes of RAM, at least 28K of which is available to the user.

THE SCREEN DISPLAY

□ 40 or 80 characters to the line – without affecting the 28K bytes of RAM at your disposal;
□ 24 or 30 lines to the screen;
□ well-formed characters, with true descenders;
□ a full European character set;
□ normal or reverse video, high resolution graphics on screen of controllable size, 256, 320, 512 or 640 horizontal resolution by 250 vertical lines;
□ a facility to set up a "page" of up to 255 lines, with the screen acting as a "window" to display it;
□ ability to maintain several such pages simultaneously, and to switch rapidly between them;
□ text may be used on graphics screen as well as on parts of the video screen not used by graphics.

CHARACTER SET

□ 512 characters, including the full ASCII set, all European accented characters, Greek and graphics symbols.

GRAPHICS

□ 20 powerful graphics commands;
□ all text characters usable on the graphics screen;
□ variable-sized graphics screen, with the rest of the screen available for text – for versatility and to save memory.

SOFTWARE

Enhanced ANSI BASIC; screen editor (32 commands); mathematics package (10 significant figures); graphics commands.

□ a very friendly screen editor – a delight to use and readily adapted to text processing;
□ arithmetic to 10 significant figures;
□ very controllable output formatting of numbers – invaluable for accounting, statistics, and scientific applications;
□ a powerful, much enhanced BASIC;
□ a very flexible operating system, which allows any data stream to be opened to any device.

INTERFACES

□ two tape cassette ports built into the processor unit;
□ a built-in printer interface;
□ a built-in communications interface (V24/RS232);
□ a video monitor interface;
□ a TV interface;
□ an expansion interface for NewBrain system expansion modules.

KEYBOARD

□ standard typewriter pitch, action, layout and size, with editing control and graphics keys.

You can get everything in the box on the

If you understand the facts and figures on the left you'll soon realise that NewBrain has to be one of the most powerful micros around.

However, if you find the box on the left a little hard to follow, don't worry.

We've got over 120 dealers nationwide who've got all the answers at their fingertips.

Either way you'll discover that NewBrain is the kind of micro that will stop the competition getting a look in.

At £269 it starts off with twice as much memory as most of its competitors and can expand to over thirty times that amount. So there's no chance of being left behind in the micro race.

It comes with a very powerful language (enhanced ANSI BASIC) and it'll take CP/M,* so it'll work on the same system as similar big business micros, giving you the capacity to use an almost limitless variety of tried and tested software.

But most of all NewBrain is a machine that can expand.

It's designed to take disks, printers and memory expansion modules (up to 2M bytes) plus anything else you'd expect a professional business micro to handle.

So, whether you understand the box on the left or not, pay a visit to someone in the know on the right.

They'll answer all your questions and give you a full demonstration.

NewBrain

Grundy Business Systems Ltd., Grundy House, Somerset Road, Teddington.

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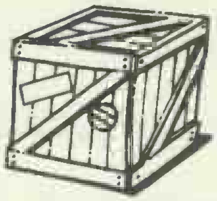

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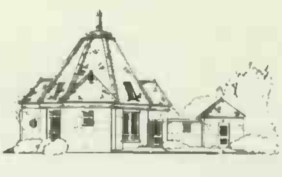

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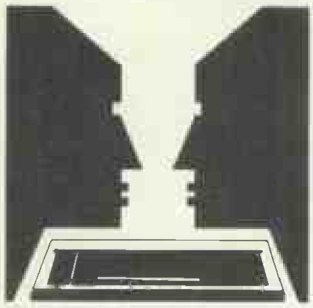

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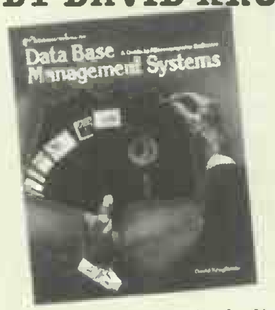

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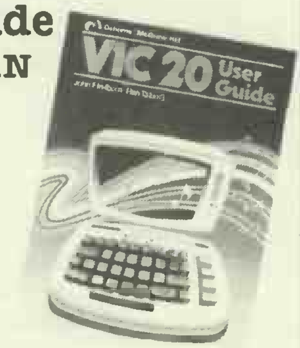

Whether you're using your VIC 20 for entertainment or practical applications, this book will help you enjoy your computer more as you build your computer skills. For beginning programmers there are tutorials in VIC 20 BASIC, complete with instructions for colour graphics and sound. For experienced programmers, the book includes detailed coverage of VIC 20 BASIC statements and functions, including a chapter on advanced colour graphics. Filled with comprehensive reference material and tutorials, the VIC 20 User Guide is the definitive source for complete information on the VIC 20.

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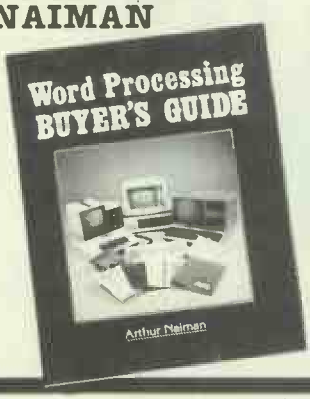

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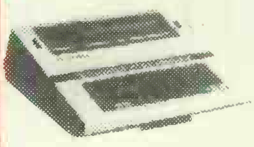

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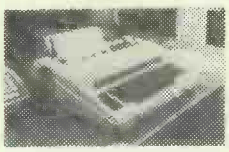

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The Brother HR is an enticing addition to your system It has a print speed of 16 CPS, range of 8 typefaces, and a choice of two models with either parallel or RS232 interfaces
Reliability, durability and attractive appearance makes the

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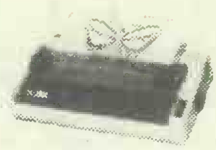

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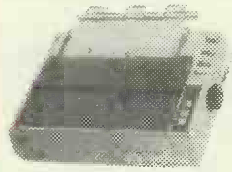

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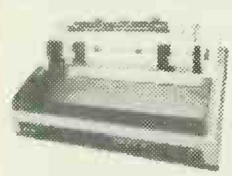

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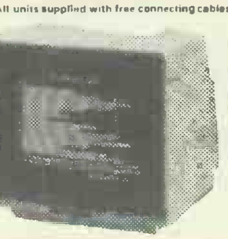

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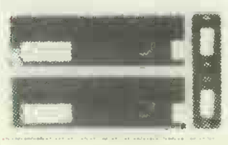

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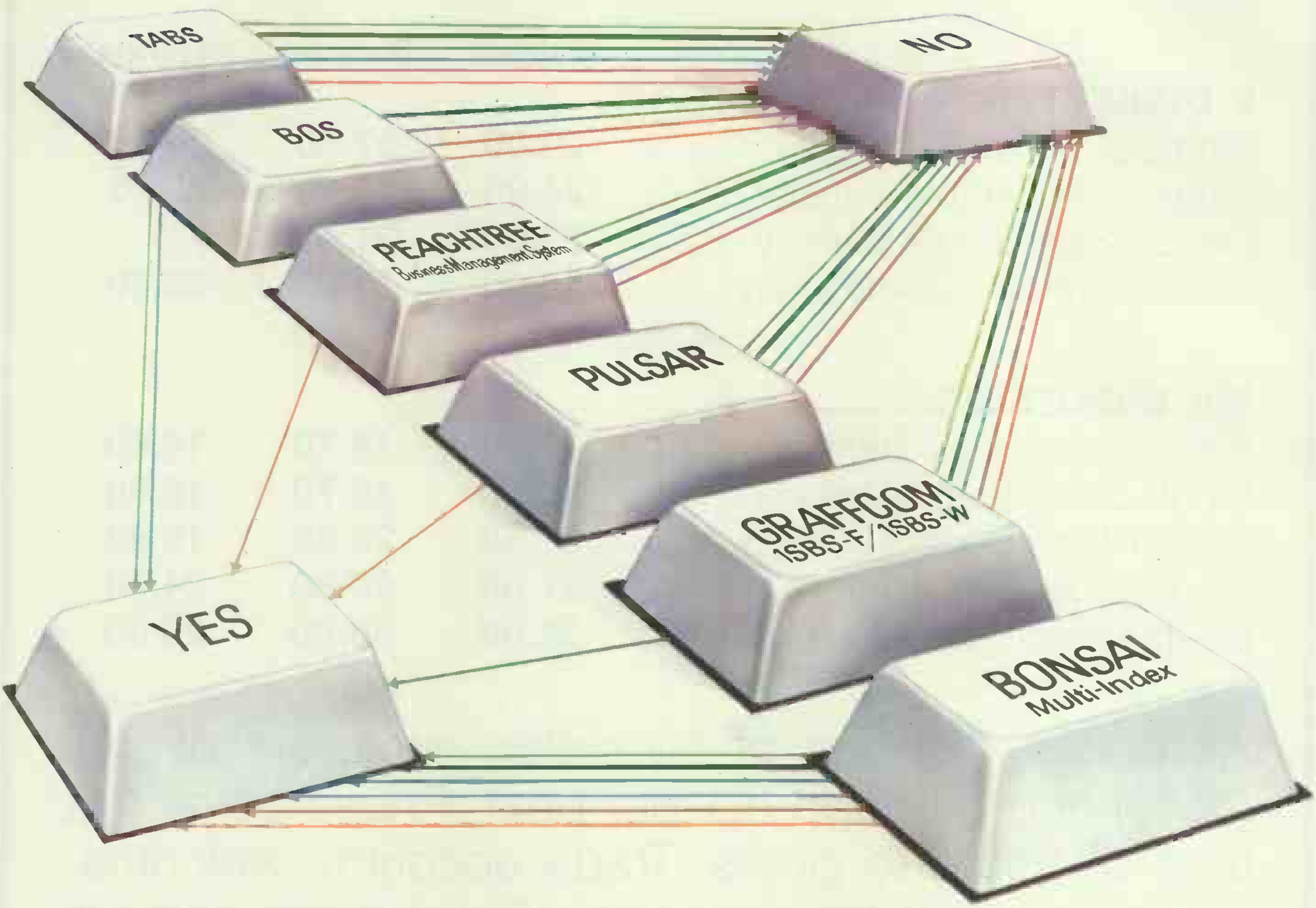

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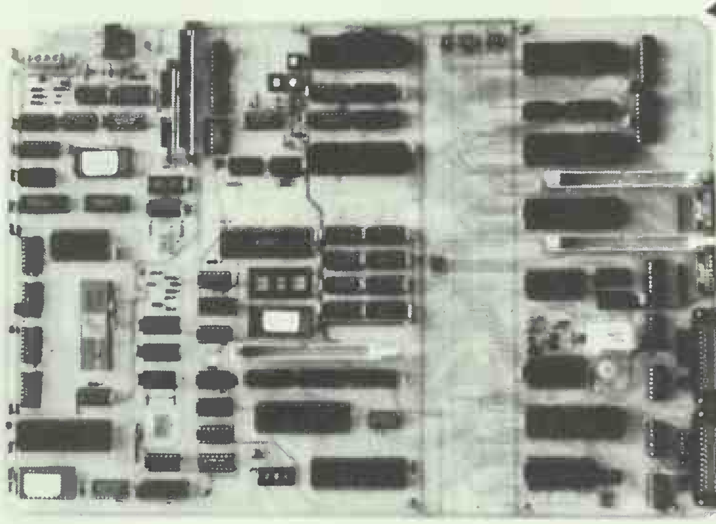

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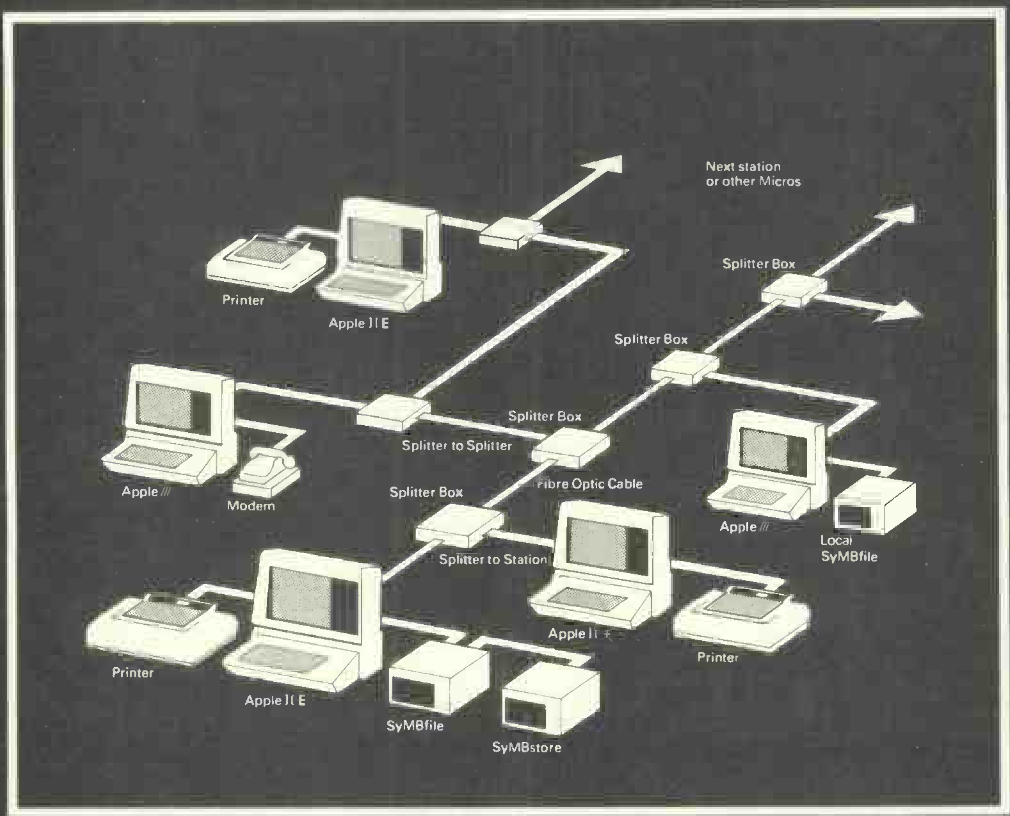

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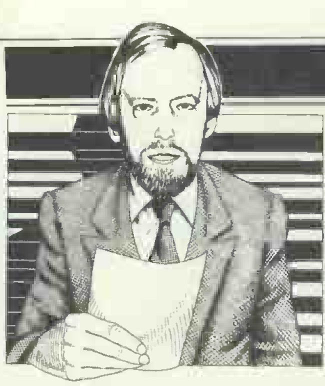


Guy Kewney delivers his monthly package of micronews.

A matter of time

'Real time' is a term most people thought we had outgrown when we left the old-fashioned mainframe industry — but it was a term which appeared in the publicity surrounding Britain's latest bandwagon, the Apricot.

For newcomers to computing, it needs to be explained that the Apricot is the first 16-bit system to be Sirius-compatible, rather than IBM-compatible.

It is the first sign that Victor, the maker of the Sirius, is not going to be obliterated by IBM's Personal Computer, but makes a computer which has become a standard of its own.

And the equally important news is that Victor will be making the Apricot, and will be selling it in the US, having set up a joint company with ACT to do this.

Apricot is a semi-portable, low-cost computer launched last month by ACT. It turns out to be faster, neater, smaller, and nicer than the best-selling 16-bit machine, the Sirius, and quite a bit cheaper, too.

And as ACT is the UK distributor of the Sirius, it took a rare bit of courage and vision to produce the new machine. Most distributors of an established machine would have trembled with horror at the thought of putting their staple product in the shade. ACT must be as aware as everybody else that the informed user will prefer to have the Apricot, and it didn't stop the company from going ahead and rushing the new micro into the public eye.

Details of the machine look very interesting. For a start, it weighs very little, because of its small 3.5 inch disk drives, and is very compact (for the same reason). So the main box, with a lot of memory and a powerful central processor chip or two, is easily portable.

It needs a fairly unusual screen because it has an identical display to the Sirius (very high resolution for those special graphics) and this isn't built into the main case. So its portability is greatly reduced, if you aren't carrying the thing to a place where you have a spare display. So ACT believes (naturally) that most of its customers will buy two displays, one for home, one for work. Possibly.

ACT's Apricot—see 'A matter of time'

The other special thing is the keyboard. The new keyboard will be available for Sirius users, too. It has a clock in it, and this is marvellous — a lot more impressive than the LCD display panel which tells you what the 'soft' function keys will do.

As users of the MS-DOS operating system will know, you have to tell the computer the time and date each time you start using it. This system won't ask you, and if you type the day before the month, it won't store the 11 May files under the fifth of November by mistake. Instead, it will ask the clock in the keyboard.

The chip in the system is the Intel 8086, which is the big brother of the 8088 used by IBM and Sirius and Digital Equipment. It runs faster, and it is backed up in the Apricot by the 8089, which does a lot of the work of talking to printers, disks, phones, and so on.

Cost of a system with two disks and a screen will be just under £2000.

The courage of ACT is seen more clearly in its choice of 3½in disks than in launching Apricot, however.

Most people would have been desperately anxious to keep total compatibility with the old machine, and ACT is probably taking a real chance in deciding that design comes first and disk compatibility second. It isn't that much of a chance, since ACT itself supplies most of the Sirius software, and will make sure it is available for Apricot users—but swapping data may be a problem.

That apart, the Apricot looks a sure winner.

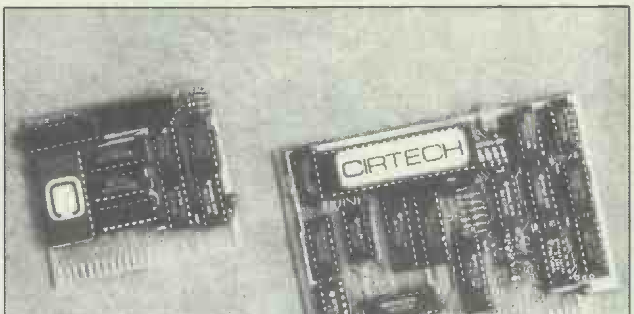
The question then arises: why would anybody who can buy an Apricot want to buy a Sirius?

ACT's answer to this is 'The Sirius will be bought in the hard-disk form as a big central data store, with people using the Apricot as an entry-level system' — which frankly doesn't wash. The system is so very much like a Sirius that attaching a hard disk will be a (relative) doddle, and it will happen very soon.

And the idea that people will buy the Sirius to read Sirius disks is true, but it won't be for long.

The real answer, which neither ACT nor Sirius/Victor will be pleased to hear discussed publicly just yet, is that people will continue to buy the Sirius because it is going to be upgraded.

Back in November last year, Chuck Peddle warned that he would have a version of the



The normal price of a Zilog chip for an Apple II is much more than the £45 charged by Cirtech. So is the normal price of a parallel printer card, for which Cirtech wants £32. I haven't used them, don't know what software they run with: and suggest you contact Cirtech direct in Dunfermline on (0383) 729770 for details.

Sirius based on the Intel 80186 or 80286 (*very* much more powerful than the 8086) in the early months of 1983. That machine may not be ready yet, but the pressure on Peddle to get it ready — soon — will now be strong.

Now for the 'real time' angle. Most of ACT's publicity concentrated on the hardware — and the value, naturally. But the term 'real time' arose when Digital Research, the company which gave you CP/M, announced proudly that 'Reinforcing a trend being set by major oems' (no, an oem isn't a Dutch uncle, it's a big customer) 'ACT has placed a contract worth £250,000 for the licensing of CP/M-86 and Concurrent CP/M-86, as well as the graphics GSX-86 package and Personal Basic.'

The announcement doesn't add that the figure (ACT says it was more, at $500,000) is really quite low considering the number of machines that ACT is likely to sell, but it is. The low price is because Digital Research will do a lot of hard work in supporting it.

All this software comes free in the £1,500 price of a one-disk Apricot, together with quite a bit more (MS-DOS is the other operating software option, and there is a big integrated database called 3D).

Concurrent CP/M-86 is, as I have been saying for more than two years, the most important operating system, apart from Lisa, to appear on micros. It is this software which Digital Research proudly described as 'real time'.

Here again, newcomers to computing will need to be informed that, once upon a time, computers worked in 'offline' mode, under 'batch' operating systems.

This was a bit like the way trains run. The ticket office attempts to keep a constant feed-through of paid-up customers pouring onto the platforms, and hopes that when the train runs it is full. Similarly, the old computers used to expect to find work waiting for them when they finished a previous job, and it was the manager's task to make sure the expensive beast was never kept waiting on a platform for some fool with yesterday's ticket.

Today's micros work 'online' — like a taxi, they don't have a time-table. They will get you to a destination — if they have nothing else to do — and they will get you there in their own way.

Real time programs are things like Space Invaders, telecommunications software, word processors, computer-aided drawing, and scientific control. They all require that the computer attend to them *immediately*.

A little reflection will show you that a machine which does only one job at a time need not work in real time. It has nothing else to do, so the fact that it ignores you in between attending to your first whim and attending to your following whim will never become apparent.

Even on some games machines, the difference is apparent. Watch an Apple running a Basic tutorial program like Little Brick Out (supplied free), or play the awful Spectral Invaders on a Spectrum, or try out the sample target-shooting program on a Lynx, and you will notice that as soon as one type of action starts, others slow down (or stop altogether). Like Gerry Ford, they can't walk and chew gum simultaneously.

But a real-time computer must constantly watch to see if the operator is pressing a key, whether the phone is ringing, what information is coming off the disk, whether the printer has finished its line of text, what characters ought to be displayed on the screen, and what time is it, anyway?

CP/M-86 and MS-DOS are *not* real-time systems. Concurrent CP/M-86 is. Bill Gates, head of Microsoft (inventors of MS-DOS) says we don't want real-time systems. His old friend, Chuck Peddle at Victor (maker of Sirius) has said that he will only support MS-DOS, not CP/M-86.

Bill and Chuck are going to have to think again.

Stop Press

The Microprofessor (benchtested page 168) may no longer be available in this country following legal action taken by Apple.

At time of going to press Apple had just obtained a high court order preventing the Microprofessor's importer Sirtel from selling or otherwise dealing in the machine. The Microprofessor, made in Taiwan, allegedly uses Apple copyright software in its ROMs. Apple does not take kindly to plug compatibles.

Peter Cobb, managing director of Apple UK, told PCW: 'We have never lost a case like this in the courts although in Britain it has never got that far before and we've always been able to settle out of court as in the case of the Apollo II. Probably the best known case we've won in the US was against the Pineapple.' In the US Apple has the support of the customs authorities which impound illegal Apple lookalikes from the Far East as they enter the country.

The injunction will be binding on Sirtel until the full trial of the case.

Meanwhile Sirtel's former boss John Ford has left the company and the new director Richard Drewnicki was not available for comment.

Multi-purpose

The news that ICL is 'making a thousand personal computers a week and selling every one it can make' can be taken with a lot of salt and remain impressive.

On the face of it, the Rair Black Box is a silly idea. It is a way of sharing a £5 chip among three people. And the ICL personal computer is the Rair Black Box: so why the sales?

The answer is that those people who have seen the ICL personal computer as a personal computer (people like me, I admit it) have been misled by their own enthusiasm for personal computers.

The ICL micro is really a minicomputer. The difference between a micro and a mini is best explained as follows:

Tom van der Loo, head of a Dutch software company called Holland Automation, sells software for accounting purposes, which runs on almost everything. It has now been put on the ICL personal computer, changing its name from Hai Line to Hi-Line. Full marketing marks to somebody or other.

Tom's theory, simply stated, goes: the ICL micro sells into the business market, not the micro market. It is a 'high value, high margin, market, and you can justify high profit in it because support is important, software is important'.

The ICL micro, he says, is a 'professional business system' and has been designed as a multi-user system. Just what a 'multi-user system' is, Tom explained: 'It is a system where several users in a business can all work on the same data. It doesn't matter if it's a network, or a single chip: it's access to the same data that matters.'

His prediction is that: 'IBM will survive. Olivetti will survive. Nixdorf might. ICL might, even with its current product, because quality of product is important only if you start to compare. Which business user compares? If you put the right price tag on it, and fill it up with support, it will sell.'

A minicomputer is a computer which does the same job as a company mainframe, but is cheap enough for the smaller company to buy.

The interesting sidelight to van der Loo's theory is that he thinks that the days of the true personal computer are over. He actually went on record last month as saying that even the IBM micro 'is not selling now'.

'All the pipelines have been filled, and there is a dip in the market. Offering a catalogue of software is crazy — like offering a catalogue of spare parts as a way of getting your own car.'

Holland Automation's software is special in that it runs under neither CP/M nor MS-DOS, nor any other outside operating software. It writes its own, which means that it can format disks to suit itself, and can swap disks between such widely differing machines as the ICL micro and the Olivetti.

You don't have to agree with everything he says. But when you notice big companies buying Tycom MicroFrames with MPSL's Multi-user Business Operating System (MBOS), and you wonder why, perhaps his words are worth considering.

Pay off

Everybody who makes toy micros has been cutting prices: the official price of a

Commodore 64 is now £230 including VAT. So the news that Oric has cut its prices should not be surprised.

The cut is by £30 on the 48 kbyte version, bringing the price to £140, while the 16 kbyte version 'returns to its launch price of £99'.

This may not seem much to you: to Oric, it is nail-biting time. Sales of its micros dropped off heavily in June and July, and one possible reason was that everybody knew about imminent price cuts from Commodore and others. Now that prices have stabilised Oric will be hoping (and praying) that people start buying Orics again.

The promising sign, for Oric, is that at the recent Computer Fair, I did see some software. Not having had a chance to try it out, I assume it is fairly average (average = normal rubbish) but at least you can buy it.

Lay it on the line

Most computer printers will, when you type "RETURN", move the print head to the left hand side of the paper, and move the paper up one line.

What you may not have realised is that there are two ways of doing this: and if you hadn't realised this, you are in the company of Tandy and Microsoft.

The first way, which the text editor WordStar prefers, is to transmit two characters. The first is called a carriage return, which moves the print head to the left. The second is called a line feed, which feeds the paper up one line. Simple, isn't it?

The other way, which all Tandy TRS-80 computers seem to prefer, is to send a carriage return only. The printer is designed so that it automatically does a line feed all by itself.

Tandy has launched a portable computer — a 'lap-held' computer, which you can even use on a jolting train journey on the London Underground.

When you get to your destination, you will probably find a computer somewhere, with its own printer. Chances are it will be an Epson. Chances are that it will be driven by WordStar. That's what a lot of people use.

You can print your text out on this printer, but be warned: Epsons driven by WordStar expect to get a line feed command. If you open the box up (lots of screws, turn the thing upside down, disentangle the wires, find the manual, move the right switch) you can change your Epson, so that it does the line feed all by itself. Of course, it won't work with WordStar, then.

You don't have to do this. The alternative, however, is to watch the Tandy 100 print your entire document on the top line of the first page.

It works like this. Each time your Epson gets a carriage return, it will return the carriage. The Tandy 100 will believe that it has also done a line feed, and will print the next line. It will save an awful lot of paper, naturally.

Of course Tandy is very sorry about this. The company agrees that the computer should be able to change itself to suit the printer. However, Tandy didn't think of this when designing the spec which Microsoft used when writing the software. Microsoft, too, is very sorry: but it wasn't in the spec, so they didn't provide it. And neither of the two plans to change it.

Devilish cunning, these Japanese.


The Tandy TRS-80 portable computer

The whole truth

If there was a hole in your IBM micro (a space on the circuit board inside) when you bought it, you can now fill it.

It was a hole meant for a secondary 'co-processor' or a computer chip that worked with the main Intel 8088 processor. It is a specialised mathematics chip, which takes over the arithmetic functions which the main processor gives it, and feeds the results back into the main system. Intel calls it the 8087.

The announcement of this as an option arrived together with a whole set of useful, if un-astonishing 'upgrades' by IBM for its little micro. They include four games, but mainly the items covered are the colour display, a binary synchronous adaptor (if you don't know, you don't need to), a 3270 emulation program so that your overpriced micro can pretend to be an even more overpriced mainframe terminal; plus various software options including a language or two.

All these options should be available from stores in September.

NCC News

The biggest computer show in the world is Hanover: the Americans, however, all believe that the biggest is the one they call the National Computer Conference, or NCC.

It dates from the days when computers were rare beasts, and the people who worked with them needed a convincing excuse, once a year, to get together and swap ideas. Somebody had the idea of bringing a few publicity materials for their own company, and it turned into an exhibition.

This year it happened in Los Angeles, right on top of Disneyland. Cynics might say that Disneyland was the only reason I went — and looking back, I find myself wondering, seriously, what else I got out of it.

First of all, it is not permitted to actually *sell* anything there. Sell? Tut, tut, how ungentlemanly: this is a conference, not a vulgar market. No, show the product, by all means: but no sales. Not even any contracts please.

Second, the people who go there are the people who don't actually rate a travel budget except to go to the NCC. It is the NCC, therefore their boss can't say 'What rinky-dink carnival is it you want to go to this time, Irving?' and fork out the air and motel fare. They are called 'system specifiers' in the trade.

To talk to these clerks, the companies provide appropriate level personnel. On each stand, there is a failed car/insurance/holiday/central heating salesman. He will smile, shake your hand, smile, invite you to the hospitality tent, smile, press brochures on you, and smile. Ask a serious question, however, and you will get a blank stare if you're lucky.

There were important people there, to be sure. I could have phoned them up and had equally fruitful discussions with most. There were products announced, like the Gavilan, which had been announced in London the month before.

Next year, I shall go to Comdex Spring.

Sharp chose the NCC to show bubble memory, still the dream of those who want to replace spinning magnetic disks with spinning magnetic 'domains' on a solid state chip.

The machine which had the bubble looked incredibly like the lap-held Gavilan, but had bubble instead of disk. I would automatically prefer the disk were it not for the fact that the Sharp, at $2000, would be half the price of the Gavilan at $4000. Apparently the full spec will include IBM-like MS-DOS operating software.

A man called Paul Terrell

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An Apple in a motor-car is 'portable' in some sense, I suppose, so the claim that the APS battery adaptor which lets you run your computer from the car power 'makes it portable' can be taken seriously.

APS also suggests that you use this anyway, with a lead-acid battery, to prevent being caught by power-cuts. At £300 or so, the system had better be on a very critical application to justify this.

Details on (0273) 420196.

wandered onto several stands, looking vague, and asking for news of portable 16-bit micros. 'I want something like the Compaq, which is IBM-compatible, but smaller and movable,' he said, 'but I want it now. Compaq can't provide enough.'

He wanted it for a revolutionary new idea (see Prism story) to sell cartridges for computers and video games by loading the software into a blank cartridge — and offering the shopkeeper a computer to do this loading job.

What is really interesting is that of the dozens of people offering IBM-compatible micros, and portable ones at that, the only one found at the NCC who could actually sell more than one or two was Compaq. And Compaq was already selling all the machines it could make.

In this country, Terrell's operation will end up using a Sanyo computer, not yet officially announced. It makes for a thoughtful few moments, doesn't it?

Teacher's opposition

'We can't use the computer given to the school by the Parent-Teachers Association, because...'

1) The Inspector won't let us plug it in until the plug has been approved;
2) It will be used for computer games, and will disrupt the class;
3) There is only one, and it will disrupt all the other children in the class who need one of their own;
4) We want to buy a more expensive machine, and will need the PTA to put up the money for a disk;
5) Nobody has shown me anything that this thing can do which I can't do better with a few coloured magic markers and a few big sheets of paper;
6) I am the mathematics teacher, and it isn't fair to start using a piece of equipment that only I want;
7) Computing is a middle-class thing, and this is a working-class area. (And while we're at it, isn't it full time we stopped this pretentious rubbish of having music lessons?)
8) The software is all crap;
9) We are not going to be any part of this conspiracy between Sinclair and the BBC to sell unnecessary gimmicks;
10) It's all too primitive still. We should wait until something better comes along. I have heard that these machines will soon come with free megaflops, and will be able to work without you having to learn to type. That will be the time to get one — didn't you know that the qwerty keyboard was actually designed to slow you down? Wait till they come with that Microwriter thing as standard;
11) I've been on a course about computers, and, frankly, having looked into it very carefully I can assure you that there will be problems. For example, the Apple that the BBC is so anxious to promote is so dangerous that the Post Office won't even let you connect it to a television. And what about hard copy? You'll need a colour monitor to run that.

And so on, and on.

It isn't often you will read in one magazine a recommendation that you buy another: so here is an unusual event. Get hold of the July/August issue of *Educational Computing* and read Derrick Daines writing about obstructionist teachers. (Also, don't miss Derrick's column in this issue of *PCW*.)

Not only does Daines have them all off pat — right down to the older teacher (backbone of the staff) who sits at the back pretending to be asleep, and snorting (too quietly to be heard by the head teacher) his apparently sceptical wisdom at every odd statement — but he has suggestions as to why they obstruct.

And also, he has suggestions as to how to try to meet their prejudices, and to turn them into thoughtful objections — which may or may not be changeable.

Derrick Daines's wisdom will serve me nothing, because there is one lesson I can add to the useful information he has collected.

That lesson is: any idea put forward by a parent is not merely suspect. It is beneath suspicion. Especially if a parent should happen to be as middle-class as every teacher in the school — with the obvious exception of the sole working class one who, naturally, has jumped into computing with both feet and is already thinking of putting a few programs on the market...

There is a lesson which teachers need to learn, however. Even if a parent says it, it remains true that computers will not replace teachers.

The reason is none too palatable: teachers are the nannies of our society. And the computer that can keep classroom discipline has not yet been dreamed of. No, I know it's not flattering to the image of teaching, but reality is reality. And in the same way that journalists exist to provide space between the advertisements, teachers exist to keep children off the streets.

A good journalist can do more, but a lousy writer need not expect to be fired for doing less. As so it is with teachers. But whether they can find ways of making classroom life interesting (for themselves as well as the pupils) or rewarding, or even educational, their

An American company based in Now Orleans will be making Welsh Dragon computers under licence, for the US and South American markets.

These three happy faces belong to James Reiss Jnr (centre), who is boss of the Tano Corporation which will do the deed. He is flanked by Dragon's Tony Clarke (left), and chairman Dr Derek Allam. The Tandy-compatible business begins here.

necessary function is to keep class order, to stop the kids knocking each other's teeth out while their parents are out earning a living.

Accumulative effect

It's possible to pay an awful lot of money for a utility program which will turn human mnemonics for the Zilog Z80 instructions into the real thing. Or it is possible to pay £30 for ZEN, and get a very popular program with most essential ingredients.

The list of computers which use the Z80 has now been increased by Kuma, a company which has produced a version that will load and run on the Newbrain.

Details from Kuma at 11 York Road, Maidenhead, Berks SL6 1SQ.

Closed shop

It is obviously sensible for Acorn to insist that BBC Micros are sold only by authorised dealers, who can fix the blessed things when they go wrong.

It would seem to be equally sensible for Acorn to tell its dealers not to 'wholesale' the micros, too. Obviously if a Dealer supplies machines to four or five Fly-By-Night Traders, he can get a bigger discount, and can duck out on fixing the things.

However, for Acorn to take this position requires that it has done its own job. It must have reasonable grounds for believing that the unauthorised shops which are getting the machines indirectly are, indeed, fly-by-night.

When the stores are in fact dealers who have been appointed by Acorn, and just can't get computers, then obviously Acorn is short of legs to stand on.

Now read this letter from a micro dealer to me.

'We applied to Acorn in the second week of November 1982, to be dealers. Meanwhile one of us spoke to Chris Curry at Compec. He suggested that we contacted the dealer man, Sandy Dow, which we did. In the first week of December, we sent out company details, including our bank's name and address and two trade references.

Within days, our efforts seemed to be rewarded, as we received a dealership application form. This we filled in, and sent it back to them. A week later we contacted Acorn to find out how our application was proceeding, and were told, very apologetically, that our trade reference details had been lost. We repeated these details over the telephone to them, and were assured that this would be dealt with as soon as possible.

About a week later we received our dealer newletters. Also at this time, another company in our town applied for dealership with Acorn— and were told that there were no dealers in our whole county, and that Acorn had no plans to appoint one.

By early January we had still heard nothing from them. We telephoned them, and were told that they had lost our trade reference details again, and could we repeat them please.

Things finally began to happen, when on 9 February we sent our first order to them, with a cheque. On 16 February, Acorn telephoned us... thanking us for the order, and could they have another cheque please, as they had lost the first.

We sent them a cheque, which they duly cashed. Then they found the first cheque again, and telephoned us when they could not cash it. We explained that as they had lost that one, we had stopped it, and issued another.

On 1st April (!) we received three BBC Model B Computers, and telephoned to find out when we could expect some more. We were told that we would receive fifteen more in two weeks—and could we give them the names and addresses of two trade references and of our bank...

These were written to them, as well as phoned to them.

In fact, two weeks later we did receive twelve computers. These were actually intended for another dealer with a similar name—who was invoiced for them.

On 26 April we were told that we had no account with them as yet, as they had not received from us the details of two trade referees and our bankers. By this time we were somewhat annoyed and insisted that they telephoned our bank immediately, which they did.

Last week we were told that we now had a credit account with them, with a limit of £10,000. This we were told by their credit controller, Mary Tucker.

Today, however, it seems that although we have an account with Acorn, no credit limit has been attached to the account, because our referees have not yet replied. We then telephoned the referees who told us that they had not heard from Acorn computers at all. We still cannot order computers from Acorn.'

A dealer has now taken action to get Office of Fair Trading interested in Acorn's habit of striking off 'wholesaling' dealers.

As the man from the Computer Retailers Association said to me, 'We are supporting Acorn in its battle over the rights to restrict supplies. It is an important principle. But frankly, and I hope you won't quote me, we do wish it had been somebody other than Acorn that we had to fight this battle over. It does stick in the throat.'

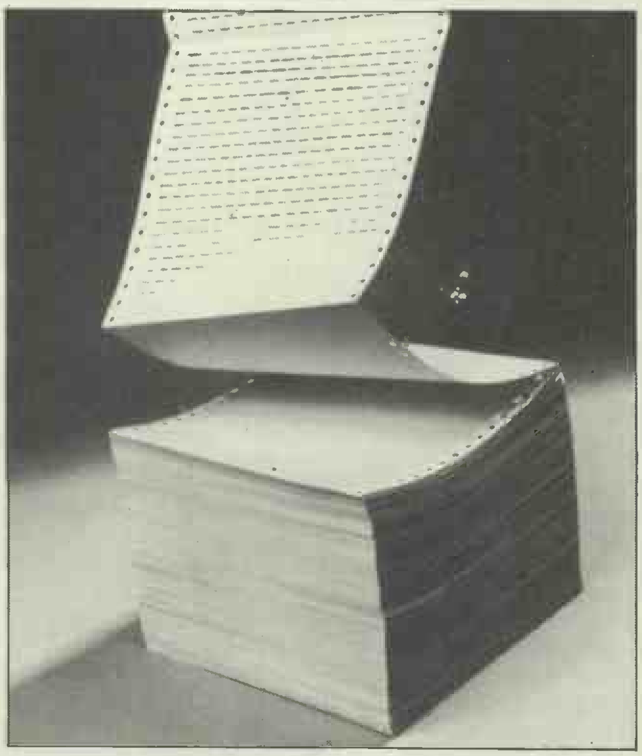
That is the story, and a sad one. But it isn't the whole story, naturally.

From Acorn's point of view, there are two important factors which all this leaves out: first, that it is working on the problem, and second, that it feels victimised by 'sniping' from people who aim to inflict jealous wounds, rather than make helpful comments.

By 'working on the problem', Chris Curry means that he is compiling a list of approved dealers, and has had this job interrupted by the need to expand the list, to cope with the launch of the Electron this month.

'I have a whole pile of "authorised dealers" plaques ready to go out,' he said. 'But we have to train the dealers to use our test equipment, and we're still doing that. It should be ready when we launch the Electron this month.'

Unlike many people, I don't doubt Curry's goodwill. But I



You may think that it's potty to keep a lot of information in a computer, but always look for it on a piece of paper. So it is: but people do it. They use the computer printer to produce lists, and then they stick the lists into index binders.

Datex Systems has produced special computer paper to make this possible. When you add a new name to the list, you just print out the new name, and slide the special paper into the index binder. If you have one, you'll need this paper.

Datex is in Brandsby, York, on (034-75) 224.

Proper use of chip-board can transform a boring old desk into a high-tech personal computer Micro Tidy, according to Abacus Marketing of Worcester. They charge £60 for it, and say it's suitable for Commodore, BBC, Dragon or Sinclair 'and many other home micros'. It even has space for cassette tapes. Details on (0905) 611161.

The alternative is the drinks cabinet, which Marcol of Southampton sells for £95 as a 'home computer and video cabinet.' Why not? Try calling the publicity agent on (01) 959 2452.

do doubt his grasp of the scale of the problem, and I think it is considerably worse than he thinks.

And even if he were in control of his own, internal-Acorn work, the chance of a highly organised Acorn preventing wholesaling is so low as to be worth a hollow laugh at best. Have a chat with Apple on the subject, and see what happens when it gets fierce with one of its retailers.

Well, actually, don't have a chat with Apple. It'll deny it. And you needn't bother asking the retailers, either: they'll deny it, too.

But the fact is that when one retailer has his money-back coupons cut off, he simply redeems them through another, until he's back in good odour. When a shop is told that it is no longer an official Apple dealer, it doesn't ring up all the customers and say 'Sorry, guys, but you'll have to find somewhere else to get them,'— it just goes to another dealer and buys them.

It's just a farce from the outside, but to the people inside the game, it's more serious than snooker. If you're hoping to be a customer, you just have to learn the rules, and never mind if they make sense or not.

Dutch treat

The news from the Dutch makers of the Tulip micro originally indicated a much higher price than its UK distributor has eventually settled on.

The Tulip micro is yet another system which aims to sell on the theory that anything which will run MS-DOS will look as though it has the IBM blessing. It outperforms the IBM in having an 8086 rather than 8088 'and is the first computer in the world to offer the eight MHz version of the 8087 arithmetic processor as an option' according to its importer.

That importer is Newport Technical Services of Bristol, which will be attaching a £2680 price tag, including MS-DOS and Basic.

The manufacturer, Compudata, also makes that maverick old machine, the Exidy Sorcerer, under licence, says Newport — 'and the multinet local area network currently in use is to be upgraded to work with Tulip'.

Those who want to know what multinet is can ring Chris Newport on (0272) 290651.

Better late...

Sinclair has at last announced his Microdrive with the assurances that you really will be able to get the things in the shops. It will let you load a 48 kbyte program in nine seconds, and that, plus the £50, is all we need to know.

At the same time, the company is about to change its mind yet again and offer a plug-in games cartridge.

Both announcements are hardly before time, given the complexity of programs available for the machine. The complexity is wonderful once the program is in the machine, but who has the patience to wait while it loads?

At a recent launch in London, software house Imagine greatly impressed the invited guests by having its newest games available on several machines in a plush hotel suite.

The guests assumed this was a nice example of the professional marketing approach. In fact it was a simple reflection of the sad reality that, given the tapes to take away and run, most journalists would have postponed the 15-minute ordeal (often repeated three times while you get the tape recorder volume control right) indefinitely.

The games, incidentally, were excellent.

Winnies for Unix

Bleasdale Computer Systems is boosting its Unix machine with mini Winnies and software to speed up disk accessing times.

The company believes that this will make it cost competitive with other Unix systems.

Bleasdale began shipping its Unix computers in January 1982 but it is still the only UK company building Unix machines. Founder Eddie Bleasdale believes that there is about to be an explosion in the use of Unix in business.

Bleasdale has improved the performance of its BDC680 with an increased clock speed on the Motorola 68000 processor from 8MHz to 10MHz. But the major improvement has come with the Atazi mini Winnies with their access time of 30 milliseconds. This compares with an industry average of 97 milliseconds.

A software rewrite has been done to optimise head movement from track to track. Here Bleasdale has improved from an average time of 15 milliseconds to three milliseconds.

Another advantage of the 5¼in disks is that they are cheaper to manufacture than 8in ones. This will bring down the cost of a 320 kbyte RAM and 13 Mbyte hard disk system to £8,844 excluding monitor.

But 20 Mbytes disk store is the minimum that Bleasdale reckons you need for Unix. The operating system arrives with 15 Mbytes of code and data.

According to Bleasdale Unix is the unrivalled first for multi-user systems, incorporating as it does features such as electronic mail, shared filestore and record level lockout. Details on 01-828 6661.

Jane Bird

Best — or boring?

My original instinct, on hearing that this paper was Benchtesting the NEC 16-bit micro (the APC) was to ring up and ask 'why was it launched in March 1982 in America, and in July 1983 in Britain?'— but on hearing of its wonderful features (like 8in disk drives, no bundled software) I changed my mind.

The machine, when launched in Australia in November, was given a 'top industry award' (not specified) as 'the best new personal computer on the market'.

Looking at it next to new British-designed things like the Advance 86, and the Apricot, I decided the question to ask should really be 'why launch this boring machine at all?'— but I found I really didn't care about the answer, so I have left it to our machine reviewer.

Suffice it to remark that NEC has joined the club of people who rabbit on about the 'value' of their system, but won't mention the price in public. There's usually a reason for this, in my opinion.

Details on 01-388 6100.

Chess Tournament

The *PCW* Fourth European Microcomputer Chess Tournament will be held at the Barbican as part of the *PCW* Show from 28 September to 2 October. Entries are invited from amateur chess programmers, commercial dedicated chess machine manufacturers and home computer chess program suppliers for a nine round Swiss tournament.

There will be three categories of prizes, though all categories will go into the same draw for the Swiss. The three categories are: 1) amateur programmer (and the ruling here is that the programmer must have the right to sell his own program — the oganisers reserve the right to make the final decision on who is an amateur); 2) commercial supplier (and here we include experimental entries by commercial companies); 3) and home computer programs (these can be cartridge, cassette or disk-based).

Those interested should get in touch with Tony Harrington at *PCW*.

Miracle working

The nicest thing about the heavy Miracle portable computer launched last month by Portico is the vast amount of free software it brings — including a typing tutor.

The new machine is both bigger (28 lb) and pricier (£1800) than a great many 8-bit CP/M portables — but it does offer quite a bit more software.

Among the 'full set' of text editing, financial and programming software, the company is offering MicroModeller, normally a very expensive bit of financial modelling software.

Plans to offer a 16-bit upgrade are now well advanced, says the company. It is now appointing dealers as quickly as it can sign them up.

Heavyweight portable — see 'Miracle working'

Damned lies and statistics?

A forecast that 'the traditional computer suppliers will start to displace the new personal computer companies this year' — made by Intelligent Electronic Europe in a study of the West European market — was only slightly spoiled by its theory that Commodore would substantially increase its sales to the user spending $1000 and over.

The report suggests that Victor/Sirius will be the only 'newcomer' to increase its percentage share of the market.

The quoted figures show Victor getting 3 percent of a one billion dollar market last year, and 6 percent of a nearly $4 billion market in 1988 — with IBM rising to 13 percent, the biggest share of the 1988 pie.

Apple, shown as the current leader with 18 percent, is forecast to be the number 2 in 1988, with 11 percent — a big increase in actual sales, of course. Commodore sales will rise similarly, though the market share will drop from 17 percent last year to 9 percent in 1988. Olivetti apparently had a bigger share of the market last year than either Sirius or Osborne (which will, they say, have no significant share at all of the 1988 market).

You may like this sort of forecast, despite my own reservations. You have to like it enough to send $1,475 to IPI, Nordre Ringvej 201, 2600 Glostrup-Copenhagen, Denmark. That's what it costs.

It is a clock, that small circuit which Brian Tannat Nash of Market Logic is holding. It runs at 4MHz, which is the speed a Zilog Z80 normally runs at — unless it is plugged into a Sharp PC3201 micro. That is a particularly slow system.

Market Logic's little thing 'will speed up the PC3201 by up to 50 percent says Tannatt Nash. It costs £30. Details from publicity agent Byron PR on Uxbridge (0895) 52131.

Research aids progress

Research Machines, the British company known for its RML 380Z and 480Z micros used widely in schools, has produced a version of the children's programming language LOGO.

LOGO, designed by Seymour Papert and born out of research at MIT into the nature of intelligence, was originally implemented on a mainframe in the 1960s. Since then, it has achieved an almost unrivalled position as the ideal introductory programming language for children, with versions being written for a wide range of micros.

RML LOGO was developed from Edinburgh LOGO, written by the Artificial Intelligence Department of Edinburgh University, one of the world's leading centres for research into LOGO.

Peter Smith, RML's Education Projects Manager, stated that most versions of LOGO currently available in Britain don't go far enough, offering only simplified turtle graphics. 'Our version will take pupils well beyond simple graphics, and includes many powerful features like list processing and recursion.'

A version for the 480Z and CHAIN network will be announced later in the year. Details on (0865) 249866.
Surya

Cheaper TABS

TABS is a very successful set of accounting software packages, all 'integrated', for both eight and 16-bit micros.

So it was very generous of TABS boss Terry Poole to announce the new 'EasyTABS' package as one which showed that he had learned 'from the mistakes we made with TABS'.

This is not quite the same as saying that 'TABS was a mistake', as one reporter seemed to think he meant, and the new package is really not competition for the money of the 3000-odd people who bought the old one.

EasyTABS is only five modules, not 18, and it is cheaper, easy for the very small business to use (they say) and can be seen as bait for the real TABS range (they didn't say that).

There is a word processor called TABwriter, a mail list program called TABmailer, a cash book, purchase ledger, and sales ledger, each costing £99.

The company is looking to change its dealer list, so those in doubt should contact the company direct on (0264) 58933. Otherwise, look in the stores.

The gibberish test

'Single button offline text reprint' is the tantalising bait which Brother is using to fascinate us with the idea of buying a new £500 daisywheel printer.

The exact meaning of this (or

why you need it) is not what really delighted me about this 'two-colour' (red and black ribbon) printer; it was the put-down of speed claims.

Apparently, there is a standard printer test, involving the repetitive printing of a nonsense sentence (for the prurient, the sentence reads 'The head and in frontal attack on an english writer that the character of this point is therefore another method for the letters that the time of who ever told the problem for an unexpected') which is (apparently) a 'very strenuous test of wheel selection, as well as carriage motion and line spacing'.

So far, so good. This is the wonderful bit:

'Brother would like to see all daisywheel manufacturers quoting their speed on this text to avoid the spurious claims being made at present.'

Spurious claims?

'One American oem recently advertised a Brother printer under his own label as achieving 200 characters per second in "white space mode" — which in English, means "paper movement only".'

Brother printers are sold through Jones Brothers in Manchester on (061) 330 6531.

Police Five

Somebody stole over £300,000 worth of Spectrum computers from distributor Prism. Apparently somebody (30 of them) has now been arrested.

The robbery made a horrible story, with an armed gang getting into Prism's warehouse by staging a fake traffic accident and getting security staff to come to their assistance. They then offered to kill them, either before or after the raid.

Police seem very satisfied that their enquiries into the case are now over, as they have recovered around 90 percent of the stock in the course of their investigations.

The sad thing is that, even though this batch turned out to be unsellable (which is how the crooks got caught) on the street markets, it now seems that crooks do regard computers as nickable. As little as a year ago, most computers that were stolen were invariably the victims of mistaken identity, being confused with television sets.

Sanyo has reported the loss of some 200 new 16-bit systems in transit from the Warrington depot to dealers. The company put a brave face on the announcement, ('we are flattered by the computer's obvious desirability') but the sad truth is that computers are becoming just another commodity.

It is time to re-plan your household insurance accordingly.

Joining the Gold standard

Epson's HX-20 has been substantially over-trumped by the Tandy Model 100 — but it still has one advantage: software.

An example of the lead the Epson machine has is the Telex program offered by British Monomarks, which will sell you a lap-held computer with software for £800.

The software connects you via phone to the Monomarks computer, which puts the Telex message onto the Telex network. It saves you the £2500 cost of a Telex machine (plus £300 a year rental).

An example of how the Tandy machine can catch up is provided by the fact that with a Tandy 100 plus a modem, a subscription to British Telecom Gold will let you send messages to other BTG subscribers in both capital and small letters, plus Telexes to Telex subscribers.

Another company to join the Gold network is ACT, which has announced a package of hardware and software plus free BTG subscription for around £250 to users of its Sirius and Apricot computers.

Look for Acorn to announce a similar deal for the BBC micro, and several other computer companies too, before the year end.

Details of the Epson link from Wilder & Co Computer Services, on Camberley 21552.

Brighter Rainbow

Dealers of the Rainbow micro built by Digital Equipment tell me that the announcement of a 'utility diskette' for that machine is, indeed, a sign that the company has found its way again.

Originally, DEC spoiled a very impressive-looking micro by announcing that it was going to 'restructure' the micro market from the outside. It was going to supply everything, and customers wouldn't even be allowed to buy blank diskettes, because there would be no format routine to make them usable.

The format routine was then produced, and it was suggested that the program be priced at £1000 — presumably to stop people using it.

Now, the programs on this utility diskette 'will be in the public domain' — normally an Americanism for 'free' but here meaning priced £170 and available from all Rainbow dealers.

Nothing can bring back the lost year (from when DEC announce the Rainbow) till now. It is quite possible that if this machine with a combined CP/M and CP/M-86 package had been available last year, MS-DOS would not have made any serious impact on the UK micro market.

That milk is spilled: the new batch is available, and it involves MS-DOS version 2.0, which is running on Rainbows today. Another good sign for DEC watchers.

Micro price cuts

The price war in the home computer market continues unabated. Following reductions by Sinclair, Commodore, Atari and Texas Instruments, Lowe Computers has announced that the Colour Genie has been knocked down from £194 to £168. This reduction is even greater than it at first seems — the previous price was for a 16k Genie, and standard memory size is now 32k.

Oric has also announced a drop in the price of its 48k model. This now retails at £139.95 and, as an added bonus, all purchasers will now receive a £40 voucher which can be put towards the cost of the Oric MCP40 four-colour printer, which was launched in June. The 16k Oric will sell for £99.95. Other Oric peripherals include the long-awaited modem and a disk drive — both are due this autumn.

Steve Mann

New printers

Micromax is a new low-budget impact printer which, it is claimed, is suitable for use with a wide variety of home computers. The small but perfectly formed Micromax measures 4¾ × 8¼ × 2½ inches and features a totally enclosed paper roll.

The printer uses normal paper and gives 24 standard or enhanced characters per line. It provides interfaces for TTL serial or RS232 serial or parallel with selectable speeds of 300, 1200 or 2400 Baud. There is a range of connection cables for VIC-20, BBC, Dragon, Acorn Atom, ZX81, Spectrum and Research Machines 380Z. Price is a very reasonable £69, with interface cables at around £15. Further details from Computopia, 30 Lake Street, Leighton Buzzard, Beds; tel (0525) 376600.

Steve Mann

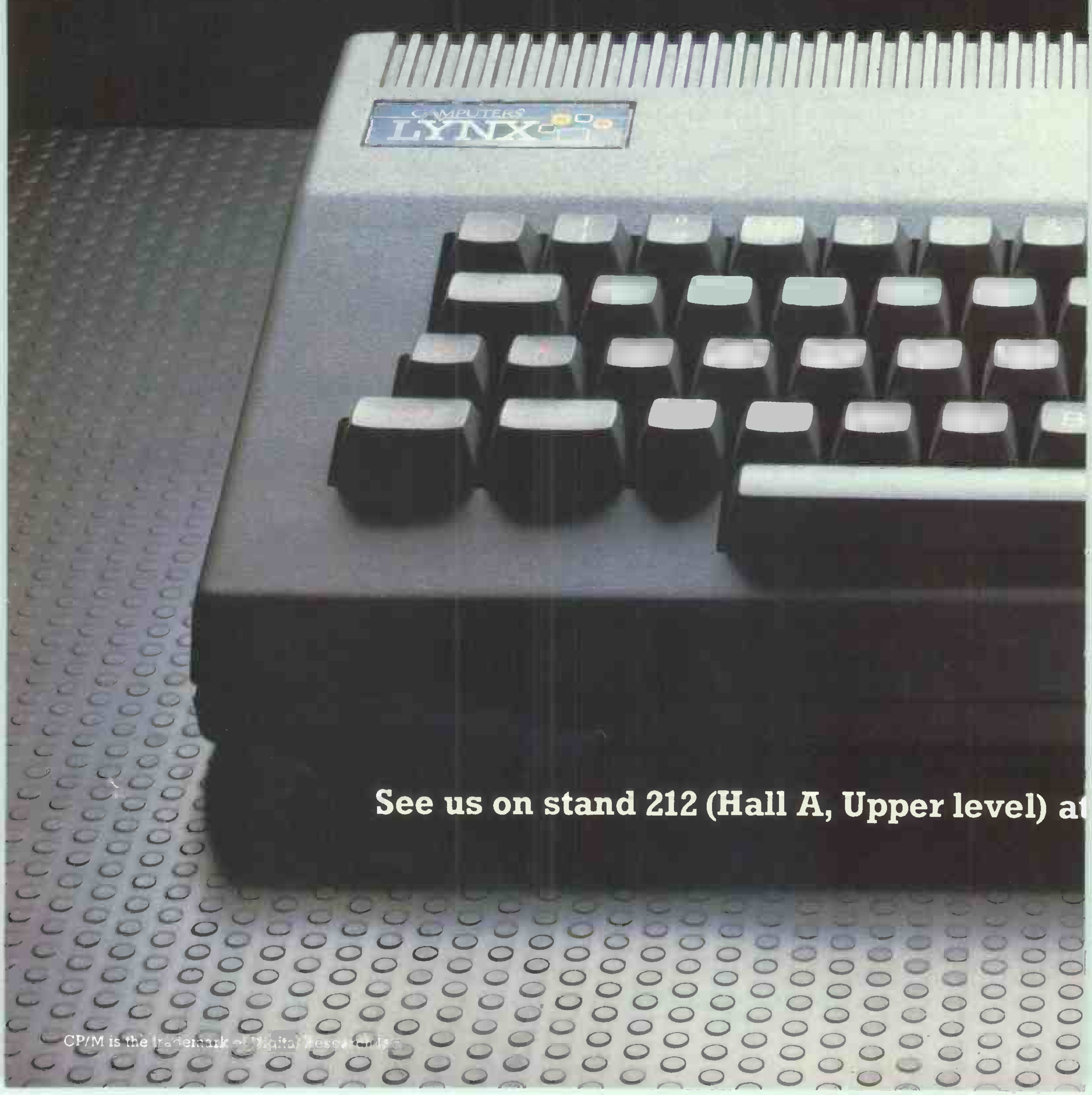
Epson Telex link-up — see 'Joining the Gold standard'

EXPANDABLE N

The Lynx micro-computer system is designed to grow as your needs grow.

When you want a more powerful machine you don't have to bin your Lynx, simply upgrade it.

At the 1983 PCW show you can see and use the 48K and



The 1983 Personal Computer World Show
Barbican, London 29, 30 September 1, 2 October

BIGGEST AND BEST

Those of you who are itching to know who's attending the *PCW* Show will be pleased to see the complete list below. Between now and the date of the Show, there may well be one or two changes, but that just adds an element of surprise.

Here is the exhibitors' list at the time of going to press:

* Acorn Computers Ltd
* Addison-Wesley Publishers Ltd
* Anirog Computers Ltd
* ACT (Holdings) PLC
* Atari UK
* Audiogenic Ltd
* BiBi Magnetics Ltd
* BICC-Vero Electronics Ltd
* Biodata Ltd
* Bug-Byte
* Bubble Bus (The Computer Room)
* Compsoft Ltd
* Camputers Ltd
* CDS Microsystems Ltd
* Centre Soft
* Commodore Business Machines
* Computer Bookshop Ltd
* Computer Town UK!
* Comshare Ltd
* Creative Computing
* Digital Equipment Co
* Dragon Data Ltd
* Druvic International
* Elan Computers Ltd
* Electrical-Electronic Press
* EMAP Business & Computer Publications
* Environmental Equipments (Northern) Ltd
* Gemini Marketing Ltd
* Group 18 Ltd
* Hofacker Elcomp
* IBM UK Product Sales Ltd
* Ikon Computer Products
* Inter Data Computer Systems
* IO Research Ltd
* International Computers Ltd
* Jarman Systems Ltd
* KGB Micros Ltd
* Kansas City Systems Ltd
* Kuma Computers Ltd
* Landau Electronics Ltd
* The Language Laboratory
* Little Genius
* Llamasoft
* Longs Ltd
* Mannesmann-Tally
* Maplin Electronic Supplies
* Mapsoft Ltd
* Mattel Electronics Ltd
* McGraw-Hill Co (UK) Ltd
* Melbourne House (Publishers) Ltd
* Memotech Ltd
* Microage Ltd
* Microdeal Ltd
* Micronet 800
* Micro Products Software Ltd
* Microwriter Ltd
* Miniature Tool Co
* Moranbrook Ltd
* MPI Ltd
* NEC Business Systems
* Opus Supplies
* Oric Products
* Paperlogic Ltd
* Peachtree Software International
* Pete and Pam Computers
* Phoenix Technology
* Pilot Software Ltd
* Postern Ltd
* Power Testing (Sales) Ltd
* Premier Publications
* Prentice-Hall International
* Psion Ltd
* Quicksilva Ltd
* Rabbit Software
* Radio & Electronics World
* Rapid Terminals
* Roadrunner Electronic Products
* Romik Ltd
* SBD Software
* Salamander Software
* Shards Software
* Sharp Business Systems
* Silicon Chip Ltd
* Sinclair Research Ltd
* Smallway Marketing Ltd
* Softsel Computer Products
* Stonechip Ltd
* Systematics International Microsystems Ltd
* TDI Ltd
* Tabs Ltd
* Texas Instruments Ltd
* Time Computer Products
* Timedata Ltd
* Transam Computers Ltd
* Virgin Games Ltd
* Visionstore Ltd
* WBM Business Supplies Ltd
* John Wiley & Sons Ltd

As you can see the variety is enormous. Nearly 100 exhibitors are listed above. The October issue, which will arrive in the shops about two weeks before the Show, will preview exhibitors in more detail. All the big selling computers will be in evidence: the Oric, Spectrum, BBC, VIC-20 and Commodore 64, Dragon, DEC's Rainbow, the IBM PC, Atari 400 and 800 and Sirius.

Commodore has a very big show planned which will feature its whole range from the VIC-20 through '64 and SuperPET (8000 series) right up to the new 700 machines, which will be shown running a range of business software. Commodore informs us that 20 completely new programs will be launched for both business and home from its stand.

ACT will, of course, show off the new Apricot, which is a machine worth a quick look. It's small (weighs only 17lbs), software compatible with the Sirius and it comes with 3½in microdrives and a small LCD on the keyboard to show what the function keys are currently doing. The Sirius itself will also appear.

The printed media will be much in evidence. Creative Computing will provide feedback from the other side of the Atlantic, EMAP and Electrical-Electronic Press (and, of course, your favourite, *PCW*) will provide news (and no doubt subscription offers) of the UK.

Games companies Quicksilva, Bug-Byte and Audiogenic will no doubt be making plenty of noise, while on the business side, companies like Compsoft and Tabs will have various business packages to offer. Many smaller companies — Llamasoft, Rabbit Software, Artic and others — will provide the familiar interesting programs and useful add-ons. Many exhibitors, as in previous shows, will offer special show prices. We've also heard of one or two competitions and some new products — but that's a secret until next month!

PCW, of course, will provide, with the invaluable assistance and organisation of Little Genius, the Scrabble Contest. Anyone attending the Show can enter and there will be four prizes for the highest scores.

We would also like to offer companies the chance to sponsor the Chess Tournament. This event has become recognised throughout the world of chess programs as a chance for new programmers and products to make their mark. Any sponsorship would naturally offer the chance of valuable publicity through the Show. If your company would like to add its sponsorship, possibilities can be discussed by contacting Sue Clements at VNU Business Publications, Evelyn House, 62 Oxford Street, London W1A 2HG, tel 01-636 6890.

Meanwhile, we look forward to seeing you all at the 1983 *PCW* Show and to the fun we know will be had by all! END

COMMUNICATIONS

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Len Warner (see 'Computer Answers' page). Address letters to 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

No offence

Dear Bird
For Heaven's sake, don't apologise to that creep Dr Brooke (*PCW* July) for apparently making some fuss or other about the indelicate use of his surname. He should be honoured. Any right-thinking person knows that to be addressed by one's surname alone implies a pleasing measure of equality.

Real doctors — not those joke jobs — come in two categories: GPs who know nothing about everything, and Specialists who know everything about nothing. In other words, far be it from the learned quack (to give him the benefit of the doubt) to throw his weight around.

Editors are a different kettle of fish altogether. The use of 'we' (the first person plural) has long been limited to monarchs, editors and ladies in-the-family way. In this respect, I suppose, you yourself could theoretically score twice — and the best of British luck to you.

But why worry about the sensitivity of your readers? My advice is forget it. Just tell us more about our machinery and systems.

I mean, here am I, tapping away at a kind of typewriter thing you avoid like the plague. It's probably quite bright in its own simple way, but hasn't a clue about high resolution graphics or any other quality that might entitle it to a mention in your columns. Indeed the advertising blurb suggest that the most indolent of secretaries can master every twiddle in the book while rolling a joint, sniffing glue, or whatever it is you do these days to keep up with the pack.

I only wish I were half as fast off the mark, with or without the help of 64k RAM, a Z80A and an absolutely baffling 4MHz. To be frank, I had thought of excusing you duty, as it were, and throwing this little lot straight at *your* secretary — we all know what it's like at the top. But, horror of horrors, I can't.

Assuming your credits are as accurate as the rest of your text and you haven't yet sacked the girl, this letter would have to begin *'Dear Dear'* . . . See what I mean? How terminal can you get! Better forget the whole thing.

Save Tracy Dear (BUPA willing). Call the good doctor. And perhaps at the same time spare a thought for those tied into their systems.

A line on word processors perhaps?

Michael M Cahill, London

Practical joke?

Can *PCW* help me solve a mystery?

See below a letter I received a while ago, and as you can see, it makes perplexing reading. I replied to the letter, saying that I did have several programs that I might be interested in having marketed, and asked for more details — in particular the identity of the authors. Not having received a reply, I now suspect that the intention of the authors may not be entirely honest.

I should imagine that they got hold of my name through the fact that I have three UK101/Superboard programs currently marketed by Merlin Micro Systems, and I believe my name is sent out with these games should the purchasers have any queries.

It seems possible now that the intention of those who wrote the letter was perhaps to get free software, or alternatively to 'steal' programmers from other firms (which would not apply in my case). Perhaps I am being over suspicious, but my suspicion has been fuelled by theirs; I am perfectly willing to trust a reputable company to be honest with software royalties, etc, but an 'accommodation address' is a different matter.

I hope you, or a reader, may be able to explain this mystery to me, and I hope it also serves as a possible warning to others who receive similar letters to be cautious.

P.S. It has been suggested that the letter was a practical joke — if so, then my congratulations to the joker. I have fallen hook line, and sinker! — and my congratulations also to his attention to detail — the postmark was from London.

48, Fitzroy Street
London W1P 5HS
14 April 1983.

Our ref. JC/57
Dear Mr Harrison,

It has been brought to our attention that you are a particularly capable programmer of micro computers, especially with regard to games.

We are a newly established computer software company currently marketing a selection of programs for micro computers to all major outlets in the UK. As a result of our success to date we are at present seeking to extend the range of games we have to offer.

With this in mind, we are able to pay significant royalties and we therefore invite you to submit details or, preferably, examples of your work.

If you wish to benefit from our well respected marketing expertise, seek high financial rewards and want to establish yourself in this highly competitive market, we should like to hear from you.

Note: For security reasons we request you to write to the above accommodation address quoting our reference number JC/57."

David Harrison, Bury, Lancs.

OK, we're baffled — any ideas? — Ed.

Back to Basics

Both in the computer press and in personal contacts I am flooded with statements that Basic is a poor language and that Pascal is superb.

The MBasic program below is the most used routine in several programs that I use for serious purposes.

It would normally be rewritten in machine code for long runs but a high level language simplifies initial testing of the correctness of the logic.

Perhaps some Pascal buff could say how he would write it effectively in Pascal with *every* bit, in each work, valid and independent.

A long winded solution is, of course, possible but processing every bit separately is incredibly slow.

```
5 DEFINT R,S,X,Y
1000 S1=0:S2=-1:S4=0:S8
=-1
1010 X=S(S) AND R:R=NOT
R
1020 Y=S(S+1) AND R
1030 X=X OR Y
1040 IF X THEN Y=S1 and
X:S1=S1 XOR X:X=Y
1050 IF X THEN Y=S2 and
X:S2=S2 XOR X:X=Y
1060 IF X THEN Y=S4 and
X:S4=S4 XOR X:X=Y
1070 IF X THEN S8=S8 XOR
X
1180:
1190 WHILE S8: SX=S8
1200 SX1=NOT
```

```
S1:SX2=NOT S2:SX4=NOT
S4:SX8=NOT S8
1210 S1=S1 AND SX8:S2=S2
AND SX8:S4=S4 AND SX8
1225 SX1=SX1 AND
S8:SX2=SX2 AND
S8:SX4=SX4 AND
SX8:SX8=SX8 AND S8
1230 Y=SX1 AND
SX:SX1=SX1 XOR SX:
SX=Y
1240 IF SX THEN Y=SX2
AND SX:SX2=SX2 XOR
SX:SX=Y
1245 IF SX THEN Y=SX4
AND SX:SX4=SX4 XOR
SX:SX=Y
1250 IF SX THEN SX8=SX8
XOR SX
1260 SX1=SX1 AND
S8:SX2=SX2 AND
S8:SX4=SX4 AND
SX8:SX8=SX8 AND S8
1270 S1=SX1 OR S1:S2=S2
OR SX2: S4=S4 OR SX4
1275 S8=0
1280 WEND
1285 S8=SX
```

This routine is the essential of the main routine of several programs. How may it be programmed efficiently in Pascal?
R G Silson, Tring, Herts.

Scientific bent

I would like to draw attention to a marked deterioration in recent months in the quality of *PCW*'s reviews of, and less formal passing references to, new machines, at least as far as scientific and technical users are concerned. Up to about six months ago, your reviewers, especially the admirable Dick Pountain, used to give some of the essential information about the quality of the arithmetic and presence or absence of important programming and library features such as matrix operations or true subroutines with formal parametal and local variables. All this has now vanished and we hear of nothing but keyboards and word processing and spreadsheets.

A particularly gross example occurred in Newsprint in the July issue concerning the Dutch Tulip machine. I know nothing whatsoever about the machine, but it is pretty certain that any computer with 8086 and 8087 processors has far better arithmetic capabilities than most and is almost certainly oriented towards mathematical work and scientific users.

Guy Kewney's flippant comments about it being nothing special for WordStar and Mailmerge are unhelpful and probably irrelevant. I would like to see a section in your reviews given over to the mathematical capabilities of the machine, at least of those which have any, and a return of Dick Pountain.
George Weeden, Edinburgh

Dick reviewed the Tandy Model 100 in August and the Pied Piper in this issue.

Steve Mann's review of the Sord M5 in the August issue and Shirley and Pete Fawcett's review of the Micro-Professor this month also contain information about the maths functions. However, some machines we review are aimed specifically at the business user of word-processing, database, spreadsheet and accountancy packages. In these cases we concentrate on those facilities.

We are very proud of our Benchtests which are generally the most comprehensive and informed reviews in the industry.

See our regular feature SubSet for how to get more out of your machine. — Ed.

Frustration

I read, with great interest, the article on Micronet 800 (*PCW* July) and while being in agreement with the general conclusions reached I cannot but voice reservations about the first few months of the service.

The initial difficulties of downloading and saving the Aladdin's Cave of free programs meant many hours of sheer frustration for BBC micro users. Only weeks later, with the arrival of an addendum sheet (dated 25 March) containing an improved version of the terminal software along with a rather mild apology for those of us who were attempting the impossible with our 1.2 system, did our micro, indeed, 'come to life'. The procedure for producing one's back-up terminal software at 1200 baud from the one issued at 300 seemed simple but how much better it would have been if a replacement cassette had been sent (if necessary limiting it to customers who requested it). The same is true of the latest version (4.0a).

Another difficulty is the generally unpredictable performance of the present acoustic modem: the whole business is rather reminiscent of the cat's whisker days of radio. I find that occasionally a telephone receiver will not fit into the modem at all and merely resting on the top produces a nil response from Prestel and a screenful of garbage: clearly there is considerable variation in size of the standard receiver.

On the positive side, however, I must extol Micronet as potentially a rich educational resource. In my work as an educational consultant I have found that pupils of 11 years of age can readily log on to the system and access the data they require for projects and download programs for use in lessons. At this stage of development many of the programs have little to offer educationally but recent additions, in particular those of CET, are of sufficient quality greatly to encourage teachers who were beginning to fear that there was no software relevant to their needs.

The system has much to offer and the friendly approach is very attractive, especially when, as in my case, it is followed-up (from my problem explained in a response frame) by two phone calls and a gratis tape of software.

I have joined Homelink via Micronet and also enjoy the benefits of telebanking through this service. My pupils have already accepted that this is how their bank transactions will be conducted when they are adults: full marks to Micronet.
O P Alexander, Bournemouth

Female role

I am studying the portrayal of women and girls in computer ads. Most ads are dreadfully sexist, but I do enjoy the occasional ad which involves women as participants, rather than spectators in computing. This is especially gratifying when it is in the lay or popular press.

Last autumn, a series of Dragon ads were particularly offensive. Some of the headlines were:
Like Father Like Son
Read this Ad to your Wife
(implying that only men bought computers)

I wrote to the company and complained, twice. But I received no reply. But in the latest copy of *PCW*, I saw a beautiful ad by Dragon. In large type, it said:

'If you want to know which computer to buy, ask your expert.'

And the expert was portrayed as a girl in cap and gown.

Maybe it was just a coincidence. But maybe my letter (and others) did influence their ads. But I did write to the company and told them that I was pleased.

If readers see ads which portray women in a particularly bad or good light, I would really appreciate a copy. Please state where and when it was published (if possible), if it is not obvious from the copy.
Thank you.
Danielle R Bernstein, 1 Ethelred Court, Headington, Oxford OX3 9DA

Don't throw stones

With reference to the Bible story about splinters in the eye, don't you feel that the attention paid to minor bugs in the reviews in Screenplay is out of place on a page where the pictures are obviously with the wrong games.
Stuart Sampson, Otley, West Yorks
Our printer is sent to try us — Ed.

Top Secret

Further to my article on cryptography (*PCW* July 83), various reports have appeared in the press saying that the RSA public-key cryptosystem had been broken. This was since my article was written. As a result I wrote to Adi Shamir, a co-inventor of the RSA system, in Israel. From his reply, it is clear that these reports were the result of a gross misunderstanding. They arose from a paper which Shamir himself had published, of which he sent me an abstract. *In this, he demonstrates the insecurity of the so-called 'knapsack' system, a rival to his own RSA system. The press took this to mean that he had in effect publicly shown that his own system was no good!

In fact, the security of the RSA system still rests on the difficulty of finding the two prime factors of a large number. This is a problem that has occupied some of our best minds since the ancient Greeks, and no easy solution has been found to date. Better computers make it a bit easier, but they also make it much easier to use codes with still larger numbers. Users of RSA systems can remain confident of their security unless some truly magical factoring algorithm is devised.

George Sassoon, Warminster, Wilts

*Shamir Adi A polynomial time algorithm for breaking Merkle-Hellman cryptosystems (Weizmann Inst, Israel, April 1982)

Retrospection

Nostalgia for the early days of microcomputing seems to be in at the moment; what we really need is a revival of the spirit we had in those days. Have our soldering irons lost their bits? Come on Guy the Private Eye, don't complain that an American machine has a modem to Ma Bell's spec, find out what's driving it then write an article on how to change it to CCITT spec. If it uses a MC14412 or that dreamy (have *you* seen the price?) AM7910 modem chip then change the Logicstate on one pin and maybe a few component values in the filters.

My current hobby horse is that too many people are changing their hardware because they think computing is about running software that someone else has written on next month's hardware; the old hardware may need an update from time to time but scrapping, *no!* My company is still using the Nascom 1 we purchased in 1979; granted it has been added to and attacked with a soldering iron from time to time, but the only redundant parts are a few EPROMs and a small disk drive board. Yes, it has got 80 column display; 64k RAM at 4MHz, without waits; twin disks, etc *and* it's a lot more flexible than most of the 'modern' machines, thanks to the (original) Nascom and Gemini companies 'get in there with an iron' attitude as opposed to 'sorry Sir, looking at a screw holding the case together invalidated the warranty'.

Clive P A Waller, Chiatronix, Luton, Beds

Macho move

I am often amazed at the novel arguments people think up to justify their attacks on computer games. A case in point is Martin Banks' 'Banks Statement' in the June issue.

The first half is largely devoted to a comparison between computer game playing (of the arcade variety) and such pursuits as drinking competitions and hazardous driving. Martin suggests that the former has replaced the latter activities as a means of allowing young people to prove themselves.

Even if you accept (and I don't) that this accounts for more than a small proportion of computer game playing, I don't see that it is an indictment of the games themselves. The fact that these games are around doesn't prevent you from doing the other things (and in my experience they are alive and well). What it does mean is that you have more choice. Many people, I'm sure, would argue that playing games in which you cannot come to any real harm is preferable to playing ones in which you can.

Martin says that computer game playing removes one from reality. This is true in so far as there are no real Pac-Men or Space Invaders but that is not the point. The skill required to score a million at 'Defender' or whatever certainly isn't unreal and if the games didn't provide some kind of genuine challenge I don't think people would enjoy playing them. The games' scenarios are fantasy, yes, but to object to them on that basis is stupid.

Martin seems unable to accept that computer games need no more justification than the fact that they are fun to play. Game playing, it seems to me, is just as legitimate an application of computers as their use in science, education or other 'real' fields.

Towards the end of his 'Statement' Martin objects that computer games 'help to push individuals down to some level of "lowest common denominator" of intellectual activity or aspiration' and that 'even the games approach can be used to better advantage'. The assumption behind these statements seems to be that all computer games have pretensions to being of some intellectual or educational value whereas, as far as I can tell, most of them strive only to be fun to play — and rightly so. You might as well object to swimming or parachuting (or drinking) on the grounds that they are not educational.

There are, of course, some very intellectual computer games but they are another matter and have a very different appeal to those of the arcade variety.

To be fair, I do not think the issue is completely clear cut and I'm sure that there are cases where computer games have been positively harmful. But there is strong evidence (their success, for instance) that these games give a lot of pleasure to a lot of people. That is surely something to be grateful for?

Finally, I think I should point out that I am not saying these things out of self-interest (I don't work for Atari or anything) and write purely as an enthusiast and occasional player. Whatever anyone says, I think the games are here to stay.

Martin Perry, Pinner, Middlesex

Martin Banks replies

It was with a certain amount of pleasure that I read Martin's riposte to my piece on games in Banks' Statement. It is good to know that there are some out there thinking more general thoughts about home computers and their implications than the size of a memory or address bus.

I do have a suspicion (and I admit that it is predominantly no more than that) that many computer games — particularly those of the arcade variety — are not entirely a good thing, and to answer Martin's points on what I wrote, I will try to explain why. I would add that I accept that many people will consider some of my views extreme, and I do not claim to be in any way right. I have just highlighted some dangers and some possibilities.

I do feel that, for many people, computer games have the power to replace such activities as outlined — and many others — and that they are used (as the activities have been used) as a means of 'proving' oneself. I have nothing as such against the games (OK, I don't go for them personally, but that's different) and no, they do not prevent one from doing other things if one wants to. My main complaint, doubt, fear, call it what you will, is that they remove people from reality. Even worse, they can give a totally distorted view of life.

Martin says, quite rightly, that there is often considerable skill involved in playing an arcade game. This means that the game typically tests manual dexterity in intercepting one video image with a moving line emanating from another video image, under operator control. The trouble is, it doesn't sound terribly exciting stated like that, does it?

Say instead that the player is 'defending your galaxy from alien invaders, armed with photon torpedoes and nuclear bombs,' and it sounds more interesting.

This is why I refer to the unreality of the games. Swimming, parachuting and drinking are, in fact, more educational than the games, if only because they are 'real'. Do them wrong and you drown, dig a very deep hole very quickly, or get sick for a week.

With the games you are throwing nuclear bombs around with gay abandon, killing God knows who, just because they happen to 'appear'. You can even get five 'lives', where the player can get wasted and miraculously brought back to life without a blemish — you don't even get a mild shock through the joystick to let you know you blew it.

Am I overstating the case? Very probably I am, but I cannot help wondering where such games could lead, and maybe it is better to state an opinion now rather than later. I view the implied violence of such games with horror, I'm afraid. It is an old saying, but 'violence begets violence' is as true now as it ever was, and attitudes to violence — its implicit acceptance as OK in the form of these games, for example — is an essential part of this. One only has to observe the relationship between violence on TV and film, and its occurrence in real life. The two quite naturally feed off each other. Many of these games are just grist to the mill.

I accept the following as a paranoid scenario but: we live now in enough danger of some political lunatic (and it is my considered opinion that the vast majority of politicians fit the bill) pressing one or two of the right buttons in a fit of high-principled pique, thus reconstituting all of us. Just imagine how much easier it will be in a few years' time when the lunatics (sorry, politicians) who lead us are drawn from the ranks of those that currently think nothing of 'nuking' whole galaxies by the hundred, and for a cost/effective outlay of only 20 pence.

Yes, I know, I'm just being silly.

Advice

I am considering buying an Acorn Atom, possibly as a kit, so I decided to contact Acorn for literature.

The first time I sent one of the coupons from an advert, but received no reply. That was at the end of February, and since then I have sent two personal letters including stamped addressed envelopes. No replies have been forthcoming, and I wonder whether my letters have gone straight into the bin or whether some enterprising secretary opens them and steams the stamp off the SAE for further use!

Please can you advise me where such literature is available?

John Cooper, Camberley, Surrey

Over to you Acorn — Ed

Forth right

I would like to counter the assertion in this column (July) by Brian Darmanin, that 'references to the Olivetti M20 are conspicuous by their absence', and also set the record straight concerning Forth.

Your reviewer of PolyForth on the IBM PC concluded with the words 'if it's speed you're after, then this is the package for you'. It isn't. OliForth, an enhanced version of the Forth 79 standard, running on the Olivetti M20 under PCOS, returns an average of 7.6 seconds across the 15 original Benchmarks, and inclusion of the 'mixed maths' Benchmark increases the discrepancy between OliForth and any other version still further.

As a director of the software house that wrote and markets OliForth, I realise that talk of Benchmark timings are often a little spurious and 'macho' — however, given that Forth is often used in time and precision-critical applications, I think mention of the above is probably justified in this instance.

Robert Ward, Tower Associates, Derby

Serious complaint

I am the proud owner of a brand new Sirius 1 computer together with an ACT 40 printer. Not unusual you may think, but I did say *owner* not *user*.

Having unpacked my new machine I eagerly reached out for the handbooks so that I could update my present Basic programs to run under Basic-86. Alas I could not find any reference in any of the three manuals to enable me to perform simple tasks, ie, clear screen, etc. I initially had to spend hours finding values for all the functions — some still remain mysteriously buried in the depths of the machine.

I have 320,000 controllable pixels at my fingertips, definition fine enough to pick out the warts on my Aunt Maude's nose, but how do I get at 'em? . . . a quick phone call to my dealer. 'Oh you need the systems hardware manual Sir.' A mere £40+ extra.

Ah well, not to despair, let's get to grips with the printer. The manual is written in JapEng . . . more hours spent clearing up reams of paper the printer insists on spewing out as I search for yet more codes.

This time a phone call to ACT in Birmingham.

'Hello I wonder if you could help me regarding the ACT 40 printer.'

'Not off the top of me 'ed Sir.'

'Well I've been having a little trouble deciphering the manual . . .'

'Oh that's alright, we don't understand it either. It's translated from Japanese you know.'

'I know.'

'What you need is the Supplementary Technical Reference Manual, it's about two inches thick and shouldn't cost you more than about twenty-five quid.'

When, oh when . . .

R M Richards, Menai Bridge, Gwynedd

Sharp eye

As a user of the PC1500 I am always interested to see this often overlooked machine mentioned in print. I was pleased to see Amanda Parfitt's contribution in the July issue in which a whole page was devoted to a program that sidestepped the problem of not being able to CSAVE or CLOAD the function key.

I tried the program, it works!! but I think that PC1500 (and PC2) users will be more interested to know that the entire RESERVE area of RAM can be CSAVEd and CLOADed in the normal way; all you have to do is select the RESERVE mode first. Since there are only 188 bytes to be saved the process only takes a few seconds. Note also that if you try to CLOAD a RESERVE file when you are in the wrong mode (RUN or PRO) the computer will ignore it completely.

Oh yes! and when is somebody going to write some decent, well-priced software? (actually this is a plug because I have!!)

Charlie Simpson, Twerton, Bath

Satisfied customer

I feel Guy Kewney is unfair in your July issue in his comments on the Tandy Model 100 (Newsprint Page 109). I find the design excellent, particularly the large screen and the resident programs.

The Telecom program is certainly more than 'useless silicon' because the 'find and dial' system for telephone numbers works straight away and the modem chip (mc 14412) is pin-changeable to CCITT standards by a connection change. I suspect any problem will be in the software and the difficulty of getting the whole unit approved by the telephone authorities. Tandy may omit it initially in Europe I believe.

In any case, an external modem on the RS232 has many advantages, for instance, one can choose the baud rate and connect to a radio transmitter or a direct line.

It is fashionable to comment on the Telecom approval process. I approached Telecom with the design of a modem which is line powered, ie, using the 50v of the telephone line so that no external power supply and hence no danger of electric shock arises, particularly in the case of the M100. I have found Telecom receptive and helpful and the fees moderate, so any obstructionism seems to be other than at the engineering level.

R J Redding, Design Automation Ltd, Maidenhead, Berks

See PCW *August for a full Benchtest — Ed.*

Clarification

I would like to point out an error in your news item headed 'Parting Company' (June 1983), which I believe was written by Guy Kewney. Datapoint is not and never has been a subsidiary of TRW Inc and so the question of 'slight embarrassment' does not apply. Until two years ago TRW distributed Datapoint products outside the US, but that was the extent of the association. Secondly, I wonder if the users of the 5,000 ARCNETS from Datapoint would agree that 'all these networks are hopelessly premature anyway'.

Glyn Jones, Datapoint

END

BANKS' STATEMENT

TOP OF THE POPS

The public relations man looked simultaneously horrified and perplexed. There may also have been a touch of cynicism thrown in for good measure.

'Cedric?' he asked, incredulously.

'Yes,' said a small, acned individual of perhaps thirteen tender and sheltered years.

'No-one is called Cedric these days, are they?' The PR man felt there was nothing left to do. Young Cedric may be brilliant—everyone said his new games program was one of the best ever—but there was no way the PR man could make either the lad or his product a worldwide success without some drastic surgery.

Acne was one thing,it could even be made vaguely romantic with a great deal of effort. But there was nothing else for it, that name would have to go.

Six hours and a bottle of gin later, the PR man returned to his bosses wearing a slightly incoherent smile and slurred 'got it, got the whole package worked out. There's only one way Shedric's program is going to be a shuccess. Gotta go back to the old days, like when we was in records. We're gonna hype the little devil till it hurts.'

And so it was that small, acned Cedric Arbuthnot from Wapping became Ivan Andov, the genius son of a white Russian emigré, who was discovered busking VIC-20 programs on a street corner off the Rue Pigalle in Paris. The acne was now an obscure, incurable skin disease picked up when his late, aristocratic mother was a cabaret programmer in a Bangkok system house supper club.

His games program, originally called Tax Avoidance Routines No 1, was re-christened Jason in the Caves of the Cay Man and went on to make its publishers — formerly a major record company — immensely rich. It would lend Ivan money

'Good games writers are liable to become "stars" in their own right. They are also liable to become as rich as many pop music stars of today...'

when he needed it or send him out on promotional trips in a borrowed Rolls Royce.

There ends, for the moment at least, this month's Story Time, and let me stress that, at this point in time, it is a story with no basis in truth. But that is only as far as I know, for I have a feeling that if it isn't happening now, it soon will be.

You see, several things have come to light recently that point to a new development in the business. Individually they are not worth repeating, but together they show that another analogy between computers and the record industry is showing up, and that it is an analogy that is not altogether wholesome in its connotations.

That analogy is, in one word, *hype*. Now that there is a goodish installed base of home computers out there, the software industry is scrabbling to jump on the bandwagon. Quite right, too, I hear someone say, and I agree with you — but only up to a point. With such a vast market growing ever more crowded with new games and hobby programs every day, something has to be done to get them noticed.

There was a time when all that was needed was a ten-penny advert in a magazine not totally dissimilar to *PCW*. The world was small enough then for it to be seen and noticed. Today that is not liable to be enough.

Already the advertisements are getting bigger and grander (quite right, too, I hear the publishers say). The authors of the programs are beginning to be publicised as personalities, which indeed some of them are. There are 'pop' charts showing which programs are selling best. It gets to look more like the record industry every day.

And, of course, the way things are going, that is exactly what it is going to be. The record companies, observing the diametrically opposing trends in sales potential of the record business and the home computer software business, are about to decamp from the former to the latter *en masse*. (OK, so they're not necessarily actually going to give up the record making business, but they do know a good gravy train when they see one.)

As such companies move in, several things are likely to happen. One is that the home software business — games and stuff like that — will go from being shoe-string to the other thing. When it comes to promotional gambits, the megabucks are about to start flying around. What we have seen so far in software promotion has been kids stuff carried out on small change. These efforts have been worthwhile for many of the participants it is true, but now the big boys are coming out to play.

Another thing that is likely to happen is that, despite their acknowledged financial clout, there is no natural follow-on that what record companies spend their money on promoting will be any good. As was witnessed in the sixties, when the record companies took Liverpool apart trying to find their own version of the Beatles, they are expert at following the trends poorly, and not half so good at picking the right new, and unknown, developments. If they are so weedy in their own back garden, it could be fun watching them treading in the doggie-do of a strange and new business.

This is where it could get interesting, for each of the companies will no doubt have its different approach. Some, I feel sure, will want to hedge their bets and cut corners by buying in the expertise. This will probably be in the form of one of the small but successful software publishing com-

'Other companies might take a different approach and try to hype their way to success.'

panies that lacks, above all else, finance.

This, in my own extremely humble opinion, would not necessarily be a bad thing. Indeed, it could be beneficial to all concerned.

Other companies might take a different approach and try to hype their way to success. It has been found before in the record business that enough money can sometimes push a product to the top despite its quality (or lack of it). The methods of achieving this are not all that wholesome either. The record industry itself has had to come to terms with the sometimes gross manipulation of the pop charts. Get something in the charts and it will become 'sellable' . . . so do what you have to in order to get it in the charts: that has been the motto.

Even now this cannot be guarded against completely in the record business, and in the software business the 'charts' are wide open to every con going. I have no specific evidence for what follows but, when someone in the business says to me that chart manipulation is going on, and that his suppliers are saying that a little financial inducement in the right direction will ensure that a program gets to the top in the next issue of a magazine, then there is an outside chance that it might not all be a pack of lies . . . know what I mean, nudge, nudge, wink-wink?

And already the power of chart positioning — manipulated or not — is being felt. The retailers are finding that they must watch the magazines closely and stock up on the ones that gain both the high spots in the charts, and the good reviews. Getting a five-star rating in a magazine means a

BANKS' STATEMENT

Illustration by Andy Leslie

program gets sales. It follows that there is a potential for some unscrupulous companies to try to acquire such ratings.

The ratings are important because the users have so little else to go on in choosing new programs. This is why the authors are likely to become personalities in their own right, for in the same way that the music business sells on the name of the artist (if you like Rod Stewart or Simon Rattle you are much more inclined to buy their new records just because you know you like them), so the software business will follow suit.

Good games writers are liable to become 'stars' in their own right. They are also liable to become as rich as many pop music stars of today, and this is attracting another problem for the industry (and another good reason for having the museum/ archive I wrote about in *PCW* July). Having read of the money some of the early 'stars' are making already, kids are starting to clamour to become stars themselves. Worse still, parents are dragging reluctant children along to publishers, just because they have bought a VIC or Sinclair and can make it print 'Get lost' . . . smart kid, eh?

One instance of this that I have heard of had parents demanding an advance royalty of £50,000 from a games publisher for a new game written by their 'brilliant' spotty erk. Two things prevented the transaction in the end. One was that the publisher had been around a bit. The game the kid had 'written' was in fact an old 8k PET program copied and modified. The kid had found it at school. The publisher remembered playing it himself all those years ago (three?). Without an archive, museum and indeed sound copyright laws, there is going to be much more of this, so publishers ought to mug up on the old stuff.

The other reason he didn't do a deal? Oh yes, he didn't have £50,000 in spare cash at the time. The record companies, of course, will have. The time is coming to buy lots and lots of Kleenex, for there are going to be some wonderful colds caught in the near future.

END

THE AUTOMATED CLASSROOM

With the increasing use of micros in education, there has been a mixed reaction from both teacher and pupil. Derrick Daines provides a valuable insight into what's going on.

Despite our relentless pioneering at the frontiers of technology, PCW has neglected a vital lead into the future — education. Now former PCW educational correspondent Derrick Daines is back with an occasional series on micros in education. Why not rally to his call, be you teacher, pupil or mortal, and send in a few opinions of your own?

As I was saying . . .

A deputy head of my acquaintance told me a little while ago that he had given up prejudging educational computer programs until he had seen the children using them. He added, half in jest, that he lets them tell him how good the program is! Another teacher remarked firmly that he wouldn't let children choose their own video nasties and so he wouldn't let them choose their own computer programs either.

To some extent, those two views encapsulate for me one of the fundamental problems facing education following the arrival of the computer in the classroom. The first man shows what I believe to be a becoming modesty and an open mind. The second shows a caring attitude and a sense of responsibility, but a closed mind. I hope that more experience with a computer in his classroom will broaden his views.

It isn't only the children who learn when a computer is put into the classroom. The teacher learns, as do the head, the governors, parents and the inspectors. I first wrote that remark a couple of years ago and an inspector friend of mine demanded: 'Are you saying that the Inspectorate are ignorant?' I ducked the question, but I noticed that a few weeks later there was an in-service day laid on for the inspectors!

So, everybody learns, albeit different things. The teacher learns first of the enormously motivating effect that the computer has on the pupils, and may even feel a twinge of jealousy that an inanimate machine can have an effect that he or she has unsuccessfully striven for over a number of years. The first reaction of many teachers is swiftly to transfer to the computer a lot of the chores of education — all of those things that pupils do not like very much and which come under the general heading of drill and practice. Why not? Why not cash in on the motivation that the computer provides? Hooray for the computer!

Drills and frills

After a while, however, it begins to dawn that even computer-generated motivation will not sustain an interest in computer-generated drill and practice, so such activities are frequently wrapped up in a game and we have drills and frills. That's the sort of thing where, as a reward for getting a sum right, the user gets to zap a Klingon or something, and — bless 'em — children are pretty loyal and don't mind if the proportion of drill to frill is kept reasonable. After all, it's what has been happening in schools for generations; only the frill has been changed.

I suspect that is where the second teacher above is right now. I suspect that he suspects that given a choice, the kids would be happier blasting away at Space Invaders or Pacman rather than working at Space Sums or whatever we call our drills and frills program. He's right, of course. After all, what could be more soul-destroying than an inanimate object coldly shoving thousands of little problems at you? I mean, you can't even put a whoopee cushion under it! It is not surprising that one hears of children who groan with dismay when it is their turn to go on the computer.

At this stage many teachers will dismiss the computer as a worthless gimmick — a novelty quickly outgrown.

It's strange, isn't it? For years the computer was resisted in the classroom because *inter alia* teachers feared that it would replace them, yet many teachers will come to dismiss the computer because it doesn't! To put that another way, just as a workcard is not a substitute for a teacher, making the computer into an animated or reactive workcard will not replace the teacher either. It cannot be stated often enough that the computer presents us with wholly new opportunities and that to confine it to present old stuff on a new medium is to stifle the opportunities.

Acclimatisation

When given new technology, it is hard for us to think widely enough and to explore freely enough. People of my generation will remember newsreels of Polish cavalry charging against invading German tanks; they were still using the methods of a generation before. Similarly, when the cine camera was invented, one of its first uses was to record stage events; the camera was stationary and simply recorded what went on in front of it. Techniques such as flash-backs, dissolves and so on came later, as did the use of these techniques to create special story-telling effects possible in no other way. It has taken eighty years of experience and experimentation with the movie camera to produce the current level of film production, and to discover the best use of the computer will probably take longer.

This is where the first teacher of my opening paragraph scores. In adopting an open-minded policy he shows himself ready to learn and experiment and re-evaluate what he is doing; willing to try to get the best out of his classroom computer and perhaps to discover new ways of teaching.

Assessment

It's good to be back in *PCW*. In the two years that I've been away so much has happened that it is almost impossible to offer a precis. Without much doubt, however, the most exciting thing that has happened has been the combined DOI and DES initiatives of putting computers into schools. In my own LEA of Nottinghamshire, not less than 95 per cent of schools have taken advantage of the offers and courses of instruction are packed. If this level of response is matched across the country, the outlook for computing is fantastic; the potential for educational, social and economic change quite immeasurable. Love 'em or hate 'em, computers are here to stay and education will never be the same again.

All at *PCW* are aware of this, and in asking me to return to writing for them, it is hoped that we will be able to provide a forum for debate and comment, as well as providing news or other items of interest to teachers. So — if you have anything that you wish to pass on to others; if you have a viewpoint that you want to air or a problem to be solved; if you have discovered an interesting way of using computers in the classroom; then this is the page.

This is *not* the page for technical queries, nor is it a free assessment service for software suppliers. The reason for this is that as a software supplier myself, I would lay myself open to charges of bias. On the other hand, if you are a non-profit-making service, then we will be glad to cooperate.

Forum for debate

From time to time — when the mailbag gets light — I intend to be rather provocative and for starters I want to suggest that perhaps teachers will be — or are — among the worst offenders when it comes to illegal copying of programs. Are you reaching for paper yet? No? How about this then — I think that as a profession we tend towards what I call the widows and orphans syndrome. That is, the widow hauled up before court for shoplifting pleads that she did it for her starving children. I suggest that the more teachers care about their pupils and the more anxious they are that a good supply of programs be available in their schools, the more they will succumb to the temptation of stealing. Of course, copying of programs is not *seen* as stealing! Stealing is lifting something and pocketing it, isn't it? How can it be stealing when you have not removed something but merely cloned it? Besides — it's for the good of the children — surely no-one minds that! Before you reject the thesis, remember that just over a year ago a school was successfully prosecuted for making photocopies of sheet music, while many others were warned off the practice. (That should start the letters rolling in!)

As I write, representatives of various governments are holding a week-long conference also attended by various international firms to discuss the problems of software copying. To be sure, they are mainly concerned about theft of large and expensive programs, mainly for commercial application and costing hundreds of pounds a time, but it does highlight a desperate problem. In schools computing, the problem has some new dimensions. Generally speaking, the programs are quite simple in concept and anyone with a reasonable expertise can reproduce it for himself. In the trade this is known as 'backward engineering' — seeing a program running and — without looking at the listing — going away to write your own program that does exactly the same thing or perhaps contains your own little modifications. Whose is the copyright? Have you stolen anything? According to existing law, an idea is not copyright; only the manifestation of that idea in copyable form such as print.

Schools are training their teachers as fast as they can. In a year or two there will be more people capable of writing programs than ever before — and remember that, generally, educational programs are fairly simple. What are the professional criteria? If you reject my thesis that many teachers will simply execute a rip-off, what standards should educationists apply to themselves when it comes to backward engineering? I would welcome any views on this thorny topic.

CTUK! NEWS

CTUK! Burton has taken the unprecedented step of imposing strict standards on the programs kept in its software library. Chris Woodford describes the evaluation procedure.

BASIC SOFTWARE STANDARDS

The recent proliferation of computer software poses certain problems for the beginner, not least of which is the question of how the quality of software can be fairly and accurately estimated.

Although it's fair to say that the amount of high quality, well conceived, ergonomically designed, well documented and well supported software has substantially increased, so regrettably has the amount of badly designed material written by people with an all too superficial knowledge of a particular machine, who make little use of a machine's more valuable and esoteric features.

Software producers — particularly amateurs — can rarely afford the opportunity to examine material prior to purchase. It's often impossible to tell exactly what your money is buying. This problem, coupled with the ever increasing cost of software for home micros, prompted ComputerTown Burton to establish a software library which would contain programs that had been stringently tested and assessed according to a set of software standards.

The standards arose from discussion about what constituted a good program (and a bad one), the examination of educational standards, the dissection of very poor quality software, the consideration of common mistakes in beginners' programs, and comments from program reviewers. Although the software library has taken rather a long time to catch on, as Maggie Burton predicted, the standards have been widely used in CTUK! Centres and schools.

In designing the standards, emphasis was placed on what the programming was like, rather than on aesthetic considerations, since it is quite often the 'internal' aspects of a program — the way in which it has been written — that determine the 'external' aspects — how it appears to the end user.

To assess a program using the standards, start with a figure of 100% and subtract the given figures according to whether or not each condition is met. You should only subtract once for each error, ie, if the possibility of a 'Division by zero error' occurs four times, subtract as though it only occurs once. It is assumed that the program to be tested has been completely debugged.

As a matter of interest, programs need to achieve a 75% rating to be considered for the CTUK! Burton Software Library.

The Standards

Internal aspects — 50%

1 Has every byte been used thoughtfully?

a) Have direct wastages of memory been avoided? For example, IF A-1=3 THEN and 10 X=4:X=X+1 **(40%)**

b) Has repetitive code been avoided by replacing consecutive statements or routines with subroutines, loops, procedures or defined functions? **(3%)**

c) Have READ and DATA statements been used instead of repeating lines where the data is implicit in the instruction, eg, LET, PLOT, DRAW. **(3%)**

d) Has the order of statements been altered to save memory? For example: **(3%)**

```
10 FOR I=1 TO 10:A(I)=RND(1):NEXT:
       FOR I=1 TO 10:PRINT A(I):NEXT
becomes:
       10 FOR I=1 TO
       10:A(I)=RND(1):PRINT
```

A(I):NEXT

e) Are variables used instead of constants wherever possible (except when a constant is used only once or twice)? (2%)

2 Is the program error-trapped? Can it cope with an inexperienced user or deliberately corrupted data?

a) Has the program been error-trapped for the user's input, pressing the wrong keys, RETURN without any data, and so on? For example, 10 INPUT"AN INTEGER BETWEEN 5 & 10";A: IF A<5 OR A> 10 OR INT(A)< >A THEN 10 (4%)

b) Has the program been trapped internally for occurrence of division by zero, square root of a negative number, and so on? For example, 10 IF B=0 THEN 1000 ELSE C=A/B (4%)

c) Does the program check to prevent animated figures or printouts from moving outside predefined boundaries, eg, games, data tabulation on spreadsheet programs? (4%)

d) Are default values used when no data is input? (3%)

3 Was the program planned?

a) Has the program been prepared using algorithms, flowcharts, blueprints, Warnier-Orr diagrams, PDL or similar techniques? (5%)

b) Is the program modular in nature to permit easy maintenance and debugging? (5%)

4 Optimisation?

a) Has the program been optimised to run in as little memory as possible or as quickly as possible? (3%)

b) Have special routines been devised to save time and memory wherever possible? (2%)

c) Has the emphasis been placed on the design of highly efficient routines? (2%)

d) Have subroutines and data been placed at the beginning and not the end of programs? NB This may not always be desirable since it can detract from the readability of the program. (1%)

5 Miscellaneous

a) Have single character inputs been achieved using GET$, INKEY$, CHR$ (INCH) to obviate the need for the RETURN key to be pressed? (1%)

b) Have the main program segments been indicated by REMs, except where virtually all of the available memory has been used up by an efficient program? (½%)

c) Has the program been renumbered so that automatic line numbering can be used to type it in? (½%)

External aspects — 35%

1 Good input and output?

a) Have the screen, keyboard, printer and other peripherals been used thoughtfully, logically, appealingly or ergonomically? (5%)

b) Is the program visually novel? Is there a good, uncluttered display? (5%)

c) Have the computer's more esoteric features been used to the greatest possible extent, eg, sound prompts, colour graphics for pie charts and so on? (5%)

2 Good quality instructions and documentation?

a) Are the instructions easily understandable and comprehensive with nothing omitted? (If there is sufficient free memory, they should be built into the program, otherwise they should be written out and distributed with each program copy.) (10%)

3 Ergonomic design?

a) Was the program designed according to the user environment, eg, mouse for businessmen, joystick for arcade games, restricted keyboard for disabled users? (5%)

b) Is it easy to use and understand? (4%)

4 Miscellaneous

a) Is the screen cleared at the beginning of the program and between major segments wherever possible? The entire screen should not be cleared if this is not desirable. (1%)

Discretionary marks — 15%

To be subtracted at the marker's discretion in the following instances, for example:

Games:

Marks might be subtracted in the absence of: a timing function; scoring and comments on it; best score or time facility; adaptation with the player and a variable difficulty degree; the correct balance between skill and luck; a hard game, though a maximum score can be obtained; constant parameter resetting is not required; an attract mode to show game operation.

Utilities:

Marks might be subtracted for poor design, if the user has to perform unnecessary work — for example, input data that could be calculated by the program.

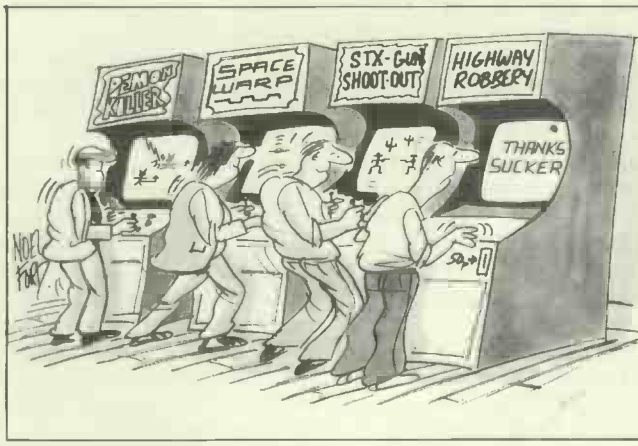
Business Software:

Marks could be lost if the program was not designed for computer naïve people, appropriate business terms are not used, special training is required, or if the program is not compatible with other business software, eg, word processing programs.

Educational Software:

Marks might be lost if the program failed to adapt to the child's ability, record his or her performance for later inspection by the teacher (where appropriate); if the program is not entirely foolproof; if it requires constant supervision; or if the child's progress cannot be monitored from a distance, eg, with appropriate sounds, border colours and so on — again, where appropriate.

Computer Town UK! is a rapidly expanding network of computer literacy centres where members of the public are given free access to all sorts of computer equipment. This is courtesy of those willing to offer time/resources. You can find a Computer Town anywhere — they're often in libraries or schools. The aim is to make micros enjoyable and non-threatening, so axe-grinding of any sort is banned. Guidelines are available for those interested in starting up their up their own 'Towns. We are intending to revamp our coverage of CTUK! shortly. In the meantime, write to David Tebbutt, 18 Countlands Close, Ruislip, Middx. Remember to enclose an A4 SAE for your reply.



MICRO CHESS

WINNER TAKES ALL

Richard Lang's chess program has gone from strength to strength since the 1981 PCW Chess Tournament. Tony Harrington reports.

Richard Lang's name has already been mentioned from time to time in these columns. As the designer of the program which won the 1981 *PCW* Tournament with a crushing score of five out of five, he could hardly have failed to get some attention.

He is one of the new breed of young enthusiasts, who has drifted into the intricacies of computer chess more or less by chance, and who has found in it something seductive and obsessive. Lang had nothing to do with computers in his school days. His school, in the village of Winnersh, near Reading, encouraged studies of the more traditional kind. And the chess that was played there was between schoolboys rather than machines.

'We played a few lightning games and the odd chess tournament,' Lang said. 'My father taught me the moves of chess when I was around eight years old, and I played a bit from time to time. But my interest in computers came when I bought a Video Genie home computer three years ago. I taught myself Basic, but that was irritatingly slow, so after a month I bought a book on machine code programming.

'The first project I tried was to write a video game. That wasn't a great success. I wanted to do something other than simply produce another version of space invaders, so I decided to have a go at writing a computer chess program.'

Writing the video game in assembler code occupied about the first three months of Lang's time after the arrival of the Genie. Thereafter, he put childish things behind him, and settled down to solve a few of the problems that perplex the AI staff of Britain's university computer departments. (AI, for those new to these pastures, stands for Artificial Intelligence.)

No one just launches into the writing of computer chess programs on instinct and native wit alone. There are certain fundamental things to be learned, as every aspirant computer chess programmer will discover. Lang quickly found that he needed some assistance in getting his program off the ground. Accordingly he went out and scoured the bookshops for likely material.

This was provided in the shape of a book by Dan and Kathy Spracklen (who, as readers of this column might remember, achieved fame as the designers of the Sargon program, and who are still writing chess programs for Fidelity). The book was *Sargon, the Chess Program*, and it provided, among other things, a full listing of one of the Sargon programs.

'That helped me considerably. I read it and absorbed a lot of what they were doing. It gave me an idea of how chess programs were written,' Lang commented. In case you think that this is all there is to writing tournament winning chess programs, I should point out that within a very short time of reading about that version of the Spracklens' program, Lang fancied that he saw several ways of improving on what they had done.

'I could see far better ways of doing a lot of the things. Much depended on finding ways of improving the speed of their program. I found better algorithms and better ways of obtaining a score for chess positions,' he said modestly.

I asked how it was that he, on his (at that stage) scant acquaintance with chess programs, was able to see further into the intricacies of composing chess algorithms than the Spracklens had produced in that program. (Not that the Spracklens haven't devised other, better algorithms since, because they undoubtedly have.) Lang was puzzled about how to answer my question.

'I simply did,' he said, and seemed to think it perfectly natural. Pressed a little further on the subject, he added: 'Understanding chess algorithms is something you either can do or you can't. It's a bit like a musical gift. I suppose practice helps, but certain people seem to be better at it than others. I found that I was one of the people who was good at it.'

Despite the high graphics content in the video game that was Lang's first venture into programming, his first chess program eschewed graphics altogether. ('To have written graphics for it then would simply have diverted me from the chess program itself.') All it did was to provide an algebraic notation of the moves. And unless the human opponent was an expert at blindfold chess, an ordinary chess board was an essential 'peripheral'.

He started writing the program in January 1981. This was a leisure hours hobby, since his ostensible occupation at that time was as an employee in the research department of British Gas, doing risk analysis. 'I used computer programs in the course of my work, but I didn't have a thing to do with writing them,' he explained. 'That all happened after the office closed for the day.'

The *PCW* Tournament for that year was, as always, scheduled for September. Lang knew of the Tournament, and he says that it was a prime incentive in sharpening up the way his program played. 'To start with, I would have written the program anyway, regardless of whether there was a tournament on or not. But once I got started and realised that it was playing reasonably well, I kept the Tournament firmly in mind.

'It was something of a race to get it into shape in time and I could have done with a few extra months. By the time the Tournament arrived, it was running on a Nascom micro with a 4 MHz clock. It did rather well and won in every round. David Levy and Kevin O'Connell took an interest in it at the Tournament and at the end of the Tournament they offered me two contracts. One for the program, and one to go and work as a programmer for them. This was very pleasing for me,' he said.

Since then, in addition to working on chess programs, Lang has written what might be the world's strongest program for the Oriental game Gomoko Renju — a game which I do not understand, but which I believe is played on a board similar to a Go-board. It involves trying to place stones in a straight or a diagonal line while preventing your opponent from achieving this end.

Lang didn't know how to play Gomoko Renju at the time and still doesn't play it. That wasn't necessary. 'It is sufficient to tell a programmer what the rules of any game are, though it probably helps a bit if you play the game,' he reflected. For the Gomoko Renju game, Lang was able to draw on the advice of a master, and that was sufficient.

Having sold the Cyrus 1 program, Lang set about writing Cyrus 2. He entered this in last year's *PCW* Show, but it didn't quite come up to his expectations. 'It was written in quite a hurry and the Tournament came in the middle of its development period rather than at the end,' Lang said. There were quite a few new ideas in the program and he didn't have much time to test them before the Tournament.

The new ideas were a combination of getting sections of the program to run faster, and building more chess 'wisdom' into it, by getting it to recognise isolated pawns, doubled pawns and the like.

Richard Lang: one of the new breed

Although it didn't do too well in the Tournament, Lang reckons that the current version of his program is demonstrably better than Fidelity's Sensory Nine.

A version of Cyrus has been bought by Dragon and now runs as a cartridge on the Dragon home computer. That, however, is another tale. Suffice it to say that on several occasions I have played against the Dragon version and have found it a worthy opponent.

Lang intends entering a new version of Cyrus in the 1983 *PCW* Chess Tournament, and that should answer any remaining questions.

Games section

White: Cyrus; Black: Cray Blitz; Pirc Defence: Notes by David Levy.

This is undoubtedly the most impressive victory scored by Cyrus to date. It was played in the speed tournament at the 1981 North American Computer Championships, and Cyrus' opponent was running on the Cray 1 computer, the world's fastest mainframe. In the previous year's competition, Cray Blitz had won the speed tournament with a score of 15 out of 15.

1 e2-e4 d7-d6
2 d2-d4 g7-g6
3 Nb1-c3 Ng8-f6
4 Bf1-b5+ Nb8-d7
5 Ng1-f3 c7-c6
6 Bb5-e2 Bf8-g7
7 0-0 0-0
8 Qd1-d3 e7-e5
9 Bc1-g5 h7-h6
10 Bg5xf6 Qd8xf6
11 Rf1-d1 Rf8-d8

(The position is roughly equal, with each player having some chances of creating play. White exerts some pressure along the d-file, while Black has play on the h8-a1 diagonal.)

12 a2-a4 a7-a5

(Otherwise White cramps Black by a4-a5.)

13 Ral-a3 Qf6-f4
14 g2-g3 Qf4-f6
15 Ra3-b3 Ra8-a7
16 Qd3-c4 Ra7-a6
17 d4xe5 d6xe5
18 Rd1-d2 b7-b6

(Intending 19 . . . Ra6-a7 and 20 . . . Bc8-a6, trading off the light squared bishops and leaving White with weaknesses on the light squares near his king.)

19 Qc4-d3!

(Now White will establish a strongpost on d6.)

19 . . . Bc8-b7
20 Qd3-d6 Qf6xd6
21 Rd2xd6 Ra6-a8
22 Rd6-d2 Bb7-a6
23 Be2xa6 Ra8xa6
24 Nc3-e2 c6-c5
25 Rb3-d3

(Completing White's domination of the d-file.)

25 . . . Ra6-a7
26 Ne2-c3!

(The start of a knight manoeuvre which capitalises on Black's weak Q-side squares.)

26 . . . Ra7-b7
27 b2-b3 Kg8-h8
28 Nc3-b5 Kh8-g8
29 Nb5-d6 Rb7-c7
30 Nd6-b5 Rc7-b7
31 Rd3-d5!

(Threatening 32 Nf3xe5 Bg7xe5 33 Rd5xe5 Nd7xe5 34 Rd2xd8+, and thereby forcing Black to weaken its position further.)

31 . . . f7-f6
32 Nb5-d6 Rb7-c7
33 Nd6-b5 Rc7-b7
34 c2-c4 Bg7-f8
35 Nb5-c3 g6-g5
36 Nf3-e1!

(Taking advantage of Black's last move by starting the knight on its way to the strong square e3 followed by g4 or f5.)

36 . . . Bf8-g7
37 Ne1-c2 Kg8-h8
38 Nc2-e3 Kh8-g8
39 Ne3-f5 Bg7-f8
40 Nf5-e3 Bf8-g7
41 Rd5-d3 Kg8-h8
42 Ne3-f5 Rb7-a7
43 Nc3-b5!

(The roof caves in on Black's brittle structure. If now 43 . . . Ra7-b7 44 Nb5-d6 Bf8xd6 45 Nf5xd6 Rb7 moves 46 Nd6-f7+, forking Black's king and the rook on d8.)

43 . . . Ra7-a6
44 Nb5-c7 Ra6-a7
45 Nc7-e6 Rd8-e8

If 45 . . . Rd8-g8 46 Ne6xg7 Rg8xg7 47 Nf5xg7 Kh8xg7 48 Rd3xd7+ etc.)

46 Ne6xg7 Black Resigns

(All this at five seconds per move CPU time!)

END

BENCHTEST

PIED PIPER

The Canadian-designed Pied Piper is yet another addition to the ever growing list of 64k, Z80, CP/M based computers. However, this did not deter Dick Pountain . . .

The recurrent nightmare among Benchtesters is that they will be asked to review a 64k, Z80, CP/M computer; the reason is that there is almost nothing left to say about such machines that hasn't already been said one hundred times before. This is a consequence of achieving Industry Standard status. Such machines are now so standard that virtually the only points of differentiation between them are a few terminal control codes which the user never even sees unless a new program needs to be installed; with the growing tendency to 'bundle' a set of major programs such as a word processor, a file manager and a spreadsheet, even this is an unlikely event.

Having said all this I should explain that I actually volunteered to test the Pied Piper Communicator, which is precisely a 64k, Z80, CP/M computer. My reason was that it looks as if it offers a very high degree of portability at a low price. The marketplace in portable CP/M based computers has become very complicated in recent months

The rear panel contains easily accessible sockets.

Photography by Ian McKinnell

and it is by no means easy to decide which is the best buy, when all the discounted prices and bundled software are taken into account. *PCW* Benchtests are intended, in the last analysis, to aid potential purchasers to make a decision, rather than to always reflect the 'state-of-the-art' in hardware design. There is still an awful lot of utility left in the 8-bit microcomputer, particularly one which runs CP/M-80. This review is being typed, under WordStar, on an 8-bit machine, and I see little possibility of this changing in the near future; at the last count I had ten different language compilers or interpreters in regular use, many of which will not be available on 16-bit machines for some time and most of which will only be able to make use of 64k when they are.

There is still a lot of room for CP/M-80 machines to become smaller, cheaper and to offer more disk storage space for the money, hence my interest in the Pied Piper.

It was designed in Canada by Semi-Tech Microelectronics Corporation of Toronto, manufactured on its behalf in Hong Kong and is due to be launched in the UK this month by Semi-Tech (Europe) Ltd.

Hardware

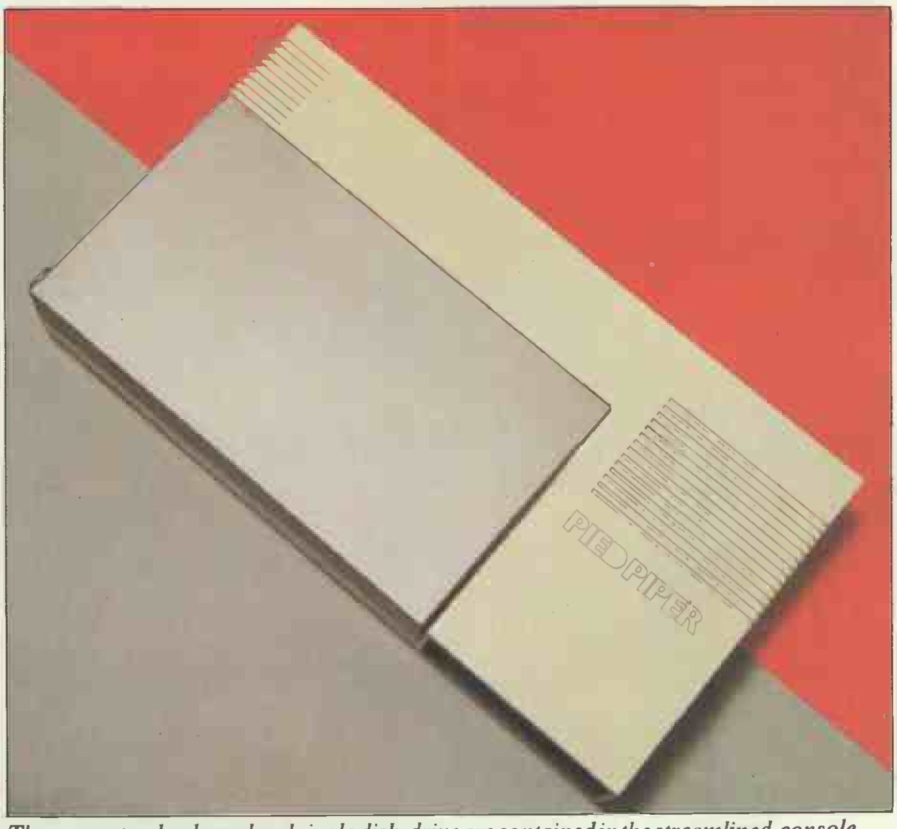
The basic Pied Piper consists of a console containing the computer, keyboard and a single disk-drive. There is no built-in display device; the machine must be connected to a separate b/w monitor, or to a domestic TV set via an optional UHF modulator. I was not supplied with this unit and so the review was carried out entirely on a green-screen monitor.

The original Canadian and US models included the option of an Epson two line by 80 character LCD display (similar to that on the Sord M23P). The European distributors, however, will not be offering this device as they feel it's too expensive and of limited appeal.

The case is a two piece moulding in ABS and is unusual in that the disk drive is housed in a bulge at the right hand end, in line with the keyboard. The keyboard thus sits in a wedge shaped depression which is covered by a removable rigid plastic lid for transportation. A retractable carrying handle is located at the back of the case. At 4 × 20.2 × 10.8in it is very compact indeed and it weighs a mere 15lbs. When in its fitted nylon carrying case it feels more or less like a small portable typewriter rather than an electric sewing machine (like its major competitors). This carrying case is a smart 'sports bag' type with a zip closure and a separate pocket on the front to hold leads; it's padded with foam.

Opening up the case, by removing six screws, reveals a mainboard which barely fills two thirds of the case area. This is formed on massively thick fibreglass and looks as if it would shrug off any abuse less than an airliner crash. The board contains the whole computer apart from the power supply and keyboard. This includes a 4MHz, Z80A processor, 64k main RAM, 4k ROM (bootstrap loader and diagnostics), 2k video RAM and 2k ROM character generator. One feature which is most unusual nowadays is that every chip on the board is socketed which makes for easy replacement. The power supply sits in the empty third of the case and is of the transformerless switching type, rated at 60 watts which is sufficient to run a second disk-drive.

A panel at the rear of the case displays a phono type plug for the monitor lead, a Centronics parallel printer socket, a DIN socket for TV-modulator output and the



The computer, keyboard and single disk-drive are contained in the streamlined console.

Smart 'sports bag' type case with a separate pocket on the front to hold leads.

Reset button which performs a cold boot restart. At the left hand corner is the mains power socket and the ON/OFF switch; unfortunately the power lead I was supplied with had an 'L' shaped plug which effectively covered this up and made it difficult to locate. At the right hand corner is a covered slot which opens to reveal an edge connector for the system bus (STD bus compatible) which is used to connect additional disk drives, or for instrument control applications.

The disk drive is the closest that the Pied Piper comes to being state-of-the-art. It is a half-height 51/4in unit from Mitsubishi which contains a massive 1 Mbyte unformatted and a gratifying 784 kbytes formatted, which makes even the Sirius look inadequate. This capacity is achieved by ordinary double-sided 96 track (40 sectors/track) recording, with no variable speed or other trickery involved and so should prove easy for software producers to emulate on their copying machines. It's fairly quiet in operation and, despite its large capacity, is not noticeably slower than ordinary drives in its access times. Having this sort of space to play with opens up possibilites such as giving two applications their own USER areas on a disk and effectively making it into two disks.

The keyboard is an ASCII standard, full sized typewriter style unit which has all the keys in sensible places. The shift and return keys are double sized and the space-bar stands on its own. The keys have an excellent light touch with progressive 'feel'; one of the nicest I have used and a pleasure to type on. The only ground for criticism is that there are only two cursor keys, with up and down being shifted. There are both backspace and Del keys but in all the programs I tried they did the same thing, a destructive backspace. A key called FUNCT at the lower left side performs special operations when used with a number key. All keys auto repeat after 1/2 sec. It is good to see an English pound sign on the keyboard, probably something to do with the machine's Canadian origins.

Above the keyboard are three LEDs which show when power is on and when either of disk drives A or B is in operation (B is an external option). Unfortunately the drive A light remained on at all times when the computer was in use, as did the red light on the disk drive, so that little information was conveyed.

When connected to a standard b/w

monitor the Pied Piper produces an 80 character by 24 line display which was both sharp and steady on the Kaga used in this test. Screen updating seemed to be unusually fast though rather messy as a fleeting 'ghost' cursor is to be seen flickering about. The 7×5 character set is not particularly pretty with minimal (1 pixel) descenders and a nasty squashed 'i'. Highlighting is supported in the form of high and low intensity characters. Since a TV set will not handle 80 character displays, Pied Piper has provided a utility program called TV.COM in their CP/M which switches the display to 40 characters; this condition is retained until you perform the next cold start. When in 40 character mode it's possible to scroll the screen sideways by running the cursor off the edge, or (much quicker) to tab sideways in jumps of 8 or 40 characters using the FUNCT key with 0 7 8 or 9.

Software

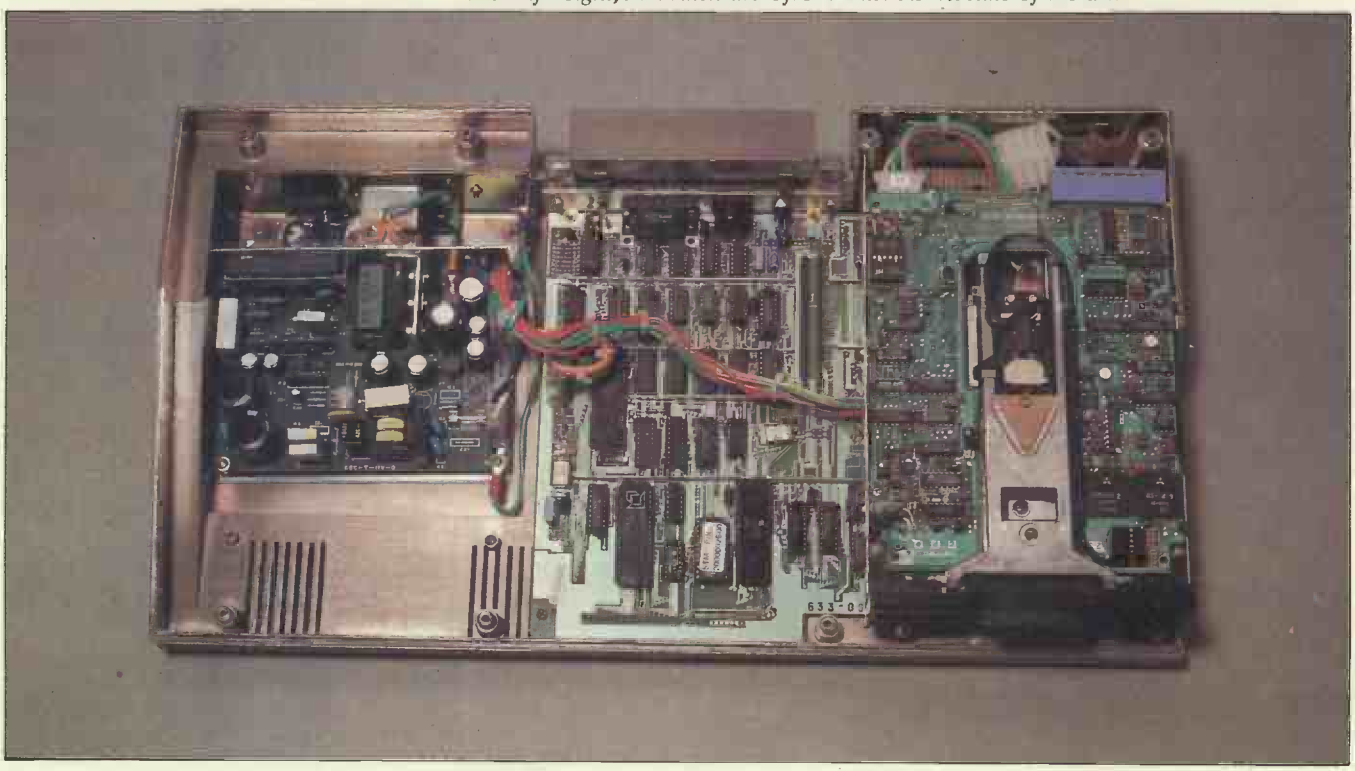
The Communicator comes with a customised CP/M 2.2 and the Perfect Software suite of programs, Perfect Writer, Perfect Speller, Perfect Filer and Perfect Calc. These are contained on three disks and a blank 'Scratch' disk is included to get you started.

The CP/M has been lightly modified in the interests of easy use. All the intrinsic commands remain the same (DIR,REN, TYPE, etc.) but some of the transient utilities are somewhat different from the standard Digital Research versions. FORMAT is replaced by a program called PREPARE which formats, verifies and writes a system onto a disk in one operation. In addition to PIP there is a program called TRANSFER which prompts you to alternately insert the source and destination disks in order to transfer a file using a single drive. COPY works in the same way to back up a whole disk. It is here that the penalty for using a single 800k drive is paid; copying a diskette requires no less than 20 changes of disk, and for that reason backing up is likely to be done less often than safety dictates. Even transferring a single file can take several disk changes since only as much as can be held in RAM is transferred at each step. This is exacerbated by the fact that this CP/M is only a 56k system, the top 8k being used for disk interface, LCD driver and 40 character display routines.

VERIFY is a command, not usually found in CP/M systems, which performs a non-destructive analysis of a disk and reports the number of bad locations found; however, since it provides no way of locking out such sectors, or of recovering data from them, the information is more of morbid interest that utility. One little feature that I liked was the way that Semi-Tech has altered the handling of CTRL P so that it tells you if the printer is not ready instead of just hanging up as it does in most CP/M versions.

There is not room here, nor is it appropriate, to review the Perfect suite. Suffice it to say that this is a high-class set of programs which has established a good reputation already in the USA. Perfect Writer is one of several word processors based on the mainframe/mini editor EMACS (others include Final Word, Mince and StarEdit). It features separate editing and formatting functions, which while not as immediately attractive as WordStar's 'what-you-see-is-what-you-get' approach, allows for far more complex and sophisticated formatting of docu-

The half-height, 5¼in disk-drive from Mitsubishi is state-of-the-art.



The main board barely fills two thirds of the case area; the power supply sits in the empty third.

ments. It's especially suitable for technical reports, manuals, theses and book work, as well as complicated form letters. Its chief drawback is a multiplicity of control and escape codes which make even WordStar look simple; the Pied Piper lacks programmable function keys which might have helped here. Definitely one for the more experienced user. Perfect Writer comes equipped with a useful spelling checker called Perfect Speller which, unlike some, will actually type in the corrections for you, and allows roots of unknown words instead of the words themselves to be stored in the dictionary. For example, if 'new' is in the dictionary then 'renew' and 'renewed' would be recognised.

Perfect Filer is a reasonably powerful and simple to use database program and Perfect Calc a spreadsheet, both of which use —as far as possible — the same command codes as Perfect Writer so that learning one helps with all. Perfect Calc is supplied with 40 pre-written tutorial and utility sheets, such as one to do Chi-Square analysis in statistics.

Surprisingly the Pied Piper comes without any high level languages so I was not able to run any Benchmark timings; in any case most *PCW* readers will have an idea of what they look like for a 4MHz Z80 by now.

Expansion and potential use

It is my suspicion, yet to be backed by any survey results, that the vast majority of purchasers of Osbornes, Kaypros and the like do not actually do any computing outside of their home or office, and that it was price and free software as much as portability that conditioned their purchase. If this is the case, then the Pied Piper's lack of a built-in monitor is not of much importance. It is possible to keep a monitor at home or the office or both, and to use a TV set if you really do need to compute in a hotel room. The saving in size and weight is really quite significant; it's quite comfortable to take the Pied Piper on the bus or tube, or even to strap it on a bicycle carrier.

On the other hand the lack of a second disk drive would quickly drive me potty and I suspect that a second drive will be the first expansion most owners will want to make, after a printer of course. With two drives you are talking about a hefty data-processing system but if this is still not enough, Semi-Tech will be able to sell you a 10 Mbyte Seagate winchester by January 1984.

Communications can be catered for be either a dual RS232C board or an RS232C/auto-dial modem board which fits onto a socket on the main board; Semi-Tech (Europe) is seeking Post Office approval for the latter item and so it will not be available on launch this month.

Documentation

The Pied Piper User's Manual is a slim 78 page affair which contains instructions on setting up the system and a brief guide to using CP/M with an explanation of the basic commands. You will look in vain for any technical information such as the terminal display control codes, which would be of use to a programmer. The Perfect programs each have their own thick, well written manual and the whole lot, including the Pied Piper manual, fits into a cardboard library case. The documentation is quite adequate for the user who wishes to get going straight away with the applications software but anyone who wishes to write programs will need something more (a language for starters, unless they plan to use ASM).

Technical specifications

CPU	Z80A (4MHz)
Memory	64k main RAM, 2k video RAM, 6k ROM
Keyboard	ASCII standard, two cursor keys, no numeric pad
Display	One 5in drive (784k formatted)
Disks	Monochrome monitor or TV set
Ports	Centronics parallel, bust extension.
Operating System	CP/M 2.2
Warranty	90 days, parts and labour

Conclusions

The Pied Piper Communicator is a solid, workmanlike CP/M computer which has the advantage of being very easily transportable. It also has at least twice as much disk space as most of its competitors, on a single drive. The supplied software is of high quality and covers most of the functions the average user would require. At £1066 it's good value for money, though remember to cost in a monitor as well. If it were mine, I would want to have the optional second disk drive kept at the place where it will be most used, since without it making frequent backups is unacceptably inconvenient and would probably not get done.

Prices

Pied Piper Communicator	£1066
TV Modulator	£24.95
Second 800k disk drive	£290
10Mbyte winchester drive	NA (Jan 84)
RS232 Port×2 Card	£100
RS232 Port+modem Card	£125

END

LEISURE LINES

Quickie

Arrange the numbers 1-9 in a 3×3 grid so that all columns, rows, and diagonals add up to the same value.

Prize Puzzle

Arrange the digits 1-9 in the 3×3 grid shown. Calculate the sum of differences between squares which are adjacent horizontally or vertically, but not diagonally. Thus, in the example shown, the sum would be 24 made up of:

$(9-8) + (9-6) + (8-7) + (8-5) + (7-4) + (6-5) + (6-3) + (5-4) + (5-2) + (4-1) + (3-2) + (2-1)$

9	8	7
6	5	4
3	2	1

Note: each difference is only counted once.

What arrangement gives the maximum sum and what arrangement gives the minimum sum?

Answers please — postcards or backs of envelopes only — showing maximum and minimum sums plus the arrangements, to reach *PCW* by 30 Sept, 1983. Send entries to: *PCW*, Leisure Lines, September Prize Puzzle, 62 Oxford Street, London W1.

June Prize Puzzle

A rather easy puzzle in logic — at least to anyone familiar with Venn diagrams. Over 200 entries were received — mostly with the correct solution of 10 cats.

Amazingly enough the winner, drawn by random selection, was A E McCafferty from, of all places, RATby, Leicester. And those of you who are familiar with the musical 'CATS', will know that McCafferty is the name of one of the star cats in the show. Perhaps my leg is being pulled.

Anyway, whether it is or not Mr McCafferty, congratulations, your prize is on its way.

Note: By the way, for those of you who are always asking for answers to the Quickies — here's your chance.

I am writing a book on Micro Puzzles (and other teasers) which will be published within the next couple of months. More about this next time.

by J J Clessa

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48 TPI suitable for 35 or 40 track operation. 96 TPI suitable for 77 or 80 track operation. 10 and 16 hard sectored versions available at same prices.

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A limited demonstration version of TLO is now available for only £50, including full documentation. This cost is fully refundable against your subsequent purchase of a full version.

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for Apple II	—	£185
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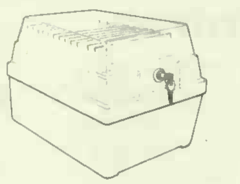

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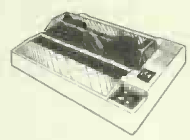
A5 Storage box (for 8" disks)	£33.60
A6 Storage box (for 5.25" disks)	£23.10

CTI – CP80 PRINTER



Features:—

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Print sample available on request.

CP 80 PRINTER	£289.00
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Special VIC20/VIC 64 Interface	£46.00

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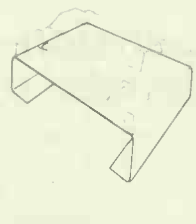

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YANKEE DOODLES

Sol Libes presents his monthly round-up of news and gossip from the Big Apple.

Does advertising pay?

There must be something to the old adage that 'advertising pays' because the sums being spent by personal computer companies are staggering. For example, last year IBM spent $19.7 million to advertise the PC, Commodore spent close to $14 million, Texas Instruments $8.8 million and Tandy $5 million. Apple got away with spending only $2.7, which may account for why it is lagging behind IBM in the image department.

Apple doings

Apple Computer is continuing to wage its battle against Apple II clones. The latest are three lawsuits filed against Jade Computer Products, Hawthorn CA, Cosmic Computers Unltd, Diamond Bar CA, and Ironsides Computer Corp, Reseda CA. Apple is charging them with copyright and patent infringement and unfair competition. Apple claims that all three companies are marketing units and software which are virtually identical to the Apple II.

In the meantime, the shortage of IIe's which existed in the first four months of the year is no more and in fact Apples are now in abundant supply which has triggered a price war. The Apple IIe system, which includes a monitor and display, lists for $1995 and is now being offered by some discounters for as low as $1599.

The Apple III has certainly not been a success story for Apple. However, the company appears committed to the III. Apple has already established 135 of its 1500 dealers to carry the Lisa and all of them have already received demo units with customer shipments expected later this summer. Apple expects to increase its Lisa dealer base to about 300 by this time next year. The company is relying on its own national accounts sales force for most Lisa sales. Apple is also expected to do a large OEM business with the Lisa (Apple already has over 100 OEM accounts).

Apple's next big effort is expected to be in local area networking for all of its products.

Random rumours

There is industry speculation that Compac, the company that to date has produced the most IBM PC compatible machine, may follow that up soon with a notebook-size version of the computer using a 24 line by 80 character wide gas plasma display. Also, the company is expected to 'go public' later this year... An Apple IIIe is expected before year end... And Tandy is expected shortly to release an IBM PC compatible at significantly less cost... There are also rumours that IBM will soon release an in-house developed DOS for the PC which will be more upward compatible to IBM disk operating systems used on their mainframes instead of the current Microsoft direction of providing upward compatibility to Xenix... Commodore is expected to drop the list price of the model 64 to under $200 and introduce a stripped down 64 with a list of under $150 for the Christmas season. Also look for a 16k version of the VIC-20. And rumours abound that Commodore will soon do away with the P-series of computers and introduce a $100 low-capacity disk drive... International Telephone and Telegraph is rumoured readying a personal computer entry at its Qume division... Spectravideo is rumoured readying a lap-size portable computer which is a souped up version of the Tandy 100 at, naturally, a lower cost... Microsoft is expected to introduce shortly versions of Xenix for the IBM PC XT and DEC Professional 350 personal computers... There are hot rumours that both IBM and Apple will launch their home computer this fall. Both are expected to be stripped down versions of their PC and IIe standard models, to include disk drive, 64k of RAM and to be transportable (in other words have handles, be slim and weigh under 30lbs). The selling prices are expected to be in the $500-600 range.

New war in software

Manufacturers and retailers had hoped to make their money on selling software at list price while discounting the computers to near cost. However, now the price war appears to have spread to software as well and manufacturers are bundling more and more software in with the basic machine. Further, manufacturers are beginning to drop prices on software in the same way that they dropped prices on hardware. Commodore, for example, has recently begun selling game software at $10, which previously sold in the $20-35 range and business-oriented software such as spreadsheets and database programs in the $50-100 range where previously they sold for several hundred dollars.

Software is now merchandised in much the same manner as audio records and tapes. There are specialised software stores and software has even begun springing up on the racks of drug stores. Distribution is now done through distributors (*à la* records and magazines) and no longer from manufacturer to dealer.

Japanese seek computer standard

Fourteen Japanese and one American company are reported to have agreed to adopt a computer standard developed by Microsoft. The standard relates more to the home computer market where the Japanese have as yet had no success in penetrating the US market-place. The standard would allow for software and peripheral compatibility and is referred to as MSX. It requires a Z80 based CPU, the TI-9918 graphics controller, the General Instruments sound chip, 64k of RAM, 32k of ROM (containing Microsoft Basic and a minimal operating system), a quadrature joystick and an NEC cassette interface.

The companies agreeing to the MSX standard include Canon, Fujitsu, General Corp, Hitachi, Mitsubishi, Pioneer, Sony, Toshiba, Sanyo and Matsushita. The one US company is Spectravideo. Digital Research, developer of CP/M, has also stated that it is developing a standard.

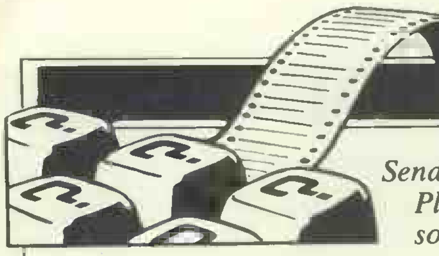
Bad times hits PC business

Texas Instruments has disclosed that as yet it has never made a profit in the personal computer business. This follows a similar statement made by Atari earlier this year. Actually TI has never been successful in consumer electronics. Its efforts in digital watches and calculators were also serious disappointments.

Atari, whose market share of the game business has slipped from 80 per cent to about 40 per cent and who at one time was number 1 in the personal computer business and is now in third or fourth place, is going through a 'consolidation' and 'reorganisation'. During the past year it has eliminated some 2000 jobs in the US and shifted manufacturing to the Far East, Puerto Rico and Ireland.

TI ordered a two-week 'vacation' for all its consumer group employees, has closed all of its retail stores and is expected to have a new round of price cuts (which intensify the current price war even further). It is estimated that TI currently

GOTO page 227



COMPUTER ANSWERS

Send your queries to Len Warner, 62 Beech Road, St Albans, Herts. Please note that Len cannot answer questions on an individual basis, so please don't send an SAE with your query.

Bit stik

In my small company, I am responsible for designing new products and bringing them into production. This calls for lots of drawings and frequent amendments, and some 3D projections to give a better idea of the end product. Most of the drawings are not complicated and would fit A4 paper.

Our work would be speeded up if it were handled by a computer, VDU and plotter, but all the equipment I have seen is priced at £25,000 upwards. Has the micro brought this facility within the reach of the very small engineering company?
L Weatherill, Wincanton

The Robo Bit Stik, reviewed in *PCW* Nov 82, page 144, seems to fit your needs with a starting price below £5,000. (Robocom, 01-263 8585). It comprises an Apple II computer with disk drives, RGB colour card and colour monitor, A4 plotter, and the Bit Stik joystick and its plotter software. Larger plotters put the cost up, from A3 at £6,600 to AO at £18,250. I tried it at a trade show earlier this year and was impressed by the ease of use of the joystick, the plotting functions available, and by the range of example drawings, including circuit schematics, engineering drawings, architectural plans and 3D drawings.
Len Warner

PC 1500 assembler

I have a Sharp PC 1500 pocket computer, but I have been unable to obtain any information on its machine code (so that I may program in machine code) and detailed description of its system and hardware configuration (for expansion purposes). Could you recommend any sources of suitable information? Do you know it there is a PC 1500 user group?
W Hedley, Benwell, Newcastle

You have probably noticed that the Tandy PC-2 and the Sharp are the same machine. Tandy has just introduced its magazine *TRS-80 Microcomputer News* to the UK, and the March issue contains the first in a series of articles by Bruce Elliott on PC-2 Assembly Language. The mag should be available from the several Tandy stores in your area, though you may have to order it. In case you miss it, I have sent you a copy of the first article, which gives a detailed architecture and memory map. I have not been able to find a user group, so if there is one, will it please get in touch.
Len Warner

Dual mode modem

I need a modem for the BBC micro with the following features:
— facility to order components by phone;
— access Micronet 800 or Prestel;
— talk to other computers; and
— have auto dialling.
R Morgan-Owen, Godalming

Prestel and Micronet need a V23 modem running at 1200/75 baud, and other dial up services need a V21 modem at 300 baud, as will most micros other than the Beebon, since few can manage asymmetric data rates. Modem pricing is rather strange, since just as the market has started to escape the GPO monopoly, it has received an added push from new, do-everything single chip modems. The cheapest dual standard modem I know is the DSL 2123 from DaComm Systems in Milton Keynes (0908 676797), at about £320 + VAT, but auto-dial will cost a lot extra, and you still have to join Micronet. Your lowest cost option is probably to join Micronet, and get the Prism acoustic coupler for £60, then find a cheap originate/answer 300 baud modem. There are some available surplus, eg, from Display Electronics. The Prism hard wired modem may be another answer, when it becomes available. Perhaps a reader knows a better solution?
Len Warner

ZX81 reset

I have put a RESET button on my ZX81 which connects to the internal Z80 chip and performs its function by grounding the RESET line. Unfortunately when it is used it resets the computer alright but I cannot get my program back afterwards.

I am also writing my own language in machine code. I have become stuck because of the difficulty of locating specific routines in the Sinclair ROM.
Paul Hills, Launceston, Cornwall

Grounding the RESET line forces the program counter back to zero, hence the routine at this address, the ZX81 initialisation routine in ROM, is executed. Part of its function is to find out the amount of RAM available by writing a specific value into each location and trying to read it back, which wipes out any program present. Also, if you are using dynamic RAM, as in most expansion RAM packs, the loss of the Z80 REFRESH signal during reset will wipe the memory anyway.

The ZX81 monitor is decoded and commented in Dr Ian Logan's books published by Melbourne House which are widely available.
James Walsh

Micro upgrade choice

I am selling my ZX81 to buy a more expensive machine. There are quite a few computers on the market now and they all appear to have the same features. I want to know which in your mind is the best that has high-res graphics, colour, sound and costs £180 or less.
M A Lamb, Sheffield

This is one of those unanswerable questions, like 'Mummy, why is May?', because it all depends on how you want to use it. Some machines, like the Atari 400 and the TI 99/4, have high power hardware at knock-down prices — but you may find cartridge software and extra peripherals rather expensive. The Spectrum has the minimum of hardware supporting its functions, so moving graphics will be slow and sound weak — but Spectrum software is very cheap and wide ranging, and add-on hardware is cheap, though limited. The Commodore 64 is a bit above your price range, but has good features and expansion potential which might make it good term investment. Other micros may give good graphics but strange dialects of Basic. Fairbairn's article in the *Sunday Times Magazine,* 10 July, and your ZX81 experience could help you choose. Ease of use, software

availability and local support (like a good dealer or computer club), can be much more important than the detailed differences between machines.
Len Warner

Corvus mirror

I have seen in an advert a computer using VCR as well as a hard disk. Can I do this on my BBC B? I have a VCR, would there be any extra expense?
Danny King, Wellingborough

You have seen the Corvus Mirror from Keen Computers. This allows you to dump a large volume of data onto a video cassette. It is not a random access device like a disk. It is used to make a 'back up' copy of a hard disk so that if some hardware, software or operator error ruins your megabytes of vital files, you can recover by copying the back up to the hard disk. The VCR is used because it is cheaper than other high capacity storage, but since computer data is very different from TV signals and the error rate on video tapes is rather high, special circuits are needed to process the data. So it is neither suitable nor cheap as a primary file store on a micro, and you will have to save for a floppy disk drive.
Len Warner

Spectrum prestel display

Uncle Sir Clive Sinclair's puffware for the ZX Spectrum states that user software can generate a teletext compatible screen format, ie, 40 characters (and attribute cells) per line. Can you explain how this trick is done?

Are there any books on the Spectrum that describe the operating system in sufficient detail to enable ROM routines to be used from machine code?
J Hind, South Wigston, Leics

The screen is refreshed by the Sinclair ULA chip from a dedicated memory area which is divided into two parts. In the Display File each dot in the picture is set to paper or ink by one bit. In the Attributes each 8 × 8 dot character cell is given flashing, brightness, paper and ink colour attributes by one byte. The characters diplayed are formed by software and their dot pattern stored in the Display File, so a different character generator routine could create the six dot wide Prestel characters and fit 40 per line. However, the attributes are linked to the Spectrum 8 × 8 character cell so the colouring of a Prestel frame could only be approximate.

Dr Logan's *Complete Spectral ROM Disassembly* gives a very detailed dissection of the Sinclair firmware. Its only slight problem is that the assembly language routines do not include assembled machine code values, so it is somewhat difficult to find the address of a routine in ROM.

Alternatively, *Spectral ROM Decoded* is an annotated disassembly listing at £4.90 inc postage from MOI, 1 Francis Avenue, St Albans, Herts (tel 52801).

Graphics micro

I would like to buy a computer in the £200-£600 price range with high resolution graphics and, very important, a high standard of chess program.
Tim Howard, Wimborne, Dorset

Probably the best computer in this price range is the BBC Model B micro. This has very high resolution graphics (640 × 256 max), as well as colour modes. This will cost £399, which leaves you with some spare cash preferably to spend on a colour monitor, as a colour TV cannot satisfactorily display the highest resolution on the Beeb. It will also improve the quality of the colour.

As far as chess programs are concerned, Micropower and Bug Byte both do programs which are worth looking at.
James Walsh

Digital electronics

I have been reading technical specifications of integrated circuits from several manufacturers and I have come across two terms I do not understand. They are 'daisy-chain priority mechanism' and 'multiplexed decoding'. Can you explain?
Paul Hills, Launceston

Can you suggest any books on digital electronics? I would like to know more about the working of static and dynamic RAM, address decoding, latches, etc, with a view to extending my Acorn Atom.
R J Middleton, Havant

Priority has its usual meaning. It is the predefined sequence in which several simultaneous requests will be granted a resource. Daisy-chaining is often used to fix I/O interrupt priority, determining which device gets first attention from the CPU. An interrupt enable control wire threads each device in turn. If a device does not need attention, it passes the enable signal down the chain. If it does, and it has the enable signal in, it causes a CPU interrupt and does not pass the enable signal on. So the request nearest the top gets service.

Multiplexing is a way of sharing one set of wires between several sets of signals. Control signals say which kind of information is present at each instant. Typically, the same bus lines are used for memory addresses and for data transfer. An address value is sent first, to select a memory location, then the data value is transferred.

Adam Osborne's *An Introduction to Microcomputers Volume 1 Basic Concepts*, McGraw £9.95, is a clear, well illustrated and well indexed source for the digital techniques used in micros.
Len Warner

"This is our range of very personal computers . . ."

Warner's corner

Disk Directory (June) If you are struggling to understand CP/M disk space allocation, you will find Jack Dennon's *CP/M Revealed* (Heyden, £13.95) enlightening, especially if you have tried the Digital Research non-explanation in the operating system manual. It includes several assembler programs to examine the disk, including one to recover erased files. If you can't get it locally, Watford Technical Books (0923 23324) can supply it, and most of the others mentioned for £1 p&p (50p each extra book). Phone them for a selective book list for your micro.

Trackballs (July) Thanks to readers Gabriel, Repton, Withers and others for confirming my first idea — in short, trackball friction drives two shafts at right angles, each shaft carries a slotted disk. Each motion sensed by two light beams, giving quadrature signals to show direction and magnitude.

Oops Apologies to Commodore owners for 'Edge wear' (May), because their edge connector is the American .156in pitch. They could make up an extender with a .156in edge connector and a piece of Vector prototype board. Make sure there is no short to the metal case! Time data has discontinued the 0.1in edge plug, but it is still available from RS Components.

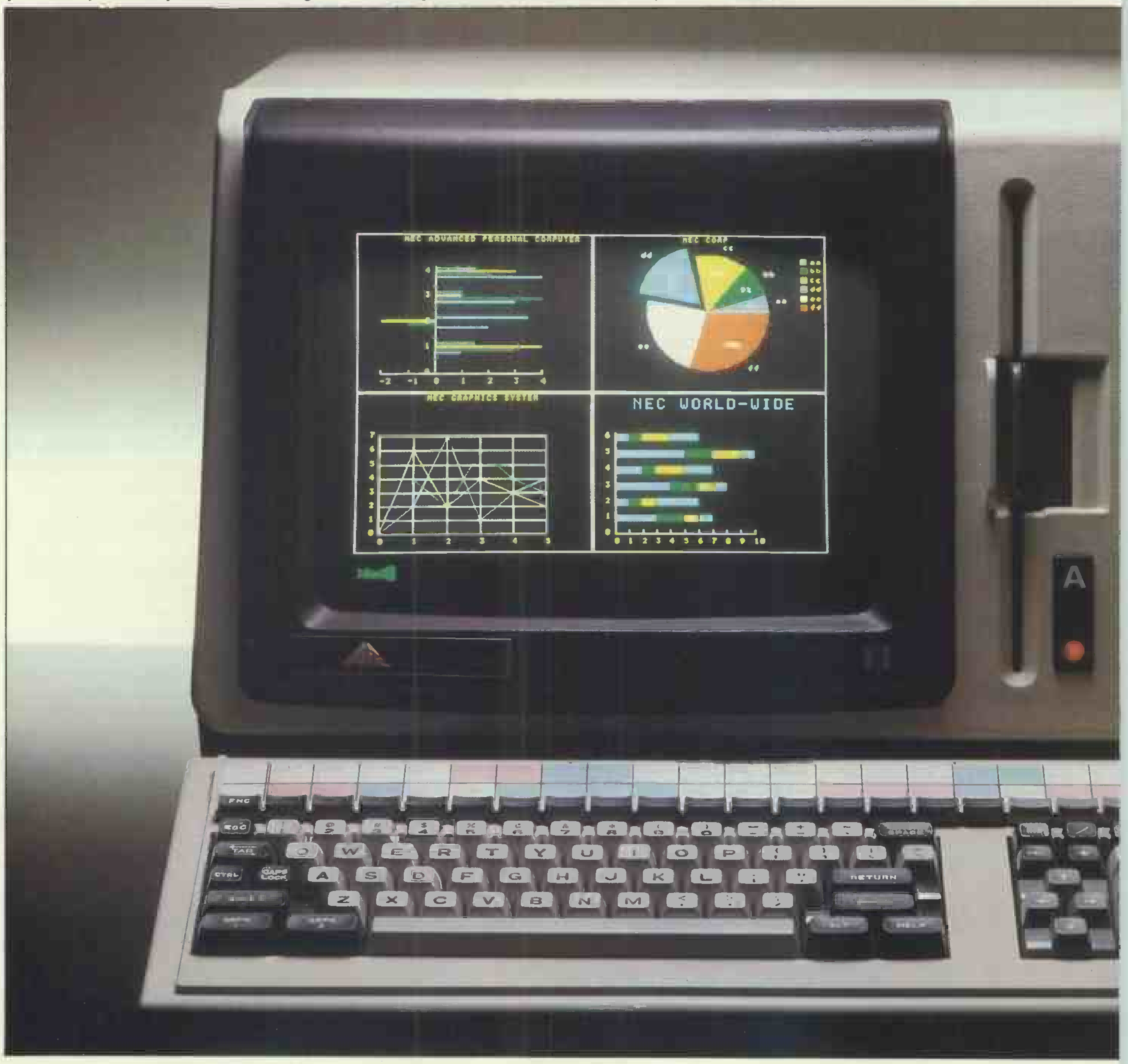
BENCHTEST

NEC APC

David Tebbutt gets the opportunity to scrutinise another Oriental offering in the micro stakes and puts NEC's recently launched APC under the spotlight.

Whenever a business microcomputer is delivered for Benchtesting, my first thoughts are: 'What on earth am I going to say about yet another twin disk, separate keyboard, standard software machine?' But each system tends to have its own personality, its own peculiar blend of good and bad points, and it's this of course that makes Benchtests a worthwhile exercise.

When I first laid my hands on the NEC APC, I thought I'd never get to like it. It was odd really, because the machine looks quite nice and it is certainly very well made. Getting it out of the box and onto my desk



The keyboard is divided into three clearly defined areas.

The machine looks nice and is very well made.

was pretty strenuous since it weighs 75 pounds (80 if you include the keyboard). Perhaps that coloured my initial feelings or perhaps it was the fact that it contains two 8in disk drives, just when I was getting used to 5¼in and 3½in drives. There's nothing wrong with large disks; in fact they hold up to 1Mbyte of data each, which makes for a very healthy amount of information and programs at your fingertips. Perhaps it was the fact that I could see so much potential in the machine but knew I'd have to plough through seven or eight manuals to master its innermost secrets. Anyway, whatever it was, it is very hard for me to pinpoint now because I'm at the other end of the project looking back and my feelings are a lot more positive.

As you might expect from a large Japanese company, the product is beautifully made and contains a number of thoughtful touches: the top, sides and back are in a one piece moulding which can be removed simply by slackening two screws; the printed circuit boards are held in a five-slot card cage and each board has removal levers attached to its top edge; and the keyboard contains back tab and keys for switching into various graphics and character modes. My most serious complaint about the quality of the hardware is the fact that the disk drives can get quite noisy when they're very active.

> *'As you might expect from a large Japanese company, the product is beautifully made and contains a number of thoughtful touches...'*

Hardware

The casing of the APC is mainly cream with the exception of the keys on the keyboard and the screen surround, which is black. The machine has only three controls beyond the keys themselves and they are conveniently located at the front of the machine. Like the NCR I reviewed last month, the APC screen and disks overhang slightly at the front. This recess contains the brightness and volume controls as well as the on/off switch. It also provides a useful niche for the keyboard when it's not in use. The unit is extremely robust and is obviously built to last.

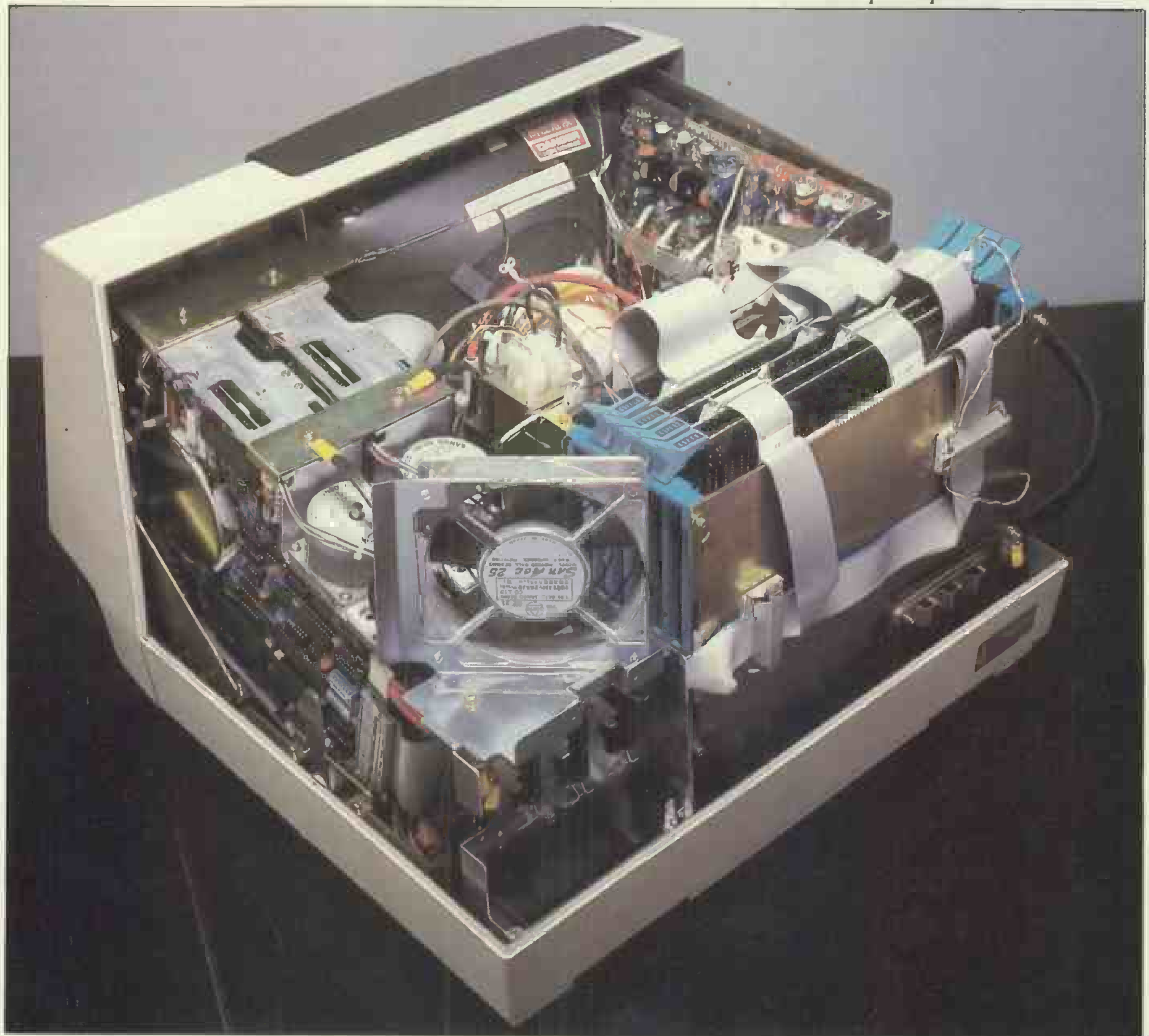
The keyboard, which lives on the end of a 5ft coiled lead, is divided into three areas. The keys of the qwerty part are all light grey apart from the controls (shift, caps lock, etc.) which are black. The numeric pad blends light grey and black in a similar way but it also has four cursor control keys in dark grey. These are positioned in a North, South, East and West arrangement. At the top of the keyboard are 22 function keys together with their own shift called FNC giving 44 functions altogether. All but six of these are user-definable and can contain multi-line instructions (eg, 01,ERA *.BAK^DIR^ would tell the key definition utility to encode function key one with the commands to erase backup files then list the new directory). For some reason that I've not yet fathomed out, the six protected keys issue the string [0 followed by one of the letters O to Z, depending on which key is pressed. The function keys have no positional relevance, they are simply stretched across the top of the keyboard, but they are accompanied by a channel which will hold a template of the available functions.

The machine lent to us for the Benchtest incorporated a colour monitor, two 8in vertically mounted, slim-line disk drives, 256k of memory, a colour graphics board and a peripheral controller which I didn't use. People with no use for colour may buy a monochrome version of the machine tested. It is also possible to buy a single disk drive, monochrome system but that sort of configuration is more likely when the APC is being used simply as a terminal to a host machine. Hard disks of 10 or 20 Mbytes are to be marketed although I think it is probably too early to expect them in the UK. The peripheral controller was, I presume, to drive a parallel printer. Since NEC is a printer manufacturer, you won't be surprised to learn that the company recommends the use of its printers with this system. The manuals pretty well state that it's no use looking to NEC for help if other printers don't work with the APC.

The 12in screen comprises 25 lines of 80 characters or 640×475 pixels. The graphics boards each contain their own RAM which means that both graphics and text may be superimposed on each other. The APC can display around 500 different characters and if that's not enough, it also allows you to define an additional 256 characters of your own. Rummaging through the APC standard character set, I came across a clock face, a little man, a superscripted '2', a floppy disk and a few fractions. Each character position on the screen comprises 8×19 pixels and within this you can define your own characters up to 8×16. This means that you will find it impossible to define characters which can join up vertically but NEC has anticipated that need by offering a fairly wide range of joined-up line drawing characters of its own. Normal characters occupy an area 7 pixels by 11. The utility which helps you design and store your own character sets is mildly irritating because you need to hold the shift key down all the time you're using it. The programmer decided that pixels should be set by an asterisk and unset by the space bar. Asterisk on the APC is above the number 8. Ho hum. This whole area became a source of frustration to me because, despite what it says in the brochures, I could not get the ALT key to access the user-defined graphics. Either I had a duff keyboard (tut, tut) or the brochure's got it wrong (tut, tut again). I could print 'my' characters one at a time by prefixing each with ESC, (and 1 but that didn't seem too friendly to me). Not only that, but this arcane information came from a different manual to the one which explained how to define the characters in the first place. A few black marks there I think, NEC. The dot matrix printers supplied by NEC will print your own design graphics but to a resolution of 8×8.

Colour can be changed using another escape sequence, so, for example, if you prefer magenta listings simply enter ESC, [, value and m where value relates to the colour required. You may choose from red, green, blue, yellow, magenta, cyan, white and black. If you need to use the machine for plotting then you will be pleased to learn that pixels may be coloured individually which makes for extremely high quality graphics. Although the review machine had the graphics board, I didn't have the software tools to develop any pixel graphics programs. I did, however, manage to get hold of a demon-

Keyboard connector, comms and centronics printer ports.



The moulding can be simply removed to reveal the printed circuit boards.

CBasic graphics extensions

BEAM	Pen on/off
BOUNDS	Set aspect ratio
CHARACTER HEIGHT	As % of Y length
CLEAR	Clear screen + pen off
CLIP	Prevent drawing exceeding boundary
COLOR	Set foreground colour
COLOR COUNT	Assign number of colours to variable
DEVICE	Assign physical device limits to variables
GRAPHIC CLOSE	Close current device
GRAPHIC INPUT	Accept X, Y coordinates from cursor position
GRAPHIC OPEN	Initialise graphics and set output device
GRAPHIC PRINT	Alphanumeric string at given point
JUSTIFY	Position text
LINE STYLE	Solid, dashed, dotted, dashed-dotted
MARKER HEIGHT	Size of special markers
MARKER TYPE	Symbols
MATFILL	Draw filled polygon from array of coordinates
MATMARKER	Draw markers according to array of coordinates
MATPLOT	Connect points defined by array of coordinates
PLOT	Connect series of coordinate pairs together
POSITION	Set beam position or assign it to a variable
STYLE COUNT	Assign number of styles to a variable
TEXT ANGLE	Approximate angle for text printing
VIEWPORT	Define window boundaries
WINDOW	Define scale of X & Y axes

stration suite and check that the facilities are as good as they sound. Later in the Benchtest I will introduce you to the software NEC will be providing for this type of work. Monochrome graphics needs its own 128k of RAM while colour needs 384k. This memory is mounted on the same board as the graphics circuitry and doesn't eat into the user's 'normal' memory.

Now here's a thing which baffles me. Programmers just seem to love getting tunes out of machines which simply weren't designed to play music. It's happened again. If you want a ghastly rendering of some Bach piece (I couldn't hazard a guess at which) then you *must* listen to it on the APC. It's truly awful. It does illustrate the fact that the machine can cope with a couple of octaves, three different tones, different volumes and a range of notes from a 32nd to a whole note. In addition it has four tempos. I can only conclude from this obsession with music on business computers that the manufacturers think that speech synthesis is on the cards in the reasonably near future.

The APC contains three types of memory: RAM, ROM and CMOS RAM which is battery backed. This means that for at least two years after switching off the APC, it will still remember the information you put into the 4k of CMOS RAM. The only evidence I had of this in action was that the APC did keep remarkably accurate time and it always knew the date. I did set the date to February 28th 1984 and it rather foolishly took me to March 1st at midnight. One of the brochures told me that it could be used to remember things like function key assignments. I scoured the manuals but couldn't find out how. It certainly didn't do it automatically. The 8k ROM contains the bootstrap and self testing programs. The machine comes with 128k (16×64k×1bit) RAM which can be extended to 256k. You don't need any extra RAM for graphics but you can save yourself an expansion slot by having 128k of 'normal' RAM tucked away on your graphics board. The APC has a theoretical memory addressing capability of 1 Mbyte so it will be interesting to see if anything is developed to soak up this potential.

The things which irritated me in this section of the Benchtest were really firmware problems. The hardware itself is quite excellent. The four-layer PCBs look just, er would you believe, beautiful? You can buy extra PCBs to handle communications and a 32-bit floating point mathematics processor which offers speed increases of 25 to 100 times over mathematics performed on the 8086. This is clearly only useful in processor bound applications with a high mathematical content.

Software

I've already mentioned a few bits and pieces of firmware and system software. Here are a few more interesting facilities. The speed at which the screen displays can be varied by hitting CTL plus a number key. If you really want to screw up somebody's demonstration, try setting this value to '0' when they're not looking. You can set a key click on or off and, unlike some machines I know, the APC has the sense not to keep hooting when characters are being repeated. Each character can possess any combination of the following attributes: overline, underline, inverse, strike through, highlight and blinking in addition to one of the colours mentioned earlier. General display functions comply with ANSI standards while direct cursor addressing can be handled by ANSI or ADM-3a escape sequences.

CP/M-80 allows you to stop and start a display by using CTRL-S, you can still do it with the APC but it also has a BREAK/STOP key which does the same thing. Similarly printing can be toggled on and off using the PRINT key. CTRL-P still does that job as well. Again, unlike many systems, if the printer is not on or not attached, the APC invites you to do something about it. The system used to have a reset button at the back of the keyboard. I suspect that this was quite often pressed in error because the system can only be reset now by pressing FNC, CTRL and BREAK all at the same time. At least you can't possibly do that accidentally. You can even power off through software. APC supply a program called 'POW' which does the job for you. This is quite useful if you leave the machine running a batch stream and want it to close down when the work is complete.

This certainly beats the way one of my friends handled a similar problem in the late sixties. He was running a system which was notoriously slow because it used paper tape as the main means of input and output. As the workload increased, he spent more and more time waiting for jobs to finish in the evening so that he could switch the machine off and go down the pub. This particular machine used a workstation with a moving carriage, rather like a typewriter, except it was about three times as long and ten times as heavy. He realised that this thing could build up quite a velocity if CR was hit when the carriage was positioned at the extreme right hand end. He drilled a hole in the on/off switch at the wall and programmed a CR as the last instruction of all his long-running programs. He fixed a hook in the ceiling and tied a piece of string to the switch, looped it over the hook and tied the other end to the platen knob on the right hand end of the carriage. At the end of the job, the carriage would whizz across, snatch the string just before the end of its travel and off would go the main switch. I seem to remember he still claimed the overtime for his late shift. Ah well, back to the APC.

The screen display is held in a 4k buffer so you can use CTRL and up arrow to scroll back up to look at things that have disappeared off the top of the screen. You get about one screen's worth of invisible information even if there's only one character per line. With a graphics chip, the screen acts as a window on an area 1024×1024 pixels and you can (according to the documentation) pan over this area which sounds like a lot of fun. Other things mentioned in the documentation which were impossible to test were zooming and partitioning. Apparently you can define windows in which all activity takes place without disturbing its surroundings.

I did get to read the CBasic manual with

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the graphics extensions which are designed to work with Digital Research's GSX. I got the right manual but the wrong version of CBasic because it flagged all my graphics instructions as errors. The extra commands are boxed elsewhere in this Benchtest but basically (ugh! Geddit?) they allow you to define graphics windows, set the scale, plot, fill, set colours, define the angle at which character strings are to be printed and define the line drawing style to be used. There are others but that gives you the general idea. GSX is an extension to CP/M-86 and it sets up a thing called a GIOS to handle all graphics calls from application programs. It looks a darned useful extension to CP/M-86 and not at all difficult to use.

Talking of CBasic (well, I was just now), I was astonished to see how slow it is. CBasic is compiled which means that it should run faster than interpreted Basics. Well, this one didn't. Apart from Benchmark 7, it was slower than interpreted MBasic on the IBM, for example. CBasic, incidentally, doesn't like the word END to occur before the end of a program listing. I substituted the word STOP and the Benchmarks ran just fine. I won't tell you how many days it took me to figure out what was wrong but future Benchtesters please note. Don't get too upset by different Benchmark timings, they are only massively relevant if your application is largely processor-bound. Most systems spend more time waiting for operators to do something than they lose by slow program execution.

Users of CP/M will feel right at home with CP/M-86. It has got some interesting extras but it is still the same old CP/M that we know and love. Of course, people who have never heard of CP/M will probably find it a bit of a pain. I mean, how on earth is PIP supposed to mean anything to an accountant? On the other hand, the addition of a command called HELP is a jolly good idea. This lets you display the contents of helpful information files on disk. It's just as well it's there because our accountant friend can then look up the word PIP which happens to be explained reasonably well. I can't help feeling that it would have been better to have made CP/M-86 more friendly. The KEY command allows you to define the role of each function key using up to 15 letters. Escape sequences can be encoded so I set a number of keys up to provide me with the various colours. I could then Benchtest away merrily in a colour to suit my mood. Right now it's yellow — what do you make of that? I forgot to mention earlier that there's even a colour called secret. I suppose it's quite useful for people having to type in passwords. The function keys are a real bonus when you have to perform repetitive tasks frequently. I set up one to compile programs, one to link them and another to execute them. It meant that I could perform each function with just three keystrokes. Not bad, huh?

Application software

I was supplied with three packages — a word processor, a mailing list manager and a spreadsheet system. I gave the word processor a try since it was in the APC livery and it was fine. Nothing about it made me want to shout its praises from the rooftops. On the other hand I have no desire to rubbish it either. It was adequate, usable and seemingly reliable. It had the odd idiosyncrasy such as having to enter numbers for menu options. Someone please tell me what's wrong with mnemonics? The colour scheme was a little garish but it was easy to use and reasonably intuitive. The manual was very good.

I gave the other two packages a cursory look and they seemed okay too, although I must say that Comshare's documentation of MasterPlanner was a dog compared with NEC's efforts. And NEC being Japanese too.

I'm pleased to see that my favourite word processor, Spellbinder, is available on the APC. UK publisher, Systematics, has done well to provide the approved accounting packages and 'good old boy', George Tate, has sneaked in again with his DBase II. MPI, Tamsys and Xitan are the people to ask about packages available for the APC. Their lists are probably growing daily. (See the separate box for prices of the NEC approved packages.) Because the APC is a CP/M-86 system, I'm sure that most software packages will migrate onto it before very long. It's not as if NEC has gone for some weirdo processor chip/operating system combination.

ASYNC and BISYNC packages means that your communications requirements are pretty well taken care of. You can let the APC pretend to be an IBM work station by using the 3270,3780 or HASP versions of BISYNC. Alternatively you could use ASYNC to let the APC think it's an ordinary terminal attached to another computer, an APC perhaps. Data can be handled in binary or ASCII format and incoming data can be stored on to the APC's disk.

Documentation

I was given seven official manuals, two unofficial ones and the MasterPlanner manual. The NEC manuals were all bound in plastic ring binders which were textured to make them feel like suede. I didn't like the feel, I quite liked the manuals though. It's amazing what a clear layout and typesetting does for one's attitudes to documentation. Apart from the Word Processor and Mailing List Manager, both called Benchmark by the way, I had two CP/M manuals — one for programmers and the other for users, an operator's guide, a maintenance guide and a system reference guide.

The operator's guide simply tells how to unpack, assemble and operate the equipment from a physical point of view. The system reference guide isn't a lot of use unless you happen to be an engineer because it's jam-packed with circuit diagrams and timing charts. The maintenance guide is in the same category as the last one which leaves us with the CP/M guides and the application guides. I can't help feeling that there should be something deeper than the operator's guide but less complex than the CP/M guides. If there isn't then I think there will be an awful lot of frustrated users out there who know they're sitting on something good but can't put their fingers on the information they need to make the thing give of its best.

Don't get me wrong, all the manuals are good but there really is something missing. I had to hunt around for the information I needed and most users just wouldn't know where to start looking, or even what they were looking for.

Prices

The machine I tested cost over £4000 which sounds like a lot of money to me. You would have to buy programs, a cable and printer on top of that so you are starting to talk about £5–6k for a complete system. I think it would be fair to compare the product with a quality motor car — if you want something that is undeniably well made and will therefore probably be reliable, then this could be a system to put on your short list. If you can afford to lose a bit of computer time here and there then you may be able to find similar facilities at a lower price. If you can live without colour for a while, this does knock £600 off the price. Whatever you do, don't buy a single drive system if you are planning to use it as

GOTO page 227

Technical specifications

Processor	8086, 5MHz
Memory	8k ROM, 4k CMOS, 128k RAM, additional 128k option
Disks	8in double sided, double density 1Mbyte each
I/O	RS232C up to 19,200 baud
Screen	12in colour or monochrome 25 lines × 80 chars, 640 × 475 pixels
Keyboard	109 keys (22 function, 25 numeric pad)
Language	CBasic
Graphics	Screen is a window (640 × 475) on 1024 × 1024
Sound	2 octaves 4 speeds 32nd to whole note 3 tones

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SCREENPLAY

Steve Mann tries out some games for the Spectrum, VIC-20 and TI-99/4A.

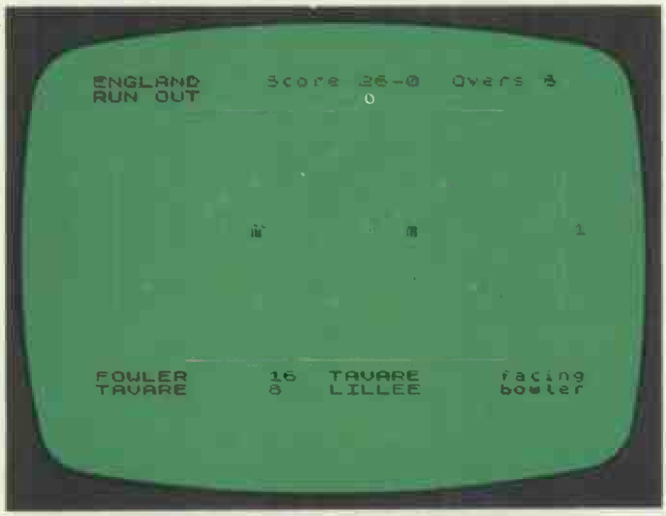
Buyers of the new Pete Shelley album (or cassette) 'XL1' may be puzzled by the hideous screeching at the end of side two. 48k Spectrum owners, however, can connect their computer to the record player and load a set of programs which simply display the lyrics of each track in time with the music while a sort of mini-light-show pulses in sync. Another performer, Chris Sievey, has a single, 'Camouflage', with three games for the ZX81 on the B-side. And a band called Mainframe claims to have started the whole thing with a single, 'Radio', released in October 1982, the flipside of which featured a 'sound-to-light' program for the Apple II.

The music business appears to be cashing in on the computer software boom with a vengeance: walk into the Virgin Mega store in London's Oxford Street and you'll be confronted by a whole rack of games software — not just Virgin's own brand but material from Quicksilva, Imagine, etc.

Software seems to be cropping up in the most unlikely places — there was a report in the press recently of a fish and chip shop owner in Richmond who dishes up programs for the Spectrum, ZX81 and VIC-20 with the rock salmon, thereby giving rise to dreadful puns like 'fish and microchips'. This new, wide availability can only be good for the micro fraternity which, until fairly recently, was forced to rely on mail order with all its attendant late deliveries and disappointment when the game on arrival bears little resemblance to the glowing ad copy. Then there's the financial aspect — three games on the backside of a £1.50 single seems like a good deal to me; even if the games aren't up to much, at least you've got a record to play.

It seems that the relationship between the computer industry and the music business can only get closer — Virgin Games, for instance, already features tracks by Steve Hillage on all its cassettes — and, let's face it, it will be extremely handy to be able to pop into your local record store for your new software. Indeed, games packaging is becoming more showbiz-oriented with writers getting credits — and in some cases their photos — on cassette inserts and, of course, the Top Ten charts that are published in various magazines, listing the best-selling programs for all the more popular micros. Next thing will probably be fan clubs for software writers . . .

Anyway, on to this month's games — all of which are basic no-frills models with nary a guitar in sight . . . One interesting-looking cassette which I hoped to include was Zzoom from Imagine. This is a beautifully designed arcade-style game with excellent graphics and overtones of Defender (which can't be bad). Unfortunately my pre-production copy had a tendency to crash without provocation so I'll have to return to Zzoom in a future issue. So this month we've got cassettes for the Spectrum and VIC-20 and, by way of a change, a couple of plug-in cartridges for the TI-99/4A. The prices given for the two TI games are Texas's recommended figures. In fact, several shops retail them at about a fiver cheaper, which is still outrageously expensive.



TEST MATCH

Computer: 48k Spectrum
Supplier: Computer Rentals
Price: £4.95

In Test Match you are given the opportunity to play a full five-day cricket match — or a one-day limited overs contest — between two teams of your choice.

On loading, you are asked if you would like to choose your own teams or use the two already in memory.

After the teams have been selected, the computer decides which team has won the toss, and they are given the opportunity to bat or field. Each team may have a maximum of six bowlers, who must be chosen at the beginning and who are ranked in order — your first-choice bowler is more likely to take wickets than number six, although any bowler can be successful. To guard against over-bowling your first choices, bowlers one to four lose some of their efficiency with every five overs they bowl.

Play then continues with the opening pair of batsmen facing the attack. The result of each ball bowled is determined by a mathematical formula involving a random number between 1 and 246, a constant (5), the batsman's number, the bowler's number, the number of runs scored by the batsman and the number of overs bowled by the bowler. The instructions say that you can work out your best chance of success with any particular bowler by a bit of calculation: this raises visions of Bob Willis jotting figures in a notebook to decide whether Botham or Dilley should bowl — hardly cricket! I just trusted to luck.

The graphics consist of a green playing surface with stick figures representing the fielding team and batsmen. Each ball bowled can have the following results: it can go straight to the wicket-keeper; it can be hit for a boundary; it can take a wicket — bowled, caught, lbw or stumped — it can go for 'extras' or it can be hit into an open space. If the latter, you have to decide whether the batsmen should run or not. Fielders change colour and shape if the ball has gone directly to them. If the ball splits the field, one fielder changes colour to denote that this is the one who will retrieve the ball. Judging whether a run is possible is perhaps the hardest part of this game — one of my early innings included seven run-outs. One particularly realistic feature is the number of extras — 40 or 50 in an innings, which is pretty much the same as in a modern match. At the end of each over you have the choice of declaring the innings closed or carrying on with a new bowler.

Each side has two innings and the game continues until one emerges triumphant or 400 overs have been bowled, in which case the game is considered a draw. The limited-over game is exactly the same, except that each side has one innings only and this is limited to 40, 50 or 55 overs. In limited-over cricket the batsmen also score considerably faster.

This is hardly a serious tactical game — strategy is less important than luck. I must admit that I found Test Match a lot of fun — but then I'm a cricket fanatic. I suspect that non-cricket freaks may well be somewhat baffled but anyone who understands the game will find much to enjoy here.

PRESENTATION
USE OF GRAPHICS
ADDICTIVE QUALITY
VALUE FOR MONEY

PARSEC

Computer: TI-99/4A
Supplier: Texas Instruments
Price: £31.95

Until this month I had no experience of using the TI-99/4A, and I must admit that I was very pleasantly surprised. Parsec is a shoot-em-up space game and shows off the TI's graphics and sound facilities admirably.

Loading the game is simplicity itself — you simply slide the program module into its slot at the right of the console, press a button and you're instantly faced with a menu, enabling you to choose TI Basic or the chosen game.

In this game you are at the controls of a spaceship, the eponymous Parsec. You are faced with waves of attack from seven different types of alien craft; there is an asteroid belt through which you must blast a path; and there is a facility for refuelling by guiding your craft through a narrow tunnel. In addition, you may select one of three levels to vary the speed at which your ship moves up and down. The game may be controlled with joysticks or via the keyboard. I suspect that a joystick is necessary to achieve a really high score — I was restricted to keyboard use and found it very difficult to get past the first level.

To start the game it is necessary to press the full-stop key ('Fire' if joysticks are utilised). You are then warned that alien craft are approaching and the first of the numerous hazards start to swarm in from the right hand side of the screen. First to appear are the Swoopers, which attack from the upper right and drop down to various altitudes above the planet surface. They do not fire at you, but simply fly straight at the Parsec. They are followed by the first wave of armed opponents — the Urbites. These are larger than Swoopers and attack with twin photon cannon. They appear at the right of the screen and are extremely accurate.

Next on the scene is another group of small fighters, the Light Triangular Fighters or LTFs. Similar to Swoopers, their streamlined shape makes them a difficult target. They too simply fly straight at you. If you get past the LTFs you are met by a much more serious hazard — the Dramite cruisers. These are armed with single rapid-fire photon cannons and are exceptionally manoeuvrable. Once you have disposed of the Dramites you face the most vicious and unpredictable of your opponents — the Saucers. These have a disconcerting habit of sneaking up behind you, attempting to crash into you from the rear. If you dodge them successfully they simply reverse direction and hurtle in from in front of you. Dispose of these successfully and you are confronted by the Bynites. Similar to Urbites and Dramites, these are armed with a photon cannon that fires clusters of photon missiles. As an added hazard, it should be mentioned that if any of your ships are lost at any stage (you have five lives) you go back to the beginning of that stage. So if, for example, you destroy all of the Urbites save one and then fall victim to the last Urbite you then go back to the beginning of that stage and have to start all over again.

Once you have disposed of all the aliens you might think your troubles are over. Not so! You then have to face the hazards of the asteroid belt. You cope with this problem by simply blasting the lumps of rock out of the way. Succeed in this and the game moves up a level and the aliens start attacking again — this time they're even harder to dispose of. At any stage in the game you may be invited to refuel. This is achieved by navigating your craft through a narrow tunnel on the planet surface and is not easy — in fact I've managed it only once.

Points are scored as follows: on Level 1 Swoopers and Urbites are worth 100 points per ship, LTFs and Dramites rate 200 points each and Saucers and Bynites rack up 300 points each hit. Getting through the asteroid belt adds a further 1000. On Level 2 the aliens increase in value by 100 points each and the asteroid belt scores 2000. Level 3 adds a further 100 points per alien, with the asteroid belt worth 3000. From this point on, all values except the asteroid belt maintain these points. The asteroid belt increases in value by 500 points per level up to a maximum of 10,000. Oh, and one other point — at Level 2 you must hit each alien twice to destroy it. Level 3 and above requires three hits per alien.

All in all, this is an excellent and addictive game. I feel that joysticks are a necessity for really high scores — using the keyboard I failed to get further than the start of the second level, but then my reflexes aren't what they once were. If you have the speech module for your TI, the game will talk to you — even without speech the sound effects are just fine. If you own a TI and can afford the high price, Parsec should give you hours of fun.

PRESENTATION
USE OF GRAPHICS
ADDICTIVE QUALITY
VALUE FOR MONEY

ALPINER

Computer: TI-99/4A
Supplier: Texas Instruments
Price: £31.95

After the hustle and bustle of Parsec, Alpiner comes as a welcome relief. In this game the object is to guide a mountaineer up six of the world's tallest mountains, battling against avalanches and a somewhat weird collection of animals.

Slide the program module into its slot and you are met with a menu, detailing TI Basic and the various different versions of Alpiner (the difference is purely in the language used — you may choose any one of seven different languages). On starting the game a naggingly familiar tune begins and a representation of a mountain-climber is depicted as he stands at the foot of Mt Hood, the first on the list of six peaks to be climbed. The mountaineer is guided by using the cursor keys, and you simply start him moving upwards. At any time you may be met with a hazard — this could be a rattlesnake, a mountain lion, a rock fall or maybe a skunk.

A total of 11 objects impede your progress on each peak and these are heralded by a warning tone (if the speech module is fitted you will get a spoken warning). Your climber has some superhuman attributes — each step he takes will move him 40 metres upwards. Bumping into any obstacle, with the exception of trees, results in your Alpiner falling back two steps or more. Each step back is 46 metres. If your climber touches another obstacle while falling back, he is knocked to the base of the mountain and you lose one of your four lives. As you climb higher, the obstacles become more difficult — bears will set you back six steps, mountain lions have a penalty value of seven, bats fly out of caves and knock you down five steps, vultures drop rotten eggs on you, causing you to lose eight steps, and rams will set you back a full nine steps. The final peak, Mt Everest, features the most fearsome of all creatures — the Yeti, or Abominable Snowman. This is mounted on skis (!) and will make straight for you; one touch sends you crashing to the bottom of the mountain.

There are certain bonuses to be gained. A time recorder is constantly on screen and you are awarded a bonus on each peak if there is still time remaining. In addition, at certain times the bears, mountain lions and rams will appear with a small green target held between their paws. Touch the target without making contact with the animal that holds it and you will rack up a bonus of between 500 and 1000 points. Touch the animal, however, and you hurtle to the bottom of the mountain, losing a life.

If you climb all the mountains successfully, the whole thing starts again — but much faster and with additional hazards. This is certainly a novel game and one that makes very good use of the TI graphics. I had a lot of fun playing five or six games, but I suspect that the novelty would wear off fairly quickly. I think that this could be an ideal game for younger children who may not be clever enough to deal with all the complexities of something like Parsec.

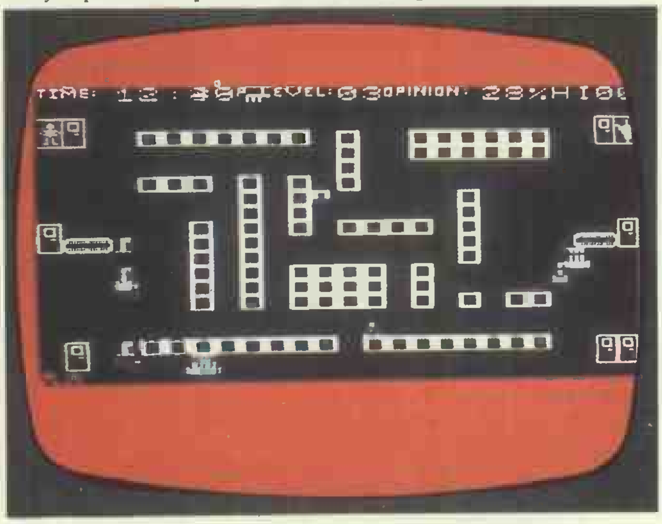
PRESENTATION
USE OF GRAPHICS
ADDICTIVE QUALITY
VALUE FOR MONEY

CATCHA SNATCHA

Computer: VIC-20 (unexpanded)
Supplier: Imagine
Price: £5.50

Catcha Snatcha is a great idea that's let down by its execution. As Barney Bootlace, your job as store detective is to prowl the shopping emporium, keeping an eye open for shoplifters, lost children and lost property. Your only aim in life is to please the store manager — his approval is shown as a percentage.

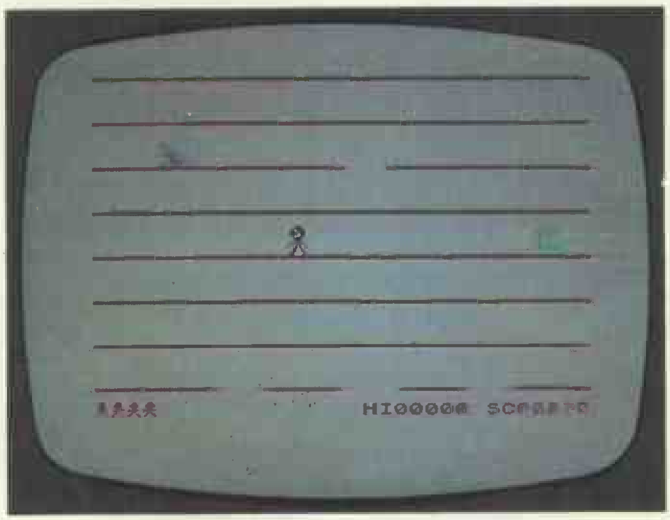
Loading the game is achieved by pressing a shift key together with Run/Stop. A floor-plan of the store is then diplayed, showing counters and shelves, a lost-property office, a couple of escalators, the manager's office, a 'lost-children' department and the main exit. Barney wanders the shop while the shoppers pile into the store. Each task that Barney carries out successfully increases his percentage rating — picking up a lost bag scores four per cent, while stopping a shoplifter gains him 20 per cent. It's interesting that saving goods scores more than saving lives — removing a parcel bomb gets him a meagre 10 per cent. A joystick is a big help in this game but, even so, it is hard to control Barney satisfactorily — he seems to move just that bit too slowly in comparison with the shoppers.



If Barney's score reaches 99 per cent he is rewarded by a move to a higher level; conversely, dropping to zero demotes him by one level. At the top of the screen is a clock — after 6pm when the store stays open for late-night shopping customers flood in and move at a speed that makes apprehending a shoplifter purely a matter of luck.

I must confess to being somewhat disappointed with this game. In general, I'm a big fan of Imagine software and the idea behind this example is excellent. But in practice it just doesn't make it: it's simply too difficult to move Barney around and I found that it palled fairly quickly. A pity — it could have been superb. Catcha Snatcha was written by Eugene Evans.

PRESENTATION
USE OF GRAPHICS
ADDICTIVE QUALITY
VALUE FOR MONEY



JUMPING JACK

Computer: 16/48k Spectrum
Supplier: Imagine
Price: £5.50

After the disappointment of Catcha Snatcha, Imagine returns to form with this little beauty for any Sinclair Spectrum. Like many a good game the concept of Jumping Jack is extremely simple — you control a matchstick man with a big nose and the object of the exercise is simply to make him jump up eight platforms to the top of the screen. The screen is divided by horizontal lines and gaps appear in these lines at intervals. When a gap appears directly above Jack, he is able to leap in the air and ascend a level.

Each set of levels negotiated brings a hazard that roams the platforms — a witch, an octopus, an axe, a train, etc, etc. In adddition, each completed screen adds a line to a limerick that begins 'Jumping Jack is quick and bold/With skill his story will unfold', and carries on in similar vein.

Jack is controlled from the keyboard, with the Symbol Shift and Space keys moving him left and right and the Caps Shift key making him spring into the air. Great care must be taken to judge his leaps exactly — the gaps move from right to left and from left to right and it is all too easy to negotiate a jump successfully and then fall straight back through a gap that is moving the other way. Falling through a gap or being hit by one of the obstacles results in Jack being temporarily stunned. While he is in this condition he is unable to negotiate any of the obstacles

—so it is all too likely that if he is stunned on the sixth level, say, he will end up falling all the way to the bottom and losing a life.

That's all there is to it—but it is impossible to describe the appeal of this game: play it once, however, and you're hooked. It's a prime example of the 'just one more go' syndrome that separates the great games from the merely enjoyable. Written by Albert Ball with graphics designed by his son Stuart, this little beauty is highly recommended to anyone who enjoys playing something that's not just a run-of-the-mill space chase computer game. Superb.

PRESENTATION
USE OF GRAPHICS
ADDICTIVE QUALITY
VALUE FOR MONEY

MISSION MERCURY

Computer: VIC-20 (unexpanded)
Supplier: Virgin Games
Price: £7.95

Virgin Games' first offering for the VIC-20 is, like the other Virgin offerings reviewed last month, very much an old standard. Mission Mercury is simply a jazzed-up Lunar Lander. The cassette insert tells you that a team of scientists has been stranded on Mercury where a freak solar flare has produced a violent burst of radiation. The scientists are feared dead when a faint message comes over the ether. You (who else?) are picked as leader of the rescue mission . . .

As an added hazard, Mercury's skies are full of asteroids and you have to pick your way through these to reach the landing pads—of which there are three. To make things just that bit harder, you can rescue only one scientist at a time, and landing on a pad renders it useless for future attempts. So you must guide your rescue shuttle down from the mother ship, pick up a scientist and return. You have to repeat the operation until the entire team is saved.

Getting your shuttle through the asteroids and onto a pad is hardly taxing—and, in fact, the pad is not destroyed if the shuttle merely lands; it is okay until the shuttle has redocked with the mother ship. This is the only difficult part of the game—it seems much harder getting back up through the asteroids than it was getting down and of course this time you have to hit a moving target. Graphics are good and the game is well designed—but the concept behind it is so old hat it makes you wonder why Virgin bothered. One unforgivable thing about this game is that nowhere on the packaging does it state that a joystick is essential. Virgin should rectify this immediately.

PRESENTATION
USE OF GRAPHICS
ADDICTIVE QUALITY
VALUE FOR MONEY

END

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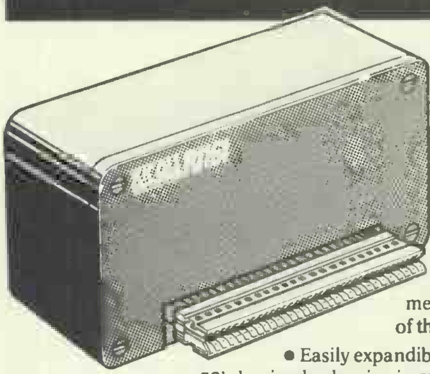

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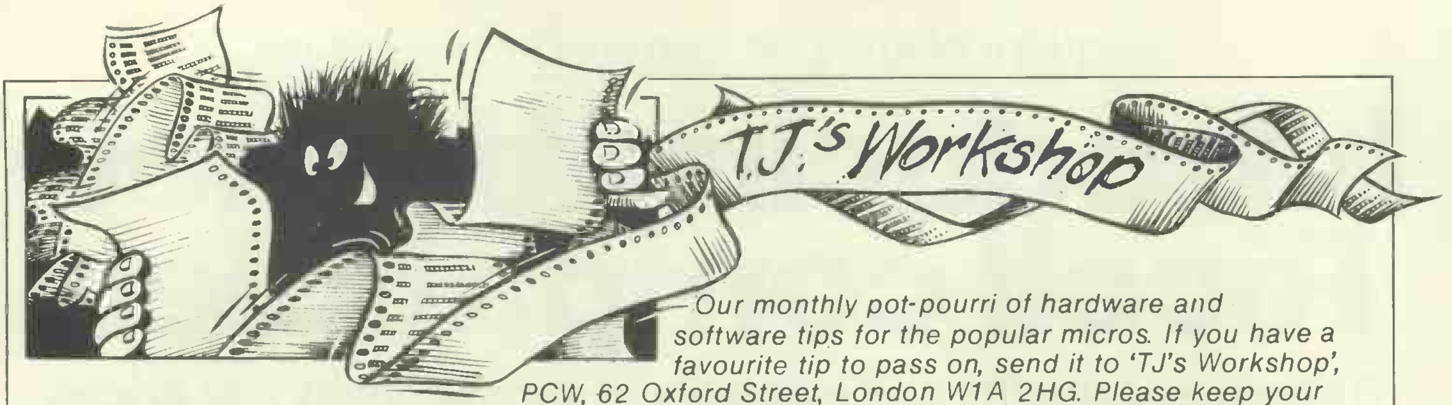
Please allow 28 days for delivery



Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', PCW, 62 Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish. PCW can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

DRAGON MERGER

The Dragon 32 provides a RENUMBER facility but no MERGE. Dragon owners might like to know that memory locations 25 and 26 contain the start of Basic address. Locations 27 and 28 contain a pointer to the start of variable storage.

The following Basic lines will move pointers above the first program:

```
10 IF PEEK(28) ≥ 2 then POKE 26,PEEK(28)–2 ELSE POKE 26,256-PEEK(28)
20 IF PEEK(28) ≥ 2 then POKE 25,PEEK(27) ELSE POKE 25,PEEK(27)–1
```

Load the second program and type POKE 25,30: POKE 26,1: CLR to complete the merge. Even if the second program has line numbers lower than those in the first it can still be renumbered correctly.

A F Allen

ACE GRAPHICS

The Jupiter Ace, like the ZX81, has pixel graphics, and an instruction PLOT which allows a program to set or clear any pixel on the screen. It would be useful, especially for games, to have some command which would test to see if a pixel is black or white. This is what this command ?PLOT does.

The command uses assembler code and, if the defining word CODE has been defined as described in the manual, can be used in the same way as a normal Forth word would be used.

The input parameters are: x-coordinate, y-coordinate, and the command returns TRUE (1) if the pixel at that position is white, and FALSE (0) if the pixel is black.

Note: any assembler code entered via CALL on the Ace enters with HL pointing at the first instruction. (CALL uses JP (HL).) This is used to construct an address in the middle of the code. This address is put into IY, so that a piece of ROM code, which exits with JP (IY), can be entered. The ROM code is part of the code for the PLOT command. It is entered with BC containing the plot type word, 0 for unplot. The coordinates are still on the stack, but PLOT will take them off the stack and use them.

On return, the following registers are useful:

A New screen character code.

E Old screen character code.

HL Screen address.

If the pixel was already black, it cannot be unplotted, and so both codes will be the same. If you want the command to leave the screen unchanged, you can put the old character back onto the screen; if you want the command to leave the pixel black, this instruction can be omitted.

Finally, the command exits via part of the ROM code for 0=. It enters with the A register zero or non-zero, and a flag value is put on the stack.

The first version of the command is the smallest possible, *but it is dangerous*! If you call it with incorrect coordinates, you get the system into such a state that the only thing you can do is switch off! You should only use this version when you are trying to squeeze a program into the available space, and you can guarantee correct parameters every time.

The second version is only eight bytes longer, but less dangerous. It will still do funny things after incorrect parameters, but it will then recover. You will find that the first thing you type in after 'ERROR 9' will do something funny, but after that, type ABORT to make sure, then you can continue as normal, and can try and correct your incorrect values.

Both versions are listed with a lot of comments, which should be omitted when typing in. All numbers are hexadecimal, which means that you should have typed in the line:

16 BASE C!

before starting to enter the command.

```
CODE ?PLOT  ( assembly code routine to test
              the state of a pixel
              input: x-coord y-coord
              returns: flag
                0: pixel was black
                1: pixel was white
              uses ROM PLOT code)
 1 C,  11 ,     ( LD   BC,0011 )  ( NB entered with HL )
 9 C,           ( ADD  HL,BC   )  ( = entry address    )
E5 C,           ( PUSH HL      )
FD C, E3 C,     ( EX   [SP],IY )  ( IY points into code )
D1 C,           ( POP  DE      )
23 C,           ( INC  HL      )
23 C,           ( INC  HL      )
73 C,           ( LD   [HL],E  )
23 C,           ( INC  HL      )  ( save IY for later )
72 C,           ( LD   [HL],D  )
48 C,           ( LD   C,B     )  ( BC = 0 meaning unplot )
C3 C, B4F ,     ( JP   B4F     )  ( enter ROM - will return
                                    by JP [IY] )
FD C, 21 C, 0 , ( LD   IY,0    )  ( restore original IY )
73 C,           ( LD   [HL],E  )  ( put original value back )
                                  ( THIS INSTRUCTION OPTIONAL )
AB C,           ( XOR  E       )  ( A = 0 if no change )
C3 C, C1F ,     ( JP   C1F     )  ( sets flag and returns )
```

Version 2 (Larger but less dangerous)

```
CODE ?PLOT  ( assembly code routine to test
              the state of a pixel
              input: x-coord y-coord
              returns: flag
                0: pixel was black
                1: pixel was white
              uses ROM PLOT code)
 1 C,  B ,      ( LD   BC,000B )  ( NB entered with HL )
 9 C,           ( ADD  HL,BC   )  ( = entry address    )
E5 C,           ( PUSH HL      )
FD C, E3 C,     ( EX   [SP],IY )  ( IY points into code )
48 C,           ( LD   C,B     )  ( BC = 0 meaning unplot )
C3 C, B4F ,     ( JP   B4F     )  ( enter ROM - will return
                                    by JP [IY] )
FD C, E1 C,     ( POP  IY      )  ( restore original IY )
73 C,           ( LD   [HL],E  )  ( put original value back )
                                  ( THIS INSTRUCTION OPTIONAL )
AB C,           ( XOR  E       )  ( A = 0 if no change )
C3 C, C1F ,     ( JP   C1F     )  ( sets flag and returns )
```

Version 1 (Small but dangerous)

(Name supplied)

T.J.'s Workshop

BBC BASIC CONVERSION

There are times when converting programs into BBC Basic when a simple, neat method of GOTOing out of FOR. . .NEXT loops would be useful. The procedure PROCFPOP allows this by effectively removing the last entry from the FOR. . .NEXT stack.

```
DEF PROCFPOP
?38=?38−15
ENDPROC
```

Location 38 holds a value that is fifteen times the number of FORs left on the stack so reducing this value by fifteen decrements the stack pointer. If you try this short program:

```
10 i=0
20 FOR j=1 TO 10
30 i=i+1:PRINT i
40 PROCFPOP:GOTO 20
50 NEXT j
```

you will find that the value of i will keep increasing. When the call to PROCFPOP is removed a 'Too many FORs' error is generated when i is ten, the maximum level of FOR loop nesting.

Some Basics, such as Atari's version, provide a 'POP' command to remove the last GOSUB from the stack in case you decide not to RETURN from a subroutine. This can be simulated in BBC Basic by the procedure:

```
DEF PROCGPOP
?37=?37−1
ENDPROC
```

This decrements the location holding the number of GOSUBs remaining on the stack and hence the stack pointer.

Unfortunately, because byte indirection is used, these procedures will not work in conjunction with a second processor. Tube compatible versions could be produced using OSWORD calls with A=5 to read from the appropriate memory locations, and A=6 to write the modified values back to memory. This program was written and tested using OS 0.1.

K Wolstenholme

COP TIPS

Here are some tips for using the second processor in the Newbrain.

In addition to the Z80A which is its main processor, the Newbrain contains a National Semiconductor COP420 4-bit processor which is used as an intelligent I/O controller and manages the keyboard, line display, and tape I/O.

Communication between the two processors is handled via two page zero locations; COPCTL and COPST. COPCTL is a command byte which is written to the COP at interrupt time, and COPST is a series of flags which tell the Z80 what the COP has done, or is doing. There is also a third location, COPBUFF, which is used as a data buffer either to or from the COP. COPCTL, COPST, and COPBUFF (the names are those used by the technical manual) are at 59, 60 and 61 respectively.

Unless tape I/O is going on, COPBUFF will normally contain the keyboard matrix value of the last key pressed. This value will remain until another key is pressed (it won't change when you release the key).

The technical manual mentions the functions of several of the commands, but is inexplicably coy about telling you what their values are . . . a deficiency which a little trial and error soon remedies.

It appears that only the top four bits of COPCTL are read by the COP, and those values for which I have been able to discover the function are as follows:

D0—do nothing (the default value, and the only one given in the technical manual).

80 — perform tape I/O (I am uncertain of the details of the operation).

F0—rescan keyboard; this will rewrite COPBUFF with the value of any key currently pressed (it will not clear it if no key is being pressed).

A0—update line display from buffer area. The line display buffer runs from 62-77 inclusive, and is in reverse order (62 is the rightmost character).

So what use is all this? Well, the 'rescan keyboard' command allows us to tell when a key is being pressed, and also when it is released, which is otherwise impossible on the Newbrain. The following Basic subroutine will return the matrix value of any key currently being held down (except STOP, REPEAT — STOP can be detected by other means, of course). If more than one key is held down at once, only one will register, exactly which depends on the key.

The value is six bits wide, the top two bits give the status of SHIFT, CONTROL and GRAPHICS; SHIFT sets bit six, CONTROL bit seven, and GRAPHIC both bits, when pressed. The value returned for each key on the keyboard follows —

```
1000 a=PEEK(61) : IF a=0 RETURN
1010 POKE 61,0 : POKE 59,240 : RETURN
```

(this returns the key in a. It clears COPBUFF and rescans the keyboard if a key is being pressed)

Key	Value	Key	Value	Key	Value	Key	Value	Key	Value
1	9	2	8	3	7	4	6	5	5
6	4	7	3	8	19	9	20	0	21
(	22	)	23	*	24	Q	14	W	13
E	12	R	11	T	10	Y	37	U	35
I	36	0	38	P	26	=	27	—	28
ESC	31	A	46	S	45	D	44	F	43
G	42	J	51	K	62	L	39	;	40
+	29	NLN	30	Z	60	X	59	C	58
V	57	B	56	N	52	M	53	,	54
	55	/	47	VTX	25	HOM	63	INS	61
SPC	15	CRL	2	CRU	50	CRD	34	CRR	18

ESC=Escape NLN=Newline
VTX=Videotext HOM=Home
INS=Insert SPC=Space
CRL=Cursor left
CRU=Cursor up
CRD=Cursor down
CRR= Cursor right.

SHIFT adds 64 to value, CONTROL adds 128, GRAPHICS adds 192.

The other COP command which I have found useful is the one to rewrite the line display. Using this the line display can be poked with values, and then updated by setting COPCTL to A0 (POKE 59,160).

The following short program demonstrates that the line display can in fact display 256 different characters, not the 64 or so stated in the manual . . . the characters are displayed 16 at a time; pressing any key shows the next group.

```
10 CLOSE #1 : OPEN #1,5
20 ba=62 : FOR i=0 TO 255 STEP 16
30 FOR j=15 TO 0 STEP −1 : POKE ba+j,i+15−j : NEXT j
40 POKE 59,160 : GET #1,a : NEXT i
50 CLOSE #1 : END
```

As you will notice, the top 128 characters are simply flashing versions of the bottom 128, and the 'new' characters are mostly pretty weird and wonderful . . .

I have written a game using the line display only using some of the new 'graphics' (a world first?), but a more practical use is to enable upper and lower case to be distinguished on the line display, by flashing lower case letters. The following subroutine does just that, displaying a$ in upper/lower case.

```
1000 IF LEN(a$)>16 THEN a$ = LEFT$(a$,16)
1010 FOR i=1 TO LEN(a$)
1020 a=ASC(MID$(a$,i))
1030 IF a>96 AND a<123 THEN a=a+96
1040 POKE 78−i,a
1050 NEXT i
1060 FOR i=i TO 16
1070 POKE 78−i,32
1080 NEXT i
1090 POKE 59,160
1100 RETURN
```

The loop from 1010 to 1050 puts the string into the buffer, converting any lower case letters to their flashing upper case equivalents. The loop from 1060 to 1080 clears the rest of the display, and 1090 makes the COP display the buffer.

Stephen Burt

BBC PERFECT LISTINGS

As many BBC micro owners who possess a printer will know, it can be difficult to obtain perfect hardcopy listings if the program contains directly embedded mode 7 teletext control characters (those which produce colour and graphics, etc). This is because the control characters can make the printer backspace or skip characters, or perform other equally weird and wonderful effects that can lead to untidy, sometimes unreadable, listings. The neatest solution to this problem is to define a spare function key as shown below:

*KEY 1vect=!&20E AND &FFFF: FOR B%=0 TO 3STEP:P%=&70: [OPTB%:CMP#128:BPL swap: JMPvect:.swap LDA#ASC("."): JMPvect]:NEXT:?&20E=&70: ?&20F=0||M

(Please note that the '||' at the end of this program is the character which appears under the break at the top right of the keyboard. This with 'M', as used here, produces a carriage return and is used in some specialised applications.)

Pressing this key before listing a program to a printer will cause all teletext control characters to be printed as a '.'. This can easily be changed by altering the 'LDA' instruction to give any character desired. Pressing the Break key will return all output to normal.

Lee Baxter

LYNX TAMER

Accessing the Lynx's video RAM is an awkward business. This is because the screen memory is in separate pages from the user RAM — the layout is shown in Fig 1. This is one of the reasons why screen handling on the Lynx is slower than on most other micros.

It can be seen that there are three screen memories, one for each of the primary colours. There is also a fourth area which can alternatively be used to produce green.

In order to access the VDU RAM, it is necessary to select the bank of memory to be accessed, read from and/or write to the screen, and then switch back to workspace RAM. It is therefore apparent that any program running in RAM cannot itself access the screen, because it will switch itself out from the memory map if it attempts to select one of the video pages.

There must be some way to read from and write to the screen, of course, and the answer is to use ROM routines to do the job. This works because, no matter what page of RAM has been selected, the ROM always gets priority on reading.

As several values have to be passed, via the processor registers, to the routine which writes to the screen, it is not possible to POKE to the video RAM from Basic. This would in any case be of little use with the bit-mapped display used by the Lynx.

The routine which writes a byte to the screen is located at 08B6H in the ROM I have inside my Lynx. The parameters which it requires in the various Z80 registers are as follows:

A must contain 65H to select bank 1, or 63H to select bank 2.
A' should contain E4H to select bank 1, or E8H to select bank 2.
BC must point to the colour area to be accessed, ie, 8000H for blue, C000H for green and red.
HL should point to the location to be accessed in the specified area. HL=0 points to the top left hand corner of the screen, while HL=1FFFH points to the bottom right hand corner, which is invisible.
E is the bit mask for the byte currently in the specified location, which is logically ANDed with this register.
D is the actual byte to be stored; in fact the result of the above operation is ORed with D and the result stored back to the screen.

An example may serve to make the above a little clearer. Suppose it was required to set four blue dots spaced one dot apart in the top left hand corner of the screen, the assembly code required would be as follows:

```
LD A,E8H
EX AF,AF'
LD A,63H
LD BC,8000H
LD HL,0000H
LD DE,5500H
CALL 08B6H
```

You can try this program if you wish, but an easier method for experimental purposes would be to use the monitor. The registers can be set up by using the 'U' command, and G8B6 should produce the desired result.

Reading the screen is somewhat simpler as only the HL register pair needs to be set up to point to the location to be accessed. This means that it should be in the range 8000H to 9FFFH to read the blue area, and it should lie between C000H and DFFFH to read the green and red areas. Location 0070H in the ROM then has to be called to read bank 1, while to read bank 2 the address is 0070H. The contents of the specified location are returned in register L, and H is set to zero. This makes it possible to read the screen from Basic by using the parameter-passing facilities provided. For example, to find the red component of the bottom right-hand corner of the screen, we execute CALL &69, &DFFF.

```
10 PROTECT 0
20 FOR C=1 TO 7
30   INK C
40   PRINT "COLOUR ";C
50 NEXT C
60 PRINT "PRESS ANY KEY"
70 FOR B=0 TO 12 STEP 4
80   OUT &0080,B
90   LET A$=GET$
100 NEXT B
```

The address DFFFH is put into HL on entry, and on exit the read-only variable HL contains the desired information.

Examining the screen-reading routine reveals that one of the banks has to be disabled before the other can be read. This is to avoid data bus contention, as the two pages of memory are seen as one. An interesting implication of this is that the banks can be disabled for other purposes, where certain colours are required to disappear off the screen. This is indeed the case, as the Basic program shows. Some spectacular effects can be achieved by rapidly turning colours on and off.

Note that bits 13 and 15 of the screen address lines are missing. This means that each colour area is phantomed in the 8k area immediately following it. Presumably the designers have done this in order to allow memory space for the graphics expansion to 512 × 248, when each colour area will occupy 16k of RAM.

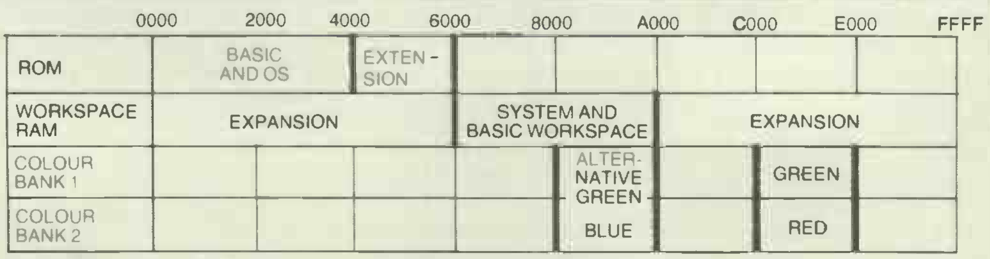


Fig 1. Memory Map for the Lynx
NB. All addresses are in hexadecimal

Chris Cytera

CP/M HINTS

A great deal of time can be saved in certain circumstances if you know the odd wrinkle or two.

Have you ever typed a line such as:
PIP B:=A:ACBD.BAS
only to discover ACBD.BAS does not exist and you meant to type ABCD.BAS?

At that stage you are not really sure what the file ought to be called and so you type DIR to look at the directory and then retype:
PIP B:=A:ABCD.BAS

You needn't have bothered. DIR is a built in command and so it does not load into memory and then run like user programs. Thus PIP which you loaded into memory was not overwritten and is still there. If only you could get the CPU program counter to point to the beginning of PIP's code and run it, you wouldn't have to re-load it.

Easy! First save a zero length file. In other words create a directory entry for a non-existent program. I call mine GO.COM. Thus, type the following line and then press RETURN.
SAVE 0 GO.COM

Now it doesn't matter what was in memory when your last program bombed out or finished. If you now type GO followed by <RETURN> provided it is not corrupted it will repeat whatever was in memory immediately before.

There are exceptions. Some programs use the whole of the transient program area including the bit at the top of the TPA used by the console command processors CCP. When a program ends, CP/M reloads CCP into memory so that it can process your next command and if your program is using this area, CCP will overwrite it and corrupt it. Very often data errors appear in this area and so although a program might still be intact, its data may be corrupted and it still will not run. Nevertheless the arrangement works in most situations.

Typewriter Mode: If you use a word processing program, you probably know what a hassle it is to do little things. First you have to prepare a text file then save it and only then can you print it. However, in some circumstances you can use your keyboard exactly as you would a typewriter keyboard and as you press each key, the printer will print each letter. This does not work with all printers, but it certainly works with several that I have used and most can be configured to accept a single character and to print it without waiting for a carriage return. However, you must be able to send line feed characters to the printer. Some terminals have a line feed key, others do not and some you can configure under software control to do this (Victor 9000, Sirius, etc).

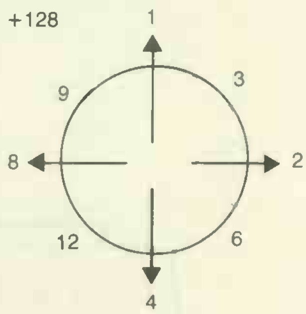
What you have to do is type:
PIP LST:=CON: and then press <RETURN>

What you have done is to map your printer on to your screen so that as you type at the keyboard whatever appears on the screen also comes out on the printer. The problem is that when you get to the end of a line you have to do both a carriage return and a line feed to ensure that your next lot of printing is on the next line. Once you have finished your document, envelope or similar, all you have to do is type a control Z. To do this you hold down both the control key and the Z key and you will then come back to the Command Mode.

Alan Secker

JOYFUL VIC

This VIC machine code routine takes 84 bytes. It is used to read joystick input. The format is as follows:



If the fire button is pressed, the routine returns a value +128, ie, JS= USR (0). If the joystick is pointed up and the fire button is pressed, JS would contain 128+1 = 129.

The routine is fully relocatable to anywhere in RAM, and is called by POKEing the high order address byte in location 2 and the low order byte in location 1, then using the USR command. It should be entered either via a monitor or by a hex loader.

Gavin Darren

```
.
., 3F9C LDA #$00
., 3F9E STA $9113
., 3FA1 LDA #$7F
., 3FA3 STA $9122
., 3FA6 LDA $9111
., 3FA9 STA $FB
., 3FAB AND #$04
., 3FAD ROR
., 3FAE ROR
., 3FAF STA $FC
., 3FB1 LDA $9111
., 3FB4 AND #$08
., 3FB6 ROR
., 3FB7 ORA $FC
., 3FB9 STA $FC
., 3FBB LDA $9111
., 3FBE AND #$10
., 3FC0 ROR
., 3FC1 ORA $FC
., 3FC3 STA $FC
., 3FC5 LDA $9111
., 3FC8 AND #$20
., 3FCA ROL
., 3FCB ROL
., 3FCC ORA $FC
., 3FCE STA $FC
., 3FD0 LDA $9120
., 3FD3 AND #$80
., 3FD5 ROR
., 3FD6 ROR
., 3FD7 ROR
., 3FD8 ROR
., 3FD9 ROR
., 3FDA ROR
., 3FDB ORA $FC
., 3FDD STA $FC
., 3FDF LDA #$D0
., 3FE1 SBC $00FC
., 3FE4 TAY
., 3FE5 LDA #$00
., 3FE7 JSR $D391
., 3FEA LDA #$FF
., 3FEC STA $9122
., 3FEF RTS
.
.
.:3F9C A9 00 8D 13 91
.:3FA1 A9 7F 8D 22 91
.:3FA6 AD 11 91 85 FB
.:3FAB 29 04 6A 6A 85
.:3FB0 FC AD 11 91 29
.:3FB5 08 6A 05 FC 85
.:3FBA FC AD 11 91 29
.:3FBF 10 6A 05 FC 85
.:3FC4 FC AD 11 91 29
.:3FC9 20 2A 2A 05 FC
.:3FCE 85 FC AD 20 91
.:3FD3 29 80 6A 6A 6A
.:3FD8 6A 6A 6A 05 FC
.:3FDD 85 FC A9 D0 ED
.:3FE2 FC 00 A8 A9 00
.:3FE7 20 91 D3 A9 FF
.:3FEC 8D 22 91 60 58
```

OSBORNE AUTOST.COM

I am sure that, like me, most Osborne 1 users get fed up with the infernal "AUTOST?" message each time a disk is booted up. This is due to the absence of the file "AUTOST.COM" which is used to chain on the program "HELP.COM". The MBasic program below will create a new file "AUTOST.COM" which contains only one instruction, a Z80 RTS [CHR$(201)], which tells the Osborne to return to CP/M without doing anything. The new "AUTOST.COM" consists of only one byte and a directory entry, so it does not take up much space. After this program has been run, whenever the disk is booted up, all that will appear is the 'A>' prompt.

Nick Wilson

```
10 ON ERROR GOTO 90
20 PRINT CHR$(26);STRING$(52,128):PRINT:PRINT:PRINT
30 PRINT,"FIXING AUTOST.COM";
40 KILL "AUTOST.COM"
50 OPEN "O",1,"AUTOST.COM":PRINT£1,CHR$(201):CLOSE
60 PRINT:PRINT:PRINT:PRINT STRING$(52,128)
70 PRINT:PRINT:PRINT CHR$(7):PRINT
80 SYSTEM
90 RESUME 50
```

BENCHTEST

MICRO-PROFESSOR

The Micro-Professor II claims to be compatible with Apple software. Bearing this in mind Shirley and Pete Fawcett set out to examine the strengths and weaknesses of this latest clone.

Sooner or later, for every micro that tops the popularity charts, there will spring up two or three or even more imitators, all offering a few more features for a little less money than their source of inspiration.

The Apple II has come of age now, and in so doing it has acquired a camp following of its own. One of the cheapest, and at first glance one of the most intriguing would-be Apples is the Micro-Professor II, from Taiwan.

At £269, the MPF-II is a great deal cheaper than the Apple II. It also appears to share many of the features that have made the Apple so popular — high resolution colour graphics, support for a disk drive, Applesoft Basic as near as makes no difference, support for a wide range of peripherals, and best of all, it claims to be able to run much of the enormous pool of Apple software.

As the name suggests, the MPF-II is the second in a series from its manufacturer, Multitech Industrial Corporation of Taiwan. Its predecessor is a tiny educational micro, and it's to be followed by a business machine. The MPF-II itself is not new, though it only arrived in this country in the spring of this year. It was launched in the USA a good 18 months ago, where it's been gently ticking over ever since. (UK distributor Sirtel says the micro has sold 28,000 in the States since last Christmas.)

According to Sirtel, this micro is aimed at 'The home computer user with an interest in Basic'. It's also angled at the educational market. The company does not stress the Apple-compatibility claims although this machine runs a modified version of Apple DOS to support its disk system.

We took a look at a standard 64k system with printer and disk drive, to see if the Micro-Prof II does live up to its reputation.

Hardware

The Micro-Professor is a severely smart little box, long and very low in a sturdy light grey moulded plastic casing, trimmed with dark grey. It stands only 30cms high, with the tiny calculator-style keyboard recessed into the top surface near the front edge. Further back is the micro's built-in speaker grille, and a red LED power indicator light.

Unlike most home micros, this one is narrower than it is deep, measuring 250cms from front to back compared with 175 from side to side. Why the manufacturer has chosen to design the machine this way round we can't imagine, since it provides less space for the keyboard and needs more space to fit it on a desk in front of the TV or monitor. Very strange.

The casing is pretty tough, though it would be impossible to stack a monitor on top, Apple-style. The front side sports the Multitech logo, then round the left and back sides are a respectable set of interfaces to allow this micro access to a good range or peripherals. Moving clockwise around the MPF, there's a port for either joystick or add-on keyboard, one for a printer, and a ROM cartridge slot which will also take the disk controller cartridge; then at the back, there are monitor, microphone, earphone, TV and power sockets.

The on-off switch is mounted on the separate power supply where, sadly, Multitech has skimped on the cable. It will probably be a case of the power socket coming to the Micro-Professor, rather than vice versa, since you get well under a metre of cable to connect up to the MPF, and less than two with which to reach your socket. That's the sort of minor annoyance that would cost very little to rectify.

There's a rather gimmicky TV switching box that fits between computer and television to let you flick between the two without needing to keep plugging and unplugging your aerial. But it makes the setting-up instructions rather daunting, and the MPF will work perfectly well without it if you prefer to connect it directly to the TV.

Memory

64k of memory comes as standard on the MPF. Or so Multitech claims, and after a fashion the company is right. But the figure is somewhat misleading, since when you start up the system you'll discover that in fact you have just under 38k to play with.

At least, you will discover that if you happen to be familiar with the ground rules of twos' complement arithmetic, in which the MPF expresses the amount of memory free. (To decode the figure, you'll need to deduct it from the 65536 bytes that make up 64k — but don't expect the manual to explain this.) The manual is indeed coy at this point. 'If your MPF-II displays a number close to −26629, then the memory of your MPF-II is all right', it proclaims.

38k may be as all right as the manufacturer planned, but it is not 64k or anything approaching it. Of the missing 26k, 16k is in fact used as ROM, to hold the Basic and various other utilities: disk boot routine, input/output routines, printer driver software, and the system monitor. That makes it a 48k micro in most people's terms. True, it is possible to switch the ROM space to be used as RAM by setting a soft switch — but only if you are using one of the cartridge-based languages promised for this micro, since you will lose the Basic that resides in ROM. Since the languages are not yet here, and no utilities are provided to help you make this difficult switch, it's not unreasonable to look upon the MPF as a 48k machine. As such, it is less in competition with the expensive top-enders such as the Apple than it is with much smaller micros like the Oric or Spectrum.

The rest of the missing memory goes to handle the low-resolution graphics or text screen. If you want to use the MPF's high-resolution graphics, you're going to have to sacrifice another 8k to do it — bringing you down to a mere 30k in which to cram your programs.

The MPF's memory map splits the user RAM into two chunks, one of 8k and one of 24k, but they are separated by the 8k of low-resolution graphics memory. Then comes the 8k of high-resolution graphics handling, I/O routines, and finally that 16k of ROM.

The discovery that of your hoped-for 64k, just 30-38 is actually yours to use might lead you to think of expanding the memory. Forget it. No memory expansion is currently available for the MPF, and according to Sirtel, none is planned. Indeed, inside that slimline case there simply isn't space for another thing. No extra memory, and no hope of running CP/M or getting an 80-column display, says Sirtel. What you sees is what you gets, so if you want a major upgrade you'll have to trade in your MPF-II for something quite different — perhaps the business-oriented Z-80 based MPF-III that will probably appear soon, most likely with CP/M.

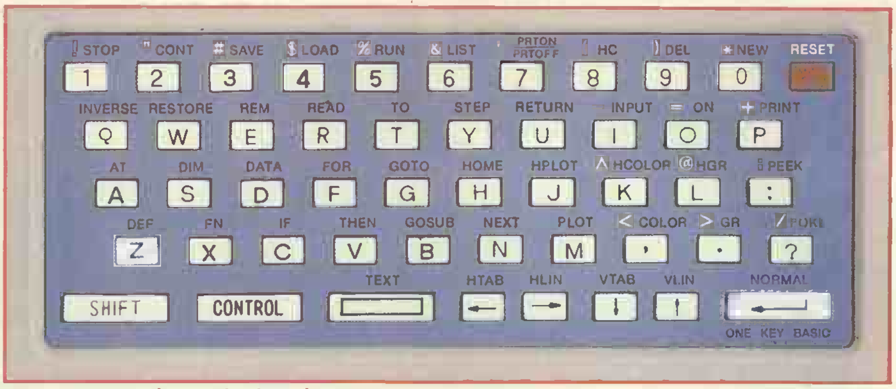
Inside

Getting under the MPF's skin is very easy, and indeed, the user manual actively encourages users to do so — presumably as part of its educational bias. Four small cross-headed screws on the underside of the micro come away to reveal a tightly-packed but neat and well-planned interior. Some 50 ICs perch on the main board, including the R6502, eight 16-pin RAM chips, and the two 28-pin chips used to store the Basic interpreter and the system monitor.

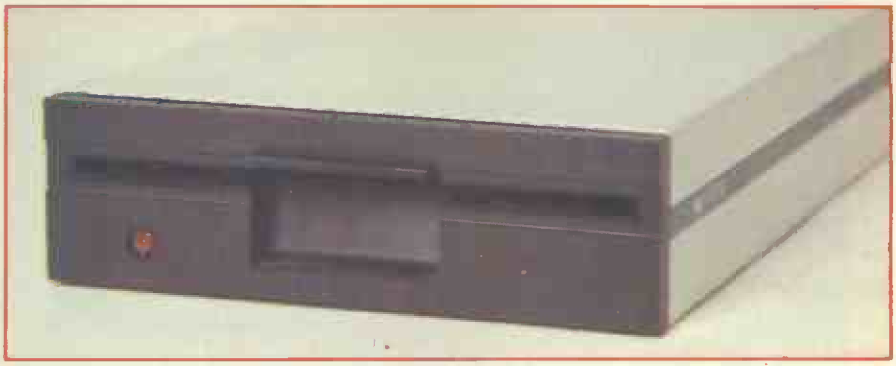
Towards the back of the board is the speaker and PAL TV system encoder. Then above the main board a second one is stacked, to handle colour, and at the front of the unit rests the keyboard. There isn't room to swing a flea inside, never mind expansion.

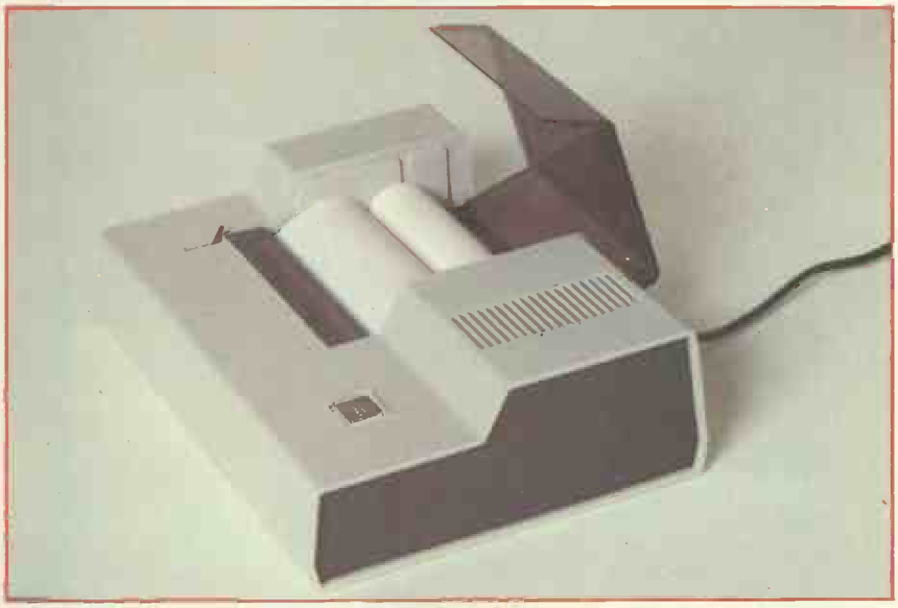
Keyboard

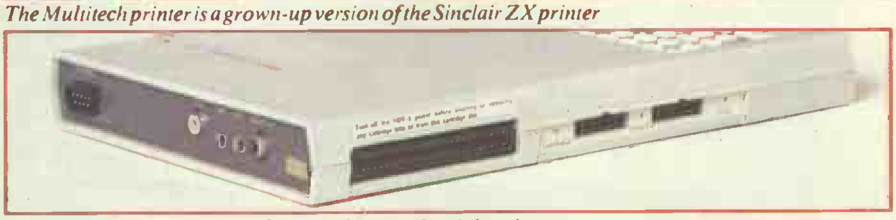
This is one Professor who's never going to teach a soul to write. The built-in calculator-look keyboard measures a miserly



A strange way to design a keyboard


The drive has the same long low profile as the MPF itself

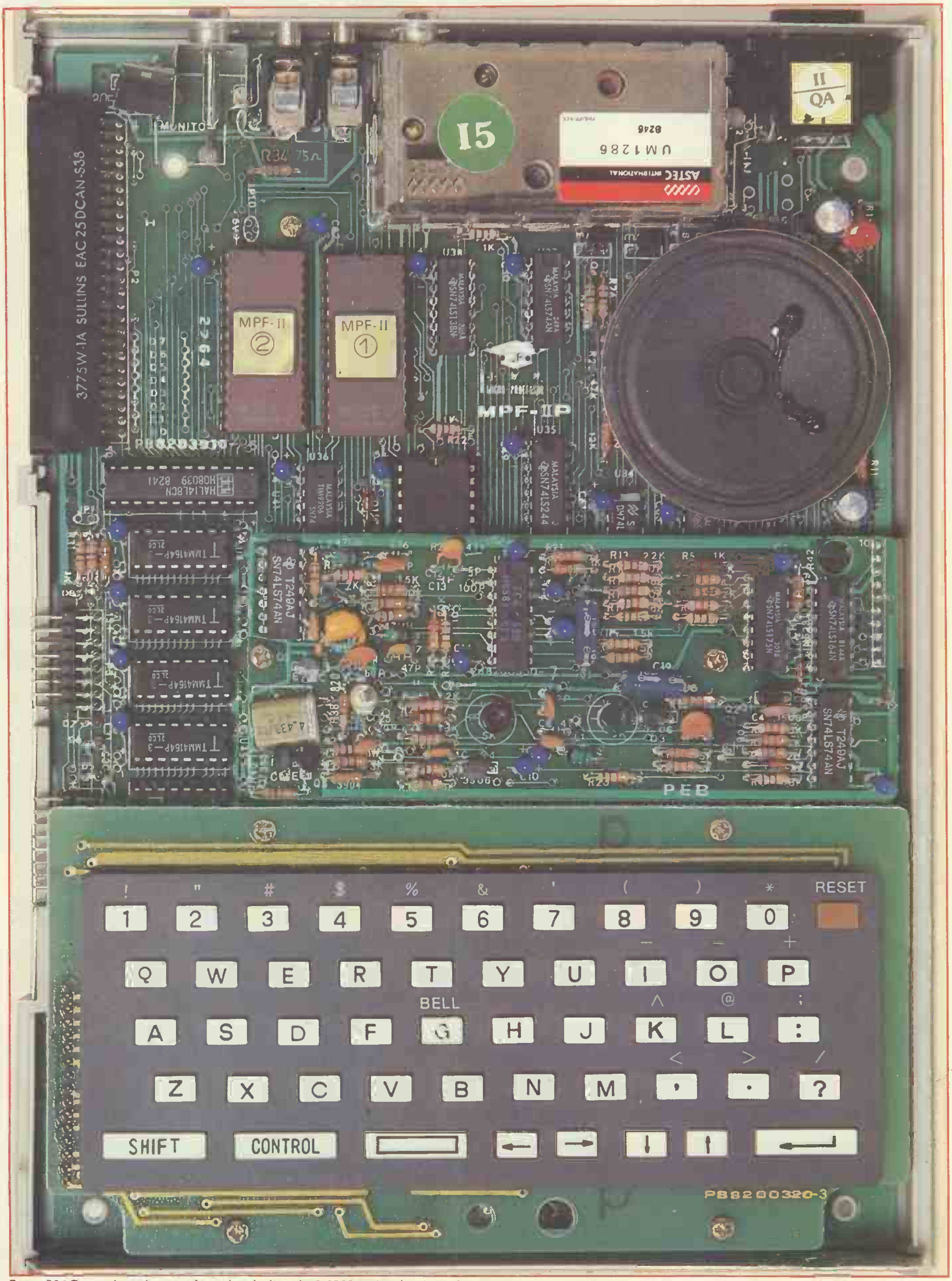

The Multitech printer is a grown-up version of the Sinclair ZX printer


A respectable set of interfaces for a good range of peripherals


At £35 the full-sized keyboard seems expensive

60cms by 155cms, and into that tiny space, Multitech has crammed 49 midget-sized moving keys. The space bar is particularly hard to use, being just twice the size of the alphanumeric keys, and it is hemmed in by shift, control, return and four cursor keys. The reset key — coloured orange for distinction — is in the upper right hand corner, and there is no escape key at all. Touch-typing on this keyboard is out of the question.

Even so, as a calculator-style keyboard, this one is not at all bad. On the whole it's preferable to membrane-type keyboards



Some 50 ICs perch on the main board including the R6502 and eight 16-pin RAM chips

such as on the ZX81. On this keyboard, the keys are hard white plastic, and they make a respectable click in reponse to even quite gentle pressure. But none of them auto-repeat.

There are two drop-over templates for use when switching into either of the keyboard's other two modes — 50 graphics characters, or single-keystroke Basic commands. Here, the Basic keywords have been positioned so that the most frequently used are closest at hand. Mind you, on this keyboard, *everything* is only too close at hand. When using them, you'll have to punctuate your statements yourself and check their syntax, since unlike the Sinclair single-key commands, these do not insert spaces or check the end result for sense.

Full-sized users can buy an optional full-sized add-on keyboard for the MPF, though at £35 it seems expensive. Sure enough, the keys are full-sized, and spaced the right distance apart, but they are those wobbly rubber pads Spectrum users know so well. They, too, lack auto-repeat, and are also impressively unresponsive to the heavy key-thumping inflicted by one-finger typists such as ourselves. They don't appear to have been de-bounced, and on our sample, the N key was so unresponsive that we asked the MPF to PRIT strings at least a dozen times. And there's no click to let you know that your key-thump has been felt by the keyboard.

Using the add-on keyboard does not disable the built-in keyboard, so you will need to be careful it does not get knocked by mistake. And the two keyboards do not have the same layout, so you will need to relearn where the RETURN, CONTROL, shift and cursor keys are in order to use it.

The add-on has half a dozen extra keys, as well as a full-sized space bar. Two of the new keys are more cursor controllers, for no very obvious reason since there are four already on the built-in keyboard. There are a pair of fire keys for games players, placed directly beneath the shift keys where they tend to get hit by accident. There's also a key bearing the MPF logo which seems to be purely decorative.

The keyboard is smartly finished, standing at a slope on stout rubber feet, though it comes in a brown and beige plastic colour scheme which doesn't go very far towards matching the MPF's light and dark grey livery. It has a curly cable with which it is plugged into the side of the MPF, in the joystick socket.

But it doesn't seem to be a sufficiently great improvement to justify spending £35 to buy it. Better, perhaps, to wait for the business add-on keyboard which may appear soon, says Sirtel, though there are no pricing details yet.

Graphics

The MPF will drive either a television set or a composite video monitor. That puts it one up on most small micros which can't use a monitor, and also one up on the Apple, which doesn't stoop to use a TV. We found the resolution perfectly acceptable on our TV, though the edges tended to waver a little.

Our biggest reservation was over the colours, which is no fault of TV or of micro, but rather of the designers' taste. Yes, the MPF produces a fairly accurate set of just six colours ... black, white, and palest baby blue, lurid orange, springtime-in-Limerick green, and a rather dainty lilac. Note the most obvious choices, and not quite the thing for those mornings when you're feeling a little off-colour.

Text mode gives you a resolution of 40 columns by 24 lines, with a clear and easily readable set of 64 characters that's equipped with 28 symbols and punctuation marks, though no £ sign, and no lower-case letters at all. There's something reminiscent of those pioneer days of punch-cards and mainframes about a micro that only uses upper-case letters. True, it's a weakness that the Apple shares, but then the Apple is an older machine, so there's more of an excuse for it.

In low resolution graphics mode, you have 40 by 48 blocks at your disposal from to construct your screens. Each block may be any of the MPF's none-too-lavish choice of six colours. (In this mode, the Apple gives you 16.) In high-res mode, which gives you 280 by 192 pixels, you are much more constrained in your use of colours. Indeed, two pages of the user manual are given over to explaining the ground rules.

Although all the six colours are still available, you cannot put them anywhere you choose. In the odd-numbered columns, you can use black, white, orange and green, while you are restricted to white, black, blue or purple in even columns. Furthermore, those 280 columns are grouped in sets of seven columns, one set to a byte full of screen information. And any one byte can only contain black, white, and combinations of either purple and green *or* blue and orange.

Never can you mix the orange and the green, not mention any of the other possible combinations. This is severely limiting.

User-defined characters are built up on a grid seven wide by eight high, using machine code to set the values of each bit. The eighth, high-order bit is used to decide the colour of the whole character.

The Basic graphics commands are much the same as the Apple's, but many of the more complex functions require you to resort to machine code — one area where the Apple pulls ahead of the MPF.

Low resolution graphics instructions include COLOR, PLOT, HLIN and VLIN for plotting horizontal and vertical lines, and SCR to return colour to the screen at particular points. HCOLOR and HPLOT handle colour and plotting in high-resolution graphics mode. There are no screen paint or shape fill commands, nor brightness control. Applesoft commands such as DRAW, ROT, SCALE, and XDRAW (used to draw predefined shapes) are not even mentioned in the MPF manual, but work perfectly well just the same. The FLASH command, on the other hand, is not there at all on this machine. But the worst thing about this Basic is the manual. Finding any information in it is well-nigh impossible, and it is riddled with both errors and omissions.

both errors and omissions.

As the Benchmarks show, the Basic is not a fast implementation by any stretch of the imagination. True, the 6502 is no super-speedy processor, but there is room for improvement.

Sound

There's just a single sound generator on the MPF, and the resulting noise is both tinny and loud — and irritatingly, there's no way of controlling the volume or even switching the sound off.

This comes as quite a shock when you try running the demonstration cartridge and find your ears being assaulted by a semi-deafening version of the 'Ode to Joy', well off-key.

Programming the MPF's sound capability comes down to your skill as a machine code programmer, since there are no special Basic commands to control the sound. The only way is to reference the appropriate memory locations by using PEEK and POKE commands. The MPF's speaker cone can be made to move in or out by POKEing to the soft switch that controls it, which causes it to beep at 1 kHz for one tenth of a second. By joining a number of these beeps together, it's possible to produce different tones. But there's no guidance given in the manual as to how you should go about shaping the tones you want.

Software

The MPF's native tongue is Basic, of the Apple variety. According to Sirtel, cartridge-based versions of Forth, Pascal and Logo are also on their way, but there is neither a date nor a price for them.

The Basic, like Applesoft Basic, is an extended version of the language, and the two are almost identical. The range of commands available includes both simple variables and multi-dimensional arrays, for strings and for numerics. The complete set of algebraic, relational and logical operators is there, as well as a broad range of mathematical functions: sine, cosine, tangent and arctangent functions, integer, sign, absolute, square root, exponentiation, logarithm, and three random functions. Calculations are rounded to nine digits in total, if you are simply using the MPF in calculator mode for basic arithmetic.

For handling the flow of control in programs, you have FOR . . . NEXT loops, IF . . . THEN structures, ON . . . GOTO statements, but no REPEAT . . . UNTIL command at your disposal.

Among the utility commands, you have a choice of LOADA or LOADT for loading cassette-based software, depending on whether the program you want to load is Apple or MPF-compatible. (And yes, there *are* differences between the Basics, as we'll explain shortly.)

PEEK and POKE are available, but none of the more exotic commands such as DEEK and DOKE, to look at two memory

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locations instead of just one. Editing and format commands include LIST, REM, TAB, SPCE and POS, INVERSE, and a rather useful TRACE function for debugging.

Editing

The MPF's editing ability is very poor. A line of code can be changed by moving the cursor with the cursor control keys provided the line has not yet been entered; but once you have hit RETURN, the only way to change a line of code is to re-key it.

There is a way round this problem, in the shape of a cassette-based screen editor. This package does offer a slight improvement, though whether it will justify the effort of loading every time from cassette is a moot point. It takes three fingers at a time to operate (shift, control and one other) and allows you to insert, change and delete lines of code in a very clumsy manner, using an illogical set of keys.

It will give you auto-repeat of sorts, a facility sadly lacking on the MPF's keyboard, but only of a single key at a time. All these facilities are ones you would normally expect to find provided on the micro in any case, so to load them from cassette is annoying and unnecessary.

Applications software

The review machine came with a large boxful of cassette-based software, all from Multitech. Most was dismal, even at the price of £5 per cassette. We tried out a road race game, where the object seemed to be to keep a racing car on the road. But the slow response from the cursor control keys made it feel more like driving an overloaded juggernaut. Gobbler turned out to be a reasonable Pacman variant, but too easy to master and rather too slow. There were various financial packages which did little more than your calculator could do, and some fairly lacklustre educational software setting out to teach addition, division, subtraction. . .

One cassette is supplied free with the machine — Micro-Nurse, a diagnosis program. Sadly, although this comes complete with a user manual, there is next to no information about what the program actually does. You can, for example, enter 'TEST RAM' to the program, and after a pause it responds with 'TEST OK'. This may be reassuring, but it leaves you none the wiser.

Compatibility

Since probably the biggest selling point for the MPF is its reputed compatibility with the Apple, the first thing most prospective buyers will want to know is just *how* software compatible the two machines are.

The answer is, hardly at all. If you have hopes of picking up a pile of Apple software and plugging it into a Micro-Professor, switching on and sailing away into the sunset, forget it. Only a very tiny fraction of that tempting mountain of Apple software is actually going to run on this machine.

The biggest problem is that, although the Basics are virtually the same on both micros, the respective machine codes are not. And relatively little Apple software is written purely in Applesoft Basic . . . and much of the stuff that *is* will be the stuff you wouldn't want to bother with anyway.

But that's not the only problem. Problem Number Two hinges on the fact that the Apple's and the MPF's memory maps are not the same. The MPF needs an additional four pages for its monitor program which the Apple does not use, and it locates those four pages in the same area that the Apple uses for its text-handling and low-resolution graphics. The MPF's own text and low-res graphics routines have been moved to the area used by the Apple for high-res graphics, and the secondary page for text and graphics is also at a different location on the MPF.

The outcome of all this musical chairs is that if you try to run Apple software on the MPF and your program tries to call code from any of those locations, then the program is not going to do at all what it is supposed to do.

We tried out various pieces of disk-based Apple software (the cassette-based variety is almost unheard of, since the Apple's virtually always sold as a disk system) under the MPF's modified version of Apple DOS.

Applesoft programs of less than 6k mostly ran, while the larger Applesoft programs were a hopeless case. (It's after the first 6k of user RAM space that the MPF's memory map starts to differ from the Apple's.) But even some of the smaller programs gave problems. Many of the keyboard instructions that the Apple uses give problems on the MPF — in particular, the K=PEEK (-16384) statement that is widely used in Apple programs to read the keyboard for keypresses.

Apple programs that swap between text and graphics modes also fail to run, since there are no bona fide text pages. And the TEXT command behaves differently on the two machines; on the Apple, it clears the screen and leaves the cursor on the bottom line, while on the MPF, it clears all but the left and bottom margins, and leaves the cursor at the top.

If you add to these problems the fact that there is no ESCAPE key on the MPF, and a great deal of Apple software uses this key, it becomes fairly obvious that most Apple programs aren't going to run unmodified on the Micro-Professor. Incidentally, you can create some interesting graphic effects as a result of the memory map differences, by running software that merrily overwrites the MPF's screen pages.

Incidentally, it is not at all clear how easy it will be to get hold of the MPF's DOS — essentially a modified version of Apple DOS. Either the dealers will supply the system, or users will need to take along their own copies of Apple DOS to be tailored. Sirtel is not very forthcoming about how this is to be achieved.

Peripherals

One of the MPF's major plus points, and a feature that puts it into competition with the bigger micros rather than with the Oric or Spectrum, is its ability to support a disk drive. At the moment, it will only handle a single drive, but a twin disk controller may follow.

The drive is priced at £300, and is a small, sleek box styled to match the rest of the system, with the same long, low profile as the MPF itself. It measures just 24 by 15 by 4cms, and is attached by a flat connector to a floppy disk interface software cartridge, which in turn plugs into the MPF's ROM cartridge slot. Its door fastens with a spring-loaded catch which doesn't seem to work terribly well. It uses an Apple-compatible 5¼in 40-track disk format so that it can quite happily read Apple disks. 140 kbytes is its capacity.

There is a joystick to be had, priced at £15, but there wasn't one available for testing. It shares the same input slot as the add-on keyboard, which is rather restricting, and only one joystick can be attached, which is very restricting.

There's no manufacturer's own-brand cassette recorder to be used with the MPF, but unfortunately there is also little guidance given in the manual about the choice of a suitable — that is to say, mono—machine.

The MPF will work with any Centronics standard printer, but there is also a Multitech thermal printer available to go with the machine.

Printer

The Multitech own-brand printer is in effect a grown-up version of the £40 Sinclair ZX printer. It's a smallish grey moulded plastic box with transparent paper cover, measuring 7cms high by 25cms wide and 18cms deep, weighing 1.5kg, and it prints on white thermal paper just 11.2cms wide — about half as wide again as the Sinclair paper.

At £185, the printer seems over-priced, especially since it can print only 40 characters per line, and then only on the special white thermal paper — though granted, it's an improvement on the silver Sinclair variety.

Printing speed is respectable, at around 150 lines per minute. And, being a thermal printer, it can reproduce graphics characters without needing special driver software; but only in black and white, of course. Resolution is quite acceptable, at up to 280 dots to the line.

Thermal printing is done by selectively heating some of the dots on each printhead — 20 per head with this printer — which then turn the paper black when contact is made. But the printer manual warns you that poor quality paper will wreck your printheads in under two hours. It refers you to an appendix for a list of suitable paper suppliers. But alas for your print heads, no such appendix is there.

MICRO-PROFESSOR

On the left hand side of the casing, there's a 16-pin parallel interface, while on top there's a paper release lever and paper advance switch.

The MPF uses the PRTON command to drive the printer, and you can choose to print one line at a time, or by the screenful. You can program the printer to underline, backspace or even retype characters, and a special graphics mode lets you program each dot on the print heads individually.

But you don't have to use the Multitech printer. The MPF will also interface to any printer with a Centronics interface, which throws the field wide open. At £185, this own-brand printer may find it hard to compete.

Documentation

Cast your mind back to the late sixties and early seventies, when Japanese electronic goods started hitting the UK in bulk. Remember the early instruction booklets that went with those stereo systems and televisions? Remember them, and if the memory is a fond one, rush out and buy a Micro-Professor. On the other hand, if you prefer your documentation in English, this is not the machine for you.

The main problem lies with the Basic manual. The user's manual is plump and informative, though finding your way around it is no joke, and there is a brief, heavily illustrated installation booklet thrown in for good measure. Both are more or less in English.

The same cannot be said of the stout, spiral-bound Basic tutorial. It sets out with the approach of teaching computer programming through the use of Basic, rather than purely teaching you this one dialect of Basic. So its almost 250 pages start out from scratch by trotting you through such fundamentals as the workings of the human brain and the history of the computer.

It's packed solid with very likeable cartoons — little jelly-bean characters cracking jokes to soften the subject. But nine times out of ten, you'll find your own set of jokes just reading this manual. How can you take much notice of a manual that greets you with a cartoon of a tiny jelly-bean professor shaking hands with a microcomputer to the strains of this typical Minglish conversation: (Micro) — 'Hey! I am micro-computer, nice to meet you!'...(Professor) — 'Oh! So Lovely!'

There are careless and confusing errors in the manual, as well as a total lack of an index to help you find the piece of information you need. It may not even be in there — several of the graphics commands are not mentioned at all in the manual, but work perfectly well. You'll probably never know what is absent and what merely not signposted in this chaotic manual. And errors such as 'The MPF-II keyboard shows the numeral zero with a slash through it' (it doesn't, in fact) do not improve matters.

The user's manual, too, is annoyingly index-less. This manual covers everything from installation and hardware specifications through the single-keystroke Basic commands and other keyboard modes, use of high and low-res graphics, sound generation, use of the system monitor and machine code programming, memory organisation, and input-output handling. Then there's a set of useful appendices featuring the 6502 instruction set, hexadecimal operation codes, a glossary of terms, and keyboard circuit diagrams. But an index is essential for finding any needles in that particular haystack.

I must have hunted for information about sound programming for half an hour before I managed to track down a few grains of information under the heading 'Input-output Expansion'.

Sirtel says it is looking at the possibility of doing a rewrite of the manuals, but there's no date fixed for that as yet. In the meantime, such documentation as there is does the MPF-II no favours at all, and is largely useless for the intended educational audience.

Support and availability

At present, Sirtel — a general electronics importer based in Peterborough and dealing in everything from computers to CB radios — is sole UK distributor for the MPF-II. The company stressed that this is not the only micro it handles, and insists that support will come from the dealers, not from Sirtel. The Spectrum stores are to sell the micro, as well as various other dealers whom Sirtel wouldn't name — and Spectrum shops should have supplies in stock now.

If the MPF-II is to sell as an Apple substitute, it will need strong support to help users overcome the various incompatibilities and train them to sort out the Apple software that will run from that which won't. Whether Sirtel's policy of leaving support up to the dealers will prove equal to this task remains to be seen. But the company promises that dealers will be ready and able to give guidance on all these matters.

Technical specifications

CPU:	R6502, 1.023 MHz
RAM:	48k
ROM:	16k
Keyboard:	49 key calculator type, built-in
I/O ports:	TV, composite video, cassette, joystick/keyboard, parallel printer, disk controller/ROM cartridge.
Disk:	Single drive only, 140 kbytes.
Printer:	Thermal, 40 columns, 150—180 lines/minutes.
Peripherals:	Keyboard, joystick.
Operating System:	Apple DOS variant.
Languages:	Basic; Pascal, Forth and Logo to come, on ROM cartridge.
Software:	Multitech brand cassette based games, business and education packages.

Benchmarks

BM1	2.8
BM2	11.0
BM3	19.5
BM4	21.3
BM5	25.0
BM6	40.2
BM7	61.5
BM8	110.6
Average	36.5

All timings in seconds. For an explanation of the Benchmark programs, see PCW Vol5 No 11, November 1982

Conclusions

As a serious low-cost rival to the Apple, the MPF-II is just too incompatible to compete and there doesn't appear to be the support to overcome the incompatibilities. As an educational aid, it's let down to the point of uselessness by poor documentation. As a rival to the smaller colour home micros, it is hampered by a lack of decent software and an equal lack of Basic commands to make programming of sound and colour straightforward.

Really, this is a machine which isn't sure what market it should be aimed at. Given a decent Basic manual and a bit more compatibility with the excellent educational software that's around for the Apple, there's no reason why it shouldn't make some headway in education. Put up against the Spectrums and Orics of this world its only selling point will be the ability to handle a disk system and run a little Apple software — for on colours, on sound and on Basic implementations, it doesn't compete, and user memory is virtually equal.

At the moment, the MPF is overpriced since it's not going to make its mark in the Apple marketplace — where, indeed, it would look cheap. It will most probably come down in price before long — and if a proper hard-keyed keyboard does appear soon, at a reasonable price, then this micro will have a small impact on the Spectrum shelves. As it stands, it will have a pretty tiny impact.

Personally, we wouldn't buy it. It has some sterling virtues, most notably the funniest Basic manual of the year, but a micro with a colour range this small and this hideous, and with a propensity for playing Beethoven off-key, is never going to win our hearts. END

Problem. *Simulating an aircraft on a small microcomputer and depicting the 3-D world outside through the eyes of the pilot.*

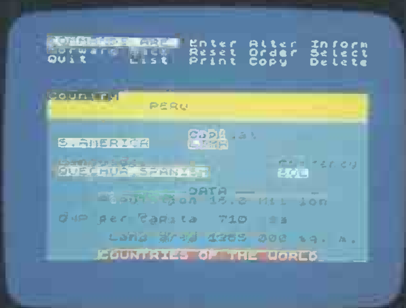
Problem. *Turning the Spectrum's numerical abilities into powerful verbal skills combined with a huge vocabulary.*

PSION HAVE BIG PROBLEMS.

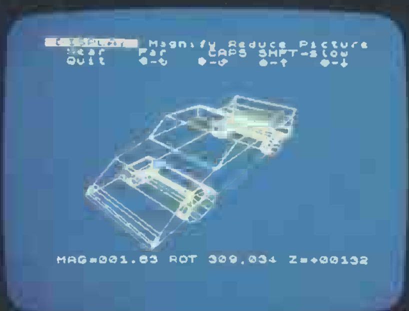
Problem. *Evaluating complex algorithms to provide sufficient depth of analysis in a short time.*

Problem. *Integrating cartoon-quality graphics with the realism of the ski-slope.*

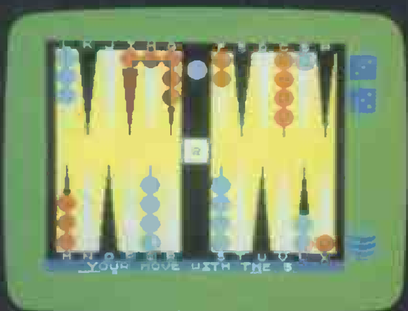
Problem. *Creating cartoon-quality graphics in an entertaining and varied game.*



Problem. *Providing complex, sophisticated data handling through easy-to-use commands.*



Problem. *Modelling in 3-D on a small micro – performing some 7.5 million calculations for one hidden line drawing.*



Problem. *Balancing the number of strategic factors required with a complex series of rules for a classic game.*

Psion have bigger, more ambitious software ideas for your Sinclair Spectrum. So naturally, our software is more of a problem to design.

Happily, we have all the right programming skills to match. In fact, Psion have one of the most advanced microcomputer software design facilities in the world. (Ask anyone who's seen a VAX 11/750 computer!)

That's why we can create the best software programs you'll ever see on a Sinclair Spectrum. (Remember – our 'Horizons' cassette was selected to introduce you to the Spectrum's capabilities.)

In all, there are 12 challenging titles, published exclusively under the Sinclair label. You can see the quality of eight of them alongside!

In addition, you can defend Earth from Space Raiders . . . destroy Planetoids . . . use VU-CALC in your business . . . even stroll in the park with Hungry Horace! And the Psion range is growing all the time – watch out for our latest program, 'Chequered Flag'.

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CHECKOUT

PROSE PACKAGING

Word processing on a Spectrum? Well, who'd have thought it . . . Steve Mann explains how to set up your own low-cost system

Now, promise you won't laugh — I've turned my Spectrum into a word processor. On the face of it, nothing could be more unsuitable for this task than Sir Clive's best-seller: after all it lacks a proper keyboard, displays only 32 characters to a line and does not have a proper printer interface. In its favour, of course, is the 39k of user RAM available to those with a 48k machine.

Over the past few weeks I have given a lot of thought to word processing. My normal practice when writing articles for *PCW* has been to work at home. This has meant that I have been writing my articles in longhand and then typing them out on the office Sirius — time-consuming and hardly labour-efficient. It was obvious that I needed some form of word processor at home. My first thought was to build up a system using the BBC Micro with disk drives. However, my lack of a personal BBC machine would have meant buying the whole system from scratch — and my finances just won't run to that at present. The obvious answer was to make the best of my trusty Spectrum . . .

The keyboard presented no problem as I already owned a 'proper' model which had been purchased as long ago as last summer from the Buffer Micro Shop in Streatham. I say 'proper' in quotes because, although a considerable improvement on the standard Spectrum keyboard, this particular model — from dk'tronics — lacks a space bar. At the time of purchase this was the only type available — if I was buying one today I'd make sure there was a standard space bar.

Next on the agenda was an interface to enable the Spectrum to be used with a printer other than the ZX Printer. Convenient though the ZX Printer is for short listings, it is obviously inadequate for word processing. So I obtained a Centronics interface from Kempston Microelectronics, which is suitable for hooking the Spectrum up to a wide range of printers, including the Epson models — I used the office MX-80.

The final component was the software. I've seen a whole range of so-called 'word processors' for the Spectrum, but very few of these have been designed for use with a full-size printer. The exception is Tasword Two from Tasman Software, which is designed for use with a range of interfaces, including Kempston's, and which redefines the Spectrum character set to give 64 characters per line — both on screen and on the printer.

Setting up

Putting the system together was a piece of cake. The Kempston interface simply plugs into the expansion port at the rear of the Spectrum and is connected to the printer via a ribbon cable. The only problem I found was that because of the design of the dk'tronics keyboard there was insufficient room to plug in the interface. This was remedied by cutting a chunk out of the rear of the keyboard casing with a fretsaw — it doesn't look very elegant, but it has done the trick.

The Kempston interface came with a setting-up program on cassette for each of the two Spectrum sizes. This is used to create a customised program for your particular printer and you would normally specify the printer codes for carriage return, linefeed, etc. This customised program would then be loaded into your Spectrum each time you use the interface.

When the Kempston interface is used with Tasword Two, however, setting up becomes, if anything, even easier. You first create a customised printer program in the manner described in Kempston's documentation, but instead of keying in the correct codes for carriage return and linefeed you simply set these to zero. Next you must load Tasword Two from tape. Having done this, you break out of Tasword and return to Basic by pressing STOP followed by 'B'. Now you merge your printer program into Tasword by

```
              < < <  T A S W O R D   T W O  > > >

EDIT - - - help page
CAPS LOCK  capitals lock                      On  EpsonFX80  Off
TRUE VIDEO cursor to word left
INV. VIDEO cursor to word right                   enlarged       Key 1
ARROWS - - cursor movement
GRAPHICS - printer control chars >>>>>            condensed      Key 2
DELETE - - delete character
<= - - - - move line left                         underline      Key 3
<> - - - - centre line
>= - - - - move line right                        italics        Key 4
AND  - - - insert line/character
OR - - - - go to end of text                      emphasised     Key 5
AT - - - - go to start of text
STOP - - - load/save/print text                 double strike    Key 6
NOT  - - - delete line
STEP - - - reform to end of para                   elite         Key 7
TO -.- - - scroll down
THEN - - - scroll up                             proportional    Key 8
ENTER  - - start of next line
CAPS + SYMBOL SHIFT - enter or leave extended mode
  C O P Y R I G H T   1 9 8 3   T A S M A N   S O F T W A R E
ENTER returns to text. Both shift keys for the other help page.
              < < <  T A S W O R D   T W O  > > >
```

Fig 1 Normal mode 'Help' page

executing LOAD "printcode" CODE 57856. Finally, you simply run Tasword and then use the define graphics/printer facility to specify the interface control codes and the codes for carriage return and linefeed (13 and 10 on the Epson range). If you then use the 'Save Tasword' option you will have a system tailored to your requirements, incorporating the codes for your particular printer, that can be reloaded at any time.

Tasword Two

Tasword Two itself is a fine demonstration of the programmer's art, providing just about every feature you would need in a word processing package. It is based on WordStar and uses the Spectrum block graphics keys for printer control codes — it comes with the graphics keys set up for an Epson FX-80. Perhaps the most surprising aspect of this package is the fact that the redefined character set is actually quite readable: a former editor of this magazine scoffed at the idea of 64 characters per line on the Spectrum but, once you have made sure your TV is tuned in properly, the text is perfectly clear.

Describing a word processing package is not the easiest of tasks. I think the simplest way to do it is to go through the Tasword features in the order in which they appear in the excellent manual — which was produced using Tasword Two and an Epson printer.

The 'Getting started' section gives the user a few pointers on how to make the most of the system, and explains the use of the Tasword Tutor, which is supplied on the tape as a text file ready to be loaded into Tasword. There then follows a section entitled 'How Tasword works', which details the features and limitations of the package. Tasword operates on a text file that contains whatever you type in from the keyboard. This file may be up to 320 lines in length (which according to my calculations gives you a healthy 20,480 characters). The television screen acts as a 'window', displaying 22 lines of the text file at a time and various control keys scroll this window through the text file in both directions. In normal use Tasword displays all 64 characters on each line of the text file. However, if your eyesight just can't handle this size of text, the window may be 'opened' to show only 32 characters at a time at normal Spectrum size.

Text is entered by using the Spectrum keys in their normal fashion. Because of the complexity of the Spectrum keyboard, it is sometimes necessary to go into 'Extended mode' to obtain some elements of the Spectrum character set. Tasword uses the Spectrum keywords — the ones printed in red on the keys — as control keys, together with the words marked in white above the number keys. Both character keys and control keys will auto-repeat if held down. A particularly useful control key is EDIT (CAPS SHIFT 1), which displays a 'Help' page on the screen; th s gives a brief description of each control key and is shown here as Fig 1.

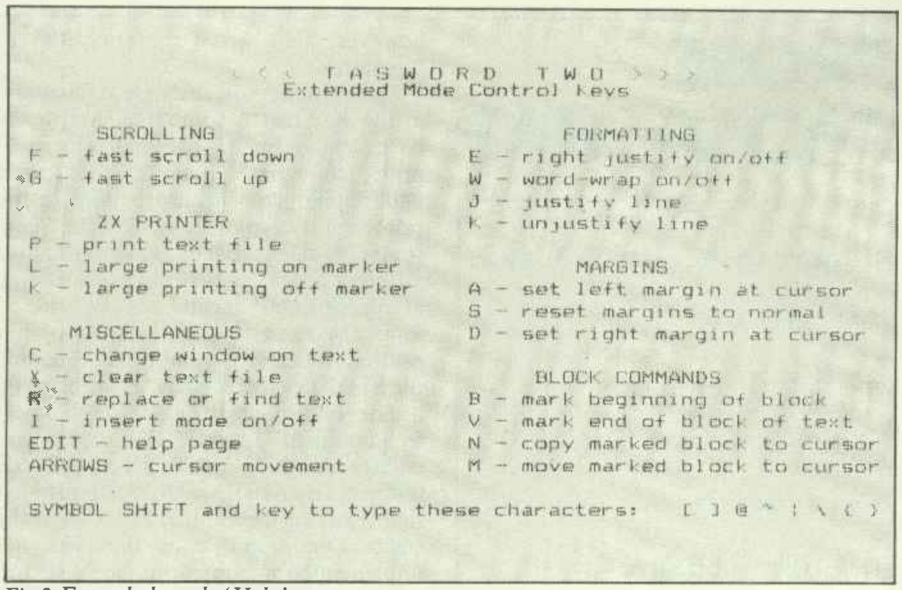

Fig 2 Extended mode 'Help' page

There are 19 control keys in normal mode (Tasword is in normal mode when the bottom line of the display — which shows the number of lines typed and indicates whether justification and word-wrap are on — is flashing). The actions of these keys are as follows:

EDIT (caps shift 1) — displays the normal mode help page. When this page is displayed pressing ENTER returns to text file; pressing CAPS SHIFT and SYMBOL SHIFT together displays the Extended Mode help page.

CAPS LOCK (caps shift 2) — toggles CAPS LOCK on and off.

TRUE VIDEO (caps shift 3) — moves cursor to the end of the next word to the left of the cursor. This enables the cursor to move rapidly left along a line.

INVERSE VIDEO (caps shift 4) — as TRUE VIDEO, but moves to the beginning of the next word to the right.

CURSOR ARROWS (caps shift 5,6,7,8) — move cursor to any position on the screen.

GRAPHICS (caps shift 9) — this key accesses the Spectrum's block graphics. These are printed as normal on the ZX Printer but are used as control codes for full-width printers.

DELETE (caps shift 0) — deletes character under the cursor and moves rest of the line left one position.

<= (symbol shift q) — moves text under and left of cursor one character position to the left.

<> (symbol shift w) — centres text on the line containing the cursor.

>= (symbol shift e) — moves text under and to right of the cursor one character position to the right.

AND (symbol shift y) — inserts new characters, words or lines into the text file.

OR (symbol shift u) — displays the end of the text file.

AT (symbol shift i) — jumps back to beginning of the text file.

STOP (symbol shift a) — used for saving, loading and printing text files.

NOT (symbol shift s) — deletes the line the cursor is on and moves all subsequent lines up to fill the gap.

STEP (symbol shift d) — reformats text after deletions or corrections have been made.

TO (symbol shift f) — scrolls display down one line.

THEN (symbol shift g) — scrolls display up one line.

ENTER — moves cursor to the beginning of the next line. If Insert Mode is on, a new line is inserted.

In addition to these control keys, Tasword uses the Spectrum's 'Extended Mode' keys as a further set of controls. These enable the user to handle such tasks as fast scrolling in either direction, formatting (right justify on/off, word-wrap on/off, justify single line and unjustify single line), outputting text to the ZX Printer, setting margins, moving blocks of text, changing the text window, clearing the text file, finding or replacing sections of text, and toggling in and out of insert mode. The 'Replace or find text' option is particularly useful. If you are typing a piece of text that contains a word or phrase that is used several times, it is a simple matter to use an abbreviation (for example, I used 'Ta' for Tasword while writing this piece) and then use the 'Replace and find' option to substitute the correct letters before printing. When using this option Tasword automatically reformats the text. When in extended mode it is also possible to set margins within the text — this is useful for highlighting certain paragraphs. When a margin is set part of the screen will change colour from white to yellow to indicate the settings. While margins are set, the <=, <> and >= keys do not affect text inside margins and will not work at all if the cursor is inside a margin. To indicate that Tasword is in extended mode, the bottom line of the display flashes. The extended mode help page is shown in Fig 2.

Unless otherwise instructed, Tasword Two automatically formats the text with right justification (text is printed with flush left and right margins) and with word-wrap. Word-wrap simply means that if a word is too long to fit in the space left in a line it is dropped down to the next line. Of course you can override this and use a

PROSE PACKAGING

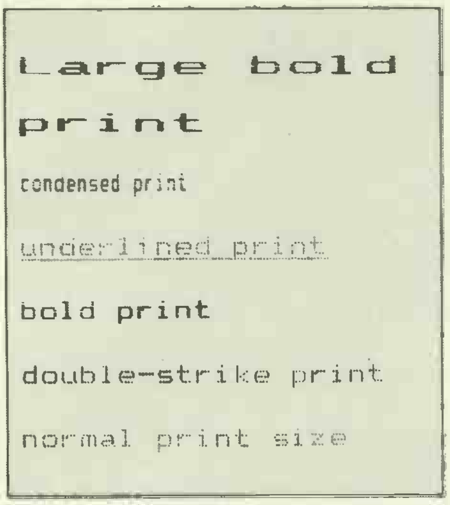

Fig 3 Some type styles

hyphen. The only time that you should use the ENTER key is at the end of a paragraph or if you want to leave a blank line. When you type the last character in a line Tasword moves the cursor to the beginning of the next line and it changes shape, becoming vertically elongated. If you type a character when the cursor is enlarged Tasword assumes that this is part of the last word on the line above and so will word-wrap — so you must type a space after each word, even if a word ends exactly at the last character position on a line. If the last character on a a line is a punctuation mark Tasword will not word-wrap when you begin the next line, even if the cursor is tall. Tasword also ignores the first two spaces that you type so that you don't indent a line by mistake. To enable Tasword to format text correctly, the manual recommends that you always type at least one space after punctuation and that you always begin a new paragraph by indenting at least three spaces or by leaving a line space.

To save and load text files, the STOP key is utilised while Tasword is running in normal mode. A menu of options then appears. A series of on-screen prompts makes loading, saving and verifying very simple — if a mistake does occur and you find yourself back in Basic, it is merely a matter of pressing RUN and your text file is retrieved. If you choose the 'Load text file' option, any text currently in Tasword will be cleared. This can be avoided by using the 'Merge' option, in which case the new text will be loaded after any text that is already there. The merge will fail if there is not enough room for both files (ie, if their total length is more than 320 lines).

Printer control characters

As mentioned above, the Spectrum block graphics are printed as normal if the ZX Printer is used. For full-width printers, however, they serve a very different function.

Most printers will allow great flexibility in the way text is formatted. Many will have facilities for large or small print, bold print (sometimes italic as well) and underlining. To send instructions to the printer, Tasword makes use of the Spectrum graphics. Each printer requires different codes, so Tasword has a 'Define graphics/printer' facility for the user to input the relevant codes for his or her printer. When in normal mode, pressing the STOP key followed by 'g' will bring up a series of prompts to enable graphic keys to be defined. Tasword Two comes with codes for the Epson FX-80 already defined. I used an Epson MX-80 and found that many of the control codes were the same. One useful code that was not implemented was for form-feed (used to move the print position to the start of the next page). For this I simply set one of the graphics keys with the code 12. Each time a form-feed was needed it was a simple matter to press the relevant key.

Conclusions

If your main reason for buying a micro is to use it for word processing, then the Spectrum would be one of your last choices. However, if you already own a Spectrum and would like to use it for processing text, this article should make it clear that such a use is perfectly feasible. I'm extremely impressed with the standard of Tasword Two — I found it easy to use and very well designed. It took a short while only to become familiar with the various control keys, and the number of on-screen prompts, together with the excellent manual, make it ideal — even for an absolute beginner. A Tasword text file holds a surprisingly large number of words — this article fitted quite comfortably into one file; there was room for considerably more verbiage. And, of course, the advent of the Microdrive — announced before this issue went to press — should allow the Spectrum to be used for a wide variety of applications that require the storage of large amounts of data. I look forward to Tasman's Microdrive-based word processing package with great interest.

Tasword Two comes complete with instructions for using a variety of interfaces — the Cobra RS232, Euroelectronics ZX Lprint, the Hilderbay, the Morex and, of course, the Kempston interface. I used the Kempston version as this was one I had received for review, but Tasword Two is so well designed that I foresee no problems with any of the others.

The Kempston interface, too, did all that could be expected of it and proved reliable in use. I do have a minor gripe about the way the ribbon cable is arranged on this interface, though — it emerges from the same side of the interface as does the connection to the Spectrum port: unless the printer is sited directly behind the Spectrum this necessitates twisting the cable so that it does not obstruct the keys. It would have been more sensible to lead the cable from the rear of the interface so that it had a bit more clearance. Kempston's documentation is not all it could be, either — it contains all the information you'll need but the presentation could stand some improvement.

The dk'tronics keyboard has taken quite a bashing over the last year or so and has come through with flying colours. The only signs of wear and tear are on the keytops — some of the key labels have become obliterated (does anyone know where I can get a set of Spectrum key labels?). The dk'tronics keyboard is equipped with a numeric pad and will set you back £45 — but for word processing I would recommend a keyboard with a space bar; these can be obtained from a number of suppliers and cost about the same — or slightly less — than the dk'tronics one.

Tasword Two is produced by Tasman Software, 17 Hartley Crescent, Leeds LS6 2LL and costs £13.95.

The Kempston interface comes from Kempston Microelectronics, 180A Bedford Road, Kempston, Bedford MK42 8BL. Price: £45.

"These educational packages sure have learned me a lot, Dad!"

WARNIER ORR PROGRAMMING
PART 3: NORMALISATION IN PRACTICE

In the penultimate part of this series Paul Overaa explains the procedure for normalising a set of data items.

We saw last month how it is possible to describe sets of data using Warnier diagrams. The general ideas involved in working backwards from the output of a program were illustrated leading to an initial Warnier diagram showing a program design for handling data input. I indicated that there are advantages to being able to impose different views on a data set without having physically to rearrange the data. This month I want to discuss a technique known as 'Normalisation' and show you some of the benefits that normalised data sets have in practice.

We were considering last month the production of a report for a company of consulting chemists. The primary data item set that we identified was described in terms of a logical input file using a Warnier diagram. This diagram is repeated in Fig 1 for convenience.

The word 'Entity' is used to describe a data item type that has 'real-life' existence. Such entities have various characteristics that we call 'Attributes'. To digress for a moment, if you were storing data about people then one entity you would deal with would be 'Person' and the attributes that you might wish to store about each person could be Name, Address, Telephone Number, Age and so on. If we return to Fig 1 then we see that the attributes of the entity Sample include Sample Identification Number, Commodity Name, Country of Origin, Type and also a collection of tests and test results that may occur more than once, eg, a particular sample may have half a dozen or more different analytical tests carried out on it. For this sample there will be that number of Test Names and Test Results present. Attributes like these that can occur more than once for a particular entity occurrence are called a 'Repeating Group'.

One obvious way to store our data set would be to regard Sample as the only entity and sequentially store the attribute values associated with particular Sample Identification Numbers as variable length records. This would represent our input file correctly but some of the data would be very awkward to get at. Imagine, for instance, that you want to find those samples that had a test for 'percentage of moisture' carried out. It would be necessary to search sequentially the whole of the data file in order to find each occurrence of the test name 'Moisture'. Such information would in fact be much easier to obtain if the details for the tests were stored separately. The first stage of normalisation concerns itself with the problems that repeating groups cause and eliminates them by removing groups and rewriting them as new entities.

From a practical point of view it is useful initially to pick out from the Input file any attributes that are candidates for static file storage methods and rewrite these items as separate entities. By this I mean the attributes where you would be likely to store a code to represent the value rather than store the attribute value itself. Country of Origin is a typical candidate since we can encode up to 256 different countries of origin in one single byte. We would therefore like to maintain a static file containing the country names and the respective code numbers that are allotted. It should be fairly obvious that several candidates of this nature exist and it is immediately useful to rewrite them as new entities as follows:

Commodity
(Commodity#, Commodity-Name)

Origin	(Origin#, Origin-Name)
Type	(Type#, Type-Name)
Test	(Test#, Test-Name)

The # sign is frequently used to indicate a number and thus Commodity# is read as commodity number. We have written the four entities shown above in a common standard form and the notation is as follows: we write the name of the entity and then in brackets we list the attributes of the entity. The attribute or attributes that uniquely identify a particular occurrence of an entity type is called the 'key' or 'identifier' and is underlined. It is the identifier that is used to search for specific record occurrences in practice.

Having done this we can write our input file shown in Fig 1 as follows:

Sample (Sample#, Commodity#, Origin#, Type#, (Test#, Test-Result))

The identifier in this case is Sample# — ie, the Sample Identification Number.

At this point we are in a position to start what is usually regarded as the first stage of normalisation. The object is to remove any repeating groups from any currently identified entity descriptions and to rewrite them as new entities. In doing this it is necessary to include in the new entity all attributes that were identifiers in the original entity.

The result of doing this is shown below. Note that the act of separating the repeating group has resulted in us identifying another entity that we have called Analysis-Result.

Sample (Sample#, Commodity#, Origin#, Type#)

Analysis-Result (Sample#, Test#, Test-Result)

It should be obvious that in order to identify uniquely a particular analysis result we would need to know to which test and to which sample we were referring. This being so we should not be surprised to see both identifiers present in the key.

The entities that we have selected to represent our logical input file are now free of repeating groups and are said to be in first normal form. It is convenient to list them together thus:

Commodity
(Commodity#, Commodity-Name)

Origin	(Origin#, Origin-Name)
Type	(Type#, Type-Name)
Test	(Test#, Test-Name)
Sample	(Sample#, Commodity#, Origin#, Type#)
Analysis-Result	(Sample#, Test#, Test-Result)

It is now necessary to examine each of the above entity descriptions to ensure that each non-identifying attribute (ie, attributes that are not part of the key) is functionally dependent on the whole of the key. This sounds frightening but it is very easy to do indeed. In effect all that we mean is that it must not be possible to identify uniquely an occurrence of a particular attribute without specifying the whole of the key. I think you will see what I mean as we work through the first normal forms.

Commodity (Commodity#, Commodity-Name)

This is an easy one since there is only one non-identifying attribute. Once we know a particular Commodity# then we have uniquely specified a Commodity-Name. Similarly, to specify a particular Commodity-Name we need only be in possession of Commodity#. It should be apparent that the attributes of the first four entities that we listed earlier, namely Commodity, Origin, Type and Test, are already such that the non-identifying attributes are functionally dependent on the whole key and other than recognising this fact we do not have to do anything to them.

Sample (Sample#, Commodity#, Origin#, Type#)

For the entity Sample we have three non-identifying attributes to be checked. We ask ourselves this question . . . 'Is it possible without specifying the Sample# of a sample to identify what commodity it is, its country of origin or its type?' Obviously to be able to say 'this sample comes from, eg, India' we would have to know to which sample we were referring, ie, we would have to know Sample#. I think you will agree that for all three cases we must know the Sample# before we can deduce the other attributes. In plain English we must know which particular sample we are talking about before we can say what it is, where it comes from or what type description it has. Again, therefore we do not have to do anything other than recognise that the attributes of this entity are already functionally dependent on the whole of the key chosen.

The last entity of our first normal set is Analysis-Result and in this case we have two attributes in our identifier or 'key'.

Analysis-Result (Sample#, Test#, Test-Result)

We look at the non-identifying attribute Test-Result. Simply specifying the sample identification number Sample# would be insufficient to determine uniquely a test result because a particular sample may, as we have already indicated, have more than one analytical test carried out. Similarly it would be insufficient to specify a reference for the test carried out since there may be many samples that had such a test performed. It is necessary to specify both the sample number and the test in question before we can identify a particular test result value and thus as in the previous cases the non-identifying attributes are functionally dependent on the whole of the selected key.

In the example we are dealing with we see that the normal entity descriptions we produced initially are not only free from repeating groups but also exhibit the qualities of functional dependence we have talked of. But things might not have been this easy, and to give you a chance to see how to proceed in less fortunate cases I want you to imagine that, in addition to storing data about the analytical test results, we also need to know which laboratory performed the analysis. If this had been part of the problem requirements then the entity Analysis-Result would look like this:

Analysis-Result (Sample#, Test#, Test-Result, Laboratory-Name)

We would convince ourselves as we did above that Test-Result was truly functionally dependent on both identifiers. We would then look at the attribute Laboratory-Name. In the case of our example each particular laboratory is set up to do certain types of work, that is to perform a certain range of tests. This being so I think you will agree that you only need to specify the Test# to know which laboratory performed the test. The attribute Laboratory-Name is therefore not functionally dependent on the whole of the key. The solution is to remove this attribute from the entity Analysis-Result and create a new entity Laboratory as follows:

Laboratory (Laboratory#, Laboratory-Name)

In this way we would ensure that non-identifying attributes were in fact functionally dependent on the whole key. Having done this our collection of entities would be described as being in Second Normal Form.

The last stage that we need to consider concerns itself with the relations between the non-identifying attributes themselves. We want to ensure that, for any particular entity, no 'non-identifying attribute' is functionally dependent on any other 'non-identifying attribute'. This part of the procedure therefore only applies to entities with two or more non-identifying attributes and in our example we consider one entity only, Sample.

Sample (Sample#, Commodity#, Origin#, Type#)

By inspection I think you will agree that if we specify a particular commodity name by specifying or defining the value of Commodity# then this tells us nothing about the sample's origin or its type value. Similarly specifying a sample's origin or type value would not help us to identify what commodity it was. In this case we can safely say that non-identifying attributes of the entity Sample are mutually independent. If dependence is found, the procedure to follow is to remove the offending attribute by creating a new entity in just the same way as we would have created the entity Laboratory if we had been required to store details of which laboratory carried out which tests.

Once we had ensured that all non-identifying attributes are mutually independent we have created the famous 'Third Normal Forms' that you read about in the database books. Please remember that it takes far longer to explain these procedures than it does actually to do it.

Let's list the three steps that we have performed:

1. Write your initial entity descriptions in the bracket notation form and then remove any repeating groups that are present.
2. Check that the non-identifying attributes of each entity are functionally dependent on the whole of the identifier that you selected. If you find that some are not, then those particular attributes must be removed.
3. Lastly, you must ensure that all non-identifying attributes are mutually independent. Again if you find that this is not so then new entities must be created.

Look at Fig 2. This shows the entities and their relations. What we must now do is consider the ways in which such a representation could be implemented in practice. One quite simple method that could be used on many small disk-based computers would be to maintain separate files for each of the six entities. Random access files would be most suitable since we will wish to extract data by referring to specific keys rather than having to search through complete files.

It is necessary to decide what method will be used to indicate or define the relations that exist. Given a particular sample number, for instance, we could from the appropriate Sample record find what sort of sample it is, where it comes from and what type classification it had. We would also need to locate the analysis details and, since these will be placed in a separate file, we will need to know whereabouts in the Analysis-Results file the data has been placed. A simple solution is to use 'embedded pointers' within the Sample records, giving for instance the address or record number of the first result and also the number of tests that were carried out. In this way we could find out which records in the Analysis-Results file were associated with which records in the Sample file. Such embedded pointers could be used to specify all the relations needed.

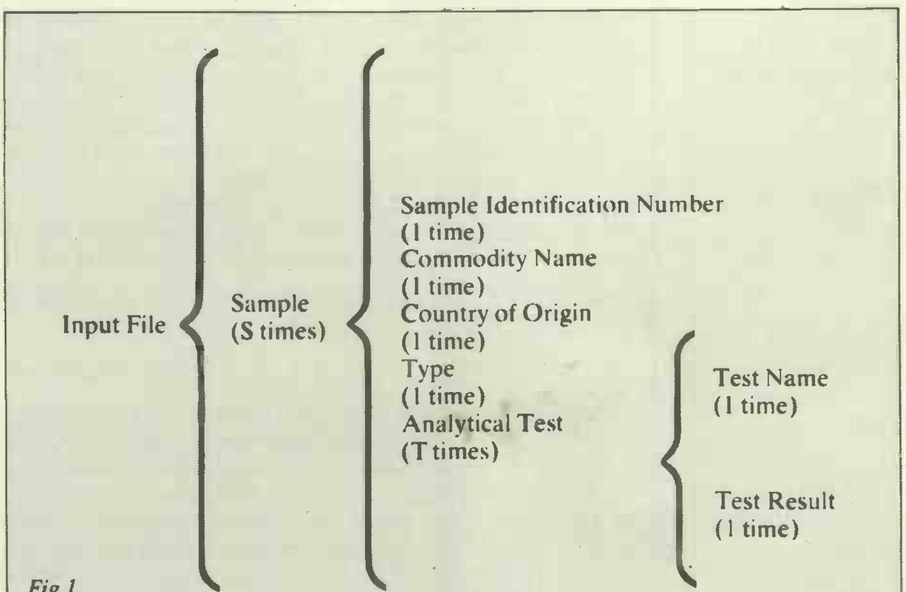

Fig 1

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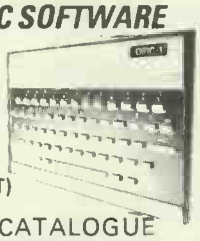

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It's the laughing gnome again; judging by the reaction to the picture above that's what most people think I am! Major news this occasion is that the KGB has moved. No, not to Moscow but to a much more regal place, Windsor. The full address and 'phone number is below. We had been desperately overcrowded in Slough for months and with larger premises and more personnel our service is even further improving.

Concurrent with our move we became WANG dealers with the full range of their 16 bit 8086 based equipment. We are delighted about this because WANG's word processing software is superb. Come along between 5th and 7th September to our opening open day (is that English?) where we will be showing WANG as well as Superbrain and Sirius, or call on Stand 344 at the Personal Computer World Show in the Barbican Centre at the end of September.

It is software that this month reflects our special offer. We have excess stock of *Personal Pearl* and the first two people to send me £90 will get a CP/M version by return. That's half the normal price so it must be a good deal! Incidentally, we offer several Database systems, most of which I have hand-picked from the thousands available. The most flexible, which is a database only, is *DBase II*. It's been around for a long time now and with the new release is very popular. It does require some effort however to use it to the full. A superb Word Processor is *Silicon Office* which qualifies as a database system because of its features. For someone who wants an easy-to-learn system there is *DMS* or, for storing transactions, *Delta*. Last and by no means least there is the very simple but well-written *Cardbox*. There should surely be one for almost every application in that lot!

Don't forget our open days. There will be lots of special offers available.

Sandy Saunderson

Sandy Saunderson is Managing Director of KGB Micros Limited, the fast growing commercial microcomputer company based in Windsor. He has extensive knowledge of the microcomputer industry and if you would like to speak to him, either on general computer matters or particularly about his own products at KGB, give him a call on Windsor 50111 or drop him a line at KGB Micros Limited, 106 St. Leonards Road, Windsor, Berkshire SL4 3DD.

WARNIER ORR PROGRAMMING
PART 3: NORMALISATION IN PRACTICE

More sophisticated ways of specifying the relations exist and the ultimate ideas of flexibility move into the realm of relational database design. I am not for one minute suggesting that such techniques are either necessary or appropriate for most applications. What I am saying is that we can frequently make use of the flexibility that a normalised relational view provides. The message then is, define your input set, normalise it and then implement the simplest physical file structure that is consistent with the resulting entity descriptions and your particular processing requirements.

Output file

We have considered, in a fair amount of detail, the input set. It is necessary also to consider the requirements of the output set. The Warnier description of the report was given last month and it is possible to take the bracket description of the report and normalise it in the same way as we did for the input file. Since the process is identical to that of normalising the input file, I will simply state that if you do this, you will rediscover entities such as Commodity, Origin, Type, Test that are already known. You will, however, discover a new entity. It corresponds to a single line in the report and has therefore been called Report Line.

Report-Line (Commodity#, Origin#, Type#, Test#, N,L,H,A,S)

The characters N,L,H,A,S stand respectively for the attributes No tested, Low, High, Average and Standard deviation as described last month.

There are two ways of creating our output or report:

1. We can compute the derived data each time new sample data is added and update a file that we would create called Report, ie, the responsibility of updating the derived data can be assigned to the input program. This is simple to do because during the input of a set of sample data the four keys required to locate a particular line in the report, namely, Commodity#, Origin#, Type# and Test#, would be known. If this approach were to be adopted the production of the report would merely entail listing the contents of the file Report.
2. Alternatively the report could be produced in real time by examining the individual sample data that had been stored during the year. Such a procedure is attractive for many reasons including the fact that we would not necessarily have to reserve disk space for the report. Such an approach would allow the implementation of quite sophisticated query facilities in addition to the main report if indeed these were required.

If we decided on this latter approach then we would have to arrange to be able to retrieve our data using the four part key Commodity#, Origin#, Type#, Test#. One way to implement this would be by using a further set of embedded pointers within the Analysis-Results file. Reading the file using these pointers would provide the required order for output processing.

To summarise, we can, by the use of pointers embedded in the record definitions of our entities, create logical pathways through a data set. In this way we can provide the view demanded by the output requirements even if that view is different from that of the input requirements. It is possible to do this because we paid special attention to the way we have chosen to represent our file structure. Normalisation enables us to identify a physical file structure that is well suited to having more than one logical view imposed upon it.

I have tried here to indicate the advantages of normalisation and have covered the basic steps involved in translating data sets into third normal form. The logical description produced is quite easily mapped to a true physical description and we have seen how embedded pointers within records can be used to imply the relationships between various records of various entities. You may well have your own ideas on other ways of implementing the necessary relationships. I have attempted to show you some of the problems that we encountered while the software to handle the report used in the example was written. The steps involved in finding a suitable file structure are quite general and I think you will find these ideas useful in many of your own projects.

Next month is the last part of this series and I want to tie up the general principles that have been discussed during the last three months. I want also to show you one last use of the Warnier diagram . . . to design 'sets of programs'. I think that you may then agree with me that programming is beginning to change from an art to a fairly well defined technique that can be taught in much the same way as we teach other sciences. END

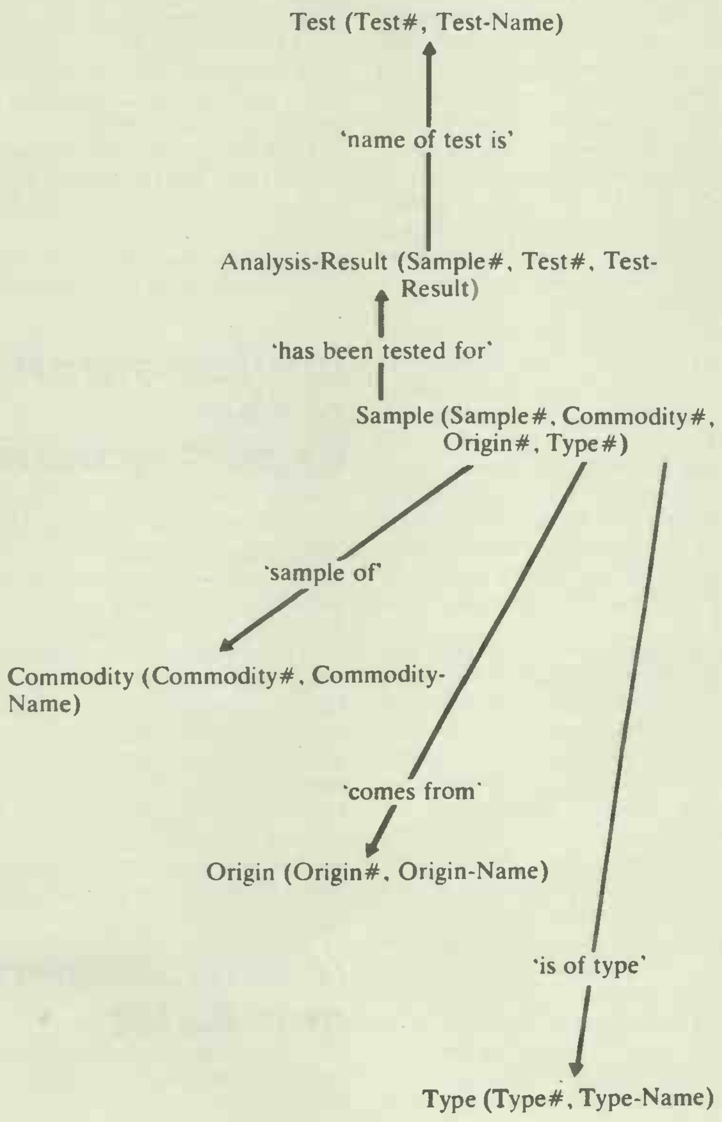


Fig 2

EXPERT ADVICE

AN EXPERT SYSTEM FOR THE MZ-80K

Chris Pratt takes a look at the flexibility of expert systems in general and focuses in on the MYCIX, specially written for the Sharp MZ-80K.

If you think expert systems will only run on powerful disk-based micros and minis, here is a pleasant surprise. You can run a perfectly respectable expert system on a 48k, tape-based machine, and what is more you can write it yourself.

Here's a description of an expert system called MYCIX which was written initially for the Sharp MZ-80K.

Before looking at MYCIX in detail, let's just look at some examples of what an expert system such as MYCIX can do.

Taxonomy

Let us say you find a toadstool and you want to know what species it is and whether it is edible, poisonous, harmful to trees and so on. Or you discover a caterpillar in the garden but you're not sure whether it is a pest or a species which will turn into a rare butterfly. Or perhaps your job involves the identification of species — for instance, micro organisms which cause disease.

You may decide to consult a human expert or you may decide to browse through a guidebook. Another alternative would be to consult an expert system.

Having loaded your expert system, you then need to load the appropriate knowledge base — fungi, insects, trees or whatever. The expert system then asks a series of questions and, assuming the search algorithm is fairly efficient, it will soon tell you the family, genus and species of your specimen. Of course, some questions may not be immediately answerable — for instance, in the case of micro organisms which may require tests to be performed to enable the questions to be answered.

So far so good, but no matter how efficient the search algorithm, there may be very distinctive characteristics which you want to tell the expert system about, to speed up the search, just as, when consulting a human expert, you would tell him or her straight away about the distinctive features.

You will probably be puzzled by the reasoning behind the questions asked by the expert system and you may want to acquire some of its expertise, so another feature you should include in the expert system is the ability to answer questions such as: 'Why did you ask me that?' and 'What have you established so far?' and 'What is the rule for such and such?'

Well, we've now got a fairly powerful expert system, but without disks, how on earth can we store all the knowledge (rules)? The answer is that we are somewhat restricted but, surprisingly enough, about 400 species, that is roughly the size of a Collins Field Guide, can be held in memory together with the expert system program.

Let's now look briefly at another couple of examples of the use of this expert system.

Diagnosing faults in men and machines

Diseases in man, and for that matter, all animal and plant life, often manifest themselves in more than one symptom and need several tests to be identified. The same applies to faults in complex mechanical and electrical machines — for instance, the automobile.

The same expert system can be used but in this case an automobile fault knowledge-base or a human disease knowledge-base is loaded.

Using the same features, the expert system will attempt to diagnose the fault.

Implementation of the expert system

Having looked briefly at some typical applications of the expert system, let us now turn to the implementation. First of all we will examine three fundamental building blocks — Menus, Assertions and Rules. Then we will turn to the database structure as this is the starting point of the design and the major factor affecting the facilities and flexibility of the expert system. The next sections deal with the program which enables us to teach the expert system and to consult it. Finally we look at that essential component of expert systems — user-friendliness and the extent to which we can achieve 'natural language' communication with a personal computer expert system.

Menus, Assertions and Rules

The expert system presents questions to the user in the form of 'menus':

Menu Title:
1. Option 1
2. Option 2
N. Option N

For example, in the case of a fungi database
Location:
1. On wood
2. On soil
3. In grass
4. Under conifer
5. Under broad-leafed tree

the user merely enters the appropriate option number.

The expert system presents conclusions or Assertions to the user. Continuing with the fungi database example an Assertion might be:

The genus is Agaricus
or: The species is Amanita Phalloides (deadly poisonous)
or simply: Field mushroom

Now let's look at the third and most important building block of the expert system — the Rules. The rules are stored and presented in the form:

If Menu Title A is Option B, Menu Title C is Option D, and Menu Title E is Option F, then Assertion G.
or:

If Assertion H, Menu Title I is Option J, Menu Title K is Option L, . . . and Menu Title M is Option N, then Assertion P.
For instance:

If colour of spores is white, surface of cap is scaly, joint of cap and stem is ball and socket, gill shape is free, and immature gill covering is ring, then the genus is Lepiota.

If the genus is Lepiota, colour of cap is dark brown, size of mature cap is 8-15cm, and flesh colour is orange when cut, then the species is Lepiota Rhacodes.

Notice how the Assertion of one rule may be a condition of another rule.

Before moving to the database structure let us look at a couple of other examples. First, a rule from a medical database, then one from an automobile database.

If the site of the culture is blood, the gram stain of the organism is gramneg, the morphology of the organism is rod, and the patient is a compromised host, then there is suggestive evidence that the identity of the organism is Pseudo-Aeruginosa.

If oil pressure is low, noise from top of engine is knocking, oil loss is below timing case, and overflow valve is not leaking, then there is evidence that there is a crack in the timing case and the camshaft is worn due to loss of oil pressure.

Database structure

If you're not used to working with arrays and pointers, you may have some difficulty

following the description of the database structure, but don't give up — it gets much easier after this.

The database structure, as illustrated in Fig 1, contains three large single dimensional arrays containing the Menus, the Assertions and the Rules.

To conserve memory, each new record, Menu, Assertion or Rule is packed next to the previous record. Of course, holding fixed length records in a two dimensional array is much simpler but the fixed record size must then correspond to the size of the *largest* record and a large proportion of the memory would be wasted. These three arrays and a Menu Index array from the knowledge base are stored on tape and loaded into memory.

Let us look at each array in the knowledge-base in turn. The Menu array contains a set of menus, each containing the data characters as displayed plus the carriage return characters. The Assertion array contains a set of assertions, each

EXPERT ADVICE

containing the characters as displayed plus a carriage return character. The Menu Index array contains two entries per menu — the first entry points to (ie, gives a displacement for) the menu while the second entry contains the number of options in the menu. The last two entries contain tail pointers for the Menu and Menu Index arrays. These point to the last entries in each array. The function of the Menu Index array will become clearer from the description of the consulting program. Menus, options and assertions in the Rule integer array are represented as follows:

Conditional assertion — Negative of the pointer to the assertion.

Menu/Option combination — Menu Index pointer × 100 + Option Number.

Concluding assertion — Negative of the pointer to the assertion — 10,000.

Using this arrangement, each condition or assertion occupies one array element, in this case, two bytes. This gives an upper limit of 320 Menus each with up to 99 options, and 10,000 assertions, which is more than adequate for a 48k machine. The last four elements of the Rule array contain tailpointers for the Rule and Assertion arrays, the number of assertions, and a tailpointer for the Rule Index array.

This last array is not stored on tape, but it is part of the knowledge-base. It is created from the Rule array each time a new knowledge-base is loaded. Each entry is a pointer to a Rule in sequential order. When consulting the expert system, rules found to be invalid are marked as such by adding 10,000 to the pointer. This prevents unnecessary searching.

In addition to the five arrays in the knowledge-base, there are two arrays for storing temporary data during a consultation. In effect, they store the characteristics of the subject of the consultation. Menus, options and assertions are stored in the same form as in the Rule array. It is a comparison of these arrays with the Rule array which enables deductions to be made about the subject of the consultation. Again this will become clearer from the description of the consulting program.

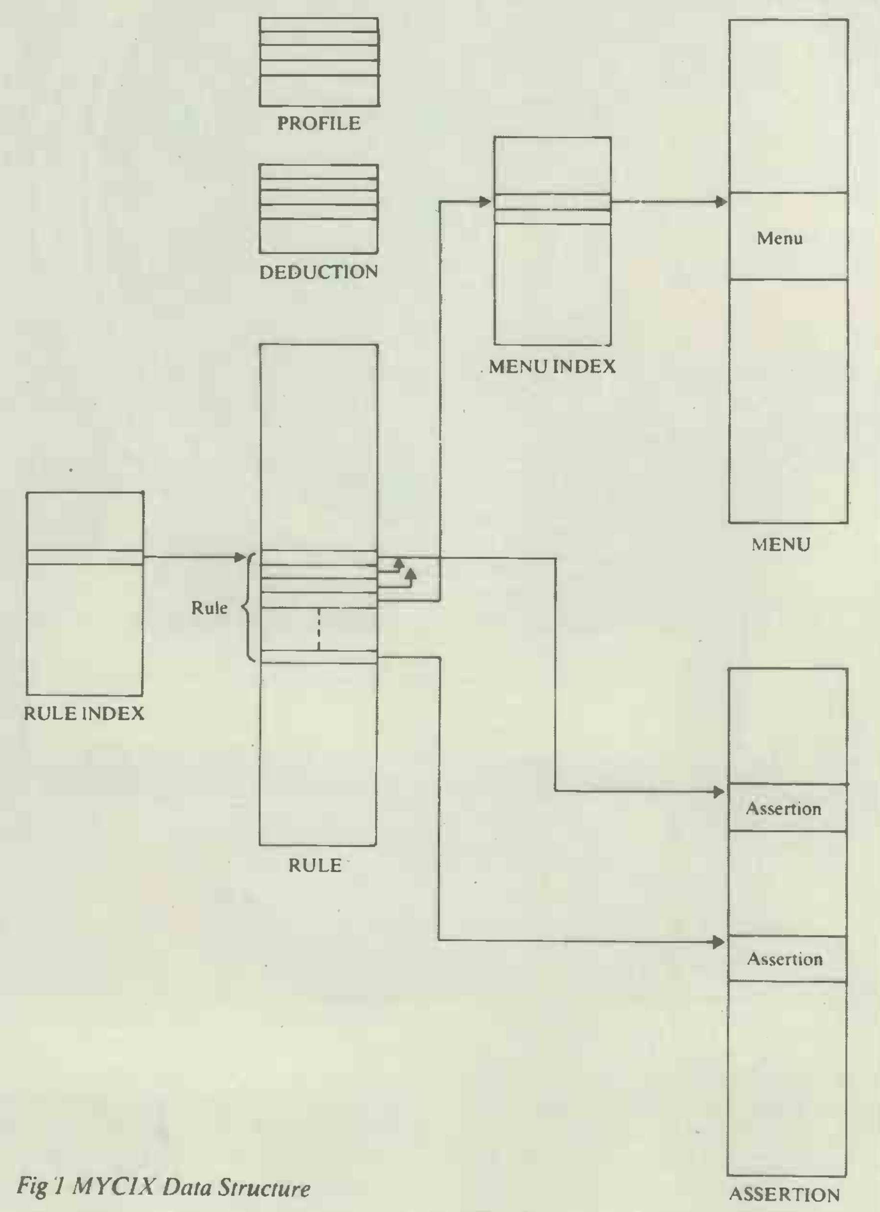


Fig 1 MYCIX Data Structure

31 Menus	5921 Bytes
305 Assertions	6207 Bytes
322 Rules	5824 Bytes

Do you want to:

1. Add Menu
2. List Menu

3. Add Assertion
4. List Assertion

5. Add Rule
6. List Rule

K Save Knowledge-Base

E End Session

Fig 2 MYCIX Learning Program

Teaching the expert system

On a small personal computer, it is not advisable to try to combine the learning and consulting program, as the larger the program size is, the smaller the database size can be.

Let us start with the learning program, that is, the program which enables a human expert to teach the expert system by creating and modifying a knowledge-base. Fig 2 shows the most important screen format presented by the program.

To add a menu, the number 1 is keyed. The system prompts the user for the menu title and options. Listing menus is possible from a Master Menu which lists the Menu titles. Keying 3 and 4 enables assertions to be entered and listed. Rules are inserted by entering assertion, menu and option numbers when prompted by the system. Listing a rule displays the full textual form of the rule.

The program ensures that all rules are self-consistent. A rigorous check that each rule is consistent with every other rule is more complex and fairly slow. The best solution is probably a separate program which just performs this cross-checking function.

The screen format in Fig 2 continuously updates a display of the total number of Rules, Menus and Assertions and the amount of array space consumed. This is a help when building large knowledge-bases.

At intervals as a knowledge-base is built up, it is saved to tape, and reloaded when additions are required.

'Change' and 'Delete' commands are perfectly possible, but at the expense of knowledge-base space.

Consultation

Having organised the database and a means of setting up the database, we are now able to construct a program for consulting the expert system. Fig 3 shows

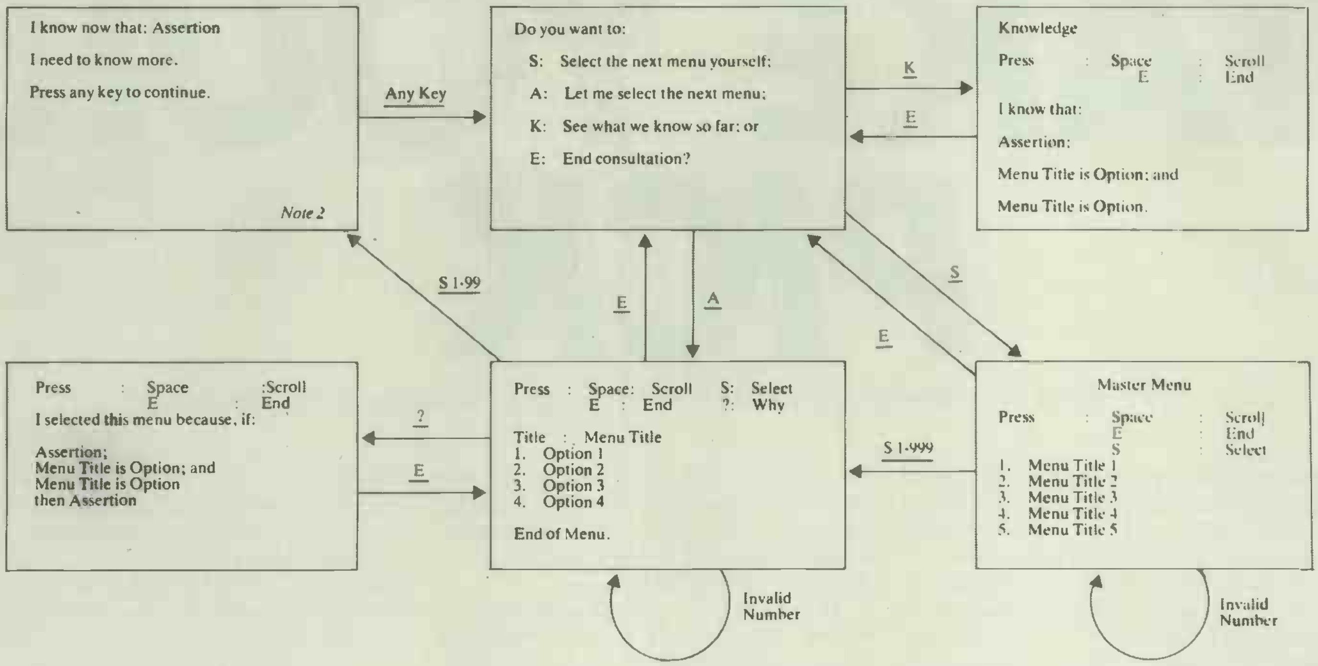


Fig 3 MYCIX Consulting Program

Notes: 1. Underlining indicates user input.
2. An alternative message type is: 'I am unable to tell you any more.'

the main state transitions for the consulting program. When the program is run, it invites the user to load a knowledge-base. It then invites the user to:
— let the expert system ask the questions (ie, select the menus); or
— select the menus himself.

Let us examine a typical consultation. The user decides to let the expert system ask the questions and he is presented with a menu. He selects an option and the expert system tells him that it needs more information. Again he decides to let the expert system ask the questions. When the next menu is presented, the user asks the system why it presented that menu. It will then display the rule in textual form that it is currently working on. The user decides that the rule is not relevant and decides to select the next menu himself.

He goes to the Master Menu and selects an option. He continues this process for a while until the system tells him that it has established something, and displays the concluding assertion. However the expert system recognises that it may be able to deduce further assertions and invites the user to continue the consultation. The user asks the system what it has established so far, and it displays the relevant assertions and menu/option combinations in a textual form. Eventually the system recognises that it can deduce no more, informs the user, and asks if he requires another consultation.

Let's now look at why we need the four arrays — Profile, Deduction, Rule Index and Menu Index.

— Profile and Deduction are normally identical and contain the user selected menu/option combinations. When the expert system locates a rule whose conditions are a subset of Profile, the concluding assertion is entered in Deduction along with any unmatched menu/option combinations. Deduction is then copied to Profile. The expert system then checks whether the new contents of Profile are capable of matching any of the rules before inviting the user to continue the consultation.

— Rule Index, as well as providing an index into the rule array, contains a flag to indicate which rules are still valid. Each time a search is made, only valid rules are searched. When all rules become invalid, the expert system tells the user that it is unable to help him any more.

— Menu Index contains the number of options in each menu. This is useful for range checking user input and for outputting rules in textual format. It also enables menu/option combinations in Rule to be held in one array element.

Having looked at the operation of the consulting program and the use of the various arrays, I should say a few words about the search algorithm. Although not very large, this part of the program needs considerable care in its design to ensure speedy response times. Fortunately, as the size of Profile gets bigger, the number of valid rules gets smaller, so the response time does not degrade.

Automatic selection of menus for display is done by selecting menus which have not been displayed, from Rules marked as valid. As this is sequential, it follows that, when creating a knowledge-base, the most frequently applicable rules should be entered first and the least frequently applicable rules entered last, for instance in the case of Taxonomy, the most common Genera and Species should be entered first.

Man-machine interface

An essential aspect of any program, but especially expert systems, is user-friendliness. The following are a few aspects which I have found to be important:

— Each new output is preceded by a clear screen command to remove obsolete information.
— Each output includes instructions to the user and lists are completed with an end of list message.
— Long lists can be scrolled on the screen.
— All user input is checked for validity and all arrays are protected from overflow. Associated with each array declaration is a variable declaration which is used for checking for overflow. When array sizes are changed, the variable must also be changed.
— Displayed information is in plain English wherever possible. In particular rules are displayed as sentences. However, rules are created using a numeric method for simplicity and to ensure that the correct links are made to the menu and assertion arrays.

CONCLUSION ———

There are no major problems in building a rule based expert system on a 48k tape-based microcomputer although a number of compromises have to be made. One simplification not mentioned so far is the omission of fuzzy logic. It is not always possible to state rules with 100 per cent certainty, so rules of the form 'If Condition then Assertion with 80 per cent certainty' can be useful. Similarly, if the user's knowledge is incomplete, it would be useful if the system could say: 'The most likely answer is x but it may be y or z' but it can't. Another simplification is the omission of 'ors' linking conditions as well as 'ands'. In practice 'ors' are far less common than 'ands' and it is always possible to implement an 'or' by creating two rules with the same concluding assertion.

TAKE YOUR PICK

Professor Brian Ripley explains how random numbers are selected by a computer:

Random numbers are an essential part of most computer games, and most Basics provide them via a function RND (although the syntax is far from standard). Random numbers also have their place in more serious applications—for example, in simulation models of operational research problems, teaching statistics, and other random processes (such as Patterns, *PCW* April & June, 1982). Random number routines are much less commonly provided in other languages on small or large computers. Random inputs to a program are often a good way of testing that all the plausible inputs have been accounted for.

Have you ever wondered how a computer can produce random numbers? The strict answer is that it cannot, and it is usual to talk about *pseudo-random numbers* in the vast literature on the subject. The prefix is appropriate, for the Concise Oxford Dictionary defines *pseudo-* to mean 'false, apparent, supposed but not real'. The sequence of numbers produced using calls to RND is deterministic; in fact usually all future values can be deduced from the current value. Nevertheless, the sequence appears similar to a random sequence, so much so that a statistician would be very hard pressed to show that it was not genuinely random. This explains the close link between pseudo-random number generation and cryptography (see *PCW* July 1983), since a good cipher will produce an apparently random sequence of characters, yet has a structure which is easily uncovered if the key is known. What we need are simple algorithms to create chaos from order.

Shift register generators

The manuals supplied with microcomputers are rarely forthcoming about how their random numbers are produced. One may have to do the equivalent of code-breaking to discover the algorithm used. For the BBC Computer I disassembled the interpreter. Fig 1 gives equivalent code in that machine's assembler (in which &20 denotes 20 in hex). It is based on a 33-bit shift register implemented in bytes 0D to 11. The inner loop is performed 32 times each time RND is called to produce a new random number. At each pass of the loop the register is shifted left one place, and a new bit 0 formed by exclusive ORing bits 20 and 32. Thus bit j of the register holds the bit generated j passes ago, say, b_{i-j}. Then $b_{i+1} = b_{i-19}$ EOR b_{i-32}

The lowest four bytes are used to form a signed 32-bit integer Y, or viewed as a 32-bit binary fraction to form a real number U between 0 and 1. Note that since only 32 of the 33 bits are used to form Y and U, the future output is not determined by these (although the current and previous values suffice).

Congruential generators

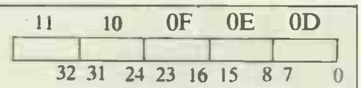
For positive integers X and M, X mod M is defined as the remainder when X is divided by M. Thus $0 \leqslant X \bmod M < M$. BBC Basic provides a MOD operation; in other dialects it can be implemented as:
DEF FNMOD (X,M) = X − M*INT(X/M)

Congruential generators are the commonest sources of random numbers. They generate the next integer X_{i+1} by
$X_{i+1} = (aX_i + c) \bmod M$
for positive integers a, c, and M. The initial value of X is known as the *seed*. The effect is similar to a roulette wheel, in which small variations in the initial velocity are magnified into the number of turns, which is then reduced to the fractional part of the turn to give the position. These generators have been explored in *PCW* Sub Set (July, September, October and December 1981, February, June and September 1982). For example, the Sinclair ZX81 has $X_{i+1} = 75X_i \bmod (2^{16}+1)$. Obviously the mod M operation is easiest if $M = 2^e$ (just keep the lowest e bits) but it is not much more difficult if $M = 2^e \pm 1$. (Let $y = ax+c$. Then $y = q2^e + r$ is easy. So $y = q(2^e \pm 1) + (r \mp q)$, and $y \bmod M = (r \mp q) \bmod M$, which is $r \mp q$ or $r \mp q \pm M$.) Again one can produce numbers between 0 and 1 by $U_i = X_i/M$ or $X_i/2^e$.

Both shift-register and congruential generators are *periodic* in that eventually they repeat the same output sequence. The *period* is the length of the sequence which is repeated. It is 2^{16} for the Sinclair generator, in which X_i takes all the values 1,2,3, ...2^{16} before repeating. The BBC generator has period $2^{33}-1$; the integers Y take the value zero once and all other possible values twice in each period. Obviously a long period is desirable. The BBC machine can produce a random number about every 1.5msecs and so would take about 150 days to complete a single period. Other generators have much shorter periods. The RML 380Z uses real numbers U_i and forms U_{i+1} by forming $38965U_i+26664$ and

(i) $M = 2^e, c > 0$. Maximum is M, attained if $a-1$ is divisible by 4.
(ii) $M = 2^e, c = 0$. Maximum is M/4, attained if the seed is odd and $a-5$ is divisible by 8.
(iii) M prime and $c = 0$. Maximum is $M-1$, attained if the seed is non-zero and a is a primitive element (or root), that is, if $a^{(M-1)/p} \neq 1 \bmod M$ for all prime factors p of $M-1$.

Fig 2 Maximum periods of congruential generators




```
.RAND   LDY #&20
.HERE   LDA &0F
        LSR A
        LSR A
        LSR A
        EOR &11
        ROR A
        ROL &0D
        ROL &0E
        ROL &0F
        ROL &10
        ROL &11
        DEY
        BNE HERE
        RTS
```

new bit 0 = bit 32 EOR bit 19
new bit i = bit i − 1   i ≥ 1
} repeated 32 times

Fig 1 The BBC random-number generator

renormalising to lie between 0 and 1. This has period 1995. (I am grateful to Research Machines Ltd for this information.)

Finding the period of a generator is not easy and well beyond the scope of this article. Fig 2 gives some conditions which ensure congruential generators have maximum possible periods. Note that $2^{16}+1$ is a prime (check it!) and 75 is a primitive element, giving 2^{16} as the period of the Sinclair generator. (To check it, set a = 75 and do a = a*a mod M 15 times, giving $65536 = 2^{16}$.) In cases (i) and (iii) X_i takes all values in 1,2,3,...M−1 during a period, and case (i) includes 0. No simple conditions are known for the periods of shift-register generators.

A long period of itself is not enough for a pseudo-random sequence to be acceptable. The values taken must be uniformly spread between 0 and 1. This is guaranteed for all the maximum period generators described here. Further, successive values must not appear predictable. For example, $X_{i+1} = X_i + 1 \bmod 2^{32}$ has a long enough period, but no one would call its output random. We will at least demand that the pairs (X_i, X_{i+1}) be uniformly spread in the unit square. Fig 3 illustrates some of the patterns which can occur, and Fig 4 lists a program for the BBC Computer to examine these patterns. It has been shown that for congruential generators the choice of c only shifts the pattern slightly, whereas the whole pattern is very sensitive to the choice of the multiplier a. One need not stop at pairs, but can examine triples, quadruples and so on.

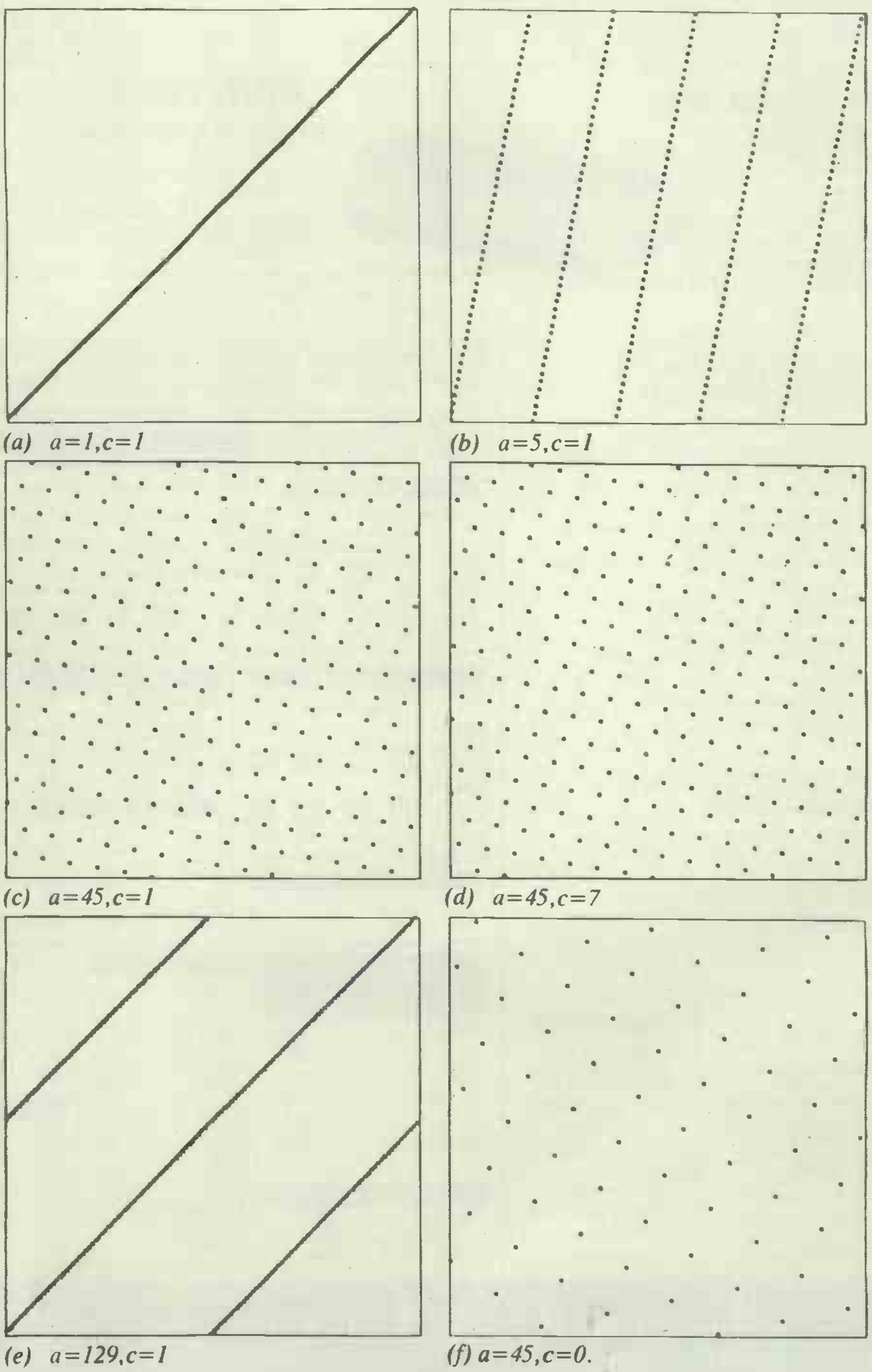
With large periods it will be impossible to examine the patterns of pairs visually — one would need years and ultra-high resolution graphics. Fortunately this is not necessary for the maximum-period congruential generators of Fig 2. Examination of Fig 3 shows that the pattern is a lattice made up of repeating a 'cell' M times. All one needs to do is to find the cell. Since there are M cells, each has area 1/M. Thus, given M, the structure of the pattern is made as fine as possible by choosing a to make the cell as nearly square as possible. Exactly similar considerations apply to triples within the unit cube. In that case the cell has volume 1/M, so at least one of the sides is longer than $1/\sqrt[3]{M}$, for $M = 2^{16}$ about 1/40. Experience has shown that structure on even this small scale can badly affect certain uses of random numbers. Unfortunately very little is known about the multidimensional structure from shift-register generators.

Finding lattice cells

Fig 5 gives a program to find the lattice cell for pairs. It works on two vectors X and Y, repeatedly trying to subtract an integer multiple of the shorter vector from the longer vector. Why it works is research level mathematics (see Beyer, Roof & Williamson, *Mathematics of Computation* 25(1971) pp 345-363 if you really want to know). When no further progress can be made the vectors X and Y contain two sides of the basic lattice cell. The program quotes their lengths. To reduce rounding errors X and Y have been multiplied by M, so they contain integers. However, integer arithmetic is not used since most microcomputers hold real numbers to higher precision than integers (32 rather than 31 bits for the BBC Computer, 23 or 24 bits rather than 15 for most others). None of the elements of X or Y ever exceeds M, so exact calculation is guaranteed in lines 130 and 150 provided 2M−1 can be represented exactly as a real variable. Line 15 allows arbitrary expressions such as 2 ↑ 16+1 to be entered for M.

The observed cells in Fig 3 can be checked by this program. It is also possible to check the generators proposed in *PCW* Sub Set. For example, the ratio of the cell sides for the Sinclair generator is 11.65, for E Thomson's a=254, $M=2^{16}+1$ the ratio is 1.02, and for his a=513, $M=2^{31}-1$ it is 8160! (These *are* all primitive elements.) In fact the longest lattice cell sides are 13.3E−3, 3.94E−3 and 1.95E−3. The second of these generators may appear adequate in two dimensions but has undesirable structure in three dimensions where the longest cell side is 22 times longer than the shortest.

The lattice cell structures in three and four dimensions can easily be checked on a microcomputer, although the response will not be as instant as it is for pairs. Fig 6 gives a program to do this on the BBC Computer. Typical timings are 0.1 seconds for Fig 5, and 0.4, 2.2 and 8.8 seconds for two, three and four dimensions with Fig 6. Considerable care has been taken to avoid rounding errors for $M \leq 2^{31}$, in particular in simulating 64-bit arithmetic to form A*L in FNmult. The variable @% in lines 970... is used to control the printing format. The availability of procedures and multi-line



(a) a=1,c=1 *(b) a=5,c=1*

(c) a=45,c=1 *(d) a=45,c=7*

(e) a=129,c=1 *(f) a=45,c=0.*

Fig 3 Plots of all pairs from maximum-period congruential generators with M = 256.

TAKE YOUR PICK

functions in BBC Basic makes the design of programs of this complexity much easier.

Fig 6 was developed in parallel with a Fortran77 version on a mainframe. The response of the microcomputer version is only slightly slower than on the time-sharing system of the mainframe. (The ratio of CPU times is 30 to 1, but the mainframe was supporting over 100 users.) However, the mainframe version has 96-bit precision and so can analyse generators of a much longer period. This is necessary, for the two congruential generators I use in simulation studies have periods 2^{46} and 2^{57}. For these the lattice structure of the outputs in two or more dimensions is certainly negligible. Unfortunately this is not true for *any* congruential generator I have met on a microcomputer. Acorn was probably wise to choose a shift-register generator for the BBC Computer, although so little is known about these generators that one cannot be totally confident of it. Perhaps designers of random-number generators for 16-bit chips will use their greater word-length and superior multiplication facilities to produce better generators. If so, they ought to consult the one authoritative book on the subject: *The Art of Computer Programming. Volume 2: Semi-Numerical Algorithms* by D E Knuth; Addison-Wesley. The second, 1981, edition is essential.

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```
10 MODE 4
20 INPUT "A,C,M,PERIOD " A,C,M,M%
25 REM Alter SCX for a square box
30 SCX = 1000 : SCY = 900
40 MOVE 100,10 : DRAW 100+SCX,10 : DRAW 100+SCX,10+SCY
50 DRAW 100,10+SCY : DRAW 100,10
60 X = 1
70 FOR I% = 1 TO M%
80   Y = (A*X+C) MOD M
90   PLOT 69,(100+SCX*X/M),(10+SCY*Y/M)
100  X = Y
110  NEXT I%
120 END
```

Fig 4 Program to plot pairs on a BBC Computer

```
10 INPUT "A,M ",A,M$
15 M = EVAL(M$)
20 DIM X(1), Y(1)
30 Y(0) = 0 : Y(1) = M
40 X(0) = 1 : X(1) = A
50 XX = X(0)*X(0)+X(1)*X(1)
60 XY = X(0)*Y(0)+X(1)*Y(1)
70 YY = Y(0)*Y(0)+Y(1)*Y(1)
80 IF XX < YY THEN L = XX ELSE L = YY
90 S = XY/L
100 IF ABS(S) <= 0.5 THEN 170
110 T = INT(ABS(S)+0.5) : IF S < 0 THEN T = -T
120 IF XX < YY THEN 150
130 X(0) = X(0)-T*Y(0) : X(1) = X(1)-T*Y(1)
140 GOTO 50
150 Y(0) = Y(0)-T*X(0) : Y(1) = Y(1)-T*X(1)
160 GOTO 50
170 PRINT "Cell sides are ";SQR(XX)/M;" ";SQR(YY)/M
180 END
```

Fig 5 Program to find cells of lattices of pairs

```
10 REM Program to calculate lattice cells
20 REM for congruential generators.
30 REM B.D. Ripley              Oct 1982
40 REM
50 DIM X(3,3),len(3)
60 DIM CON(2),T(3),IN%(3)
70 INPUT "DIM,MULT,MOD " R%,MULT,M$
80 M=EVAL(M$) : K%=R%-1
100 PROCinit
110 IF FNstep1 THEN 110
120 IF FNstep2 THEN 110
130 PROCres
140 END


150 DEF PROCinit
160 REM
170 REM Initiali es array X to initial
180 REM lattice basis.
190 REM
200 L=1
210 FOR I%=0 TO K%
220   X(0,I%)=L
230   L=FNmult(L,MULT,M)
240   NEXT I%
250 FOR I%=1 TO K% : FOR J%=0 TO K%
260     IF I%=J% THEN X(I%,J%)=M ELSE X(I%,J%)=0
270     NEXT J% : NEXT I%
280 FOR I%=0 TO K%
290   A=0 : FOR J%=0 TO K%
300     A=A+X(I%,J%)↑2 : NEXT J%
310   len(I%)=A : NEXT I%
320 ENDPROC


330 DEF FNstep1
340 REM
350 REM Apply 2D reduction to
360 REM each pair of rows in turn
370 REM
380 CNT=0
390 FOR I%=1 TO K% : FOR J%=0 TO I%-1
400     XY=0 : FOR L%=0 TO K% : XY=XY+X(I%,L%)*X(J%,L%) : NEXT L%
410     IF len(I%)<=len(J%) THEN I1%=I%:I2%=J% ELSE I1%=J%:I2%=I%
420     A=XY/len(I1%) : IF ABS(A)<=0.5 THEN 490
430     L=INT(ABS(A)+0.5) : IF A<0 THEN L=-L
440     CNT=CNT+1 : A=0
450     FOR L%=0 TO K%
460       B=X(I2%,L%)-L*X(I1%,L%) : X(I2%,L%)=B : A=A+B*B : NEXT L%
470     len(I2%)=A
480     IF len(I2%)<len(I1%) THEN 400
490     NEXT J% : NEXT I%
500 =(CNT>0)
510 DEF FNstep2
520 REM
530 REM Sort the rows of X into
540 REM increasing length.
550 REM
560 FOR I%=0 TO K%-1
570   A=len(I%) : L%=I%
580   FOR J%=I%+1 TO K%
590     IF len(J%)<A THEN L%=J% : A=len(J%)
600     NEXT J%
610   IF L%=I% THEN 660
620   len(L%)=len(I%) : len(I%)=A
630   FOR J%=0 TO K%
640     A=X(L%,J%) : X(L%,J%)=X(I%,J%)
650     X(I%,J%)=A : NEXT J%
660   NEXT I%
670 IF R%<3 THEN =FALSE
680 REM
690 REM For 3D and 4D compare third
700 REM and fourth longest rows with
710 REM adding +,- or 0 times each
720 REM shorter row.
730 REM
740 CON(0)=0 : CON(1)=-1 : CON(2)=1
750 FOR I%=2 TO K%
760   AL=len(I%)-0.5
770   IN%(I%)=1
780   SU%=3↑I%-1
790   FOR S%=1 TO SU% : S1%=S%
800     FOR L%=0 TO I%-1
810       T1%=S1% DIV 3
820       IN%(L%)=CON(S1%-3*T1%)
830       S1%=T1% : NEXT L%
840     A=0 : FOR J%=0 TO K%
850       B=0 : FOR L%=0 TO I%
860         B=B+X(L%,J%)*IN%(L%) : NEXT L%
870       T(J%)=B : A=A+B*B : NEXT J%
880     IF A>AL THEN 940
890     len(I%)=A
900     FOR J%=0 TO K% : X(I%,J%)=T(J%) : NEXT J%
910     REM Found a shorter combination
920     PRINT "Step2 success"
930     =TRUE
940     NEXT S% : NEXT I%
950 =FALSE

960 DEF PROCres
970 @%=10
980 PRINT "DIM ";R%;" Cell side lengths"
990 @%=&10308
1000 FOR I%=0 TO K%
1010   PRINT SQR(len(I%))/M; : NEXT I% : PRINT
1020 @%=&40A
1030 PRINT "Ratio ";SQR(len(K%)/len(0))
1040 @%=10 : ENDPROC
1050 DEF FNmult (A,L,M)
1060 REM
1070 REM Calculate A*L MOD M correctly
1080 REM for M up to 2↑32 by letting
1090 REM A = A1*2↑30+A2*2↑15+A3 etc.
1100 REM
1110 LOCAL A1,A2,A3,B,B1,B2,B3,LL,LM,L1,L2,L3,M1,M2,M3
1120 LL=2↑15 : LM=LL*LL
1130 IF A<0 THEN A=A+M
1140 IF L<0 THEN L=L+M
1150 A1=INT(A/LM) : L1=INT(L/LM)
1160 A2=A-A1*LM : L2=L-L1*LM
1170 A3=A2 MOD LL : A2=A2 DIV LL : L3=L2 MOD LL : L2=L2 DIV LL
1180 B=INT(A*L/M) : B1=INT(B/LM) : M1=INT(M/LM)
1190 B2=B-B1*LM : M2=M-M1*LM
1200 B3=B2 MOD LL : B2=B2 DIV LL : M3=M2 MOD LL : M2=M2 DIV LL
1210 B=A1*L1-B1*M1
1220 B=B*LL+A1*L2+A2*L1-B1*M2-B2*M1
1230 B=B*LL+A1*L3+A2*L2+A3*L1-B1*M3-B2*M2-B3*M1
1240 B=B*LL+A2*L3+A3*L2-B2*M2-B3*M2
1250 =B*LL+A3*L3-B3*M3
```

Fig 6 Program to find cells of pairs, triples and quadruples

DATA SHAKER

BASIC FOR THE COCKTAIL ENTHUSIAST

At the time of going to press, we're sweltering in 90°F heat and a cocktail selection program seems like a prayer answered. Mark Huckvale quenches our thirst.

A good stock of spirits, wines, liqueurs, mineral waters and juices naturally enables you to make hundreds of classic cocktails. *Not* having such a grand collection can put you off cocktails altogether. However, with expert advice on cocktail recipes, you can make a large number of cocktails from a limited number of ingredients. This article gives some practical advice in the preparation of cocktails and introduces an expert that is the greatest thing in cocktail mixing since Jeeves.

Mixing cocktails

Traditionally, cocktails are a mixture of spirits with other liquors to make an aperitif. Folklore has grown up over their origination, and also with their techniques of preparation. From a recipe, making cocktails relies on no special skills, so don't listen to people who tell you that stirring is better than shaking, or that the order of adding ingredients is important. There is only really one rule, and that governs any way of making a cocktail — make it cold.

Briefly then, start with half a cocktail shaker or half a mixing glass full of ice, measure in the ingredients, shake for about three minutes or stir for about five, and strain the chilled liquid into one or more glasses. Remember that a cocktail is an aperitif, so keep it short.

Where recipes call for fruit juice, use freshly squeezed fruit whenever practical; when they call for sugar syrup, mix this up from three parts white sugar to one part water. Decorate with maraschino cherries or slices of lime or lemon and serve with panache!

For further advice, recipes and folklore, I recommend *Cocktails and Mixed Drinks* by Anthony Hogg (Hamlyn 1979).

Cocktail selection

The Murphy's law of cocktail making states that: 'the desire for a cocktail varies inversely with the availability of its ingredients.' In other words: if you would like it, you can't make it. The following program sidesteps Murphy's law by preparing, from your ingredients, a list of cocktails that it is possible to make — a kind of recipe book turned inside out. You tell it what you have, it tells you what you can make. In fact, at my house, the guests use it themselves.

Let me describe the operation of the program by listing its commands and what they do:

INITIALISE: In response to the INITIALISE command, the program prompts you with the name of each ingredient in turn, and you reply 'Yes' if you stock it, or 'No' if you don't.

SELECT: Once you have initialised the availability of ingredients, the SELECT command will compute and list names of cocktails that can be made from those ingredients.

PRINT: From a cocktail name, you can

```
1000 REM ********************************************************************
1010 REM ****    C O C K T A I L   S E L E C T I O N   P R O G R A M    ****
1020 REM ********************************************************************
1030 REM
1040 REM  VANILLA BASIC VERSION / M.A. HUCKVALE / SEPTEMBER 1982
1050 REM
1100 REM -------------------------------------------------------------------
1110 REM PROGRAM CONSTANTS
1120 NQUANTY=15 : REM NUMBER OF QUANTITY TYPES
1130 NINGRED=20 : REM NUMBER OF INGREDIENTS
1140 NRECIPE=50 : REM NUMBER OF RECIPES
1150 YES$='YES' : NO$='NO' : BLANK$='' : REM CONVERSATION CONSTANTS
1200 REM PROGRAM ARRAYS
1210 DIM QUANTY$(NQUANTY) : REM QUANTITY DESCRIPTIONS
1220 DIM INGRED$(NINGRED) : REM INGREDIENT NAMES
1230 DIM RECIPE$(NRECIPE) : REM RECIPE DESCRIPTIONS
1240 DIM AVAIL(NINGRED)   : REM INGREDIENT AVAILABILITY FLAGS
1250 DIM MAKES(NRECIPE)   : REM RECIPE 'MAKE-ABLE' FLAGS
1260 FOR I=1 TO NINGRED   : REM NO INGREDIENTS AVAILABLE
1270 AVAIL(I)=0
1280 NEXT I
1300 REM VARIABLES USED BY STRING DECODING FUNCTION
1310 DIM CQUANTY(10)
1320 DIM CINGRED(10)
2000 REM -------------------------------------------------------------------
2010 REM PROCEDURE TO INITIALISE QUANTITIES
2020 QUANTY$(1)='One measure of '       : REM A
2030 QUANTY$(2)='Two measures of '      : REM B
2040 QUANTY$(3)='Three measures of '    : REM C
2050 QUANTY$(4)='Four measures of '     : REM D
2060 QUANTY$(5)='Five measures of '     : REM E
2070 QUANTY$(6)='Six measures of '      : REM F
2080 QUANTY$(7)='Seven measures of '    : REM G
2090 QUANTY$(8)='A twist of '           : REM H
2100 QUANTY$(9)='A teaspoonful of '     : REM I
2110 QUANTY$(10)='Two teaspoonfuls of ': REM J
2120 QUANTY$(11)='A dash of '           : REM K
2130 QUANTY$(12)='Two dashes of '       : REM L
2140 QUANTY$(13)='Three dashes of '     : REM M
2150 QUANTY$(14)='One or two '          : REM N
2160 QUANTY$(15)=BLANK$                 : REM O
2200 REM PROCEDURE TO INITIALISE INGREDIENTS
2210 INGRED$(1)='ANGOSTURA BITTERS'
2220 INGRED$(2)='BRANDY'
2230 INGRED$(3)='CALVADOS'
2240 INGRED$(4)='CHERRIES'
2250 INGRED$(5)='COINTREAU'
2260 INGRED$(6)='GIN'
2270 INGRED$(7)='GRENADINE'
2280 INGRED$(8)='LEMON JUICE'
2290 INGRED$(9)='LEMON PEEL'
2300 INGRED$(10)='ORANGE BITTERS'
2310 INGRED$(11)='ORANGE CURACAO'
2320 INGRED$(12)='ORANGE JUICE'
2330 INGRED$(13)='PASTIS/PERNOD'
2340 INGRED$(14)='RUM'
2350 INGRED$(15)='SUGAR SYRUP'
2360 INGRED$(16)='VERMOUTH (DRY)'
2370 INGRED$(17)='VERMOUTH (SWEET)'
2380 INGRED$(18)='VODKA'
2390 INGRED$(19)='WHISKEY'
2400 INGRED$(20)='WHITE OF EGG'
2410 REM PROCEDURE TO INITIALISE RECIPES
2420 RECIPE$(1)='AFFINITY$B19A17L01'
2430 RECIPE$(2)='BACARDI$C14A08I07'
2440 RECIPE$(3)='BALALAIKA$A18A05A08'
2450 RECIPE$(4)='BETWEEN-THE-SHEETS$A02A14A05K08'
2460 RECIPE$(5)='BOMBAY$B02A16A17K13L11'
```

```
2470 RECIPE$(6)='BOURBONELLA$B19A16A11K07'
2480 RECIPE$(7)='BRANDY COCKTAIL 1$D02A17K01'
2490 RECIPE$(8)='BRANDY COCKTAIL 2$D02A11L01N04'
2500 RECIPE$(9)='BRANDY GUMP$A02A08L07'
2510 RECIPE$(10)='BRONX$C06A16A17A12'
2520 RECIPE$(11)='CALVADOS$B03B12A05A10'
2530 RECIPE$(12)='CLOVER CLUB$B06A07A08O20'
2540 RECIPE$(13)='COMMODORE$D19A08L10O15'
2550 RECIPE$(14)='DAIQUIRI$C14A08M15'
2560 RECIPE$(15)='DEPTH CHARGE$A02A03L07M08'
2570 RECIPE$(16)='GIN AND IT$A06A17N04'
2580 RECIPE$(17)='GREEN ROOM$A02B16L11'
2590 RECIPE$(18)='HARVARD$A02A17L01K15H09'
2600 RECIPE$(19)='INK STREET$A19A08A12'
2610 RECIPE$(20)='JACK ROSE$C03A07A08'
2620 RECIPE$(21)='LEVIATHAN$B02A17A12'
2630 RECIPE$(22)='LIBERTY$B03A14K15'
2640 RECIPE$(23)='LITTLE PRINCESS$A14A17'
2650 RECIPE$(24)='MACARONI$B13A17'
2660 RECIPE$(25)='MAIDEN'S PRAYER$C06C05A12'
2670 RECIPE$(26)='MANHATTAN (DRY)$B19A16H09K01'
2680 RECIPE$(27)='MANHATTAN (MEDIUM)$D19A16A17'
2690 RECIPE$(28)='MANHATTAN (SWEET)$B19A17K01N04'
2700 RECIPE$(29)='MARTINI (DRY)$A06A16K10'
2710 RECIPE$(30)='MARTINI (MEDIUM)$B06A16A17'
2720 RECIPE$(31)='MARTINI (SWEET)$B06A17N04'
2730 RECIPE$(32)='MONKEY GLAND$C06B12L13L07'
2740 RECIPE$(33)='MORNING GLORY$B02A11A08L01L13H09'
2750 RECIPE$(34)='OLD FASHIONED$J15M01N04O19'
2760 RECIPE$(35)='PICCADILY$B06A16K13K07'
2770 RECIPE$(36)='PINK LADY$D06A07O20'
2780 RECIPE$(37)='R.A.C.$B06A16A17K10K07N04'
2790 RECIPE$(38)='ROB ROY$A19A17K01N04'
2800 RECIPE$(39)='SHANGHAI$D14A13C08L07'
2810 RECIPE$(40)='SIDECAR$C02A05A08'
2820 RECIPE$(41)='SUISSESSE$A13A08O20'
2830 RECIPE$(42)='SWEET MEMORIES$A14A16A11'
2840 RECIPE$(43)='T.N.T.$B02A11K01K13'
2850 RECIPE$(44)='TANGO$B06A16A17L11K12'
2860 RECIPE$(45)='THREE MILER$B02A14K08I07'
2870 RECIPE$(46)='VODKATINI$B18A16H09'
2880 RECIPE$(47)='WHIP$A02A13A16A11'
2890 RECIPE$(48)='WHISKEY COCKTAIL$D19A11L01N04'
2900 RECIPE$(49)='WHITE LADY$B06A05A08K20'
2910 RECIPE$(50)='WHIZZ BANG$B19A16L13L07L10'
3000 REM -------------------------------------------------------------------
3010 PRINT
3020 PRINT 'THE PATENTED COCKTAIL SELECTION PROGRAM'
3030 PRINT '======================================='
3040 PRINT
3090 ANSWER$='H' : REM FIRST COMMAND IS 'HELP'
3100 REM MAIN COMMAND LOOP
3110 IF ANSWER$=LEFT$('INITIALISE',LEN(ANSWER$)) THEN GOTO 4000
3120 IF ANSWER$=LEFT$('MODIFY',LEN(ANSWER$)) THEN GOTO 5000
3130 IF ANSWER$=LEFT$('SELECT',LEN(ANSWER$)) THEN GOTO 6000
3140 IF ANSWER$=LEFT$('CHECK',LEN(ANSWER$)) THEN GOTO 7000
3150 IF ANSWER$=LEFT$('PRINT',LEN(ANSWER$)) THEN GOTO 8000
3160 IF ANSWER$=LEFT$('HELP',LEN(ANSWER$)) THEN GOTO 9000
3170 PRINT '? Not a command'
3200 REM GET COMMAND
3210 PRINT
3220 PRINT '- - - - - - - - - - - - - - - - - - - - - - - - -';
3230 PRINT ' - - - - - - - - - - - -'
3240 PRINT
3250 PRINT 'Commands are: INITIALISE, MODIFY, SELECT, CHECK, ';
3260 PRINT 'PRINT, BYE and HELP.'
3270 PRINT 'Enter Command : ';
3280 INPUT ANSWER$
```

list out its recipe with the PRINT command.

CHECK: An alternative means of searching for a cocktail is by the ingredients that it contains. The CHECK command allows you to ask which cocktails use a particular ingredient. You can use it to search for cocktails that might suit your taste. It also tells you which of those you can make.

MODIFY: When ingredients run out, or when you are experimenting, the availability of ingredients can be changed with the INITIALISE command all over again. Alternatively, the MODIFY command allows you to change the availability of particular ingredients by name.

There is also the command HELP which gives brief details about which commands do what, and BYE which takes you out of the program.

Program details

I have deliberately avoided a specific dialect of Basic to try to make the cocktail selection program more widely applicable. The Basic language in the listing is 'plain vanilla' Microsoft, although I have used long, variable names for clarity. However, the first two characters of the variable names can be used as unique identifiers.

The only real conversion problems you might have are with decoding the recipe strings. Each recipe is stored as a string of characters: firstly the name, then a dollar sign, then a list of ingredients. Each ingredient is encoded into three characters: a quantity descriptor (eg, 'one measure of') from the letters 'A' to 'O', and an ingredient number from '01' to '20'. The routine at line 10000 decomposes a recipe string into its constituent parts.

The program allows the use of truncated command strings and recipe names, etc, through the use of a special string comparison statement (eg, line 3110). If you cannot convert this idea into your Basic, then a simple string comparison will do as well.

I have tried to keep to the more commonly available and most widely used ingredients for cocktail mixing. There are some famous cocktail names missing as a consequence. Ideally the ingredient and recipe data should be stored in a disk file or in DATA statements. I leave that — and the addition of more recipes — up to you.

Other ideas

My experience with this program shows that it generates a great deal of interest from non-computer people. I think that this is because it is *novel* and because it is *practical*. The program fulfils a function not easily duplicated by other means, and the computer is your assistant rather than your adversary.

Novel and practical programs give home computing a credibility not generated by games software or by the current 'home finance' type software. While the cocktail selection program is not earth shaking, I think it is constructive in bringing home computer software to ordinary people.

GOTO page 229

Illustration by Arthur Brown

NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Probably the **first** thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. Well, in the words of *The Hitch-hikers' Guide to the Galaxy,* don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which the computer's output is displayed'. This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *PCW*.

For those completely new to computing, let's start with the question: what is a microcomputer? We can think of a micro as a general-purpose device as opposed to a typewriter which can only be used for typing, a calculator to perform calculations, a filing-cabinet to file information and so on. A micro can do all those things and more.

If it is to be of any use, a general-purpose device needs some way of having a function assigned to it. We do this by giving the computer a set of logical instructions called a **program**. The general term for computer programs is **software**. Every other part of a microcomputer system is known as **hardware**. 'If you can touch it, it's hardware.'

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a code known as a **computer language**. There are literally hundreds of different languages around, the most popular of these being **Basic**. Basic is an acronym of Beginners' All-purpose Symbolic Instruction Code. Although originally intended only as a simple introductory language, Basic is now a powerful and widely-used language in its own right.

Other languages you're likely to come across in *PCW* include **Forth, Pascal, C** and **Comal**. These are known as **high-level languages** because they approach the sophistication of a human language. You'll also see references to the **low-level languages, assembly language** and **machine code**. We'll look at high and low-level languages in a moment.

The heart of a micro, the workhorse, is the **processor** or **Central Processing Unit (CPU)**. The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor around, the Z80, 6502 and 8088 being the three most common. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.

Being electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by **binary** (base two) notation, the two binary digits (known as **'bits'**) being 0 and 1. It is possible to program computers in binary notation, otherwise known as **machine code** (or machine language) programming.

Machine code is called a low-level language because it operates at a level close to that 'understood' by the processor. (Languages like Basic are known as high-level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.)

Between high-level languages and machine code is a low-level language known as **assembly language** or, colloquially, **assembler**. This is a mnemonic code using symbols which the processor can quickly convert to machine code.

Since there is no binary equivalent of a comma or the letter 'a', for example, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the American Standard Code for Information Interchange, **ASCII**. This system assigns each character a decimal number which the processor can then convert to its binary equivalent.

There are two types of program to do this translation for us. The first of these is a **compiler** which translates our whole program permanently into machine code. When we compile a program, the original high-level language version is called the **source code** while the compiled copy is called the **object code**. Compiled programs are fast to run but hard to edit. (If we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code.) For this reason there is a second translation program: an **interpreter**. An interpreter waits until we actually **run** (use) the program, then translates one line at a time into machine code — leaving the program in its original high-level language. This makes it slower to run than a compiled program, but easier to edit.

There are two strange-sounding Basic words you're likely to come across: **POKE** and **PEEK**. When you program in a high-level language, you are normally unable to choose which part of the machine's memory the processor will use to store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'POKE' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above POKE with 'PEEK 10000', the computer would respond by displaying the value 56. (POKEing and PEEKing is normally done to increase program speed. It's a compromise between Basic and machine code.)

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of memory. There are two types of memory known as **Read Only Memory (ROM)** and the badly-named **Random Access Memory (RAM)**. ROM is so-called because the processor can **'read'** (get things out of) its contents, but is unable to **'write to'** (put things in) it.

ROM is used to store **firmware**, which consists of software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and data (information). The second important difference is that RAM needs a constant power-supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8-bit binary number. 8 bits make one byte and 1024 bytes make one **kilobyte** or **1k**. 32k, for example means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 ... 1024 being the nearest binary multiple to 1000.

There are numerous forms of **permanent** or **backup** storage, but by far the most common are the **floppy disk** and **cassette**.

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a **disk drive**. Disk drives comprise a high-speed motor to rotate the disk and a read/write head to record and 'playback' programs and data.

The disk is divided into concentric rings called **tracks** (similar to the tracks on an LP) which are in turn divided into small blocks by spoke-like divisions called **sectors**.

There are two methods for dividing the disk into sectors. One method is called **hard-sectoring**, where holes punched in the disk mark the sectors, and the other is **soft-sectoring** where the sectors are marked magnetically. (The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers do seem to have begun to acknowledge that this situation can't go on forever, and they are working on making their disks compatible with each others.')

Since the computer needs some way of tracking the whereabouts of everything on the disk, we have a program called a **Disk Operating System**, more usually known simply as the **Operating System (DOS or OS)**. The operating system does all the 'house-keeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available (each with its own advantages and disadvantages). The two most popular OSs are **CP/M** (Control Program for Micros) and **MS-DOS** (MicroSoft Disk Operating System).

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and is adequate for games and the like.

Another type of disk you'll see referred to is the **hard disk**. This is an extremely efficient method of storing large amounts of programs and data. Hard disk capacity generally starts at around 10 Mbytes (10 million bytes) and rises to . . . well, you name it. Besides offering a much greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

Since computers need some way of communicating with the outside world, we need input and output devices. Input and output devices include all manner of things from hard disk units to light-pens, but the minimum requirement for most applications is a typewriter-style **keyboard** for input and a tv-like **Visual Display Unit** for output. The Visual Display Unit is variously referred to as a **VDU, Cathode Ray Tube (CRT)** and **monitor**.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, etc) may all be built in to a single unit or they may be separate, connected by cables.

Take this paragraph slowly and it makes sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — **parallel** or **serial**. **Parallel input/output (I/O)** requires a number of parallel wires. Each wire carries one bit, so with 8 wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). **Serial I/O**, in contrast, uses a single wire to transmit a series of bits one at a time with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different **interfaces**. An interface is simply a piece of circuitry used to connect two or more devices. The most common standard serial interface is the **RS232** (or **V24**) while the **Centronics** standard is popular for parallel interfaces.

When two computers want to communicate with each other over a distance, there are again two ways of doing it. Both methods use the public phone network. The simplest and cheapest method is to use a device known as an **acoustic coupler**. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. However an acoustic coupler is slow and not exceptionally reliable.

A more sophisticated (and correspondingly more expensive) method is to use a **modem**. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from British Telecom.

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SOFTWARE

WHICH SPREADSHEET?

SPECTRUM SPREAD

Mike Liardet continues his series with a comparison of Psion's Vu-Calc and Microl's The Spreadsheet, both available for the Sinclair Spectrum.

When Sinclair Research launched the ZX Spectrum in April 1982 the company was already in the record books, having sold more computers than any other company in history. Well yes, each sale was only £70 or so, but it had only been selling computers for two years. And just a few months (or should I say (K)nights? — groan) later, with 300,000 Spectrums sold, total Sinclair sales edged over the magic million mark.

It is a reasonable assumption that many of the thousands of Spectrum purchasers use the computer simply for games or educational purposes, and of course most of the Spectrum software is aimed at this sector of the market. But the fact is that packed into that small case, only slightly larger than a paperback book, is a computer of considerable power and sophistication. This fact will be amply demonstrated by the arrival of the much heralded micro-disk drives (for about £40) and networking facilities which will make the Spectrum almost as powerful as a CP/M business machine (costing ten times as much).

Anyway it is possible to run fairly sophisticated applications on the Spectrum, and a trickle of such packages are now becoming available. These include indexing and text processing systems, and of course spreadsheet systems.

In this article we are going to compare two of the currently available Spectrum spreadsheet systems: Psion's Vu-Calc and Microl's The Spreadsheet. Microl claims that: 'The Spreadsheet outperforms all Spectrum spreadsheets including Vu-Calc.' We shall certainly put that claim to the test!

Firstly, for the benefit of the non-Spectrum owner we will deal with the Spectrum itself. Actually *PCW* June 82 contains a full, in-depth evaluation of it. Next we will deal with Vu-Calc and The Spreadsheet individually, and then tie the whole lot together at the end. Just as a final bonus we will wind up with a brief review of all the cassette spreadsheet systems covered so far in the series.

'...packed into that small case, only slightly larger than a paperback book, is a computer of considerable power and sophistication.'

Getting going

Being completely new to the Spectrum and all its software I was quite well-placed to evaluate the introductory guides and see just how easy it is to get everything up and running from scratch.

The complete package, a 48k Spectrum with printer and power supply, etc, arrived in two well-padded boxes. Once the boxes were open, I had to pause for some time just to marvel at the Spectrum: with 48k of RAM, an excellent Basic interpreter in ROM and high-resolution colour graphics it has a specification not unlike the original Apple II, which must be forty times larger, and a good bit more expensive too!

In common with most small, inexpensive machines, the Spectrum must be connected to an ordinary domestic cassette recorder and television set in order to make up a complete system. It is fairly obvious how everything fits together — all sockets are labelled and all plugs that need to be different *are* different and so it is difficult to go wrong. I experienced only minor hold-ups before I could get started: I had to fit a mains plug to the power supply and solder different plugs onto the cassette leads, as my archaic recorder did not accept the jack-plugs fitted by Sinclair. Once everything was connected my desktop somewhat resembled a plate of spaghetti, with leads trailing everywhere, but everything seemed to work okay.

After a brief glance at the keyboard, I quickly decided to try out the keyboard familiarisation course instead of immediately delving into the two spreadsheet systems. The keyboard, although laid out in the conventional qwerty pattern, had lots of extra unfamiliar symbols printed on each key and also lacked a few of the usual computer keys, like SHIFT, CONTROL, ESCAPE, etc.

The keyboard course is provided for free with the Spectrum, and is on a cassette tape. Loading this provided me with some initial practice with the cassette recorder, getting volume levels right and so on. Incidentally it is written by Psion, who also wrote Vu-calc, and in fact a number of other Spectrum packages. The Spectrum keys are actually made of rubber, and feel more like calculator keys than VDU keys, but work reliably enough all the same. After about half an hour of keyboard training, I felt I knew enough to try out one of the spreadsheet systems . . .

Vu-Calc

Psion, the producer of Vu-calc, is one of a number of software houses working in close co-operation with Sinclair Research. It is also now converting some of its product range (including Vu-calc) onto the BBC machine. It has reputedly sold over a million software tapes for the Spectrum and ZX81 and its products range from games like Hungry Horace, to an indexing system (Vu-file) and, of course, the spreadsheet system: Vu-calc.

Vu-calc is supplied as a single cassette tape, in a standard plastic cassette box. My first impression was that there was no documentation at all, but closer inspection revealed that the paper liner for the cassette box actually unfolded into a short seven page leaflet. Although initially unimpressed by this, I found that, in practice, it was quite adequate — indeed slightly easier to use than Microl's 45-page manual for The Spreadsheet.

With my newly acquired keyboard skills I found loading the Vu-calc software completely straightforward: just type in the LOAD command, set the tape running and wait two or three minutes. Psion provides a bit of light relief while the tape is being read with a high resolution graphics image of the planet Saturn — actually the company logo.

Once Vu-calc is fully loaded and operational, the screen clears to a fairly typical spreadsheet display of four columns, each wide enough to display six digit decimal numbers and 18 rows. The display is actually in colour but as I was using a monochrome TV I could only gaze wistfully at the colour picture on the front of the Vu-calc documentation. If that is a true representation of the software then users with a colour TV will get the benefit of relaxing pastel blues and greens while they are Vu-calcing.

As with most spreadsheet systems the screen simulates a window over the entire sheet. A wide blob filling a whole column width of one row indicates the current cell, the cell which will receive any number, text or formulae that may be keyed in. This blob, or cursor, can easily be moved around the sheet by pressing the four arrow keys on the Spectrum keyboard. Each key moves the cursor in the obvious direction and attempts to move the cursor off the edge of the screen cause a very rapid redraw. The effect is as if the screen window has been dragged to a new position by the cursor.

Holding a key down for a few seconds causes a series of rapid redraws, stopping when the cursor hits an outer edge of the spreadsheet. In this way I quickly established that Vu-calc's spreadsheet extends down 60 rows and across 60 columns. Of course the screen window (occupying about 6in by 6in on a 12in TV) permits only 18 rows by 4 columns to be viewed at any given moment. Thus the software is simulating a window onto a piece of paper about eight feet wide and two feet long.

With a few keystrokes it is possible to 'jump' the cursor to any named cell. Cells are identified by letters of the alphabet for the row they occupy (A to Z for the first twenty six, then AA, AB . . . BH for the remainder) and numbers (1 to 60) for their column. Thus A1 is the top left hand corner of the spreadsheet and BH60 is the bottom right. Most spreadsheet systems do not operate this way, but copy the original Visicalc convention of naming rows with numbers and columns with letters. I prefer Vu-calc in this respect, since it is fairly common to reference, say, the thirteenth column (for yearly totals) and I can never remember what is the thirteenth letter of the alphabet. With Vu-calc, I simply need to remember the thirteenth number (ie, 13).

Having established the overall dimensions of the spreadsheet, I started keying in the Benchmarks. These marks, described fully in *PCW* Nov 82, are designed to stretch systems to the limit, pushing both the processor and RAM memory as hard as possible. Most spreadsheets have a fairly large theoretical sheet size, but exhaust either the processor or available RAM or both long before the sheet is completely filled with numbers and formulae. This did not happen with Vu-calc. In fact it sailed through all the Benchmarks with flying colours (see below). Perhaps not as fast as some, but fast enough, and with the capacity to fill each and every one of the 3600 cells available.

Once the Benchmarks were completed I started looking for any special facilities and was disappointed to find very little in this department. Noticeable absentees included row and column deletion, variable column widths and logs and trig, not to mention more sophisticated facilities like split screens, graphics and so on. Having only simple arithmetic is particularly restrictive, and is a slightly puzzling omission since the Spectrum comes ready supplied with all the necessary maths software as part of its Basic interpreter in ROM. Another nasty was the error trapping. Illegal arithmetic, or referencing non-existent cells, etc, causes the system to drop into Basic. Simply type GOTO 9000 and everything is restored to normal. Actually you quickly get used to this, and in any case The Spreadsheet is the same, but you must be careful to key in the right line number!

'An interesting facility is EDIT. If a formula is EDITed, then not only the current cell is affected, but also every replication of it.'

Of course Vu-calc does provide facilities for loading and saving spreadsheets to cassette and these operate at quite a reasonable speed (see Benchmarks). There is also a formula replication command, permitting both relative and absolute copies to be automatically written into a line or rectangle of cells. An interesting facility is EDIT. If a formula is EDITed, then not only the current cell is affected, but also every replication of it. Thus it is unnecessary to redo the replication after a formula has been corrected.

Incidentally this latter facility gives some clue as to why Vu-calc performs so well under the Benchmarks. When the Benchmark formula (consisting of 20 characters or so) is replicated, instead of mindlessly making numerous variations of the formula for each cell, consuming 20 bytes of memory for each, it economically uses just two or three bytes as a reference to the original formula. A subsequent EDIT of this formula automatically corrects all cells which refer to it, an advantage in both storage space and time saved for the user. This implementation device is, of course, completely invisible to the user (the above description is my deduction of what must be happening underneath) and all formulae, whether resulting from a replication or not, always appear correctly displayed as if they were really stored explicitly. Incidentally a formula can also be corrected without affecting any previously made copies of it: simply type in a replacement formula without using the EDIT facility.

About the only other major facility is PRINT, which copies the screen to the Spectrum's ZX printer. This printer, not much larger than a packet of cigarettes, provides a fairly noisy printout on metallised paper.

The Spreadsheet

Microl are currently selling a selection of packages for the Spectrum, mostly prefixed by 'The'. Thus we have 'The Database', 'The Word Processor' and also 'The (aforementioned) Spreadsheet' (from now on 'TS'). TS's packaging is certainly more impressive than Psion's. TS is supplied in a neat cardboard box, containing a cassette, nicely printed manual and various leaflets on Microl's other goodies.

Getting started with the system proved quite tricky. Firstly the manual states that LOAD "spread" is the Basic command to get the software loaded from the cassette and running in the Spectrum. Actually, after several abortive attempts I deduced that the manual was wrong and successfully used 'LOAD "TS" ' instead. This actually loads TS and sets it up with demonstration data for the tutorial. The manual claims that the cassette also has a version of TS without demonstration data but after trying both sides of the cassette, I was unable to find it.

Fortunately, it is possible to clear TS's spreadsheet, so I was able to clear out the demonstration data to put the system through its paces. But as soon as I started replicating the Benchmarks formulae the system started bombing out—ie, dropping into Basic with a cryptic error message. Eventually I found the right section in the manual for getting restarted: type GOTO rs. But the error problem still persisted.

Actually, on the point of phoning Microl, I managed to discover what was wrong. When using the CLEAR command, to clear out the demonstration data, TS requests information on spreadsheet dimensions: the more columns you want the fewer rows available and so on. By the way, once this choice is made you can only change it by CLEARing and losing all the spreadsheet model, which is quite a serious disadvantage in itself. Anyway, in preparation for the Benchmarks, I opted for 13 columns. The system responded by saying that this permitted '<=72 rows', so naturally I selected 72, as the maximum possible. Actually it turns out that this recommended figure is wrong, and if a lower figure, say, 71, is selected then the system works correctly thereafter.

Once over these obstacles, things went reasonably smoothly. TS does have more facilities than Vu-calc, notably a full range of maths functions and variable column widths. But I found it quite a frustrating system to use.

First the minor complaints: a row-sum facility exists, but it cannot be replicated down a column. The space bar must be pushed (to set the system into 'expression mode') before a formula or number can be entered — I kept forgetting and being treated to an error message. Formulae are converted into an internal format, which is the one chosen for display. The original format can only be viewed after a considerable pause following a special key-stroke.

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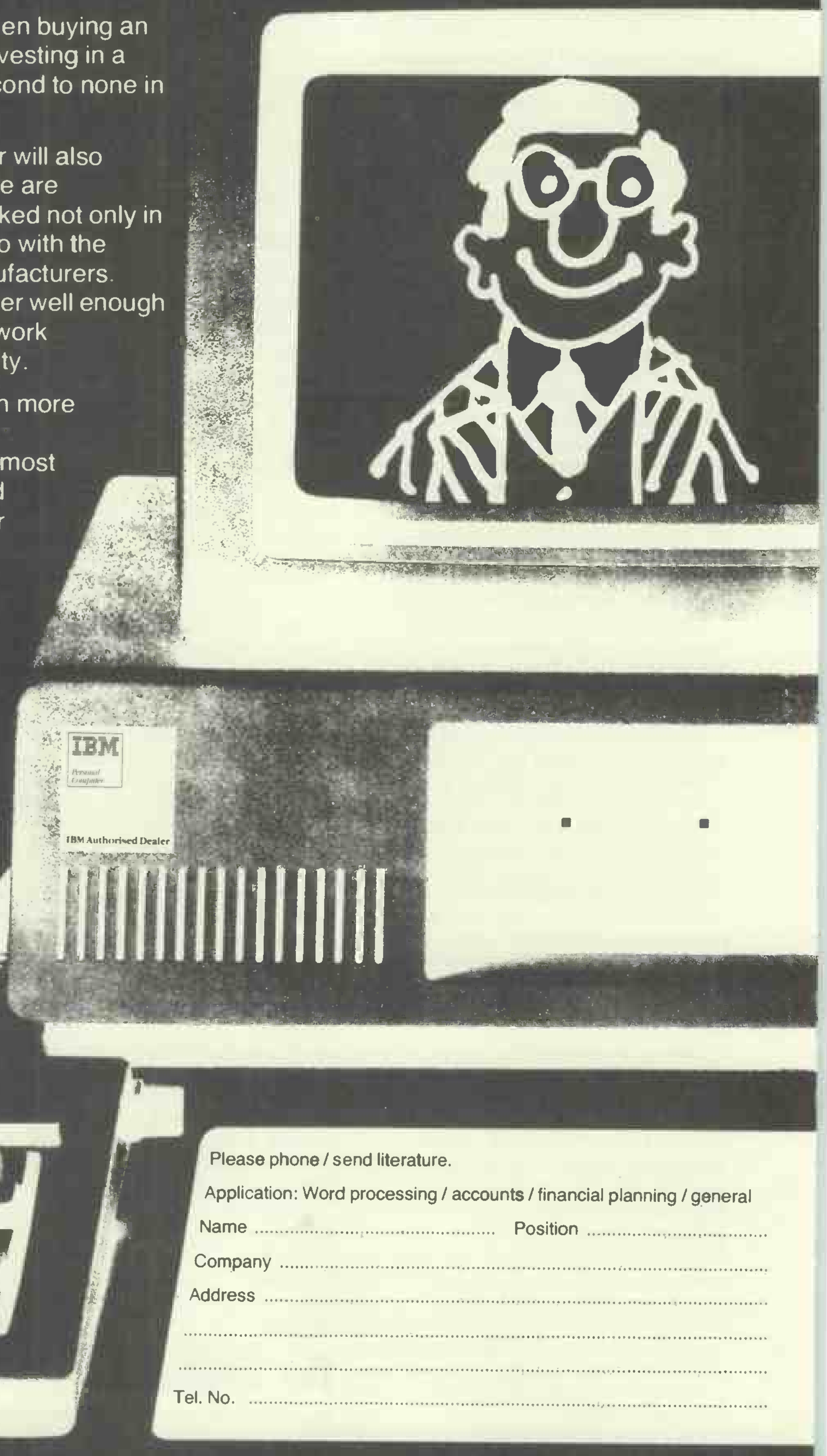

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SPECTRUM SPREAD

Lastly, I found the style of the manual occasionally condescending and authoritative: 'Finally, some more about the art of estimating . . .', etc.

Anyway, most of these minor complaints can be tolerated, but there is one major problem that makes the system very difficult to use, at least for spreadsheet models of any reasonable size. TS is, unfortunately, irritatingly slow. Like Vu-calc, and many other spreadsheet systems, it provides the usual 'windowing' facility but can take over forty seconds to redraw the screen if a shift of window is required by a cursor move. (Vu-calc does this practically instantaneously.) Some of the other major facilities also take an excessively long time. For example, replicating the Benchmark formula right across all available cells takes around ten minutes. Admittedly this is a fairly Herculean task, and one would expect some sort of delay from any spreadsheet system, but ten minutes is a long time to wait.

Having dispensed with the grumbles, were there any features of TS that I actually liked? Well, it does have comprehensive maths facilities, in fact access to all of the considerable number of maths functions in the Sinclair version of Basic. The actual screen display was clearer on my TV set. I imagine that it is actually a colour display, but the choice of colours provided a clearer image than Vu-calc on my monochrome TV. Also TS gives a short 'click' on the Spectrum speaker after every key-hit. The rubber keys on the Spectrum provide no sound on their own, and this is slightly disconcerting when you are used to the rattle of a conventional VDU keyboard. So Vu-calc operates in complete silence and TS simulates the clicking of a normal keyboard!

'Like Vu-Calc, and many other spreadsheet systems, it provides the usual "windowing" facility but can take over forty seconds to redraw the screen if a shift of window is required by a cursor move.'

In conclusion

The Spectrum is a very powerful micro packed into an incredibly small case and at a very low price. Vu-calc complements it very nicely, working quickly and efficiently with no major glitches or problems. My only major criticism of Vu-calc is the lack of maths functions. Unfortunately, anyone wanting more than + – * / will have to cross Vu-calc off their list.

Although The Spreadsheet offers a few more facilities than Vu-calc, in particular extensive mathematics, it is very slow and this makes it very difficult to use.

What about Microl's claim that it 'outperforms all . . . including Vu-calc'? I can see no validity in this claim whatsoever. Yes, it does have facilities absent from Vu-calc, but anyone can fit an electric toothbrush to a bicycle. I doubt that Microl would claim that this makes it 'outperform' a motor-bike.

Checklist Vu-Calc v The Spreadsheet

*Where one system is clearly superior to the other it is marked with a **

	Vu-calc	The Spreadsheet
Available for 16k Spectrum	*Yes	No
Available for 48k Spectrum	Yes	Yes
Error handling	Poor	Poor
Documentation	Fair	Fair
User-friendliness	*Good	Too slow
Printouts	Yes	Yes
Arithmetic	+ – * /	*Extensive
Display formats	Few	*Many
Insertions/Deletions	No	No
Replication	Yes	Yes
Cursor jump	Yes	Yes
Auto/manual recalculation	Manual	Manual
Price	£8.95	£9.95

Benchtests and other measurements

*Where one system is clearly superior to the other it is marked with a **

	Vu-calc	The Spreadsheet
(See *PCW* Feb 83 for more information)		
1 (a) Max £ rows calculation	*240	71
1 (b) & (c) Calc speed (rows/sec)	*1	0.15
1 (d) Vertical scroll (rows/sec)	*4	0.08
1 (e) Horiz scroll (cols/sec)	*3	0.03
2 Max # rows of text	*240	71
3 Max # rows of numbers	*240	71
4 Cassette speed (rows/sec)	*1.5	0.33
Max number of rows	60	99
Max number of columns	60	26
£ digits numeric precision	8–9	8–9
Column widths	(fixed) 7	(varies up to)*30

Cassette-based spreadsheets: the story so far

Now that the series has been running several months and we have evaluated several spreadsheet systems, both disk and cassette-based, it is an appropriate time to take stock of all the cassette-based spreadsheet software reviewed to date.

In fact one could expect cassette-based machines to have spreadsheet systems almost as good as disk-based. This is because spreadsheet software feeds primarily on a micro's central processor and RAM memory — and the cheapest cassette micros provide identical processor power and nearly as much RAM as many of the more expensive disk-based computers. In spite of this there is a fairly considerable quality gap between disk and cassette spreadsheet software.

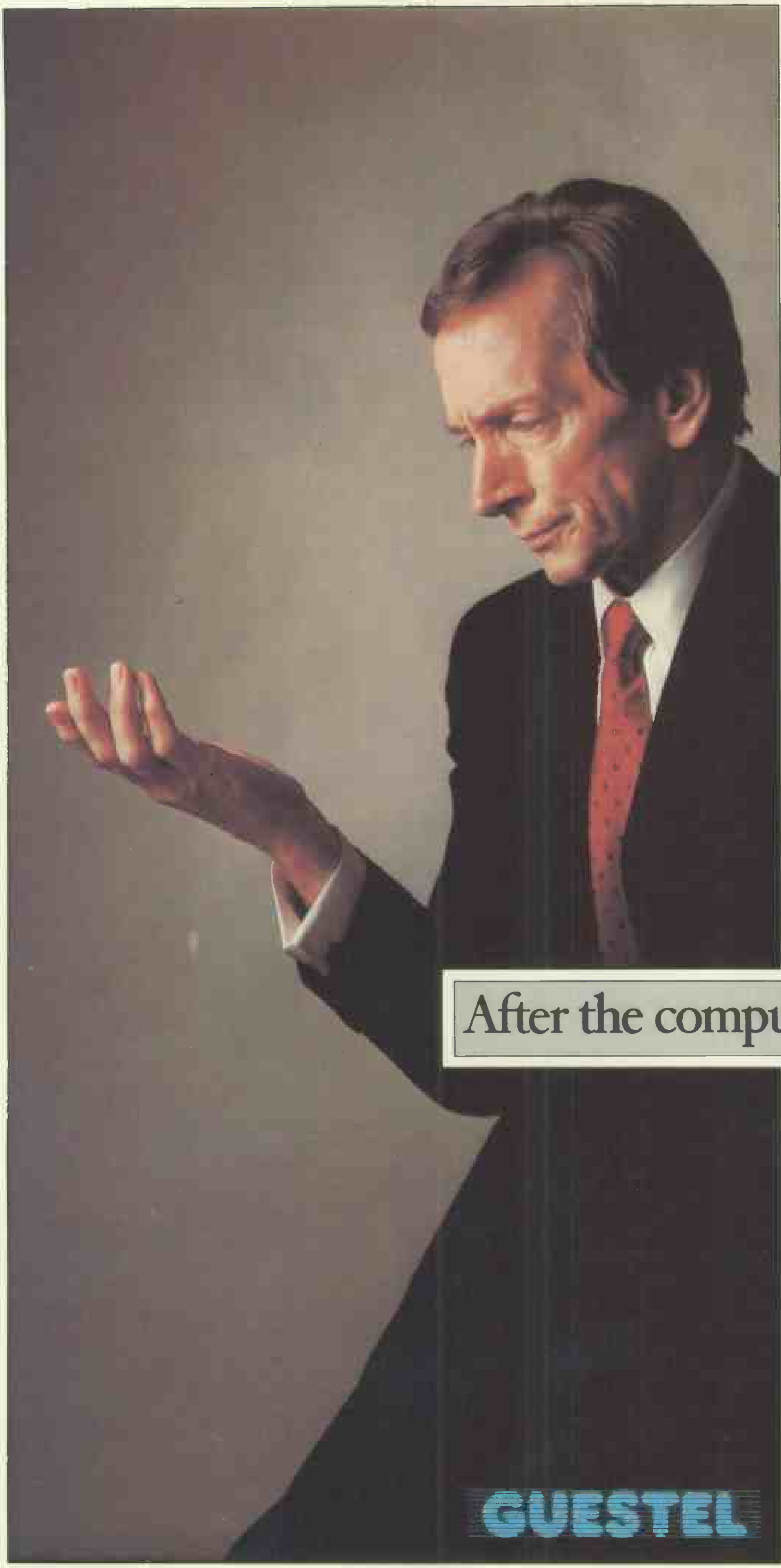
I suspect that the reason for this is because disk-based machines, with a huge choice of programming languages and editors, etc, do provide a superior environment for 'writing' spreadsheet software. Perhaps when cassette machines grow disks or can be easily loaded with software actually developed on a larger machine then this state of affairs may greatly improve.

So none of the cassette spreadsheets match up to the disk systems. Of the systems covered so far, their relative merits are as follows:

* Prophet II (*PCW* March 83): Hardware (a TV, cassette unit and Acorn Atom in metal box) and software available only in combination. Very good software, but on ugly heavy hardware. Expensive.
*ECalc (*PCW* July 83): Available for the Epson HX-20. Lovely hardware, but fairly poor software.
*The Spreadsheet (see above): Available for the Spectrum. Too slow.
*Vu-calc (see above): Available for the Spectrum (and now also BBC) micro. Good fast software, but provides only the basic maths functions.

Out of the four systems tested to date I would nominate Vu-calc as a best buy. Both hardware and software worked very well, and a complete set-up can be obtained for a very modest sum. The Prophet II system has better software, but it is quite a lot more expensive.

END

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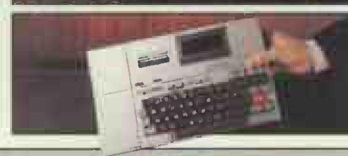
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BIG BROTHER IS WATCHING YOU

The Data Protection Bill will have complex ramifications for the home and business computer user if it becomes law. A Sandison considers the consequences.

Credit is easily obtained by the credit-worthy, but some people find they are not; and wonder why. Somebody somewhere has a file about them. It so happens that one of those credit checking agencies has a phone number which differs from mine by only one in the first digit. I get several wrong numbers every day, some of which start gaily 'Can I have a check on Mr...' before I can even identify myself. How I long to say 'very reliable' or 'quite untrustworthy' according to my mood. But so far I have resisted the temptation.

Personal data files

That such credit checking agencies exist and use computers is well known. That you are entitled to send a small fee, receive a copy of your file and have errors corrected, is less well known. That there ought to be a similar right to be told what is said about you in other types of personal data file is a widely held view. The Government has set out to provide such a right in the 'Data Protection Bill' which was lost at the election, but has now been reintroduced. It is inspired by an economic need to ratify a European convention.

The Bill has proved highly controversial. The debate, both in Parliament and in the country at large, has tended to concentrate on the very difficult issues of what should remain confidential and when national interest requires or overrides confidentiality. The relevant professional organisations have fought lengthy battles and the lawyers, at least, have won exemption from access by the individual if they can claim legal professional privilege. The professional debates will no doubt continue long after a Bill becomes law.

Manual files

Another major debate has been whether the Bill's provisions should be restricted to computerised files, or whether the need for access to paper files is not just as relevant. The EEC convention refers only to computers and that will do for the Government. But the 'Data' to be covered by the Bill is 'information recorded in a form in which it can be processed by equipment operating automatically in response to instructions given for the purpose'. The British Library recently announced (*British Library News*, 1983, No 83) a successful prototype of equipment to read any printed document into a computer where it is susceptible to all the manipulation which this makes possible. So the attempt to distinguish manual from computer files is already out of date and the Bill's effects may be far more widespead than at present envisaged by the civil servants involved.

How it is meant to work

Far too little attention has been given to the mechanics of the controls envisaged. The Bill starts by defining 'Personal data' as (computerised) information about, and manipulated by reference to, living individuals who can be identified from that information. It sets up a Register of nearly everyone who 'uses' such data, but the Home Office evades the crucial question whether a 'user' owns the data or operates the keyboard to 'control the contents and use of the data'. Then the Bill will make it an offence to 'hold' such personal data, or provide services to manipulate them without being registered for the particular type(s) of data for the particular purpose(s); as it will to obtain information from sources, or to disclose the information to someone or to some country, not mentioned in the Register entry. Registration fees to cover the costs of the Register will, of course, be charged. 1984 certainly seems the right year to start!

Exemptions

There are a few exemptions from registration. Personal data 'held by an individual and concerned only with the management of his personal, family or household affairs are exempt', but this hardly includes hobbies such as the family history of unrelated individuals of the same name, nor calculating batting averages for the county teams. If you allow someone else to use your machine for any non-exempt purpose, then you are running a 'computer bureau' and must register that activity.

Next, personal data held by an unincorporated members' club and relating *only* to members of the club are exempt: a local Residents' Association can computerise its members' names and addresses, but not that of the landlord or his agents! Then, data held *only* for the purpose of distributing, or recording the distribution of, articles are exempt provided they consist *only* of names and addresses or are kept *only* for distribution or accounting purposes: be it noted that recording whether they replied to a circular and what they said will not be exempt! And both the club members and the recipients of the distribution must have given permission for the data to be held in that way — so that a club which computerises must retain a manual system for the objectors! How naive the lawyers are!

As a result of the debates before the election, exemptions are now also granted to word processing systems used *only* for preparing texts and data kept *only* for calculating wages and pensions or accounting for goods and services supplied. But these exemptions are very tightly worded and many obvious and simple extensions of these operations still require registration. Businesses might well be advised to apply for registration to avoid committing unintentional offences by extending their use of the computer in a new way.

But recording other transactions with clients, by estate agents, lawyers, doctors, architects, are registerable. So are library or other catalogues which list things by living authors or donors. So are the membership records of all the incorporated societies, and business records showing which customers are interested in which products as distinct from who bought and who paid. And so on.

Will it work?

But what is this vast Register (costing over £15 million to set up, with similar annual running costs) going to achieve? First it is supposed to enable the Registrar, and his staff of about 20, to allow individuals who think someone somewhere may have a file about them, to see the Register or to have, at a price, a copy of any entry. That sounds all right, until you consider what happens next.

Suppose you think a credit checking agency may have a file about you and you inspect the Register. There could well be a hundred agencies (and from their point of view, the more the merrier) operating at addresses which provide no guidance. Even their sources of information may be

GOTO page 229

SOFTWARE

DATABASE BENCHTEST

STAR QUALITY?

Kathy Lang evaluates InfoStar, MicroPro's recently launched data management package running under the CP/M operating system.

InfoStar is MicroPro's entry in the CP/M-80 data management stakes. It has been available in Europe for only a couple of months in its present form, and in the US for just a little longer, but it is already second in sales of CP/M-80 data management packages in the US only to the long-established dBASE II. There are probably two very good reasons for this, excluding the inherent merits of the package. Firstly, it consists of two elements: a data entry and interactive query part, which is actually our old friend DataStar, and a reporting element, ReportStar, which is new. So anyone who already has, say, an early version of DataStar would be very likely to want InfoStar to give flexible reports on the data. Secondly, the data file format is identical with that used by Mail-Merge (used with WordStar to produce personalised letters and 'boiler-plate' documents) and by CalcStar, so anyone who uses either of those packages may expect to find InfoStar a natural partner. But for uncommitted users, how does the package measure up to the plethora of competition?

The two sections of InfoStar—DataStar and ReportStar — consist of several parts which may be invoked directly from CP/M or from within its associated module. For instance, after creating a data file format on the screen, you may then go directly to DataStar to enter data; but to set up report formats and run them, you go back to CP/M and invoke ReportStar direct. Throughout InfoStar, each screen displays the commands available at the top of the screen, in a very similar way to the prompts in WordStar. This makes it easy to see where you are in the package, and to give the commands in the appropriate format. After an initial reading, I found I very rarely needed to look at the manual for straightforward functions. (That was just as well, because for all its clarity and comprehensiveness I still didn't find it all that easy to get the overall picture from the manual, or to find the particular piece of information I needed.)

Information in InfoStar is stored in the simple 'comma delimited' format used by many packages and by Basic programs. Data entry and display are governed by a display 'form' created by the FormGen part of the package — one form per data file. This form is created by 'paint-a-screen', supplemented by question-and-answer where features such as data checking are needed. Because 'comma delimited' fields are used in records, the size of fields can be changed after records have been stored. However, as records are stored they are indexed, and the specification of key fields cannot be changed after entry. Only one index file, based on one or more key fields, is allowed for each data file. There are extensive data validation and calculation facilities. Once stored, individual records can be retrieved by specifying the key, or the file or parts of it may be scanned in stored or key order.

Those of you who are already familiar with DataStar will know that within its limitations it is a good 'workhorse' package, with flexible form-filling facilities and good 'help' features. Its reporting features have, however, always left a lot to be desired, and ReportStar goes a long way to solving this problem. This program consists of three main sections: to create a report format; to sort the file if necessary; and to print or display the report using the pre-defined format. Formatting is achieved in a similar way to screen form design.

Constraints

A data file must be capable of being displayed on a screen format 255 characters wide by 255 characters deep as a maximum, including captions and messages to the form-filler. No field may exceed 255 characters. But these are generous limits, which few other packages can match. A single key is permitted, made up of one or more complete fields not exceeding 120 characters altogether. This rigidity in key field specification is one of the less attractive features of the package. Other constraints (none as serious for most applications) are shown in Fig 1.

File creation and indexing

Once a form has been created using FormGen, the first invocation of DataStar triggers off the setting up of the data and index files. So the form must contain all the information needed to set up these files. The form consists of a grid of 255 by 255 characters, which can be displayed on the screen by moving the cursor into the desired area. The underline character is used to indicate a field and its length; any other characters typed on the screen are treated as labelling information used for display purposes only. A typical screen format which I used for the Benchtest is shown in Fig 2. To indicate a key field, you just put the cursor somewhere in the set of underline characters which shows the field placing, and press CTRL/K; the underlines are then replaced by asterisks. As you can see from Fig 2, I used the first field, Refnum, as my key field. If you use more than one field to construct the key, the fields are ordered in the index as they appear in the design form. If that would be inconvenient for data entry, then the actual display order can be changed, using

'InfoStar can be tailored to a wide variety of terminals and printers. There are also facilities for patching the code to deal with special circumstances, as in WordStar and the other MicroPro products.'

the 'enter field attributes' command.

Field attributes are assigned by moving the cursor to the field to be defined, pressing CTRL/R, and then answering the questions posed. This is the place where the extensive data validation features come in, with the most powerful features being provided by the 'edit mask' option. This allows you to say whether a field must be entered (with various riders), and what kind of field it must be — eg, all letters, all numbers, a mixture, including special characters such as a decimal point, etc. It also specifies copying a field from a previous record. Range checking is provided too.

Fields may also be derived, either from calculations or from a list of allowable values stored in a separate file. So if you have, say, a field which must always contain the name of an English county, you could list all the county names in a separate file, and DataStar would allow you only to input a valid county name in that file. You can specify that a key field must take a unique value, and you can use DataStar's 'tie-breaker' feature to make non-unique keys unique. Calculated fields may be based on constants and/or other field values, using the arithmetic operators with brackets if required. Finally, you can request operator verification: this may be either by asking the person entering data just to check by sight that the field is correct, or by asking for the field to be retyped, thus providing a 'type and verify' facility as in conventional key-to-disk systems.

The index file is updated as data is entered, amended and deleted. However, the manual recommends that 'file maintenance' should be carried out regularly to give efficient access to files which are frequently updated. This may be done within DataStar, or (much more quickly, says the ReportStar manual) using the FormSort program which is part of ReportStar.

Max file size	CP/M limit (8 Mb) — may occupy more than one volume
Max no records	Not stated
Max size record	255×255 characters
Max no fields	255
Max field size	255
Max no keyfields	25, totalling 120 characters, in one key; only one key allowed per data file
Field types	Character, numeric; several varieties of each may be validated in DataStar

Fig 1: Constraints

Ref num ***** ____	Name ____		Date ____
Type ____	Description ____		
Supp1 ____	Price1 ____	Supp2 ____	Price2 ____
Supp3 ____	Price3 ____	Supp4 ____	Price4 ____
System1 ____	System2 ____	System3 ____	Rating ____
Ref1 ____	Ref2 ____	Ref3 ____	Ref4 ____

Fig 2: Typical Data Entry Screen

BM1	Time to add 1 new field to each of 1000 records	1hr 23mins
BM2	Time to add 50 records interactively	Scrolling time
BM3	Time to add 50 records 'in a batch'	6mins 40secs
BM4	Time to access 50 records from 1000 sequentially on 25-character field	NA*
BM5	Time to access 50 records from 1000 by index on two fields totalling 25 characters	2secs/key+ scrolling time (+6mins 25secs to sort & index)
BM6	Time to index 1000 records on 25-character field	1min 50secs
BM7	Time to sort 1000 records on 5-character field	5mins
BM8	Time to calculate on one field per record and store result in record	1hr 11mins
BM9	Time to total three fields over 1000 records	2mins 30secs
BM10	Time to import a file of 1000 records	1min 25secs

Notes: NA* = Not available as tested — key must match exactly when selecting interactively

Fig 3: Benchmark Times

Data input and updating

Records may be entered directly to the data file and verified at the same time, or they may be entered in a batch without verification and verified later. This makes it possible to have data which is to be verified by the 'type and retype' method to be entered by one person and verified by another. In either case, the screen displays the form as created by FormGen, and data is simply entered in situ, using control characters to move from one field to another (backwards as well as forwards . . .). Once the record has been entered, you are asked to confirm that it should be stored, and given the option to make further changes.

Data access for updating or viewing may be by entering a key field value; exact matching is used, and if more than one field is needed to construct the key, then values for all the fields used must be entered. If duplicate keys exist, DataStar shows the first record with the required key. Alternatively, the file may be scanned in key order or in the order the records were entered. These approaches can be used in combination; for instance, you can find the first record of interest in key mode, by specifying the key exactly, and then switch to 'Index Scan' mode to display records in key order. For instance, if your file were keyed by surname, you could use this approach to look for, say, all the Smiths. Scanning by Index or Entry order may be modified selecting particular records for viewing or amending — see 'Selection' below.

Screen display

Within DataStar, records are displayed using the form created in FormGen; only one form is permitted per record, so you can't use DataStar's retrieval facilities to show, say, just parts of a record. DataStar records may also be displayed using the report formats created in ReportStar, which are discussed in the next section.

Reporting

Printed or displayed reports are created with the ReportStar arm of InfoStar. This consists of three parts: a report generator, called RGEN, with its associated editor REDIT; the sorting program FORMSORT; and the REPORT program which actually prints the report. ReportStar cannot be used except within InfoStar, as it requires the data definition file set up by DataStar to describe the records to be printed. The report generator sets up a report format, giving you the option of using a simple default format which just spreads the chosen fields of the record across the report using appropriate column widths and column titles. Totals and counts are also available at this simple level. Alternatively, you may set up your own format from scratch. In either case, once the format has been set up, it can subsequently be edited to provide more complex forms of report.

In the advanced report generation provided within REDIT, the facilities are so extensive that it would be impossible within a short review to describe them all. They include flexible field calculation, merging of information from several files, conditional line printing, emphasis (bold, underlining, etc), sub- and super-scripts, up to nine levels of page-break and sub-totalling, operator entered fields, control over the frequency with which a field is cleared, and limited conditional execution. There are, of course, extensive formatting features controlling field and line display, including various kinds of edit masking. Any report may be either printed or stored in a file, from which you can list it

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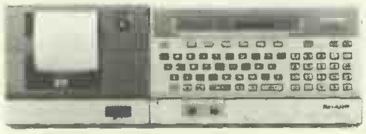

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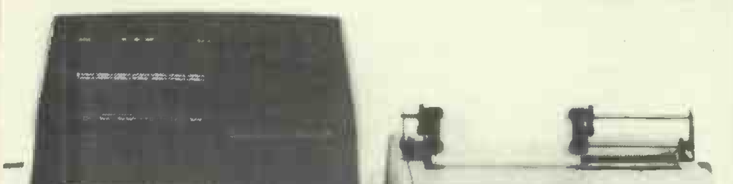

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STAR QUALITY?

(under CP/M) or edit it in WordStar.

Within the reporting mechanism a number of facilities are provided for writing new data files. This is the area where it is most obvious that InfoStar consists of a new suite of programs grafted onto an older package. Many of these facilities for creating data files would more naturally have been implemented either as separate procedures or else within the interactive, data handling package, DataStar. For instance, to change the structure of a file to add an extra field, it is necessary to create a new file definition (amended from the old) within DataStar, create a report definition which includes the new field, and which tells ReportStar to write all input and new fields to the output file. Finally (assuming you don't want to print each record out as it is copied across) you suppress the printing of the detail line in the report format.

Selection

Records may be selected for screen display within DataStar by using a mask, to select particular values for fields other than those which make up the key. Initially this mask is set entirely to asterisks, which match any character. The asterisks may be replaced by match characters in any way desired. For instance, to find everyone who lived in Essex, you would simply replace the first five asterisks in the County field by the letters Essex. To find all those whose surnames began with B, you would enter a B in the first position and leave the rest as asterisks. If entries are made in more than one field, only those records which meet all the conditions are satisfied — there is no 'OR' facility. So you can't, for instance, select in one operation all the people who live in Essex, Kent, Surrey or Sussex unless you have another field which identifies those four counties as a group.

You can do this within ReportStar, where one of the options when defining a field in the report is an 'INCLUDE IF' command. This allows any tests you might need, including tests on substrings, tests with the usual relational operators, and comparisons with field values or constants. If several conditions are set, you can specify that all or some of them must be passed, using both 'and' and 'or' to combine conditions, with brackets if necessary. On the minus side, in string comparisons upper and lower case characters are considered as equivalent. However, the need to set up a report format to do this kind of selection adds an extra level of complexity; you can't change your mind so easily, or play around with selections until you get what you're after. So it works well for information with a regular, well-understood processing sequence, but less well for exploratory situations.

A further level of selection within ReportStar allows you to include records if they correspond with records in another file, so that you only display fields from a record if the key field matches the key field in a record in the second file. It is also possible to include information from more than one file in the same report.

Sorting

Another program in the ReportStar suite, FormSort, allows you to sort any data file on up to 25 fields totalling 120 characters. The sorting is quick and efficient. The sort program can also very quickly produce new index files. It is possible to use these two features in conjunction to keep a data file ordered by one set of key fields and indexed on another set, which would to some extent mitigate the disadvantage of only having one index file. However, the user would have to take steps to ensure that the correct data order was maintained, by sorting and indexing after each update session.

Calculation

Both at input and when reporting, InfoStar allows you to calculate field values using other field values and constants, with the usual arithmetic operators and brackets. These calculations may be carried out on character fields as well as numeric, and there is a sub-string function for handling parts of fields. More extensive functions are provided within ReportStar, including some mathematical functions and string concatenation; limited control over whether a calculation takes place is also provided in reports with an UNLESS function.

Tailoring

InfoStar can be tailored to a wide variety of terminals and printers. There are also facilities for patching the code to deal with special circumstances, as in WordStar and the other MicroPro products. I didn't try patching, but normal tailoring was easy enough. Within the packages, there aren't any tailoring features as such — for instance, you couldn't design your own menus for a particular application.

Multiple files

When setting up a file definition in DataStar, you can specify that particular fields are to be copied from another file. Similarly, within reports you can include fields from records in several different files (up to 25 files, in fact). So you could, for instance, have one file of patient records, another of patient consultations, and merge data from the two when reporting.

Housekeeping

There are no file housekeeping facilities within InfoStar — you use CP/M itself for file deletion, copying and so on. There didn't even seem to be a way to use one report format as the basis for another, keeping both, except by going out to CP/M, copying the original with PIP, and then invoking REDIT to modify the copy.

Links with outside

Importing a data file from elsewhere into ReportStar is quite straightforward: you just set up an appropriate definition file within DataStar, make sure that your data file is written in 'comma delimited' format, and then use FormSort to construct an index file. But it is a pity that the only place the manual mentions this is in a 'handy hint' at the end of the Tutorial Guide.

User image

'Like the curate's egg — good in parts' is a description that I've employed a good deal when describing user images in this series — but if ever a package deserved that description, then InfoStar does. The 'Help' banners at the top of each screen are well thought out and very helpful. Each of these screen banners includes a 'procedure number' which cross-references with the manual — an unheard of helpfulness which I have been advocating without much hope of success for a long time. Some of the other prompting features, like showing the characteristics of a field when you move the cursor into it, are also good.

On the other hand, the use of 'question-and-answer' techniques for setting up complex options, a practice found throughout ReportStar, is to my mind muddling and tedious in the extreme. This is exacerbated by the habit of showing just the current question and a few before it at any one time, so you don't always have the full context, and never know what's coming next. For instance, when setting up field attributes in reports, it is quite possible to find yourself pressing the RETURN key (for the default option) a dozen or more times to get to the one option you want to change for that field. It would be very much better to display a complete list of options, allowing the user to move the cursor to the one or two required, and using a control character to move into the detailed definition.

It would also be better to have more 'sets' of defaults for common tasks: for instance, to add one field to the record format for the Benchtest (BM1), I had to go through this process of changing the single field attribute 'write to output file?' for each of the 21 fields separately. That meant I had to press RETURN 15 times, type the number of the output file (even though there was only one valid number it would allow me to type), enter the destination field number (the same as in the input file) and press RETURN twice more. By the time I'd done that complete operation 21 times I was not in the best of tempers. Of course, that particular task is not something you'd want to do every day, but there are other less extreme examples of long-windedness in things that you might want to do quite often. And it's the totally unnecessary nature of that sort of time-

Software News

INNOVATIVE
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AIRBUS

Airbus continues the line of highly accurate flying simulators stocked by Molimerx. It follows in the footsteps of Shuttle and Jumbo.
The Airbus A300 is a twin engine, wide bodied jet manufactured in Europe. There are many models. The specimen chosen by the author is that powered by two General Electric CF6-50C2 turbo fans with a maximum seating of 330 and maximum all up take-off weight of 140,000 kg.
We only stock simulations which are precise models of the original, and Airbus is no exception. Indeed, Airbus could be said in some respects to be a more accurate simulation of flying the aircraft than was Jumbo, and the latter certainly set new standards in this area. The big difference between the two is that Airbus incorporates radio navigation. Five VOR's or Omnis (radio direction beacons) are included in the simulation, all of them in the Holland/Belgium/Germany area. Furthermore, they all include Distance Measuring Equipment facilities. Four runways at three airports are available for landing and take-off. Airbus also includes randomised engine failure simulation.
Like Jumbo, Airbus is flown on instruments and only on instruments. Some of these are graphic representations of instruments. One of them is the Instrument Landing System instrument. This, without a doubt, is the best graphic representation of such an instrument produced for any computer outside of those used in actual aircraft themselves. There are 31 instruments in all:

1. Indicated air speed gauge
2. Artificial horizon
3. Power setting for No. 1 engine
4. Power setting for No. 2 engine
5. Slat setting
6. Flap setting
7. Compass
8. VOR tracking instrument
9. Instrument Landing System
10. Clock
11. All up weight
12. Fuel
13. Fuel flow
14. Vertical speed indicator
15. MACH speed
16. Precise pitch
17. Precise roll
18. Altimeter
19. Landing gear status
20. Nose wheel status
21. Wheel brakes status
22. Air brakes status
23. True air speed
24. Wind direction and velocity
25. Ground speed
26. Destination runway, place & number
27. Distance to go
28. Precise heading
29. Precise track
30. Data from No. 1 DME/VOR
31. Data from No. 2 DME/VOR

An extensive illustrated manual is supplied comprising some 27 pages. It takes the reader through the control panel in general and then in detail. Discusses the controls at length; general discussions are held on flying technique of Airbus and then simple flight manoeuvres are described, such as normal take-off, noise abatement take-off, take-off with engine failure, climb, cruise, turning, descent, approach, final approach and landing. Procedures in overshoots and engine out emergencies in various situations are described. Two pages of simple flight briefings, in other words, instructions for suggested flights, are included. There are seven Appendices, including detailed discussions of the VOR/DME navigation system and the ILS approach system. Purchasers of Airbus may also buy the educational section of the Jumbo manual for £1 if they wish.
The program is compiled Basic and is disk orientated only. The compilation enabled the author to include very precise slow down loops in the source code. Thus as we have said, the simulation is as exact as it is possible to get. The compatibility of the program with various disk operating systems and machines will depend upon the compatibility of those DOS's and machines with the Microsoft Compiler. As far as we know, on TRSDOS it is compatible on all Genie machines (with the exception of the Model III) and of course the Tandy Model I. It is also compatible with LDOS on these machines. On the Tandy Model III the choice of DOS is somewhat more crucial as many disk operating systems running on that machine are not compatible. TRSDOS 1.3, for instance, is not. A patched version of the run time file, to enable use on the Model III under LDOS or smal-LDOS is included in the package.

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STAR QUALITY?

wasting that is so irritating, to users as well as reviewers.

Documentation

The complexities of option definition are made no easier by the documentation. There are three manuals for InfoStar: a DataStar guide, a ReportStar Training Guide, and a ReportStar Reference Manual. Good points first: all three have an index (not as comprehensive as they might be, but at least they exist), and each suite has a Reference Card. The DataStar manual I found quite readable, the Training Guide I thought quite helpful at a 'here's how to get started' level, if you can stomach the 'happy campers' style of drawings of satisfied customers learning all about the package. I didn't find it so helpful when it came to trying to get an overall view of what the package could accomplish — indeed, I gleaned a lot of my information about that from the 'hints' section at the end, which reads like a throwaway add-on but which is actually very useful.

You really do need some overview information, as the Reference Manual is very tough going indeed. It has a series of 'Road Maps' covering each section, but these were very detailed, and it wasn't at all easy to guess where a particular facility might be provided. This was particularly true in the area where ReportStar has to be 'stretched' to provide facilities — for instance, for reformatting data files, which would ordinarily be in the data entry part of the package. I very much regret having to criticise to this extent, as the manuals are of a very high standard typographically, and a lot of effort has clearly gone into them. Unfortunately, it's almost as bad to have too much and too complex information as it is to have too little.

Summary

Package Type	Data management: variable length 'comma delimited' records, data from more than one file may be included in screens and reports.
Facilities	Screen display, sorting and reporting in three modules. Direct retrieval based on one key (several fields) per record. Reporting very flexible. Sorting flexible and fast.
Drawbacks	Limitation to one key. Complexity caused by use of report program for data management functions. Interactive selection limited. No true multifile capability. No housekeeping within package.
Ease of Use	Good at the simple level. Very tedious when specifying complex options. Connections among programs not complete.
Error Messages	Reasonably clear.
Documentation	Clear, well presented and structured, but very verbose. Has (not very comprehensive) indexes.
Costs (ex VAT)	£295
Supplier	MicroPro Inc. Review copy supplied by Tamsys Ltd, tel (07535) 56747

Conclusions

My overall impression of InfoStar is that it is rather an uneven package in the facilities it provides. The report formatting is extremely flexible, with a power I have not come across elsewhere. The selection and sorting features for reports are good, but I suspect that people who need that degree of flexibility in reports also want a high degree of flexibility in data entry and screen display. If so, they may well find the limitation, during data entry and interactive display, to a single index file and one screen format an irksome constraint.

Some parts of the package are unusually fast, particularly the index sorting with FormSort. Others, such as procedures involving writing a complete data file (for instance, to update all prices by ten per cent) are not so quick: Benchmark times are given in Fig 3. Disk space is economically used, because the process of storing records in comma-delimited format means that an empty field occupies only one character.

On the user image side, the similarity with WordStar and CalcStar must obviously help people who need a suite of programs, but I think many people will find the more powerful features of ReportStar difficult to use. Personally I wouldn't feel that the family resemblance was enough to give InfoStar the edge, with WordStar users, over other packages which can read and write Mail-Merge formats. However, those reporting features, even if they are tedious to use, would be extremely valuable in some environments, and if that is your requirement, then InfoStar would be well worth investigating. END

WRITING FOR PCW

PCW welcomes approaches from would-be writers, even those who have never appeared in print before. In this game it's often those with practical experience who have important things to say so we don't mind if your prose is less than perfect — providing submissions have a sensible structure and follow a logical sequence, we can take care of the polishing.

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We can now accept articles on a limited number of disk formats: standard IBM 3740 single-sided, single-density 8in, and the following 5¼ in formats: Superbrain SSDD 35-track; RML 380Z SSSD; Sharp MZ-80K/A DSSD, Cromemco SSSD, Nascom DSSD, Rair/ICL DSDD, SD Sales SSSD, Triton 35 track SSDD and ACT Sirius 1 (CP/M-86 or MS-DOS) single-sided. By prior arrangement we can accept stuff over the phone by modem using BSTAM at 300 baud but as we can only do this during office hours (10am to 6pm) it's not exactly a cheap way of getting your article to us! In the near future we hope to be able to accept material by The Source and Rewtel. Please note that if you want to send your article in this way, it should be as an ASCII file rather than as a 'work file' for any one type of word processor — ie, use your word processor to print the text to disk instead of to paper.

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Once you've sent off your article or proposal, please don't hassle us for a decision. We receive far more submissions than we can ever use and it takes us a while to sort through them, acknowledge receipt and give an opinion one way or the other. Please be sure to tell us if you've sent the article to another magazine — it would be very awkward indeed if the same article appeared simultaneously in two publications! Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work but please be patient! Payment *normally* follows about 4-6 weeks after publication.

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PORTABLE PROBLEM

Personally, I think Adam Osborne has a lot to answer for. He used to write a column in the American trade newspaper *Infoworld*. Its title — 'From the Fountainhead' — irritated me a lot (you'd be laughed off the page for using that title here but apparently what we would regard as unspeakable pretension is quite acceptable in the US) but in it Adam often spoke a lot of sense, even when he was going against conventional microwisdom, which was often.

Eventually, he decided to put his money where his pen was and practise what he'd been preaching. And so he gave us the Osborne 1, one of the most successful ever computers. My immediate reaction, when I first saw and tried out an O1, was that he was playing some kind of cruel joke on us: the tiny screen, the horrible keyboard, the minute disk capacity, the flimsy casing, and above all the size and weight of what was billed as a portable computer — all seemed quite ludicrous.

As we now know, the O1 was a tremendous success despite all these apparent drawbacks — it has sold like the proverbial hot cakes and the recently-announced Executive model will probably be equally successful. Fine: thousands of people are happily computing away and the Osborne coffers have swelled suitably.

But what Adam did — intentionally or not — was to spark off a whole range of 'portable' computers. Other companies saw the success of the O1 and thought, 'If he can sell that many, there must be a big market for portables — we can make a machine which is lighter/better built/has a bigger screen/has bigger disks/looks better/etc and make money too.' So they did, and we have a whole flood of portable machines from which to choose.

But do we actually want portable computers like the ones now being offered? I can't speak for the States, where different values apply, but in the UK I am certain, through conversations with people who use and sell the machines, that the O1 has not sold well because it is portable — it has sold because it is *very cheap* and comes with a useful amount of ready-to-use software. If it was twice the size and four times the weight it would still have sold well provided it sold at the same price and came with the same software.

I must immediately stress that I'm not denying the usefulness or desirability of portables. But at the moment, we don't have the technology to build a really useful portable computer — we're still waiting for a flat screen which will give a proper display of 25 lines by 80 characters. This is now the minimum acceptable screen size for serious use; if you disagree because you use a machine with a smaller screen and think it's marvellous, then either you've not tried a 25×80 screen and don't know what you're missing or you're one of the minority which is happy with a smaller screen — most of us aren't in that category.

I personally have no use for a portable machine, even though I'm a journalist who travels a lot. My Microwriter is smaller than any portable computer with a proper screen and keyboard could ever be and suits me fine for mobile use — I can dump text from it into my Sirius when I get home and polish and format it with a word processing package before printing it out. There are of course a great many people who would find a true portable computer a real boon but I can't help feeling that at the moment they are being somewhat conned by many manufacturers of supposedly portable machines.

Here's what a portable machine should offer. Firstly, there's the flat screen display, currently not possible but generally thought to be available before too long. Apart from the size and weight advantages of something like a large-scale LCD display, it is far more rugged than a delicate CRT tube as used in most portables, and — even more importantly — it uses only a fraction of the power required to drive a CRT, making battery operation — and hence true portability — a reality. (I know there are some portables with battery packs but who really wants something which will only run for a couple of hours or so before you have to recharge the batteries?)

Mass storage is the next problem. Bubble memories were once the great hope of the portable builders but they have never really caught on well enough for the price drop resulting from mass production to come into effect and make them economically worthwhile in general use. They're too expensive, in other words, and seem likely to remain so unless a big manufacturer decides to take a risk and create a market by mass producing them and selling them at competitive prices. EAROMs (electrically alterable ROMs) are more likely to succeed, once they can be produced in large enough quantities in versions which require a lot less power than existing ones, have a higher bit density and work on a single 5 volt power supply. This leaves us with conventional magnetic disks, a far from ideal medium because the drives use a lot of power and disks are rather fragile. The best current compromise is the 3in or 3½in microfloppy, as used in the Apricot and HP 200 machines. At least the disks are small and protected by a sealed, rigid envelope. Forget about making the machine IBM-compatible — the Americans, like a flock of sheep, have jumped onto the IBM bandwagon with a vengeance and currently seem incapable of thinking about anything else. But by the time technology has advanced to make possible the sort of portable machine which I am describing, the IBM compatibility craze will have largely died down and become irrelevant.

This brings us to processors and other considerations. Already, it's scarcely worth building an 8-bit machine, except to sell it at a *really* low price — well under £1000 including screen, twin disks and software. Because we want a battery-operated machine, we need CMOS chips, which use very little power. A CMOS version of the 8086 16-bit chip has recently been announced so that problem is solved — our true portable will be based on this chip and will have *at least* 256 kbytes of CMOS RAM. Ignoring the display for the moment, such a machine would be incredibly expensive to build today, but every chip manufacturer worth his silicon is getting deeply involved in CMOS technology and by the time we have our big LCD display these chips will be pretty cheap.

Physically, there is a limit to how small you can make a portable machine. This is imposed by the keyboard, which must be of typewriter size and pitch. The Epson HX-20 or Tandy 100 size is probably about the minimum practical. Add a little height to squeeze in the microfloppy drives (under the keyboard with the doors at the front, perhaps) and put on a lid with the LCD display inside it and there you have it — a machine occupying the same desk areas as an A4 sheet of paper, with a total height when closed of three or four inches, totally self-contained except, maybe, for a battery charger unit, and weighing at most maybe 2 or 3 kilos. I don't think this is at all fanciful but we may have to wait for a couple of years before we can buy it; and when it does appear, we shouldn't have to pay more than £800 for it — with software, which should include a word processor, a diary/appointments manager, a database system of some sort, electronic mail capabilities (probably using a built-in modem), the inevitable spreadsheet and Basic.

In the meantime, if you want a cheap computer you can buy an Osborne or one of the other low-cost 8-bit machines now appearing. If you want a serious, non-portable, rugged machine capable of handling the hammering of daily business use, spend some more money for a proper desk-top machine. And if you want a portable, take weight-lifting classes first and don't expect to be able to use it if you're more than two metres away from the nearest power socket.

END

PCW SUBSET

Alan Tootill and David Barrow present more useful assembler language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET,* PCW, *62 Oxford Street, London W1A 2HG.*

MYSTERY AND MAGIC

Unusual for Sub Set, we stir the murky depths of Basic and sneak up on Computer Answers in response to the following letter:

'I often look at the items in 'Sub Set' as I read through PCW *and wonder what one is supposed to do with them.*

Now I've seen one or two items that look as though they could be of some use to me, I am moved to write to ask if some clue as to how to use these routines could be given — perhaps either as a supplement, or even a separate article. Or is the whole thing always to remain an esoteric mystery for the experts?

I have entered one or two Z80 machine routines in the form of REM statements and found they worked quite well on the ZX81. Some of them are in decimal form, others in hexadecimal and I've never understood why.'
AJS McMillan, Keynsham, Bristol

No mystery, Mr McMillan, but Sub Set is really for readers who have some understanding of machine code fundamentals. You would not expect to find Basic or Forth tutorials in the Programs section of *PCW* and, similarly, we do not set out to teach machine code programming in Sub Set. However, if you do know something of machine code, the series gives you a marvellous opportunity to expand your knowledge and skill by working through the routines.

The considerable amount of documentation and comment in each Data Sheet is a valuable learning aid.

The stated aim of Sub Set is to publish machine code subroutines of general usefulness and with sufficient documentation to enable their use by people who do not know, or even want to know, how they work. But they are written to be used within, or called by, machine code programs and not as USR routines to be called from a Basic program. Not that it stops you adapting them for USR routines if that is what you require but you do need to know some machine code to be sure of success.

It is common in the case of Z80 routines for arguments, ie, the values to be acted on, to be passed to and from the routines in registers. If these values are initially held in Basic variables then you have to POKE them into any free RAM before the USR command. You must then have a USR machine code routine that will PUSH the register contents on to stack and LD the values into the registers from where they are stored in memory before CALLing the particular subroutine in which you are interested. After RETurn from the subroutine, your routine will have to store the result values in RAM, POP the original register contents back into the registers from stack and RETurn to the Basic program. Use PEEK to get the results back into the variables.

REM statements are often used in Basic programs to provide space for machine code subroutines. Whether you type the numbers in as decimal or hexadecimal values, or even as Roman numerals, is not particularly important as long as you also include a section of Basic program to POKE these numbers into the correct RAM addresses. POKE usually uses decimal arguments so hexadecimal or any other numbering system would have to be converted to decimal before POKE.

6802 BLOCK RELOCATION

R G Cath of Chandler's Ford has sent RRL which uses a very efficient algorithm to move a block of memory to a lower address location, shifting the memory at that lower location up to fill the gap. In effect it is a rotation right by a variable number of places as shown in Fig 1.

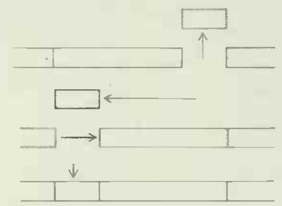

Fig 1.

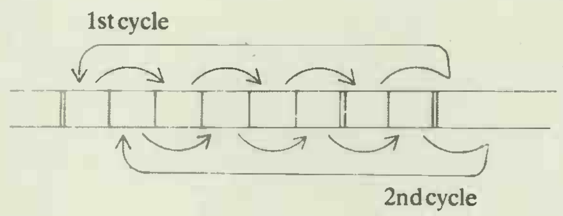

Fig 2.

To achieve the relocation by the three stages shown in Fig 1 would require the provision of a buffer large enough to hold all the bytes being shifted down. That would be very expensive in terms of memory usage, although probably the quickest way to do it. Instead, RRL works by performing a series of exchanges, illustrated in Fig 2, which may be a slower method but has the distinct advantage of only needing a one-byte buffer.

Each byte is, of course, moved by the number of bytes equal to the length of the block to be shifted down. When the pointer to the next exchange goes past the highest address being dealt with, it wraps around to continue again from the lowest address plus the amount of overflow. The process continues until the pointer gets back to the start address. However, this does not necessarily mean that all the bytes have been moved. If the number of bytes in the block being moved down is a factor of the total number of bytes in the memory being processed, it becomes necessary to increment the pointer to a new start byte and go through another cycle. In Fig 2, two cycles are needed to complete the process. In fact it is the number of wraparounds that determines when all the bytes have been moved.

DATASHEET

```
:+ RRL - Rotate Right Long.
;/ CLASS:  2
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Rotates a block of memory to the right (ie to
;/               higher addresses) by a given distance.
;/ ACTION: Initialise
;/         WHILE wraparounds <> movelength
;/          start<-- pointer
;/          (stack)<-- (pointer)
;/          REPEAT
;/             REPEAT
;/               (stack)<-->(pointer)
;/               pointer<-- pointer + movelength
;/               UNTIL pointer >  end of block
```

```
;/                  pointer ← pointer - blocklength
;/                  wraparounds ← wraparounds + 1
;/               UNTIL pointer = start
;/               (pointer) ← (stack)
;/               pointer ← pointer + 1
;/           ENDWHILE
;/ SUBr DEPENDENCE: None
;/ INTERFACES:  None
;/ INPUT:  M0,1 = Address of first byte of block to rotate.
;/         M2,3 = Address of block + 1.
;/         M4,5 = No. of bytes distance to rotate.
;/ OUTPUT:  Cy set:  Block rotated by (M4,5) places.
;/          Cy reset:  Invalid input, no rotation.
;/ REGs USED:  A X Y P M0 to MB
;/ STACK USE:  2
;/ LENGTH:  121
;/ PROCESSOR:  6502

RRL:    LDY £0        ;initialise Y for zero index              A0 00
        STY M6        ;and wraparounds to zero                  84 ZZ
        STY M7        ;                                         84 ZZ
        LDA M0        ;and pointer to first byte in block       A5 ZZ
        STA M8        ;                                         85 ZZ
        LDA M1        ;                                         A5 ZZ
        STA M9        ;                                         85 ZZ
RRL1:   LDA M4        ;compare wraparounds with movelength      A5 ZZ
        CMP M6        ;                                         C5 ZZ
        BNE RRL2      ;                                         D0 08
        LDA M5        ;                                         A5 ZZ
        BMI RRL8      ;exitif negative movelength               30 57
        CMP M7        ;exit, process completed, if              C5 ZZ
        BEQ RRL9      ;wraparounds = movelength                 F0 58
RRL2:   LDA M8        ;save pointer start address               A5 ZZ
        STA MA        ;                                         85 ZZ
        STA MB        ;                                         85 ZZ
        LDA (M8),Y    ;move indexed byte to stack               B1 ZZ
        PHA           ;                                         48
RRL3:   LDA (M8),Y    ;exchange indexed byte with               B1 ZZ
        TAX           ;byte on stack                            AA
        PLA           ;                                         68
        STA (M8),Y    ;                                         91 ZZ
        TXA           ;                                         8A
        PHA           ;                                         48
        CLC           ;clear for addition                       18
        LDA M8        ;add movelenth to pointer                 A5 ZZ
        ADC M4        ;                                         65 ZZ
        STA M8        ;                                         85 ZZ
        LDA M5        ;                                         A5 ZZ
        ADC M9        ;                                         65 ZZ
        BCS RRL7      ;exit if overflow occurs                  B0 38
        STA M9        ;                                         85 ZZ
RRL4:   SEC           ;set for subtraction                      38
        LDA M8        ;get overshoot into A and X               A5 ZZ
        SBC M2        ;                                         E5 ZZ
        TAX           ;                                         AA
        LDA M9        ;                                         A5 ZZ
        SBC M3        ;iterating until pointer is               E5 ZZ
        BBC RRL3      ;past end of block                        90 DD
        INC M6        ;increment wraparounds                    E6 ZZ
        BNE RRL5      ;                                         D0 02
        INC M7        ;                                         E6 ZZ
RRL5:   PHA           ;add overshoot to block start address     48
        TXA           ;for wraparound next pointer address      8A
        CLC           ;clear for addition                       18
        ADC M0        ;                                         65 ZZ
        STA M8        ;                                         85 ZZ
        PLA           ;                                         68
        ADC M1        ;                                         65 ZZ
        STA M9        ;exit if end of block is lower            85 ZZ
        BCS RRL7      ;than start of block                      B0 16
        CMP MB        ;repeat until pointer gets                C5 ZZ
        BNE RRL4      ;back to pointer start                    D0 DC
        LDA M8        ;                                         A5 ZZ
        CMP MA        ;                                         C5 ZZ
        BNE RRL4      ;                                         D0 D6
        PLA           ;complete cycle by moving stacked         68
        STA (M8),Y    ;byte to pointer start location           91 ZZ
        INC M8        ;increment pointer ready for              E6 ZZ
        BNE RRL1      ;another cycle                            D0 9F
        INC M9        ;                                         E6 ZZ
        JMP RRL1      ;                                         4C YY YY
RRL7:   PLA           ;remove stacked byte and                  68
RRL8:   CLC           ;reset Cyfor exit showing                 18
        RTS           ;invalid input.                           60
RRL9:   SEC           ;set Cy for exit showing                  38
        RTS           ;process completed okay.                  60
```

6809 TURNAROUND

Fire-breathing Mike Kerry of Seaford, still in the vanguard of the 6809 invasion, demonstrates once again the superiority of that processor over the Z80 with his translation of John Hardman's MATRAN (*PCW* June 1983).

MATRAN reconfigures a two-dimensional array or matrix which is stored column by column in linearly addressed memory into row by row storage. Or perhaps the other way about. Whichever it is, Mike has not provided us with any uses to which this transposition may be put — any suggestions? Neither has he come up with a method of performing the transposition within the original area of memory used by the source matrix, perhaps by a similar method to that used by RRL?

DATASHEET

```
;= MATRAN - Matrix Transposition, 6809 version.
;/ CLASS:  1
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  In-RAM move of a 2-dimensional array or matrix
;/               changing from row by row storage at source to
;/               column by column storage at destination or vice versa.
;/ ACTION:  For each column of Source
;/              save Source pointer
;/              For each row of source
;/                  Move element from Source to Destination and
;/                  Increment Destination pointer
;/                  Add No. of columns to Source pointer
;/              Restore Source pointer
;/              Increment Source pointer
;/ SUBr DEPENDENCE:  None.
;/ INTERFACES:  Source RAM or ROM.  Destination RAM same byte length
;/              as source.
;/ INPUT:  X = 1st byte of source matrix
;/         Y = 1st byte of destination RAM
;/         A - no. of source rows, B = no. of source columns.
;/ OUTPUT: Transpose of Source matrix at Destination.  All registers
;/         returned unaltered.
;/ REGs USED:  A B X Y
;/ STACK USE:  11
;/ LENGTH:  26
;/ TIME STATES:  (rows * 22 + 38) * cols + 26
;/ PROCESSOR:  6809

MATRAN:  PSHS  CC,D,X,Y      ;save registers.                       34 37
COLLP:   PSHS  D,X           ;counts and source pointer stacked     34 16
         LDB   6,S           ;get no. of cols from stack            E6 66
ROWLP:   LDA   ,X            ;move byte from source to dest.        A6 84
         STA   ,Y+           ;and increment destination pointer     A7 A0
         ABX                 ;point next source row, same column    3A
         DEC   ,S            ;repeat for all rows in                6A E4
         BNE   ROWLP         ;current column                        26 F7
         PULS  D,X           ;restore counts and source pointer     35 16
         LEAX  1,X           ;point to next column of source        30 01
         LDA   1,S           ;recover rows                          A6 61
         DECB                ;repeat for all                        5A
         BNE   COLLP         ;columns                               26 EA
         PULS  CC,D,X,Y,PC   ;restore registers and return.         35 B7
```

Z80 MESSAGE ASSEMBLER

If you have ever typed lots and lots of very similar messages in to your computer, you have probably cursed it for not being intelligent enough to generate its own messages from a database of basic words and phrases. That achievement would probably need quite a sophisticated artificial intelligence program so, until you get round to writing it, try making life a little easier by using MAKMSG from Simon Sellick of Pershore. MAKMSG acts recursively to print messages composed of ASCII characters and also 'submessages' whose addresses are embedded in the higher level message preceded by a non-ASCII 'escape' byte.

DATASHEET

```
;= MAKMSG - Message assemble and print routine.
;/ CLASS:  2
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Recursive procedure to assemble and print messages of
;/               ASCII bytes and submessages.
;/ACTION:  IF character picked up is a null (0) THEN exit
;/         ELSE IF character is ASCII THEN print it and get next
;/              ELSE pick up escape address and CALL MAKMSG.
;/SUBr DEPENDENCE:  'WRCHAR' - subroutine to print ASCII character in
;/                  A.  It must not corrupt HL.
;/INTERFACES:  None.
;/INPUT:  HL addresses first byte of message.
;/OUTPUT:  HL addresses null byte at end of message.
;/REGs USED:  HL A F
;/STACK USE:  0 + 4 * no. of sub-messages
;/LENGTH:  25
;/PROCESSOR:  Z80

MAKMSG:  LD    A,(HL)     ;get byte in A, test to see          7E
         OR    A          ;if it is a null and if so, exit     B7
         RET   Z          ;as end of current level reached     C8
         CP    80H        ;test for ASCII and                  FE 80
         JR    C,MKMSG1   ;branch if it is.  Else it is an     38 0C
         INC   HL         ;'escape' to a substring, so pick    23
         LD    A,(HL)     ;up substring address in HL from     7E
         INC   HL         ;next two bytes, saving this level   23
         PUSH  HL         ;address on stack for                E5
         LD    H,(HL)     ;continuation after return from      66
         LD    L,A        ;processing lower level              6F
         CALL  MAKMSG     ;recurse to print substring          CD YY YY
         POP   HL         ;restore this level pointer and      E1
         JR    MKMSG2     ;skip the printing this time.        18 03
MKMSG1:  CALL  WRCHAR     ;go print valid character            CD XX XX
MKMSG2:  INC   HL         ;point  to next byte and             23
         JR    MAKMSG     ;repeat till null byte found.        18 E7
```

The true worth of a routine such as MAKMSG can only be appreciated in an application which uses many similar messages but as an example we show how the system can be used to construct jargon phrases. Fig 3 gives the hex dump mixture of ASCII codes and 'escapes', written at an arbitrary address, followed by MAKMSG's decoding.

```
1234:  20  49  4E  46  4F  52  4D  00
123C:  80  34  12  41  54  49  4F  4E
1244:  00  20  54  45  43  48  4E  00
124C:  80  45  12  49  43  41  4C  00
1254:  80  45  12  4F  4C  4F  47  00
125C:  80  54  12  80  4F  12  00  80
1264:  54  12  49  53  54  00  20  44
126C:  45  54  41  49  4C  00  80  3C
1274:  12  80  54  12  59  00  80  3C
127C:  12  80  63  12  00  80  4C  12
1284:  80  6A  12  00  80  6A  12  45
128C:  44  80  3C  12  00  80  5C  12
1294:  4C  59  80  34  12  45  44  00

1234:  INFORM
123C:  INFORMATION
1245:  TECHN
124C:  TECHNICAL
1254:  TECHNOLOG
125C:  TECHNOLOGICAL
1263:  TECHNOLOGIST
126A:  DETAIL
1272:  INFORMATION TECHNOLOGY
127A:  INFORMATION TECHNOLOGIST
1281:  TECHNICAL DETAIL
1288:  DETAILED INFORMATION
1291:  TECHNOLOGICALLY INFORMED
```

Fig 3.

END

SHARP LOGIC AND BASIC INGENUITY

In 'Making the most of the MZ-80K' (PCW, March 83), Maurice Hawes discussed the weaknesses in Basic SP-5025 and looked at methods of compensating for these by extending the interpreter. This is indeed one way of dealing with the deficiencies of SP-5025; J P L Hooper wonders whether a little ingenuity might not be another.

At first glance, the conditional statements allowed under Basic SP-5025 appear somewhat limited. Although numeric values can be compared both for equality (as in IF A=5 . . .) and inequality (IF A<>5 . . .), strings can be tested only for equality. There is no direct equivalent to the statement 'IF A$<>"Y"', for example. Similarly, although AND (test succeeds if all ANDed expressions are true) and inclusive OR (one or more of expressions are true) are supported, Exclusive OR (one, and only one, expression true and NOT (converse of expression true) are not. With a little creative coding, however, these limits can be overcome.

Unlike some Basics, SP-5025 does not use the words 'AND' and 'OR' in conditional statements, but employs instead the arithmetical symbols '*' and '+' — and this provides the clue as to what the interpreter is doing. Each expression in the statement is tested individually for truth (or untruth) according to the rules of Boolean Algebra, and the value of the whole conditional part of the conditional statement is then assessed upon the basis of simple arithmetic according to the signs '+' (plus) and '*' (multiplied by). It works as follows:

1) Each individual expression — for example, A=5 — is evaluated; in this case, does A equal 5 or not? If true, the value −1 is the result (on some micros, 1 results). SP-5025 can be made to do this, according to S N Brown, *PCW*, page 149, July 1982, by POKEing 8861,20: 13541,20: 13562,20), while if false the result is 0. A typical Boolean Algebra equation might read
B=1−(A=5)
which, if A *is* 5, means B=1−(−1), =1+1, =2, and if A is *not* 5 means B=1−(0), =1. Similarly, the equation
C=20−2* (A=5)
gives C=22 if A *is* 5, and C=20 if A is *not* 5.

2) In a conditional statement such as
IF A=5 THEN PRINT "IT DOES"
the interpreter evaluates the 'A=5' part, and comes up with −1 or 0 depending on whether A is 5 or not. The whole statement is then dealt with on the basis that if the whole conditional expression (in this case 'A=5') evaluates to zero then the test fails, while if it evaluates to anything else — to *any non-zero value* — then the test succeeds.

In a conditional statement like
IF (A=5) + (B<6) THEN . . .
each Boolean expression is evaluated separately and then — and here is the real core of the matter — the separate results are combined *arithmetically* according to the symbol involved (which, in this example, is '+'). So, if A *is* 5, and B is *not* less than 6, then:
'A=5' results in −1;
'B<6' results in 0;
and the combination results in (−1) + (0), =−1.
The combination has a non-zero value, so the test succeeds.

Incidentally, if B *was* less than 6 then:
'B<6' results in −1;
and the combination results in (−1) + (−1), =−2. The test still succeeds — so that this is an *in*clusive OR!

So, how does all this help with string inequalities? Read on.

SP-5025 allows string equalities like A$="YES" but not inequalities like A$<>"YES".

In a conditional statement such as
IF A$="YES" THEN PRINT "YES"
the expression 'A$="YES"' is evaluated as −1 if true and 0 if false, and the test succeeds if the result is anything but zero. What is needed, then, is for the evaluation results to be the other way round — for the result to be 0 if A$ is "YES" and −1 (or, indeed, any non-zero value) if A$ is *not* "YES".

This can very easily be achieved simply by modifying the expression used in the conditional statement — by adding 1!

Thus:
IF (A$="YES") +1 THEN PRINT "NO"
(where the modification is the '+1' part) is what is needed. Why? Because the expression '(A$="YES")' has the value −1 if true and 0 if false. And the expression '(A$="YES") +1' has the value 0 if A$ *is* "YES" and +1 if A$ is *not* "YES".

So, where (A$="YES") is true, (A$="YES") +1 is not true, and where (A$="YES") is not true, (A$="YES") +1 is true. Hence the whole conditional statement is in effect comparable to the statement
IF A$<> "YES" THEN PRINT "NO"
— and so string inequalities are 'possible' after all!

The expression '(A$="YES")+1' used in this example actually evaluates to 1 when A$ is not "YES", rather than to −1, and this may make it rather difficult to use in a more complex statement of the kind
IF (A$="YES") +1) + (B$="MAYBE") THEN . . .
because if both expresions are true (A$ is *not* "YES", and B$ *is* "MAYBE") then they evaluate to +1 and −1 respectively, and the whole, (+1)+(−1), evaluates to zero . . . and the test fails, which is probably not what was intended at all! This, however, is easily solved simply by reversing the sign of the complete '(A$="YES")+1' part, and making it instead
−(A$="YES")−1
which evaluates to 0 if A$ is "YES" and to −1 if A$ is not "YES". This is just what is required; now the arithmetic of the conditional statement comes out all right:
a) if both are true (A$ is *not* "YES", and B$ *is* "MAYBE") then the result is
(−1)+(−1), =−2 (and the test succeeds)
b) if neither are true, then the result is
0+0, =0
c) if one only is true, then the result is either (−1)+(0), =−1
or (0)+(−1), =−1

Note, however, that the original way round
(A$="YES")+1
results in what is in fact an *ex*clusive OR, because
a) if both are true, then the result is
(+1) + (−1), =0 (and the test fails)
b) if neither is true, then the result is
(0) + (0), =0
c) while if one only is true then the result is either (+1) + (0), =+1
or (0) + (−1), =−1

This leads naturally to a more general Exclusive OR statement though applicable only to *two* expressions (with the proviso that each expression evaluates to −1 when true), namely one of the type
IF (expression)−(expression) THEN . . .
— observe that the normal '+' has been changed to a '−' (minus sign). This works because:
a) if both expressions are true then the result is
(−1)−(−1), =0 (and the test fails)
b) if neither is true, then the result is
(0) − (0), =0 (and the test fails)
c) if one only is true then the result is either (−1) − (0), =−1
or (0) − (−1), =+1
(and in either case the test succeeds).

While dealing with string inequalities and inclusive ORs the logical NOT crept

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SHARP LOGIC

pass unannounced — for, after all, NOT (expression) is merely the converse of the truth of the expression, with NOT (expression) evaluating to 0 when the expression itself evaluates to −1, and vice versa. And, as shown, this converse is achieved just by adding 1 (and, optionally, changing the sign of the whole).

Accordingly, if a statement like

IF NOT (A=5) THEN . . .

is needed (and assuming that 'A<>5' is not to be used!) write instead

IF (A=5)+1 THEN . . .

or

IF −(A=5)−1 THEN . . .

To be frank, there are few occasions when the inability to NOT, EXOR and/or test for string inequalities is serious enough to cause weeping and gnashing of teeth. Now and again, however, it would be neater, and possibly faster, to be able to use these features.

Many programs need to ask the operator questions requiring a 'yes' or 'no' answer, and it is convenient to accept a single key imput, 'Y' or 'N', using the GET function. A standard routine to do this might be as follows.

```
100 REM ANSWER 1
110 REM ——————
120 GET AN$: IF AN$="" THEN 120
130 IF AN$="Y" THEN PRINT "YES":
    GOTO 160
140 IF AN$="N" THEN PRINT "NO":
    GOTO 160
150 GOTO 120
160 [CONTINUE WITH REST OF
    PROGRAM]
```

For those who like structured programs, without a proliferation of GOTOs, this is very messy. So, they can use:

```
200 REM ANSWER 2
210 REM ——————
220 GET AN$:IF (AN$="")−
    ((AN$="Y")+1)*((AN$="N")+1)
    THEN 220
230 IF AN$="Y" THEN PRINT
    "YES"
240 IF AN$="N" THEN PRINT "NO"
250 [CONTINUE WITH REST OF
    PROGRAM]
```

This illustrates a problem of this technique with regard to the arithmetic involved. It would at first sight seem that what is needed is

IF (AN$="")+((AN$="Y")+1)*
((AN$="N")+1)

(note the first '+') but this evaluates incorrectly when AN$ is nothing (i.e., when no key has been pressed). Thus, if AN$ is a null string the result is

(−1)+((0)+1) * ((0)+1),
= −1+(1)*(1), = −1+1, =0,

which is *not* what is required!

Luckily this can be cured by ExORing instead of InORing the expression

(AN$="")−((AN$="Y")+1)*
((AN$="N")+1)

(note the 'minus') evaluates correctly for all inputs, including a null input — thus, if AN$ is null then the result is

(−1)−((0)+1)*((0)+1),
= −1−(1)*(1), = −1−1, = −2,

and the IF test succeeds, as is required.

Another example might concern the examination of the individual characters of a string to find some particular character. For instance, in a name and address program each person's name and address might be stored as a single 'packed' string, in which the name is separated from the address by a slash ('/'), needing unpacking at some time during program operation in order to resurrect one or other portion on its own. A typical case might store, under NA$, a name and address such as

"FRED BLOGGS/1 THE STREET,
ANY TOWN"

and a routine for getting the name portion (N$) is as follows:—

```
100 REM FIND NAME 1
110 REM ——————
120 L=LEN (NA$): N$=""
130 FOR A=1 TO L
140 C$=MID$ (NA$,A,1)
150 IF C$="/" THEN N$=LEFT$
    (NA$,A −1) : A=L
160 NEXT
170 [CONTINUE]
```

which actually is both neat and fast. But it could be done like this:

```
200 REM FIND NAME 2
210 REM ——————
220 L=LEN (NA$): B$=""
230 FOR A=1 TO L
240 C$=MID$ (NA$,A,1)
250 IF (CS="/")+1 THEN N$=N$+C$
260 IF C$="/" THEN A=L
270 NEXT
280 [CONTINUE]
```

which, in this particular case, is not any neater or faster than the first version.

Finally, SP-5025 afficionados (there must be some, somewhere!) will be aware that conditional statements like

IF A THEN . . .

are allowed (if A is zero then the test fails, while if A has any non-zero value the test succeeds), so that zero and *any* non-zero values of A can be distinguished, but that the comparable

IF A$ THEN . . .

is *not* allowed (because what's tested must have a *numerical* value), so that null and *any* non-null string cannot so easily be distinguished. This omission can now be rectified in at least two ways (if rectification is really needed), thus:

IF LEN (A$) THEN . . .

(LEN (AS) is only non-zero if A$ is other than a null string), or

IF (AS="")+1 THEN . . .

(the expression is non-zero for any A$ except a null string; this is like saying 'IF NOT (A$="") THEN . . .' as discussed above).

S N Brown *(loc cit)* points out that the equating of '−1' with 'true' causes complications in statements like

IF (A=5) * (B=6) + (C=7) THEN . . .

which, if *all* the expressions are true, evaluates to

(−1)*(−1)+(−1),= +1 −1, = 0

and the test fails when apparently it should succeed. He notes that if 'true' was '+1' then the statement evaluates instead to

(+1)*(+1) + (+1), = +1 +1, = 2

and the test succeeds. The POKEs he suggests make this modification (with acknowledgements to Avalon's commented assembly listing for SP-5025, what they actually do is convert the address for the floating point constant define byte '−1' to that for '+1' in those parts of SP-5025 that a) evaluate Boolean expressions, b) work out integer values in accordance with INT, and c) hold a sequence of routines for Boolean functions called from elsewhere).

If SP-5025 is changed in this way then — naturally — expressions like

(A$="YES")+1

must themselves be modified into the form

(A$="YES")−1

and close attention to the arithmetic involved means that a number of consequential changes need be made to the various expressions suggested above. However, the more the Basic is modified the more likely program crashes become — a program written with the modifications of one Basic in mind may not run on a machine using a Basic that does not have those modifications — and while it is of course possible to have every program start with a procedure that modifies the Basic as desired not only is this a bore but in some cases it may lead to disaster (when the second Basic has already been modified in a manner incompatible with the proposed further modification!). Accordingly, if any assumptions are to be made it is best to assume that the Basic to be used is standard SP-5025, and to make the program do what is required despite SP-5025's drawbacks.

Thus, coming back to S N Brown's problem — that

TRUE AND TRUE OR TRUE
(−1) * (−1) + (−1)

evaluates 'incorrectly' (to 0) — an answer is to observe the sign change caused by multiplying two negatives, and to change it back by prefacing the ANDed portion with '−' (minus), like this:

IF − (A=5) * (B=6) + (C=7) THEN . . .

which gives all the correct results.

a) If *all* are true, then the result is
−(−1) * (−1) + (−1), = −1−1, = −2 (and the test succeeds).

b) If *none* are true, then the result is
−(0) * (0) +(0),
= 0 (and the test fails).

c) If any one is true then the result is
either −(−1) * (0) + (0), =0 (fail)
or −(0) * (−1) + (0), =0 (fail)
or −(0) * (0) + (−1), = −1 (succeed)

d) If any two are true, then the result is
either −(−1) * (−1) + (0), = −1 (succeed)
or −(−1) * (0) + (−1), = −1 (succeed)
or −(0) * (−1) + (−1), = −1 (succeed)

All of these results are correct!

To generalise this, it is necessary to make any ANDed expression negative when all the individual parts are true, and this can be assured simply by multiplying the expression with $(-1)^{n-1}$ where n is the number of individual parts.

Thus:

$(-1)^1*(A_1=Q_1)*(A_2=Q_2)$

$(-1)^2*(A_1=Q_1)*(A_2=Q_2)*(A_3=Q_3)$

. . . .

$(-1)^{n-1}*(A_1=Q_1)*(A_2=Q_2)*(A_3=Q_3)\ldots*(A_n=Q_n)$

END

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A BEGINNER'S GUIDE TO PROGRAM CONVERSION

Our Programs Editor, Surya, provides some direction for those trying to get to grips with program conversion.

When you've just picked up your copy of *PCW* and spotted a nice little cassette-based database for the MZ-80K (see Programs!), it's very tempting to sit down in front of your Dragon 32 and start tapping away, altering lines as you go and hoping that it will run when you've finished it. Unfortunately, while you can sometimes get away with this on very short programs, anything longer than twenty or thirty lines and you quickly find yourself in a mess. The first rule of program conversion is stop and think! This brief article is not a definitive guide to program conversion, but it should give a few pointers to those relatively new to the game.

So where do you start? Well, first of all think about whether a conversion is really the best approach to the problem. Although modifying an existing listing may sound easier than writing the program from scratch, this is not always the case. In choosing between a conversion and a complete rewrite, there are a number of factors to be considered:

(a) The compatibility of the machines.

Some machines support very similar dialects of Basic. The TRS-80 and the Video Genie; the Dragon 32 and the Tandy Colour, and so on. In a number of cases, the program may require only a few minor changes here and there to enable it to run on a similar machine. You may even find that no changes at all are needed.

Other machines, however, are almost entirely incompatible. Converting from a Commodore machine, for example, with its cursor-control statements embedded in the text, can be a real pain. Equally, converting from a powerful machine to a lesser beast may cause problems: the BBC's recursively-defined procedures (procedures within procedures) and REPEAT-UNTIL loops can be very difficult to rewrite efficiently for a machine which doesn't support a structured Basic.

Although converting from a simple machine to a more sophisticated one is generally easier than the other way around, you will be sacrificing the features for which you bought the machine. Any ZX81 listing will run on a Spectrum, but then what's the point of having a Spectrum?

(b) Sound and graphics.

However compatible machines may be in other respects, they usually bear not the slightest resemblance where sound control and graphics resolution are concerned. Where a program relies heavily on these features, therefore, rewriting the program from scratch would probably be easier than attempting to modify it.

(c) Machine-code, assembler, PEEKs and POKEs.

Any program relying heavily on machine-code or assembler, or where a significant amount of PEEKing and POKEing is done, will be extremely difficult — if not impossible — to modify for a different machine. Anyone who knows enough about low-level programming to do the job would almost certainly be able to write their own routines in a fraction of the time taken to convert someone else's.

(d) The structure of the program.

I must confess a sneaking sympathy for the view that 'all that matters is that it works'. When I'm writing ordinary day-to-day programs for use around the office or whatever, my programs are neither elegant nor structured. having publicly owned-up to this fatal flaw in my otherwise perfect character, I am now going to sing the praises of structured or modular programming.

Structured programming, is the art of assigning each component function of the program a routine of its own. Take the example of a simple database, there would be one routine to display the menu, another to accept input, another to sort data, yet another to output data to a printer, and so forth. Each routine, or module, is entirely independent of any other, being called by a central 'control' module. You could, for example, remove the printout routine simply by deleting a solid chunk of code and deleting the option from the menu. The rest of the program would be totally unaffected.

A well-structured program is not only easy to read and edit, it also lends itself to modification for a different machine. If (say) the bar-chest section cannot be used on your machine because of the difference in screen-addressing, you can simply replace it with your own routine without necessitating all kinds of changes in other sections of the program.

If a program is very badly structured, it is often easier to write your program rather than wading through GOTOs, attempting to follow a logical path which jumps in and out of loops and so on, and altering one part of the program may have unforeseen effects in a completely different part.

(e) The program as a whole.

Does it do exactly what you'd like it to, or merely approximately what you want? There's little point in modifying an exciting program if you're then going to have to spend a lot more time on it in order to get it to do something else.

Do you understand the way the program works? If you don't, then not only are your chances of carrying out a successful modification pretty slim, but the program may not do what you thought it would even if you succeed!

By this stage, then, you should have decided whether you're going to modify the program as it stands, or write a completely new program of your own to do the job. If you decide on the latter, it doesn't necessarily put you right back at square one. The general structure of the program may provide a good starting-point, and you may also be able to incorporate some of the routines into your own program. Treat the original program as a source of ideas and techniques, but don't be limited by it.

Let's say you've decided on a conversion. I'll identify the sections likely to cause problems. PEEKs and POKEs are an obvious place to start. The author should have added REMark statements telling you what they do, and you need only figure out how to achieve the same effect on your own machine. If not, they you're into the business of getting hold of the host machine (that is, the machine the program was written for) and trying out anything you're not sure of.

Next to look for is the screen displays: mainly graphics and PRINT AT statements. These will probably have to be completely rewritten. Work out what is happening — what is being plotted and where messages appear on the screen. This can sometimes be tricky, particularly where those quaint Commodore control-codes are concerned (you may have gathered that I don't go a bundle on Commodore screen-handling). Bear in mind that you don't have to duplicate the original screen exactly — or even approximately — for menus and the like. Generally, the only time when you need to recreate the screen faithfully is during games where the graphics are vital. The difficulty of adapting such programs has already been mentioned.

By now, you will probably have come across several sections of code that appear totally alien to the version of Basic supported by your machine. In these cases you must work out exactly what is happening, when, where, why and how.

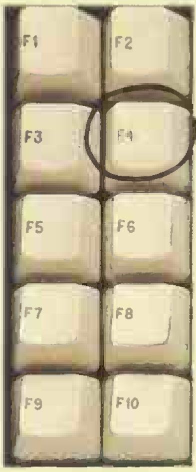
GOTO page 227

GET TO KNOW CORTEX-

THE really VERY FRIENDLY COMPUTER

TEN FINGER EXERCISE

You'll be amazed how simple word processing is with CORTEX'S new version of WordStar. No more fumbling with messy key sequences.

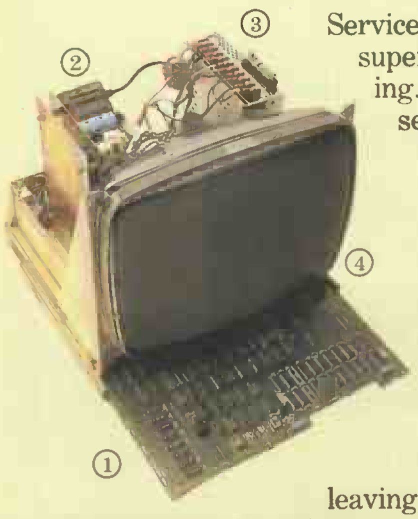


CORTEX has 10 special keys to give 40 commands. This is ERASE. Hit it and a letter disappears. Hit SHIFT ERASE and a word goes. Press CONTROL ERASE and the whole line is demolished. It's as easy as that. And it's free! CORTEX's £1495 price includes a copy of C/WP's WordStar 3.3.

AS BRIGHT AS A BUTTON

The twin-processor 104k CORTEX is not only smart in performance (faster in benchmark tests than Sirius or IBM-PC) – its appearance takes some beating too. Examine its slim, but solid 83-key IBM-style keyboard. Admire its bold clear 12-inch screen, set in a minimal-sized cabinet. "But where is the computer?", we are often asked. It's there in the same small cabinet, lying flat across the bottom, screened from interference and cooled naturally, without the whine of a fan. CORTEX has been designed not to dominate your desk, to leave room for your calendar, your telephone, your in-tray and the rest. If you want it inconspicuous, buy it in conventional cream. But for the extroverts, and the fashion conscious, CORTEX comes in bright, bright colours – warm red, C/WP green, sunshine yellow, ice white and all black.

A FRIEND IN THE NUDE



Service men love CORTEX's superb modular engineering. (Yes, you can get service anywhere in Britain.) If anything goes wrong (which won't be often) he undoes four screws and the computer (1) slides out like a drawer. A few seconds work and the video electronics (2) slip out, or the power supply (3), leaving only the "bottle" (4). CORTEX is your friend because it's reliable. And, if it goes wrong, it's easier and quicker to mend.

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It's unfair on other micros. For CORTEX has a dedicated "second computer" (as powerful as Apple II) which does nothing but handle its screen. That's why CORTEX has such dazzling quick-fire graphics. Now CORTEX's superb graphics hardware is matched with Digital Research's CP/M Graphics software (£275). Create bar charts, pie charts, scatter graphs in a few seconds and incorporate them into your reports or display them 2, 3 or 4 at a time on your screen, or make overhead projector or conventional slides.

C/WP CORTEX

C/WP Computers, 108 Rochester Row, London SW1
Telephone 01-828 9000

ALL THIS FOR £1495 + VAT

Send me details of the 104k twin-processor CORTEX with 83-key IBM-style keyboard, 12-inch green screen, twin double-density (400k) floppy drives, CP/M and C/WP's user friendly WordStar, for £1495.

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Address and Telephone ______________________________

SIRIUS GRAPHICS

An add-on graphics board for the ACT Sirius I? It's not quite as crazy as you might at first think. A D Osborne points out the advantages.

In a previous article (*PCW* Aug 82), I bewailed the fact that, although the ACT Sirius I had superb potential for producing high resolution displays, the means of producing them was woefully inadequate. GW-Basic, which has since appeared, has many features which are not implemented on the Sirius and one is still rather limited in programming Graphics displays with those that are.

Recently, a high resolution graphics board for the ACT Sirius/Victor 9000 machines has been marketed by Magus Computer Systems Ltd, tel: 045 423 231. One might immediately ask why a high resolution micro needs an add-on graphics board! The answer to this is that it enables one to program graphics displays without using up precious memory. A screen full of high resolution display uses 40k of memory and a 128 element character set 4k. Thus, if one wishes to work with two displays (a screen display and a virtual display) together with two supplementary character sets, 96k of working memory would be required, not counting memory for an expanded Basic Interpreter.

The Magus board has 128k of RAM which more than compensates for the requirements of two displays and supplementary character sets. When used in non-graphics mode, this RAM produces a full 128k expansion. This is worth taking into account when considering the cost of the board which is £279+VAT. Instead of an expanded interpreter, graphics are produced by machine code subroutines residing in ROM in high memory (starting at D8000H). Having the routines as primitives also has the advanatge that they may be called from other languages such as Pascal or Fortran. There is provision for storing displays to diskette and for dumping the screen to an Epson type printer. The graphics board comes with a diskette containing the Linker module as well as demonstration programs and character sets. There is both a CP/M-86 and an MS-DOS version and, for an extra £10, the makers will supply both Linker modules. There is also a clear and informative manual which explains, with examples, how to use the routines with Basic 86 and how to call them from MS-Pascal (but not from MS-Fortran).

The Linker program (linkg) reserves the memory necessary for two displays and two × 128 element character sets over and above the standard 256 element set of characters and logo elements. The architecture of the machine is such that the 40k memory for the screen display must be in low memory and must not cross the 64k boundary. The screen display memory reserved by linkg begins at 4400H and the second display (virtual display) is placed directly above this. The area reserved for character sets is below 4400H, so that if too many character sets are loaded, these start to encroach on the screen area. On the graphics board, there is 2k of dedicated RAM above the ROM (starting at D9000H) which is used as a scratch-pad area, but also contains a three word space for the Address Parameters by which strings are handled under the Microsoft calling convention. There are 16 graphics routines as outlined in Fig 1.

Most of the functions are self-evident from Fig 1 but 'Draw' and 'Shape' deserve special mention. Draw is controlled by coordinates x%, Y% and by a one-word integer f%. Bits 0 and 1 of this determine the drawing mode. This allows four modes: (i) Exclusive OR the points (toggle them on/off by previously drawn points) in the path of the 'pen'; (ii) Turn points in pen

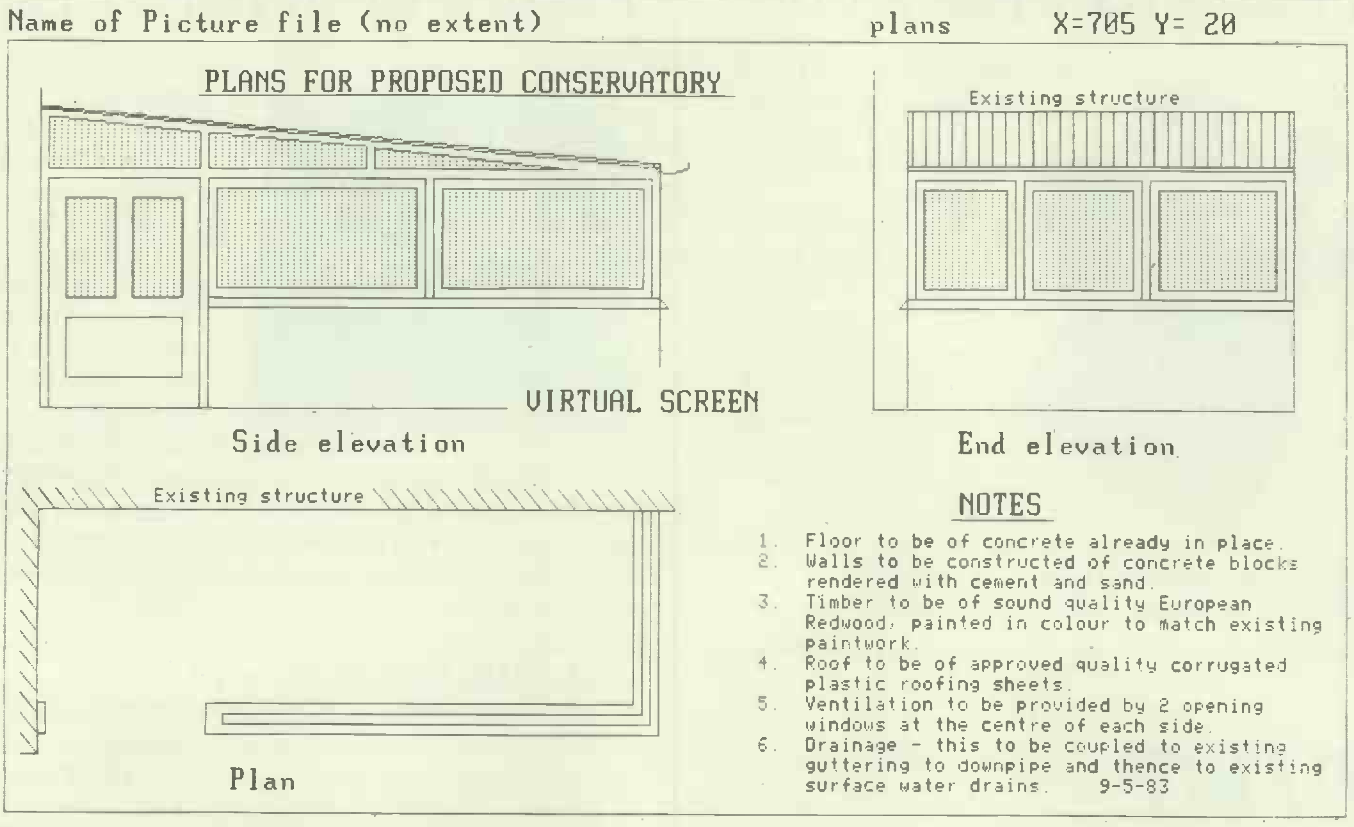


Diagram reproduced from Magus demonstration program path ON; (iii) Turn them OFF; (iv) Do-nothing. Bits two to eight allow ways of controlling how the line is drawn depending on which of the bits is set (eg, solid/broken lines) and bits nine to 15 are ignored.

'Shape' is a routine which draws an ellipse. This routine is very powerful because the axes of the ellipse and their orientation on the display can be controlled, as well as the number of points plotted. This allows easy drawing of regular polygons. Thus, if the axes are made equal and five points are plotted, a regular pentagon results. The aspect ratio of the Sirius/Victor is 1.4 and this can be allowed for automatically by the routine to produce undistorted displays, even under rotation of the figure. The Epson printer has an aspect ratio of 1.2 and an undistorted print-out can be achieved by scaling X by this factor. However, this cannot be done automatically.

There is a skeletal program on the diskette called GRAFSUB.BAS which contains subroutines starting at line 10000, which in turn call the various graphics routines. The header listing is standard in lines 10-70 so that the user's program can be slotted in starting at say line 100-. The diagram is then programmed by defining the appropriate variables and strings and then using GOSUB statements. Any interrupt which occurs, automatically switches the system into TEXT mode and this applies to INPUT statements (but not INPUT£ statements) which cannot, therefore, be used while in HIRES mode. Data must therefore come from diskette or from DATA statements although INKEY$ may be used for single character input without tripping the system back into TEXT mode. Because the routines are in machine code, drawing is very fast indeed, which is a great advantage when drawing complicated displays.

Information on interfacing with MS-Pascal is set out clearly in the Appendix to the manual and there is an object module called ROMLINK.OBJ on the diskette which must be linked to the program. There is also a listing of a procedure called set-up-fcb (file control block) which must be used to process strings to conform to the Microsoft calling convention before they are passed to PREAD.PWRITE and CHLOAD. I found that this and another procedure called MESSAGE (which passes a message to the screen) did not work without some amendment. Using Pascal gives the advantage of programming in a structural language and the compiled program runs much faster than the Basic Interpreter. This advantage is considerably off-set, however, when one is experimenting with displays because the two pass compiler followed by the linker are tediously slow. Indeed, even with some programming facility, it is generally quicker to draw a diagram with pen and ink than by computer! But this may soon be changed; Magus is about to produce a Graphics Screen Editor which is analogous to a word processor enabling blocks of graphic displays (as opposed to text) to be drawn and shunted around at will under keyboard control without any knowledge of programming at all. I hope to review this package in a subsequent article.

Routine	Function
SETTEXT	Change to text mode
SETHIRES	Change to graphics mode
PATTERN	Produce a user defined symbol
DRAW	Draw solid or dotted lines
EPSON	Dump the screen to printer
WRITECH	Write a character to a specified point on the display
CHLOAD	Load a character set from disk
SHADE	Produce a user defined shading pattern
RUBCH	Rub out a character
CLEN	Return the dot width of a character
DEL	Clear an area on a display
SHAPE	Draw an ellipse
SETORG	Set the 1h bottom corner of a display to user specified point
PREAD	Read a diagram from disk
PWRITE	Write a display to disk
PSWAP	Interchange screen and virtual display

Fig 1.

COMPUTERISING YOUR BUSINESS

Michael Becket gives helpful advice on how to introduce a computer into your business.

Before you install a computer, consultants used to warn companies, your office organisation must be made logical, systematic and consistent — and once you have done all that you probably do not need a computer. But that was before the advent of minicomputers. Then the cry used to be that every fourth person you employ should be a computer.

With the arrival of cheap micros it has changed again: now there are few businesses, no matter how small, that can justify not owning one. Except for the problems. Because if you get it wrong, no matter how little the electronics cost, it can make an expensive hash of the company: bills are wrong, information hides, and stock control evaporates. Or worse.

So what do the experts tell us now? It is the same advice for business machines as for home computers and sounds reasonable and right — the sensible way is to pick out the applications you really need, find the best sort of software to run it, and only as the final decision do you pick the computer to run the programs you have chosen.

Alternatively, if there is nothing strictly suitable, there are professionals who will write tailor-made software for sophisticated needs so one only need find the person/firm specialising in that area and commission the program suite. This is not really feasible for the small business as made to measure programming is fearfully expensive.

Having found the perfect software which does everything you have always dreamed of, from producing cash flow forecasts to compiling a shopping list, one need but look around to see which chunk of electronics runs it most quickly, efficiently and economically. And bingo, you are on the way to organised riches. Right?

Wrong. It sounds wonderful and even logical, but it just does not work. T H Huxley once said the history of science was the slaying of beautiful theories by ugly facts. So it is with buying computers.

Illusions

For a start, somebody who has never used a computer before finds it almost impossible to specify just what he wants. But even if he does know, how in heaven's name is one to specify it with sufficient precision to enable anybody, much less a beginner, to sort out which highly-advertised set of programs can do it best? It is very easy to tell if one lump of tangible kit is different from another: there are specifiable characteristics. This one has 48k of RAM and that one has 128k. You may not know precisely what it means, nor how much it should have, but at least you can tell them apart. If one machine has two floppy disks containing a maximum of 1.2Mb while another costs more yet has only 600 kbytes, you know one gives you more for your money.

Programs have no measurable characteristics. They do have facilities but until you have used them, it is impossible to tell whether the highly-touted fancy gadgetry is necessary; and more to the point you do not discover until using the damn things that what you do want to do is impossible.

Take a very simple example. Some word processing programs allow pretty clever doings: you can substitute words throughout the text, shift paragraphs, change the margins and so on. But if what you really want to do is set the text in two or more columns, many of the best known ones will not let you do it. Unfortunately it is not until you have used the program for some weeks that the notion occurs and by that time it is probably too late. Or if you find it impossible to tell the size of a number without the commas for thousands and millions, you will not like Supercalc, yet nowhere do you see that little quirk mentioned.

When it comes to complex packages like accounts the problem is considerably greater. I have started a small publishing company and decided to put the accounts onto the computer. Being methodical, I prepared a list of the accounting requirements of Flame Books, drawn from a prolonged analysis of the way I do things at the moment. It did not follow slavishly the mechanical method — that would have been silly — but it ensured everything now available would continue to be so. Here is what I came up with:

Order processing

A — from an input of customer name and address, number and type of goods ordered, plus discount, the program should produce an invoice.

B — simultaneously the computer should debit the customer's account and adjust stock levels.

C — this should be able to cope with non-standard orders (eg, not an established customer but a one-off requiring no new file), with up to five discount rates, and if required it should at the time of invoicing be able to produce a list of previous orders from that customer indicating which have been paid and total the rest to a statement.

Management information

A — sales per month of each line by number and by value.

B — total value invoiced during a stated period.

C — total cash received during stated period.

D — total of outstanding debtors.

E — list of debtors owing for more than 30 days, classified by size specified.

Continuous information

A — ability to find customer by name and by town.

B — ability to pick out large volume customers.

C — ability to aggregate some accounts for statements (common ownership).

Audit

A — the system should provide all necessary information for statutory audit.

B — it should leave clear audit trail.

This may seem excessively pernickety but since very nearly everything can now be done with comparative speed from five exercise books, I naively thought a clever computer could do it with ease. Not so. Some very clever people including software companies and computer consultants said it was too demanding and I would have to write my own software, probably using something like a database package to help. For a man who broke his basin and almost severed his big toe trying to decorate the bathroom, do-it-yourself holds few attractions; trying to produce anything as complicated as an interlocking set of programs to carry out all those tasks is clearly beyond me.

Step by step

But really this is jumping ahead. The first question really is: what software do you really need. Experience has taught one useful lesson — a spreadsheet is essential. In case anybody reading this does not consult the back of this magazine or comes to it completely raw, it may be necessary to explain that a spreadsheet is in effect a squared sheet of paper in which you can tell the computer to manipulate the figures in one square and put them in another.

Anybody who has ever gone through the torture of preparing a cash flow forecast will go dizzy with joy when first starting to play with it. No longer do you sit there all weekend with pocket calculator in hand trying to remember what base rate is and when you have to pay certain bills. No longer do you agonise about the insertion of a sale figure for June, in case it turns out too pessimistic and you have to do the whole thing all over again. No longer do you have to curse the know-it-all who says: 'Yes that's very good but what if, as I suspect, interest rates rise in October?'

You just feed in the assumed sales along the top, tell the computer to multiply each one by price (specified), add on costs such as postage (multiply that and that by that and put the figure here), take costs from receipts and add the total to your bank balance (which in turn is adjusted for the interest rate). And oh the joy of saying 'Ah but what if...' and changing a couple of figures to make the computer work it out all over again at the press of a button.

No business can prosper without a cash flow forecast and in these tough times it is doubtful if it can survive. Bank managers are rather keen on them too. They are comforted by figures, no matter how spurious. And the company itself should get used to producing monthly management accounts to give you an idea where you stand. These are then fed into a parallel set of figures to your forecast and the two compared to see where the forecast went wrong. The advance warnings about money problems can save you from insolvency.

Word processors — although popular — are probably only necessary for organisations which have words as their main product: consultants, solicitors, surveyors, etc. They are also useful for maintaining mailing lists and also for marrying them to standard letters. For most companies, whose main use would be for letters, a typewriter is probably just as handy. There is the point that once you have bought a computer for other purposes, and decided to get a daisy-wheel printer for its output, it is probably cheaper to buy a word processor package than a typewriter. Since few companies would want to be without a typewriter, the answer may be to buy an electronic one which can be used as the printer of the computer. Then you still have the option at a later stage of buying a word processing package if you really cannot do without one.

Accounting packages are not so much essential as the main reason for buying a computer in the first place. Here you are going to be completely at sea. For any popular computer (for example, my own Sirius) there is a bewildering choice of packages. If there is a way of telling apart the products of Omicron, Tesson, Consultancy Consortium, Pulsar, Pegasus, Exact, Logic, Merit, Sapphire, Open, Microproducts, Tabs, Padmede, Graffcom or Action File, I have not found it. (I did not make up that list — that was not heavy-handed satire, those really are the purveyors of accounting software to Sirius owners.)

Get advice

The answer is to talk to as many people as possible. The National Computing Centre gives a certain amount of free advice, your accountancy firms are pretty knowledgeable — more to the point they are very keen to get closer to small companies and are therefore ready to help free of charge. On top of that you just have to read magazines which do reviews. No they will not ask the questions you do because reviewers do not run small business on the programs for six months as a way of testing them, but you will get a comparative feel.

You will also find special suites of programs tailored for specific industries. Pubs to publishing, reinsurance to road haulage, minicabs to mail order, there are hundreds of them. Everything from corner shops to multimillion pound organisations can find off-the-peg packages. Check them carefully — many are partial solutions to a sector's problems and you may still have to add on so many other (non-compatible) bits and bobs that the original specialist service may be less than useful. To be fair though, some are economic ways of solving a small problem, and can be run on low-cost computers like the BBC B, Commodore 64, Newbrain, etc.

Accounting packages come in separate units: sales ledger, bought ledger, nominal ledger, invoicing, payroll, and stock control. You can get these piecemeal from around £200 a time and this will help spread the cost and the labour of transferring files. But make sure the units interlink and have enough capacity for your number of customers. There are also some complete packages like the Financial Director but either way you can expect the whole shebang to cost between £750 and £1500, plus VAT (for some reason nearly all computer prices are listed without VAT). A higher price is not necessarily an indication of greater quality.

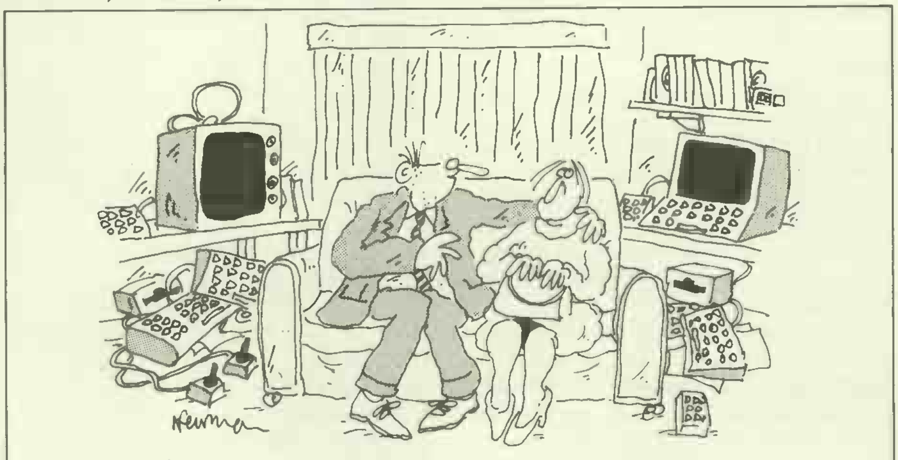
Finally, the only other type of software you are likely to need is database management. This piece of computerspeak means access to information. It will for instance enable you to enter all customer names and then call for them with few facts — eg, Mr ? Robinson, London; or a retailer in Cumbria who orders glottle-stop holders; or customers in Devon who order in large quantities and so on. It can also allow you to manipulate your information and so can build up your own programs, even accounting suites. Probably the best known one is dBaseII, though a highly-praised newcomer called Superfile is reckoned to be even more flexible. But clearly this is a luxury at the start, expecially as it is likely to cost upwards of £500.

Every company's detailed needs are different, but the essentials are much the same. Financial planning and running the books are vital and computers can make both less time consuming and more accurate. Companies which are now small and have no megalomaniac ambitions (I do), like a shop or a pub or garage or a small manufacturing concern, can probably make do with a fairly low cost system — the programs for home computers are enviably cheap. But once you get a proper business system (you will find disk storage pretty well essential for both types), costs rise to £2000 and up.

Warning

Two final warnings: it is going to take a long time to learn the systems, and do not get rid of your paper system just yet. Even the most 'user-friendly' programs have to be learnt — you can get the hang of spreadsheets like Supercalc (which I use) and the popular Visicalc in a matter of an hour or so but it took me something over eight hours to master WordStar (the word processing package on which this article is written), and dBaseII can take weeks to understand fully. And until you have got the hang of shifting things around the computer you will almost certainly foul something up, lose a file or just fail to get at the bit you want. So for the first year run the two in tandem, and make sure you buy from a dealer who will hold your hand when the bloody thing refuses to obey you — as it will.

Next month John Vogler describes his experiences transferring a small business onto the BBC micro.



"How would you like to see my disk collection?"

TI IN MOTION

Adrian Bicker looks at some of the intricacies of TI Extended Basic and presents a few programs.

'TI Extended Basic is known for its sprites. These move over a 256 dot square grid, the bottom quarter of which is not visible on the screen.' That is what the manual says but it is not the case.

The first clue to the actual situation is the behaviour of a sprite moving across the screen at 45 degrees. If the grid were square, it would follow the same path each time it passed across the screen. In fact, the sprite steps across the screen each time, taking eight passes to revert to its original path. This shows that the grid is rectangular, with the lengths of the edges in the ratio of seven to eight. From this it seems that there are only 224 dots down the screen.

This is strange as the sprite sub-program accepts dot-row values from one to 256. The following program shows how this range of values is treated:-

```
100 CALL MAGNIFY (4)
110 CALL CLEAR
120 CALL CHAR (40, RPT$ ("F", 64))
130 R, P = 1
140 PRINT :: DISPLAY AT (21,1): R;P:R
150 ACCEPT AT (22,2) SIZE (−3):R
160 CALL SPRITE (#1,40,13,R, 200,0,0)
170 CALL POSITION (#1,P,C)
180 GOTO 140.
```

The program accepts a row number and positions the large square sprite accordingly. The sprite's actual row number is then displayed for comparison against the original figure.

Entering row numbers from 195 to 226 gives varying results. For any of these values, the sprite is positioned at a row which is either 32 greater or 32 less than the row number selected. This shift appears to be random as can be seen if the same row number is entered repeatedly.

A significant point is that if you 'hide' a sprite off the bottom of the screen by using a row number of 192 or more you may be in for a surprise. If you used row 200 for instance, the sprite sometimes appears at row 168 which is actually visible on the screen!

This positioning problem only occurs if the sprite has a velocity specified in the SPRITE or MOTION sub-programs, even if the velocities are zero as above.

Getting back to the problem of the dimensions of the grid, the changing of the row numbers by plus or minus 32 for rows 195 to 226 results in rows 195 to 226 never being used.

This is consistent with the grid having only 224 dot rows. These would be numbered 1 to 194 followed by 227 to 256. This can be confirmed by running the program below which repeatedly prints the row of a sprite which is moving slowly down the screen.

```
100 CALL SPRITE (#1,43,13,1, 200,2,0)
110 CALL POSITION (#1, R,C)
120 PRINT R
130 FOR I = 1 TO 80 :: NEXT I :: GOTO 110
```

Understanding the strange arrangement of the row numbers is important for anyone who intends to use sprites seriously. There are two main ways in which it affects the planning of a program.

If you wish to have a regular sequence of sprites moving up or down the screen, their initial row numbers will have to be evenly spaced. In calculating these positions, remember that there are really only 224 rows not 256. Also, remember that the distance between rows 194 and 227 is one not 33!

A more insidious problem is overcoming the most significant limitation of TI sprites. This limitation is that you can use no more than four sprites across any row of the screen. More than this and the sprite with the highest number blanks out.

You can control this to some extent by careful planning of the positions and relative motions of the different sprites. With vertical motion, some sprites may have to start off the bottom of the screen. If so, avoid referring to rows 195 to 226 since the 32 row shift can play havoc with the careful planning and even worse, the fault is intermittent due to the random nature of the shift.

TI-99 joystick emulation

Joysticks are often the easiest way to control movement on the screen and they are frequently used in games programs. If you are still saving for your joysticks and want to convert a program to respond to the keyboard instead, the following routine should solve your problem:-

```
100 REM SET UP
110 N = 0
120 FOR I = −1 TO 1
130 FOR J = −1 TO 1
140 N = N + 1
150 JY (N) = I * 4
160 JX(N) = J * 4
170 NEXT J
180 NEXT I
1000 REM SUBROUTINE
1010 CALL KEY (0, I, J)
1020 I = I − 50 * (I<0)
1030 P = POS ("ZXCS#DWER", CHR$(I),1)
1040 X = JX(P)
1050 Y = JY(P)
1060 RETURN
```

The set up section needs to be put at the start of the program as it sets all the necessary values.

Use GOSUB 1010 as a direct substitution for the CALL JOYST statement in the program to be converted. Note that the X and Y in lines 1040 and 1050 will have to be changed to correspond with the variable names used in the original JOYST call.

As it stands, the subroutine will sense the eight directions of a joystick using keys W,E,R,S,D,Z,X and C as you might guess from line 1030. This can be restricted if necessary to respond to only four directions by substituting '#X#S#D#E' in that line.

In some circumstances, there is no advantage in the subroutine repeatedly returning nil values as an unpressed joystick would. This can be avoided, decreasing the initial response time by changing line 1020:-

```
1020 IF J = 0 THEN 1010
```

Similarly, if it is preferable to press a key repeatedly rather than have auto repeat, line 1020 could be changed to:-

```
1020 IF J<1 THEN 1010
```

There is one other problem you could have in converting a joystick program. What do you do if you are expected to press the action button? The answer is simple. Press either Q or Y according to whether joystick one or two is meant to be in use. Do not press Q and shift on the old TI-99/4s or you will quit Basic!

Try converting the following short program:-

```
200 CALL CLEAR
210 CALL COLOR (2,7,7)
220 CALL COLOR (3,13,13)
230 CALL HCHAR (24,1,40,64)
240 CALL VCHAR (1,32,40,48)
250 PY = 12
260 PX = 16
270 CALL HCHAR (PY,PX,48)
280 CALL JOYST (1,X,Y)
290 TY = PY − Y/4
300 TX = PX + X/4
310 CALL GCHAR (TY,TX,R)
320 IF R = 40 THEN 280
330 PY = TY
340 PX = TX
350 GOTO 270
```

As it is written, the subroutine can be used in TI Basic or Extended Basic on the TI-99/4 or on the TI-99/4A using the shift or alpha lock key to get the upper case letters. To make the program sensitive to lower case, just substitute small letters in line 1030.

Character redefinition

When redefining numerous blocks of characters in TI Extended Basic, it is frequently necessary to include long strings of '0's. The available RPT$ function is cumbersome to use too frequently. A neater approach is to define a string as follows:-

```
DEF Z$(X) = RPT$("0",X)
```

Z$() can then be included in the character code string. For example:-

```
CALL CHAR (96,Z$(15)&"101" & Z$(28) & "808")
```

The same technique can be used in TI standard Basic by changing the definition of Z$(). Make sure that you put in enough zeros for your requirements.

```
DEF Z$ (X) = SEGS("00000000 0000000",1,X)
```

TI Display

One of the problems encountered with the standard TI-99/4A Basic is that there are no cursor control commands so that a PRINT statement invariably results in screen scrolling. This is often inconvenient especially when a screen layout has been produced for game playing.

The only way to overcome the problem is to position each character on the screen in turn using the HCHAR or VCHAR subprograms. The following subroutine can be used to print any string or number on the screen without screen scrolling:-

```
500 CALL HCHAR (R,C,32,L)
510 FOR I = 1 TO LEN(W$)
520 CALL HCHAR (R,C+I−1, ASC (SEG$(W$,I,1)))
530 NEXT I
540 RETURN
```

Before the subroutine is used, the row and column numbers R and C must be set and W$ must be assigned the string to be printed. If a number is to be printed assign STR$ (number).

Line 500 overcomes the remaining problem that if a short word overwrites a longer one, the end of the longer word remains on the screen. It blanks out a portion of the row starting at column C. Set L to equal the number of blanks required. If this feature is not required, use GOSUB 510.

Add the following lines and try running the test program.

```
100 CALL CLEAR
110 W$ = "TEXAS"
120 R = 4
130 L = 7
140 FOR C = 20 TO 8 STEP-2
150 GOSUB 500
160 NEXT C
170 FOR J = 1 TO 5
180 READ R,C,W$
190 GOSUB 510
200 NEXT J
210 GOTO 210
220 DATA 4,14,INSTRUMENTS
230 DATA 18,14,BASIC
240 DATA 12,11,TI BASIC OR
250 DATA 15,13,EXTENDED
260 DATA 7,7,THIS PROGRAM RUNS IN
```

If you prefer your words to be printed vertically on the screen just use VCHAR in line 500 and change the expressions in 520 to R+I−1 and C.

This approach to displaying information on the screen has another advantage over using the PRINT statement as it enables you to use the full 32 columns rather than the usual 28.

NUMBERS COUNT

THE PARTITIONS OF A POSITIVE INTEGER

More of Mike Mudge's mathematical problems.

Background

(i) Congruences: Given three integers a, b and c we say that a is congruent to b modulo c and write a=b(modulo c) if and only if a−b is an integer multiple of c. Thus: 15≡1(modulo 7) because 15−1=14=7×2.

(ii) Partitions: A partition of a positive integer, n, is a non-increasing sequence of positive integers whose sum is n.

p(n) denotes the number of partitions of n. Thus: p(4)=5 because 4=4, 4=3+1, 4=2+2, 4=2+1+1, 4=1+1+1+1.

Problem

(a) (i) Calculate, as efficiently as possible, p(n), the number of partitions of a given n, verifying, if possible, the following results: p(10)=42, p(20)=627, p(50)=204226, p(100)=190569292.

(a) (ii) Factorise the calculated p(n) into prime factors.

(b) Verify the following observations of S Ramanujan:

(i)p(4),p(9),p(14),p(19),... ≡0(modulo 5)

(ii)p(5),p(12),p(19),p(26),... ≡0(modulo 7)

(iii)p(6),p(17),p(28),p(39),... ≡0(modulo 11)

(iv)p(24),p(49),p(74),p(99),... ≡0(modulo 25)

(v)p(19),p(54),p(89),p(124),... ≡0(modulo 35)

(vi)p(47),p(96),p(145),p(194),... ≡0(modulo 49)

(vii)p(39),p(94),p(149),.. ≡0(modulo 55)

(viii(p(61),p(138),... ≡0(modulo 77)

(ix)p(116),.. ≡0(modulo 121)

(x)p(99),... ≡0(modulo 125)

Now in 1919, S Ramanujan made the following remarkable conjecture, based upon empirical evidence, including the above results: 'If d = $5^a7^b11^c$ and 24k =1(modulo d), then: p(k),p(k+d),p(k+2d),...≡o(modulo d). This theorem is supported by all the available evidence, but I have not yet been able to find a general proof.'

Now c1930 S Chowla found a counter example to the Ramanujan conjecture; p(243)=133978259344888 ≢ 0(modulo 7^3) however 24×243 ≡1(modulo 7^3)

Note: A fully modified conjecture was proved in 1967 by A O L Atkin; viz. If d = $5^a7^b11^c$ and 24k ≡ 1(modulo d), then: p(k) ≡ 0(modulo $5^a7^{[(b+c)/2]}11^c$) where [X] denotes the greatest integer not greater than X. We make no attempt to explore this brilliant result on this visit to the theory of partitions.

(c) Find other counter examples to the Ramanujan conjecture as quoted above.

Submit a program, or suite of programs, which tabulate p(n) as a function of n, together with its prime factors (and appropriate multiplicities). Interpret these within the context of the Ramanujan conjecture. All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order). A prize of £10 will be awarded to the 'best' entry received.

Entries, to arrive by 1 November, to: Mr M R Mudge BSc FIMA FBCS, Room 560/A, Department of Mathematics, The University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Note: Submissions will only be returned if a suitable stamped addressed envelope is included.

Review—May 1983

The Triangular, Tetrahedral and Fibonacci Numbers introduced in May, produced responses from Belgium and Norway in addition to the UK.

There was complete agreement on the solution sets:

a) {1,10,120,1540,7140}

b) {1,3,21,55}

c) {1,8,13}

The completeness of the solution set for Problem a) has been established theoretically: AVANE SOU.B., ACTA. ARITH.,12,1967 pp 409-419.

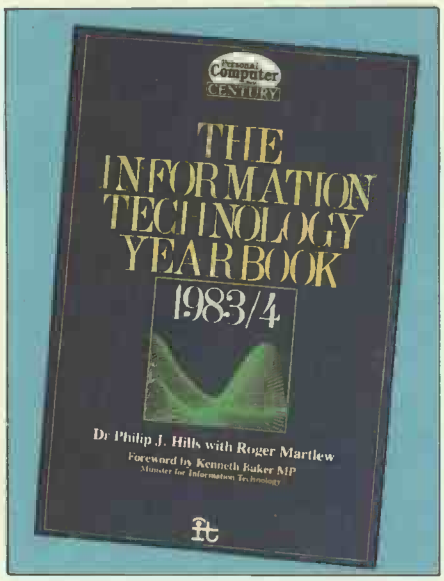
There is, however, no such result for either b) or c) known to the present author; indeed some mathematicians have expressed an intuitive feeling that these have infinite solution sets in spite of the empirical evidence.

The competition was very close this month, the 'best' entry was ultimately considered to be that generated in Basic using an Epson HX-20 by Paul Fierens, of Paul Fredericqstraat 84, B9000, Gent, Belgium, to whom a suitable prize will be sent.

BIBLIOFILE

Computer novice, enthusiast or just eager to keep up with the automated society? Linnet Evans gives her personal appraisal of some of the many publications available in the computing market-place.

THE INFORMATION TECHNOLOGY YEAR BOOK 1983/4



The Information Technology Year Book
Editor: Dr Philip J Hills & Roger Martlew
Publisher: Century/PCW
Price: £14.95

Why did we need IT82? A boost for industry and something to distract the minds of the masses? If so, the Falklands conflict achieved the same end in a fraction of the time, and spawned a slightly better level of TV documentary afterwards too. 'How could the new technology help in your office' crowed a questionnaire from the GLC that recently landed on my desk. I opted for a new drinks machine.

So why do we need an IT yearbook? In publishing terms, IT has come of age; schools, libraries and the like actively want to acknowledge its presence. Meanwhile, there are upwards of 60 software type periodicals on the news stands, a choice of dealers in every High Street, and it ain't just Channel 4 carrying the commercials. In human terms, we badly need a port in the storm.

The 1983/84 *Information Technology Year Book* edited by Dr Philip J Hills, makes a very commendable debut in this role. It consists essentially of a number of reports from the inside on different aspects of IT and its present and future effect on commercial and private life. There is a conscious effort to mirror some of the media's well-trod paths. Diana Green's taut and tidy piece on Women in IT, featuring a case study of F International, is a quintessential example. Robin Bradbeer writing on The Role of Computers in IT, and the section from Peter Gibbs, Information Technology and Finance, highlight the fact that the everyday media do not often allow the luxury of this level of calm, lucid, narrative writing.

Of necessity, this collection must be something of a PR exercise. The main backlash is the air of studied optimism that settles almost everywhere: a breakfast-cereal wholesomeness that's neither a reflection of nor an encouragement to the dodgems and helter-skelters that make up a greater part of the real computer world.

Interspersed are a number of lists of manufacturers, suppliers et al of the kind that can be located every month in *PCW*. In years to come, I suspect this side will offer more contents and comments, thus softening the likelihood of being instantly out-of-date. Already, it stands well aside from *The Computer Users' Year Book*.

For the individual reader, *The Information Technology Yearbook* provides a useful orientation course into this very variegated and newsworthy area, despite my reservations, and despite the price. For schools and libraries, whatever port in whatever storm, it's probably inevitable.

KIDS AND COMPUTERS

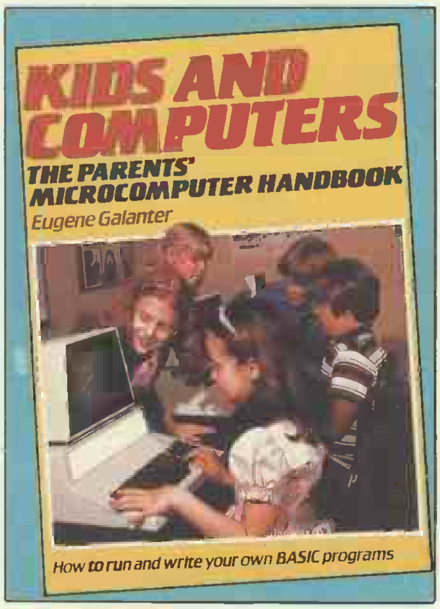
Another volume with a deserving subtitle is *Kids and Computers* from Eugene Galanter re-defined as *The Parents' Microcomputer Handbook*. Galanter is an educator, a parent, and founder/director of an institution called The Children's Computer School in New York. It was this latter, with almost half its students in the over-21 bracket, that gave the groundswell for the present book.

While the level of personal computer ownership per head is not as high overall in the States as it is in this country, the transatlantic saga has been longer-running and more intense. The US review is therefore to some extent the UK preview. But the publishers have taken great care to have the text retuned for the UK market.

Galanter is another good writer too. Bright, crisp, well-paced and oozing with prior knowledge, he steers his subjects with absolute accuracy without being didactic or patronising. The prime aim here is to enable an interface between the world as we know it, and a youth cult bigger than the Beatles *and* Johnny Ray. It's not simply a game of crack-the-code with your socially diffident, faintly radioactive progeny either. Crucially, Galanter also sells the idea of interactive computing involving, in various senses, all the household.

Readers are offered a very sound idiot's guide to hardware options, to the physical location of the kit to avoid glare, social conflict, etc, and to the basics of LOAD, RUN, proprietary software assuming a cassette-based machine of the VIC type. The potentially long initial learning curve for all parties is treated with respect, though not with kid gloves (sic). The buying guide that intercepts this train of thought stirs up the arguments with unusual thoroughness: after all, for small children, ease of keyboard use may indeed put RAM size in the shade. Tiny C's are also apparently less likely to shove an integral machine onto the floor than a separate VDU. The voice of experience speaks clearly.

In summary, this is a well-designed, trenchant book making good use of its novel approach.



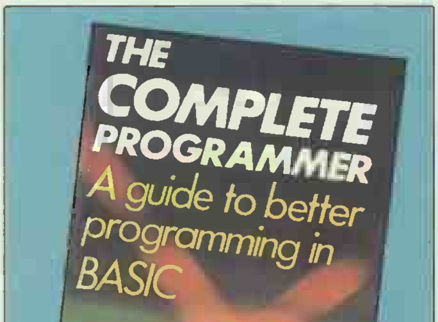
Kids and Computers
Author: Eugene Galanter
Publisher: Kingfisher
Price: £5.95

THE COMPLETE PROGRAMMER

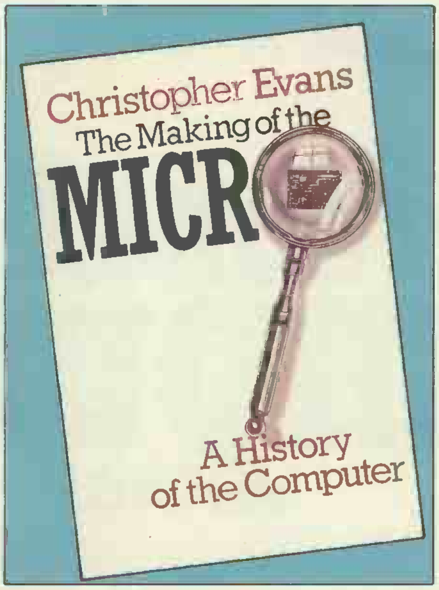
The subtitle to Mike James' *The Complete Programmer* is *A guide to better programming in Basic.* Yet no way should this book be taken (or declined) as yet another syntax dictionary or moral tract on the worthiness of structured programming. James is hardly the first writer to joust with questions of policy and philosophy, such as there may be, that can underlie the programs that you and I may from time to time bodge together. Where he does score so well is in his capacity to speak, candidly and trenchantly, to a potentially very wide readership, and in the level of very warm and practical encouragement, to back this up.

All programming theory ultimately rides on the rails of program code, and it's this code-awareness that bootstraps the whole book. Swift, relevant examples are quoted frequently: James goes out of his way to draw positive virtues from more limited or wayward dialects. In mapping out many stones left unturned by the average PC owner's manual (or for that matter the more slap-happy end of commercial programming), an overview is offered of, for instance, the various sort and search routines likely to be appropriate to micro environments. If the reader is left searching beyond this book for a real response to a real question, this is part of the author's intention. The particularly tacky and virtually intangible area of testing and debugging is given a decent airing in a later chapter, with entirely practical advice on tactics.

This book should appeal to — even seduce — the heads, hands and hearts of newer programmers: interestingly, it also provides a fair refresher course for those old hands among us who now can't see the trees for the wood. If *The Complete Programmer* doesn't always give the complete answer to the complete question, then that can only be another plus factor for a book which hasn't wrapped up its subject by its last page.



The Complete Programmer
Author: Mike James
Publisher: Granada
Price: £5.95



THE MAKING OF THE MICRO

I'm sorely tempted to propose that Dr Chris Evans, were he still alive, could in a certain sense have done more for the IT spirit than the whole official party-line caboodle.

Chris Evans (we're not related) was promiscuously interested in anything and everything. This, with a rippling racy style and a benign love of entertaining his readers, rendered him the perfect pop pundit.

Some years ago, I was asked to put together a light-hearted article for a hi-fi magazine concerning the relationship between music and plants. After Kew Gardens and more had all professed ignorance of this wayward topic, in semi-desperation I phoned our man. I thereby gained the one-line quote I needed, which was 'bollocks', but rather more nicely phrased. Thrown in for good measure was an exquisite demonstration of fledgling voice recognition applications and a trailer for what are now known as expert systems. So far the pop punditry has held good.

It would be churlish to dub *The Making of the Micro* just a posthumous potboiler, though it reveals nothing new. Fans of his best-selling *The Mighty Micro* will recognise a very substantial sharing of text. Though tidied up for publication, it is manifestly unfinished.

The book consists partly of thumbnail sketches of the various, generally eccentric, characters whose inventions and interventions seeded the Apples and Apricots of today; and partly of cogitation and comment on the duration and duress of the computer revolution. Whether the past events are utterly 'true', or the big predictions really fulfillable, isn't important. They're both credible enough to allow us to sit back and enjoy a wheeze of a read.

The Making of the Micro
Author: Christopher Evans
Publisher: Oxford University Press
Price: £1.95

PRACTICAL INFORMATION PROCESSING

In *Practical Information Processing*, G G Skinner and E M Prentice make public some of their experience in further education. While Pitman's, RSA and other institutions now offer Word Processing as an exam subject, the book is more squarely aimed at the broader requirements of the Business Education Council (BEC) and the Technical Education Council (TEC). There's also an unintentional sidelong glance at the lone office manager trying to grasp concepts before talking to salesmen.

The text falls into two halves. One deals with the tools of the trade: basics, hardware, 'attributes of a good operator'. A worthwhile if slightly limited sprinkling of buzzwords and configuration options are provided. The way in which certain technical details are stoically hauled upfront may still turn a few stomachs; conversely, more immediate attention could have been given to the organisation and management side of small computer-based systems. More diagrams and fewer publicity shots of VDUs might have been helpful too.

The raison d'etre is the second section with its sequence of WP assignments which should encourage students to read up on their (non-specific) kit before performing 30-minute workouts. An outline foreknowledge of office practice is assumed, and programmable dot-matrices won't save anyone from the traditional dinner-dance menu:

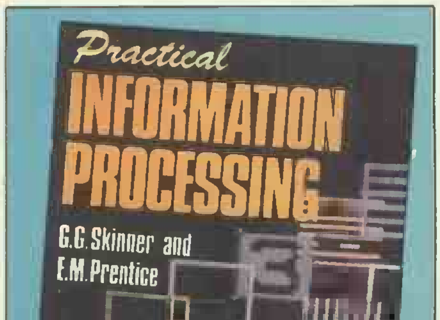
—o—O—o—

Cheese and Biscuits

—o—O—o—

Of necessity, more gentle mention is made of other proprietary software such as spreadsheets and databases.

Though personal reactions are invited, this is hardly a personal handbook, and the elements of new ground covered in the second section can't disguise the shortcomings of the first.



Practical Information Processing
Authors: G G Skinner & E M Prentice
Publishers: Hodder & Stoughton
Price £3.45

NEC APC

Continued from page 157

a free standing micro. The hassle you go through trying to secure your disks will cost you more than you save in a very short time.

HARDWARE	£
Monochrome, single drive	2077
Monochrome, dual drive	2495
Colour, dual drive	3118
Mono graphics	396
Colour graphics	687
Serial controller	215
Printer cable	59
10 Mbyte hard disk	1632–1828

SOFTWARE	£
CP/M-86	64
Benchmark Word Processor	311
DBase II	428
ASYNC	188
BISYNC (each)	529
Ledgers (each)	350
MasterPlanner	245

Conclusions

This machine is one of the best quality offerings I have ever evaluated. It is beautifully made and will almost certainly prove to be a reliable workhorse. Of course, you find that you have to pay for this quality and I'm not at all sure if it isn't just a little bit too expensive. The manuals are well presented but there appears to be a gap in the range between the very basic operator's guide and the CP/M-86 user's guide. Quite a few application packages are already available for the APC and I'm sure that others are joining the list daily. If you're looking for a top quality business computer, then this machine should be on your shortlist for consideration.

END

Benchmarks

CBasic (compiled)	
BM1	2.3
BM2	2.3
BM3	13.7
BM4	17.6
BM5	17.8
BM6	32.0
BM7	34.8
BM8	37.1

All timings in seconds. For an explanation and listings of the Benchmark programs, see PCW Vol 5, No 11, November 1982.

A BEGINNER'S GUIDE TO PROGRAM CONVERSION

Continued from page 216

Once you've done that (he says lightly), it should be a straightforward matter to replace the offending code with your own routine. This is when you find out just how structured the program really is. I once followed a series of about nine GOTOs, the final one ending on the line following the first one with nothing having happened in between. OK it's an extreme example, but there are some funny people about . . .

Anyway, next on the agenda is to go through the listing making a note of anything which looks slightly, rather than totally, out of place in your machine's Basic. You'll find that most of the changes will be fairly obvious even if you've never seen some of the keywords before. Most people would guess that HOME is the same as CLS, for example. I hope the *PCW* Basic Converter Chart will help you sort out the stranger idiosyncracies of some machines. I don't think anybody unfamiliar with the BBC micro is likely to have a sudden intuition that perhaps the equivalent of FRE() is HIMEM-TOP!

If you're converting to a less powerful Basic then you may have to work at simulating some of the more sophisticated features. FOR-NEXT loops come in very handy to simulate functions such as INSTR$, STRING$ and so on.

And this is the point where you start hammering away at the keyboard! Provided you've done all the above thoroughly, a combination of the full new *PCW* Basic Converter Chart and good old-fashioned trial-and-error should see you through!

END

YANKEE DOODLES

Continued from page 144

has over 200,000 computers in dealers stock, another 200,000 units in its own warehouses and a similar quantity in parts for production. Thus there are predictions that TI will soon begin dumping these units on the market at substantially reduced prices.

In the meantime, Apple and IBM are reported talking to mass merchandisers about marketing new stripped down versions of the IIe and PC. They are both trying to enter the larger home computer marketplace without upsetting their dealers.

Random news

Fortune Computer Systems, the first company to introduce a 68000-base Unix system, will announce a loss for the second quarter ending in July. Fortune attributes it to a drop in orders and delays in software shipments . . . Shugart is expected to introduce a 12in optical-disk drive later this year with a one gigabyte storage capability. Price is expected to be close to £10,000 . . . Digital Equipment Corporation has disclosed that it will abandon production of 36-bit minicomputers in favour of its 32-bit machines . . . Computerland has filed a suit against Softwareland seeking to have the company stop using the suffix 'land' in its name . . . Computers International, Los Angeles CA is reportedly at work on a 100cps daisy-wheel printer . . . TandonCorp, the disk drive manufacturer, will enter the personal computer market with a system sold under a private label by Atari . . . Romox, Campbell CA, has demoed a reprogrammable game cartridge with the expectation that customers will bring their old Romox game cartridges back to their dealers to have them reprogrammed with new games at $10 each . . . Microsoft has named a new VP of corporate communications (that means PR) who comes from a soap company. Guess it needs its act cleaned up.

Latest in the price war

I could hardly believe my eyes, but there was the ad in my local paper . . . the Timex 1000/Sinclair ZX81 on sale for $29.97 . . . how much lower can it go? And then the same store advertised the Commodore 64 for $199.97 and there are reports of prices as low as $194.99. And the VIC-20, Atari 400 and TI-99/4 are fighting it out at the $69 level.

Price erosion has even begun on the more expensive machines. For example, I recently saw a newspaper ad for the Osborne I computer for $988. And there are special discounts being offered on the Apple IIe when bundled with peripherals and software, so that the effective street price of the machine is now down to well under $1000.

END

DATA SHAKER

BASIC FOR THE COCKTAIL ENTHUSIAST

continued from page 193

```
3290 IF ANSWER$=BLANK$ GOTO 3270
3300 PRINT
3310 IF ANSWER$<>LEFT$('BYE',LEN(ANSWER$)) THEN GOTO 3100
3320 PRINT 'Bye'
3330 STOP
4000 REM ------------------------------------------------------------
4010 REM PROCEDURE TO INITIALISE INGREDIENT AVAILABILITY
4020 PRINT 'Set up availability of ingredients.'
4030 PRINT
4040 FOR I=1 TO NINGRED
4050 PRINT 'Do you have any ';INGRED$(I);', YES or NO ';
4060 IF AVAIL(I)=0 THEN PRINT '[N] : ';
4070 IF AVAIL(I)=1 THEN PRINT '[Y] : ';
4080 INPUT ANSWER$
4090 IF ANSWER$=LEFT$(YES$,LEN(ANSWER$)) THEN AVAIL(I)=1
4100 IF ANSWER$=LEFT$(NO$,LEN(ANSWER$)) THEN AVAIL(I)=0
4110 REM OTHERWISE NO CHANGE
4120 NEXT I
4130 PRINT
4140 PRINT 'Finished. Use INITIALISE or MODIFY to change availability.'
4999 GOTO 3200
5000 REM ------------------------------------------------------------
5010 REM PROCEDURE TO MODIFY INGREDIENT AVAILABILITY
5020 PRINT 'Change the availability of ingredients.'
5030 PRINT
5040 PRINT 'Currently available :'
5050 FLAG=0
5060 FOR I=1 TO NINGRED
5070 IF AVAIL(I)=1 THEN PRINT '    ';INGRED$(I)
5080 IF AVAIL(I)=1 THEN FLAG=1
5090 NEXT I
5100 IF FLAG=0 THEN PRINT '    none'
5110 PRINT
5120 PRINT 'Change ingredient : ';
5130 INPUT ANSWER$
5140 IF ANSWER$=BLANK$ THEN GOTO 3200
5150 FOUND=0
5160 FOR I=1 TO NINGRED
5170 IF ANSWER$=LEFT$(INGRED$(I),LEN(ANSWER$)) THEN FOUND=I
5180 NEXT I
5190 IF FOUND<>0 THEN GOTO 5230 : REM JUMP IF INGREDIENT FOUND
5200 PRINT 'Sorry, I can't find an ingredient called ';ANSWER$;'.'
5220 GOTO 5110
5230 AVAIL(FOUND)=1-AVAIL(FOUND) : REM SWITCH AVAILABILITY FLAG
5240 PRINT INGRED$(FOUND);' is now ';
5250 IF AVAIL(FOUND)=0 THEN PRINT 'not available.'
5260 IF AVAIL(FOUND)=1 THEN PRINT 'available.'
5270 GOTO 5110
6000 REM ------------------------------------------------------------
6010 REM PROCEDURE TO SELECT COCKTAILS
6020 PRINT 'List of cocktails that can be made :'
6030 PRINT
6040 GOSUB 11000 : REM FIND OUT WHICH COCKTAILS MAY BE MADE
6050 FLAG=0       : REM COCKTAIL NAME PRINTED FLAG
6060 FOR I=1 TO NRECIPE
6070 IF MAKES(I)=0 THEN GOTO 6120
6080 CRECIPE$=RECIPE$(I)
6090 GOSUB 10000 : REM DECODE RECIPE STRING
6100 PRINT '    ';CNAME$
6110 FLAG=1
6120 NEXT I
6130 IF FLAG=0 THEN PRINT '    none'
6999 GOTO 3200
7000 REM ------------------------------------------------------------
7010 REM PROCEDURE TO CHECK USAGE OF AN INGREDIENT
7020 PRINT 'Usage of an ingredient in cocktail recipes.'
7030 PRINT
7040 PRINT 'Check ingredient : ';
7050 INPUT ANSWER$
7060 IF ANSWER$=BLANK$ THEN GOTO 3200
7070 FOUND=0
7080 FOR I=1 TO NINGRED
7090 IF ANSWER$=LEFT$(INGRED$(I),LEN(ANSWER$)) THEN FOUND=I
7100 NEXT I
7110 PRINT
7120 IF FOUND<>0 THEN GOTO 7150 : REM INGREDIENT FOUND
7130 PRINT 'No cocktails contain ';ANSWER$;'.'
7140 GOTO 3200
7150 PRINT 'The following cocktails contain ';INGRED$(FOUND);' :'
7160 GOSUB 11000 : REM FIND OUT WHICH COCKTAILS MAY BE MADE
7170 FOR I=1 TO NRECIPE
7180 CRECIPE$=RECIPE$(I)
7190 GOSUB 10000 : REM DECODE RECIPE STRING
7200 FOR J=1 TO CNUM
7210 IF CINGRED(J)<>FOUND THEN GOTO 7250
7220 PRINT '    ';CNAME$;
7230 IF MAKES(I)=1 THEN PRINT '     * ingredients available';
7240 PRINT
7250 NEXT J
7260 NEXT I
7999 GOTO 3200
8000 REM ------------------------------------------------------------
8010 REM PROCEDURE TO PRINT THE RECIPE OF A COCKTAIL
8020 PRINT 'Print a recipe.'
8030 PRINT
8040 PRINT 'Name of cocktail : ';
8050 INPUT ANSWER$
8060 IF ANSWER$=BLANK$ GOTO 3200
8070 FLAG=0 : REM FLAG FOR A RECIPE PRINTED
8080 PRINT
8090 FOR I=1 TO NRECIPE
8100 IF ANSWER$<>LEFT$(RECIPE$(I),LEN(ANSWER$)) THEN GOTO 8210
8110 REM PRINT RECIPE I
8120 CRECIPE$=RECIPE$(I)
8130 GOSUB 10000 : REM DECODE RECIPE STRING
8140 PRINT 'To make a ';CNAME$;' :'
8150 PRINT
8160 FOR J=1 TO CNUM
8170 PRINT '    ';QUANTY$(CQUANTY(J));INGRED$(CINGRED(J))
8180 NEXT J
8190 FLAG=1
8200 NEXT I
8210 IF FLAG=0 THEN PRINT 'Sorry, I don't have the recipe to ';ANSWER$;'.'
8999 GOTO 3200
9000 REM ------------------------------------------------------------
9010 REM PROCEDURE TO GIVE HELP ON COMMANDS
9020 PRINT 'Help on Commands :'
9030 PRINT '     INITIALISE = Specify which ingredients are available,'
9040 PRINT '     MODIFY     = Change the availability of an ingredient,'
9050 PRINT '     SELECT     = Get a list of which cocktails can be made,'
9060 PRINT '     CHECK      = Find out which cocktails use an ingredient,'
9070 PRINT '     PRINT      = Print the recipe for a cocktail,'
9080 PRINT 'Type BYE to finish.'
9999 GOTO 3200
10000 REM -----------------------------------------------------------
10010 REM FUNCTION TO DECODE STORAGE OF RECIPE
10020 REM INPUT IS : 1. CRECIPE$ = AN ENCODED RECIPE STRING
10030 REM OUTPUT IS: 1. CNAME$   = NAME OF COCKTAIL
10040 REM            2. CNUM     = NUMBER OF INGREDIENTS
10050 REM            3. CQUANTY  = ARRAY OF QUANTITY DESCRIPTORS (1..15)
10060 REM            4. CINGRED  = ARRAY OF INGREDIENT NUMBERS (1..20)
10070 REM A). FIND SPLIT BETWEEN NAME AND INGREDIENTS
10080 FOR K=1 TO LEN(CRECIPE$)
10090 IF MID$(CRECIPE$,K,1)='$' THEN SPLIT=K
10100 NEXT K
10110 REM B). EXTRACT NAME OF COCKTAIL
10120 CNAME$=LEFT$(CRECIPE$,SPLIT-1)
10130 REM C). EXTRACT INGREDIENTS IN TURN
10140 CNUM=0
10150 FOR K=SPLIT+1 TO LEN(CRECIPE$) STEP 3
10160 CNUM=CNUM+1
10170 CQUANTY(CNUM)=ASC(MID$(CRECIPE$,K,1))-ASC('A')+1
10180 CINGRED(CNUM)=VAL(MID$(CRECIPE$,K+1,2))
10190 NEXT K
10200 RETURN
11000 REM -----------------------------------------------------------
11010 REM PROCEDURE TO DETERMINE WHICH RECIPES MAY BE MADE USING THE
11020 REM  CURRENTLY AVAILABLE INGREDIENTS.  CALLED BY SELECT AND CHECK.
11030 FOR I=1 TO NRECIPE
11040 MAKES(I)=1
11050 CRECIPE$=RECIPE$(I)
11060 GOSUB 10080 : REM DECODE RECIPE STRING
11070 FOR J=1 TO CNUM
11080 REM IF ANY INGREDIENT IS NOT AVAILABLE, THEN RECIPE CANNOT BE MADE
11090 IF AVAIL(CINGRED(J))=0 THEN MAKES(I)=0
11100 NEXT J
11110 NEXT I
11120 RETURN
```

BIG BROTHER IS WATCHING YOU

continued from page 201

in no more specific terms than 'banks and retailers'. So you have 100 names. If you have the energy, persistence and cash for postage and fees, you start writing to each of them, providing proof of identity and the appropriate fee, asking for a copy of the file about you (if any). You may be told it can't be supplied because it cannot be done without disclosing information about someone else who has not given permission. And each may take up to 40 days to reply. If you write to more than five or ten you will have done well.

This is just not a practical proposition. The Register is no more than a waste of many millions of public money and extra civil servants by a Government which claims that both are anathema. And the costs of registration to commerce and industry in totally unproductive man-hours and fees can only be inflationary, which the Government is pledged to reduce.

In practice you will know from personal experience, far more easily than from any Register, very nearly all the places where files about you may be held — your employers, banks, retailers, clubs, tax offices, and any other organisations with which you have corresponded over the years. It does not take a Register to introduce a right of access to the information they hold about you. A Register of those places where there are files of second-hand information about you might be a bit more useful. If your bank has told the ABC agency about you, then ABC could have to register. Such a Register might perhaps be small enough to be useful and, since the agencies are computerised, their indexes of names could be available on-line to the Registrar and through him to those who seek files about themselves. But it would be easier to require the bank to get your permission before passing on information and to tell you who they have given it to and when.

The Bill sets out certain sensible 'Data Protection Principles'. All of these could be given the force of Law without a Register. Unauthorised disclosure, even in machine-readable form, could count as libel if defamatory. Unauthorised access to or use of information in a file should count as 'file-breaking' or 'data-theft', and be offences as such. They would, at the same time, provide useful safeguards in many fields beyond those of personal data, such as general industrial espionage. An Office of Fair Filing could investigate complaints and initiate prosecutions without wasting anyone's time on a Register.

If you think the Register sounds like an ineffective and wasteful bureaucracy, you could write to your MP. Tell him what use you make of your personal or business computer to handle personal information which the person concerned knows you possess, is not obviously 'sensitive' and is not covered by the exemptions I have described. Ask him whether registration extends to yourself as proprietor or to your keyboard operators? And ask if it is true that you will have to register this activity under the terms of the Bill, what benefit you or the 'data subject' will get and what registration is likely to cost.

USER GROUP INDEX

As supplied by the ACC, here we present a list of User Groups throughout the country. Any alterations or additions should be sent to: ACC, c/o Rupert Steele, 17 Lawrie Park Crescent, London SE26 6HH.

W Midlands
380-Z West Midlands User Group. Contact Mr S Instone, 59 Avenue Road, Leamington Spa CV31 3PF. Tel: 0926 38751.

National
6502 Users Club. Contact W Wallenborn, 21 Argyll Avenue, Luton, Bedfordshire LU3 1EG. Tel: 0582 2697.

Hants
6502 Users Club, (Southern Region). Contact Mr S Cole, 70 Sydney Road, Gosport, Hants. Acorn, Aim, Apple, Atari, Atom. Kim, Microntan, Pet, Syn, Superboard. UK101 etc.

London
68 Microgroup. Contact Mr J Anderson, 41 Pebworth Road, Harrow, Middx. Tel: 01-422 4724.

Cornwall
6809 User Group. Contact Mr W Gibbons, Clarence Lodge, Hurdon Road, Launceston, Cornwall PL15 9DB.

W Midlands
Birmingham User Group (Atari 400/800/1200). Contact Mr M Reynolds-Jones, 66 Cyril Road, Smallheath, Birmingham 10. Tel: 021-773 2849.

Bucks
77/68 Users Group. Contact 40 Bartholomew Street, Newbury, Berkshire. Tel: 0635 30505.

National
National TRS80 Users Group. 80-NET. Contact L Heller and B Pain. Tel: (0908) 566660.

9900 Users Group (TIMUG). Contact Mr C Cadogan, Department of Computer Science, University of Manchester, Manchester M13 9PL.

Staffordshire
ABACUS. Contact Mr L Ellington, 18 Underwood Close, Parkside, Stafford. Tel: 0785 41153.

Clwyd
Abergele Computer Club. Contact Mr W F Jones, 77 Millbank Road, Rhyl, Clwyd, N Wales.

National
ACC. Contact Mr R Steele, 17 Lawnie Park Crescent, London SE26 6HH. Tel: 01-778 6824. Mr P Whittle (Chairman) Tel: (0865) 721180.

National
Acorn Atom User Group. Contact Mr P Frost, 18 Frankwell Drive, Coventry CV2 2FB.

Cheshire
Alsager Computer Club. Contact Mr M Smith, 4 Mill Hill Drive, Sandbach, Cheshire. Tel: Sandbach 2929.

Altrincham Computer Enthusiasts. Contact Mr M Hickling, 39 Barrington Road, Altrincham, Cheshire WA14 1HZ.

BFPO 47
Amateur Radio & Computer Club, Officer I/C, Royal Air Force, Gutersloh, BFPO 47.

National
Amateur Radio Special Interest Group. Contact Mr P Whittle, 49 Bartlemas Road, Oxford OX4 1XW.

Norfolk
Anglia Computer User Group. Contact Mr J Rejzl, 128 Templemere, Sprowston Road, Norwich NR3 4EQ.

National Program Exchange
APEX (Astrocomputing Program Exchange), Contact Mr M V Gavin, 79 Ardrossan Gardens, Worcester Park Surrey.

National Apple
Apple Music Synthesis Group, Contact Dr David Ellis, 22 Lennox Gardens, London SW1. Enclose a SAE.

West Sussex
Arun Microcomputer Club, Contact Mr P W H Cherriman, c/o Wick Amenity Centre, Wick Farm Road, Littlehampton, West Sussex BN17 7BL. Tel: Littlehampton 7607.

Notts
Ashfield Computer Club, Contact Mr Derrick Daines, c/o 18 Cuttings Avenue, Sutton-in-Ashfield. Tel: Mansfield 553198 or Notts (0380) 56198.

Surrey
Ashtead Computer Club, Contact Mr P G Palmer, 8 Corfe Close, Ashtead, Surrey. Tel: Ashtead 77418.

Surrey Apple
Ashtead User Group (Apple), Contact Mr M Lawrence, 15 Petters Road, Ashtead, Surrey. Tel: Ashtead 73906.

London
Association of London Computer Clubs, Contact Mr L Stuart, Secretary ALCC, 89 Mayfair Avenue, Worcester Park, Surrey KT4 7SJ. Tel: 01-337 3747.

Norfolk Atari
Atari User Group, Contact Ken Ward, 45 Coleburn Road, Lakenham, Norwich, Norfolk NR1 2NZ. Tel: Norwich 661149.

Bucks
Aylesbury Computer Club, Contact Mr K Knight, 22 Mount Street, Aylesbury, Bucks HP20 2SE. Tel: 02965181.

South Yorks
Barnsley Co-Operative Computer Club, Contact Mr J Bridson, c/o 39 Keresforth Hall Road, Barnsley, South Yorks S70 6NF. Tel: Barnsley 41753.

Beds
Bedford Amateur Computer Club, Contact Mr R Bird, 7a High Street, Great Barford, Bedford MK44 3LB. Tel: (0234) 870763.

National BBC
BEEBUG (BBC Users Group), Contact Mr D Graham or Mr S Williams, Dept 1, P.O. Box 50, St. Albans, Herts.

Birmingham Apple
Birmingham & Region Apple Group (BRAG), Contact Mr M Golder, New Club part of BASUG. Tel: 021-426 2275, other contact Mr M Bayliss. Tel: 021-743 7197.

West Midlands
Birmingham Computer Club, Contact Dr M Bayliss, 125 Berryfield Road, Sheldon, Birmingham B26 3UU. Tel: 021-743 7197.

Midlands
Birmingham Nascom User Group, Contact Mr M Sidebotham. Tel: 021-744 3093.

Lancs
Blackburn Micro Computer Club, Contact Mr R Longworth, 12 Shap Close, Accrington, Lancs.

Lancs
Bolton Computer Club, Contact Mr D Atherton, 16 Douglas Street, Atherton, Manchester M29 9FB. Tel: 0942 876210.

Cambs Acorn
Bottisham Acorn Users Group, Contact Mr P M Rank, 27 Bell Road, Bottisham, Cambridge CB5 9DF. Emphasis on BBC Micro. Tel: Mr J Harris on 0233 811487.

Dorset
Bournemouth Area Computer Club, Contact Mr P Hibbs, 54 Runnymede Avenue, Bournemouth, Dorset BH11 9SE. Tel: Bournemouth 576547.

Dorset BBC
Bournemouth BBC User's Group, Contact Mr N Carey, 26 Felton Road, Parkstone, Poole, Dorset. Tel: Poole 749612.

London
Brent/Barnet Users Group, Contact Mr J Fox, 4 Harman Close, London NW2 2EA.

Essex
Brentwood Amateur Computer Club, Contact Mr R L Sadler, 18 Wanescot Road, Brentwood, Essex CM15 9HD.

Middlesex
Brigadier Computer Club, Contact Mr S Ward, 28 Brodie Road, Enfield, Middlesex EN2 0EU. Tel: 01-363 3786.

Avon
Bristol Computing Club, Contact Mr L Wallis, 6 Kilbernie Road, Bridge Farm Estate, Bristol BS14 0HY. Tel: 0272 832453.

Herts Apple
British Apple Systems User Group (BASUG), Contact Mr J Sharp, BASUG, PO Box 174, Watford WD2 6NF. Tel: (09273) 75093, or Mr D Bolton, 0727 72917.

National Apple
British Apple Users and Dabblers (BAUD), Contact Mr G Smythe, Datalink Microcomputer Systems Ltd., 10 Waring House, Redcliffe Hill, Bristol BS1 6TB. Tel: 0272 213427.

National TI
British TI Users Club, Contact Mr P Rowley, 2 Woodside Crescent, Clayton, Newcastle-under-Lyme, Staffordshire ST5 4BW.

Avon
Brunel Computer Club, Contact Mr R Sampson, 4 The Coots, Stockwood.

Avon
Brunel Technical College Computing Club, Contact Mr S W Rabone, 18 Castle Road, Worle, Weston-Super-Mare, Avon BS22 GJW. Tel: 0934 513068.

Bucks Apple
Buckinghamshire/Berkshire Area, Contact Mr S Proffitt, The Granary, Hill Farm Road, Marlow Bottom, Bucks. Tel: 01-759 5511 ext 7298 day, or 06284 73074 eves or weekends.

Lancs
Burnley Computer Club. Contact Mr C Tallon, 27 Basnett Street, Burnley, Lancs BB10 3EQ. Tel: 0282 25103 (eves) or 34683.

Cambs
Cambridge Microcomputer Club. Contact Mr D Tripp, 3 Spurgeons Avenue, Waterbeach, Cambridge CB5 9HN. Tel: Cambridge 861804.

National Sorcerer
Canadian Sorcerer User Group. Contact Mr M Dow, 84 Camberley Crescent, Brampton, Ontario, Canada L6V 3L4. Tel: 416451 9452.

West Midlands
Cannock Computer Society. Contact Mr T Sale, 20 Redwood Drive, Chase Terrace, Walsall WS7 8AS.

Kent
Canterbury ACC. Contact Mr L S Fisher, 21 Manwood Avenue, St. Stephens, Canterbury, Kent CT2 7AH. Tel: Canterbury 65948. Proposed new club.

Essex
Canvey Computer Club. Contact Mr D Williams, 17 Mornington Road, Canvey Island, Essex SS8 8AT.

Wales BBC
Cardiff BBC Microcomputer Club (BBC). Contact Mr G Barker. Tel: Penarth 701023.

Surrey
CBBS-London. Contact Mr P Goldmann, PO Box 100a, Surbiton, Surrey KT5 8HY: Sundays 1600-2200. Tel: 01-399 2136 (Data only).

Herts Pet Group
ICPUG (N. Herts). Contact Mr B

USER GROUP INDEX

Grainger, 73 Minehead Way, Stevenage, Herts SG1 2HZ. Tel: 0438 727925.

National
Central Program Exchange. Contact Mrs J Brown, The Polytechnic, Wulfruma Street, Wolverhampton WV1 1LY. Tel: Wolverhampton 28521/27371.

Stirling
Central Scotland Computer Club. Contact Mr J Lyon, 78 Slamannan Road, Falkirk FK1 5NF, Scotland. Tel: 0324-22430.

Gloucester
Cheltenham Amateur Computer Club. Contact Mr M Hughes, 36 Riverview Way, Cheltenham, Gloucs. Tel: 0240 75213.

Beds
Chiltern Home Computer Club. Contact Mr S Betts, 42 Walace Drive, Eaton Bray, Beds LU6 2DF. Tel: 0525 220922.

Bucks
Chiltern Microcomputer Club. Contact Mr W Tibbitts, Ellwood, Deanway, Chalfont St. Giles, Bucks.

Wiltshire
Chippenham and Calne. Contact Mr M Jones, Pinhills, Calne SN11 0LY.

Lancs
Chorley Computer Club. Contact Mr C Hicks, 131 Market Street, Chorley, Lancashire. Tel: 025 72 78376.

Cleveland
Cleveland Micro Computer Users Group. Contact Mr J Telford, 13 Weston Crescent, Norton, Cleveland.

Essex
Colchester Computer Society. Contact Mr A H Potten, 14 Foxmead, Rivenhall, Witham, Essex CM8 3HD. Tel: Witham 516335.

Essex
Colchester Microprocessor Group Information Centre, University of Essex, Near Colchester.

Essex
Colchester Sinclair User Group. Contact Mr R Lawn, 102 Prettygate Road, Colchester, Essex. Tel: Colchester 61066.

Clwyd
Colwyn Computer Club. Contact Mr D Bevan, c/o 20 Abergele Road, Colwyn Bay, Clwyd LL29 7PA.

Hants Pet Group
ICPUG (South Hants). Contact Mr T Cooke, 7 Russell Way, Petersfield, Hampshire GU31 4LD. Tel: Slough 34585 ext. 81.

National COMP-80
COMP-80 Users Group. Contact Mr P Probetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ. Tel: 01-540 3713.

London Compucolor
Compucolour Users Group (UK). Contact Mr B Donkin, 19 Harwood Avenue, Bromley, Kent BR1 3DX. Tel: 01-460 2626 (eves).

Avon Compukit
Compukit User Club. Contact Mr P Crabb, 21 Jones Close, Yatton, Avon. Tel: (0934) 834808.

West Midlands Compukit
Compuikit User Club. Contact Mr S H Grisvenor, 11 Bernard Road, Oldbury, Warley, West Midlands. Tel: 021-422 3298.

Essex Compukit
Compukit User Club. Contact Mr A Waters, 117 Haynes Road, Hornchurch, Essex RM11 2HX. Tel: Hornchurch 40490.

Ireland Education
Computer Education Society of Ireland. Contact Mr D McCarthy, 7 St. Kevins Park, Kilmacud, Blackrock, Co. Dublin.

Tyne & Wear Computertown
Computer Town N.E. Contact Mr J Bone, 2 Claremont Place, Gateshead, Tyne and Wear NE8 1TL. Tel: (0632) 770036.

Eire
Cork Amateur Computer Club. Contact Mr T Moriarty, 'Tiger Bay', Rochestown, Douglas, Cork, Eire. Tel: 021-293651 (home) or 021-882433 (work).

Cornwall
Cornwall Area Computer Club. Contact Mr M F Grove, 35 Causeway Head, Penzance, Cornwall. PET/ZX80/UK 101.

National 1802
Cosmac Users Club. Contact Mr J Cunningham, 7 Harrowden Court, Harrowden Road, Luton, Bedfordshire LU2 0SR. Tel: 0582 423934.

West Midlands
Coventry Computer Circle. Contact Mr C Baugh, 9 Hillman House, Smithford Way, Coventry CV1 1FZ. Tel: 0203 25802.

National CP/M
CP/M IRL. Irish CP/M Users' Group. Contact Mr D Notley, Gardner House, Ballsbridge, Dublin 4. Tel: Dublin 686411.

National CP/M
CP/M User Group (UK). Contact Mr D Powys-Lybbe, 11 Sun Street, Finsbury Square, London EC2M 2QD. Tel: 01-247 0691.

Crewe
Crewe Computer Users Club. Contact Mr B Knight. Tel: Nantwich 623375.

London
Croydon Micro Computer Club. Contact Ms E Cranstown, Flat 7, 10 Lancaster Road, South Norwood, London SE25 4AQ. Tel: 01-771 3525.

Lancs DAI
DAI UK User Group. Contact Mr D Atherton, 16 Douglas Street, Atherton, Manchester M29 9FB. Tel: 0942 876210.

Durham
Darlington Computer Club. Contact Mr L Boxell, 8 Vane Terrace, Darlington DL3 7AT. Tel: 0325 67766.

National Dec
Decus UK & Ireland. Contact Mr T Pardoe, DECUS, PO Box 53, Reading, Berks RG2 0TW.

National Pet
DENSPET, Rock House, Ballycrog, Westport, Co. Mayo, Eire.

Derbyshire Pet Group
ICPUG (Derbyshire & District). Contact Mr R Davies, 105 Normanton Road, Derby DE1 2GG. Tel: 0332 41025 (day) or 0332 514016 (eve).

Derbyshire
Derby Microcomputer Society. Contact Mr M Riordan, 172 Blagreaves Road, Littleover, Derby. Tel: 0332 769440.

South Yorkshire
Doncaster Amateur Computer Society. Contact Mr J Wilkinson, 316 Bawtry Road, Doncaster, South Yorkshire. Tel: 0302 868379 (6-9pm).

Durham
Durham Computer Club. Contact Mr L Boxell, 8 Vane Terrace, Darlington. Tel: 0325 67766.

Norfolk
East Anglia Computer User Group. Contact Ms J Rejzl, 88 St. Benedicts Street, Norwich NR2 4AB. Tel: 0603 29652.

Leicester
East Leake Computer Club. Contact Mr A Jones, 59 Bateman Road, East Leake, Loughborough, Leicester LE12 6NN.

London
East London Amateur Computer Club. Contact Mr F Linger, 82 The Drive, Ilford, Essex IG1 3JA. Tel: 01-554 3288.

London
East London Computer Club. Contact Mr J Grieve, North East London Polytechnic. Tel: 01-553 4761.

Notts TRS-80
East Midlands TRS-80 Users Group (Nottingham). Contact Mr M Costello, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BU. Tel: Nottingham 751753.

Nottingham
Eastwood Town Micro Computer Club. Contact Mr T Ryan, 15 Queens Square, Eastwood, Nottingham NG16 3BJ. Tel: Langley Mill 65011.

Lothian ZX
Edinburgh ZX C. C. Contact Mr J Palmer, 56 Meadowfield Drive, Edinburgh. Tel: 031-661 3183.

National TRS-80
Educational User's Group for TRS-80 & Video Genie. Contact Mr D Futcher, Head Teacher, Beaconsfield First and Middle School, Beaconsfield Road, Southall, Middlesex. Tel: 01-574 3506.

National
Educational ZX80/81 Users Group (EZUG). Contact Mr E Deeson, Highgate School, Balsall Heath Road, Highgate, Birmingham B12 9DS.

National
European Sorcerer Club. Contact Mr C Morle, 32 Watchyard Lane, Formby, Liverpool L37 3JU. Tel: 07048 72137.

Surrey
Ewell Micro Club. Contact Mr D De Silva, 316 Kingston Road, Ewell, Surrey KT19 0SU. Tel: 01-393 1469.

Devon
Exeter & District Amateur Computer Club. Contact Mr D Bates, 2 Station Road, Pinhoe, Exeter EX1 3SA.

National
Exidy Sorcerer User Group. Contact Mr A Marshall, 44 Arthurs Bridge Road, Woking, Surrey GU21 4NT. Tel: 04862 66084

Hants
Fareham and Portsmouth Amateur Computer Club. Contact Mr A J Smith, c/o 7 Francis Close, Lee-on-the-Solent, Gosport, Hants PO13 8HB. Tel: 0705 550907

Surrey
Farnham Computer Club. Contact Mr A Sharp, 14 Thorn Road, Boundstone, Farnham, Surrey.

Fife
Fife Computer Users Club. Contact Mr M Simpson, 31 Tom Steward Lane, St Andrews, Fife KY16 8YB. Tel: 0334 72485.

National
Forth Interest Group UK. Contact Mr K C Goldie-Morrison, 15 St Albans Mansion, Kensington Court Place, London W8 5QH. Tel: 01-937 3231.

Humberside
Forum 80 Users Group. Contact Mr F Brown, 421 Endike Lane, Hull HU6 8AG. Tel: (0482) 859169.

London
Forum-80 London. Contact Mr L Jay. Tel: 01-286 6207.

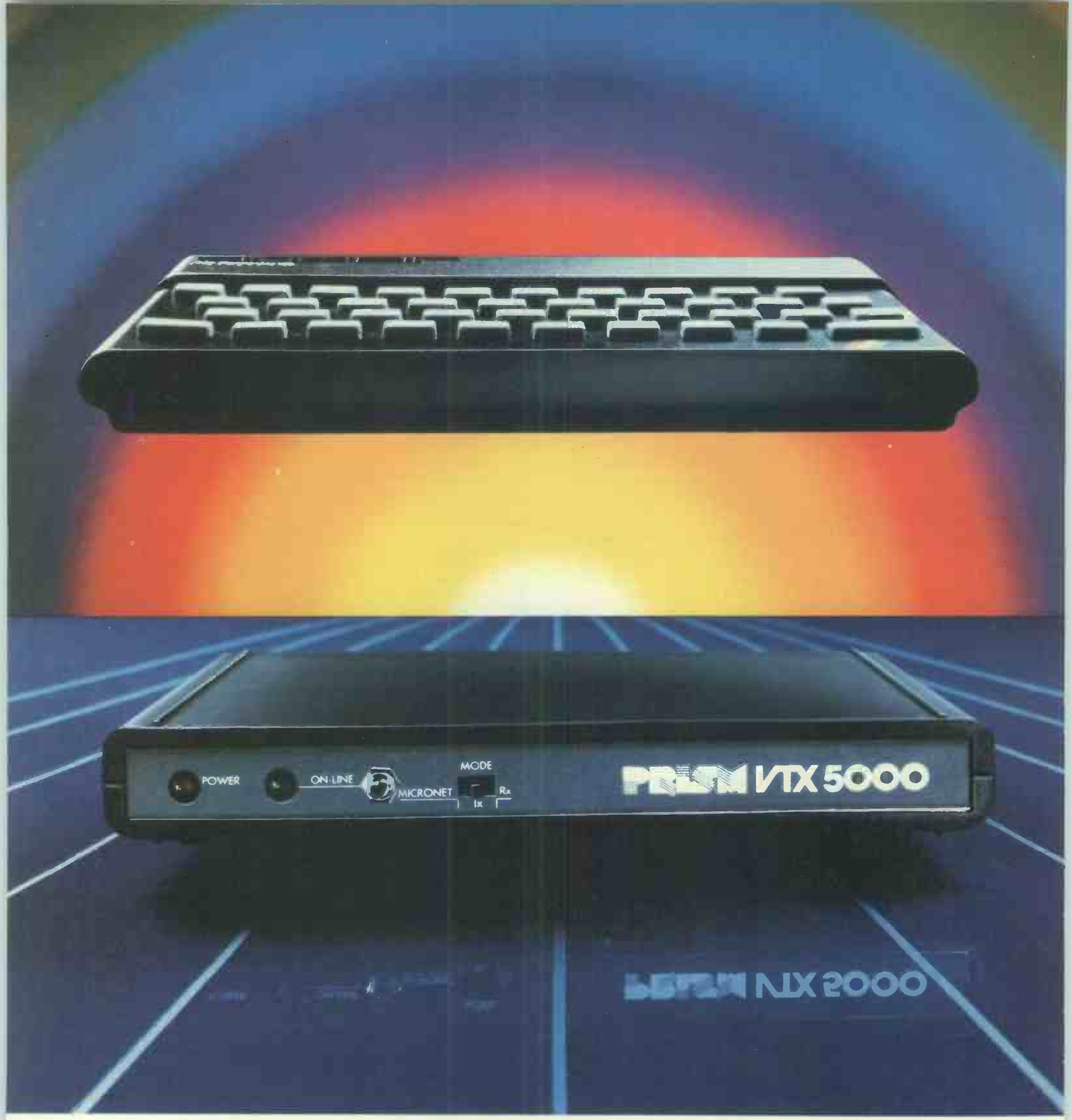
London
Forum-80 Wembley. Contact Mr V Saleh. Tel: 01-902 2546.

National
FX500-P Users Association. Contact Mr M Francis, 38 Grymsdyke, Great Missenden, Bucks HP16 0LP.

Glos
GCHQ BBC Micro User Group. Contact Mr D W Adam, 16 Court Road, Prestbury, Cheltenham, Glos.

Derbyshire
Glossop Computer Club. Contact Mr J Dearn, 2 Spinney Close, Glossop, Derbyshire.

Grampian
Grampian Amateur Computer Society. Contact Mr A J Morrison, 21 Beech Road, Westhill, Skene, Aberdeenshire AB3 6WR. Tel: 0224 741387.



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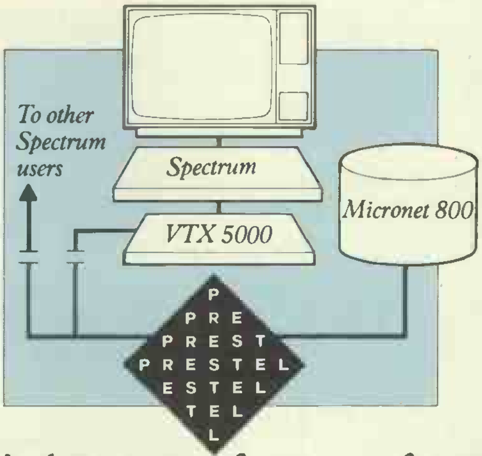

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USER GROUP INDEX

Kent
Gravesend Computer Club. C/o The Extra Tuition Centre, 39 The Terrace, Gravesend, Kent DA12 2BA. Tel: 0474 50677.

W Yorks
Greenhead Grammar School Computer Club. Contact Mr B Smith, Greenhead Road, Keighley, West Yorks BD20 6EB. Tel: Keighley 62828.

S Humberside
Grimsby Computer Club. Contact Mr J Lee, 29 Park View, Cleethorpes. Tel: 0472 42559 (day).

Guernsey
Guernsey Microcomputer Users Club. Contact Mr T Thorne (Chairman), Summerfield House, Vale, Guernsey. Tel: (0481) 44955.

Surrey
Guildford Area Microcomputer Users Group. Contact Mr M Bawtree, Royal Grammar School, Guildford, Surrey GU1 3BB. Tel: Guildford 502424.

Surrey
Guildford ZX81(80) Users Group. Contact Mr A Bond, 54 Farnham Road, Guildford, Surrey GU2 5PE. Tel: Guildford 62035.

Gwent
Gwent Amateur Computer Club. Contact Mr R Harris, 16 Alanbrook Avenue, Newport, Gwent, Wales NPT 6QJ. Tel: 0633 852924.

Herts
Harpenden Microcomputer Group. Contact Mr R S Welch, 7 Tylers, Harpenden, Herts AL5 5RT. Tel: 05827 3398.

London
Harrow Computer Group. Contact B Butcher, 16 St Peter's Close, Bushey Heath, Watford, Hertfordshire WD2 3LG. Tel: 01-950 7068.

Suffolk
Haverhill Microcomputer Club. Contact Mr A Holliman, 5 Trinity Close, Balsham, Cambridge CB1 6DW. Tel: West Wratting 583.

National
Heathkit User Group. Contact Mr J Smithson, Heath (Gloucester) Ltd, Bristol Road, Gloucester GL2 6EE. Tel: 0452 29451.

Herefordshire
Hereford Amateur Computer Club. Contact Mr S Edinborough, 2 Warwick Walk, Bobblestock, Hereford HR4 9TG. Tel: (Home) 0432 269700 (Work) 0594 269700.

Cheshire
Holmes Chapel Micro Club. Contact Ms M Baker, 1 Helton Close, Holmes Chapel, Crewe, Cheshire. Tel: 0477 34238.

National
HP-85 User Group. Contact Ms M Corbett, 10 Nichols Green, Montpelier Road, Ealing, London W5 2QU.

N Humberside
Hull & District TRS-80/BEEB Souter, 25 Carr Lane, Willerby, Hull HU10 6JP. Tel: 0482 654117.

Birmingham
ICL Birmingham Branch Micro-Club. C/o W.B.A. Ecclestone, 26 Browns Lane, Tamworth, Staffs.

Cheshire
ICI Micro Users Group. Contact Mr K Heron, 32 Norfolk Road, Congleton, Cheshire. Tel: 932 5499.

S Yorks
ICPUG (Barnsley). Contact Mr B Wood, 13 Ward Green, Barnsley, South Yorkshire. Tel: 0246 811585.

Suffolk
ICPUG (Bury St Edmunds). Contact Mr A Morris, 30 Kelso Road, Bury St Edmunds, Suffolk. Tel: Bury St Edmunds 61870.

N Ireland
ICPUG (Carrickfergus). Contact Mr D Bolton, 19 Carrickburn Road, Carrickfergus, County Antrim BT38 7ND, Northern Ireland.

Gloucester
ICPUG (Cheltenham). Contact Mrs A Schofield, 78 Hesters Way Road, Cheltenham, Gloucester. Tel: 0242 580789/27588.

Clwydd
ICPUG (Clwydd). Contact Mr J Poole, 6 Ridgeway Close, Connah's Quay, Clwydd CH5 4LZ.

Warwickshire
ICPUG (Coventry). Contact Mr W Light, 22 Ivybridge Road, Stvyechale, Coventry, Warwickshire. Tel: 0202 413511.

Dyfed
ICPUG (Dyfed). Contact Mr S Kniveton, Penpompren Hall, Talybont, Dyfed. Tel: Talybout 303,

Essex
ICPUG (Essex). Contact Ms C Taylor, 101 Courtlands Avenue, Cranbrook, Ilford, Essex. Tel: 01-554 5246.

Strathclyde
ICPUG (Newton Mearns). Contact Dr J MacBrayne, 27 Paidmyre Crescent, Newton Mearns, Glasgow, Scotland. Tel: 041-639 5696.

Gloucester
ICPUG (Gloucester and Bristol Area). Contact Mrs J Rich, Rose Cottage, 20 Old Court, Springhill, Cam, Gloucester GL11 5PF. Tel: 0453 47708.

Hants
ICPUG (Hampshire Area). Contact Mr R Geere, 109 York Road, Farnborough, Hants.

Strathclyde
ICPUG (Kilmarnock). Contact Mr J Smith, 19 Brewlands Road, Symington, Kilmarnock KA1 5RW. Tel: 0563 83047.

Norfolk
ICPUG (Kings Lynn). Contact Mr P Petts, Bramley Hale, Wretton, Kings Lynn, Norfolk PE33 9QS. Tel: Stoke Ferry 500692.

Lancs
ICPUG (Liverpool). Contact Mr T Bond, 27 Ince Road, Liverpool L23 4UE, Lancs. Tel: 051-924 1505.

Lancs
ICPUG (Manchester Area). Contact Mr D Jowett, 197 Victoria Road, Thornton Cleveleys, Blackpool, FY5 3ST. Tel: 0253 869108.

Northamptonshire
ICPUG (Northampton). Contact Mr P Ashby, 215 Lincoln Way, Corby, Northamptonshire. Tel: 05363 4442.

Northumberland
ICPUG (Northumberland). Contact Mr G J Saunders, Starling House, 22 Front Street, Guide Post, Northumberland. Tel: 0670 823242.

Kent
ICPUG (SE-Canterbury). Contact Mr J Bickerstaff, 48 Martin Down Lane, Whitstable, Kent. CT5 4PR. Tel: 0227 272702.

Berks
ICPUG (Slough). Contact Mr B Jones, Dept. of Maths and Computing, Slough College of Higher Education, Wellington Street, Slough. Tel: Slough 34585 ext. 81.

Kent
ICPUG (South East). Contact Mr M Ryan, 164 Chesterfield Drive, Sevenoaks, Kent. TN13 2EH. Tel: 0732 53530.

National
ICPUG (Staffordshire). Contact 57 Clough Hall Road, Kidsgrove, Stoke on Trent, Staffordshire.

Worcester
ICPUG (Stourport-on-Severn). Contact Mr M J Merriman, 12 York Street, Stourport-on-Severn.

Middlesex
ICPUG (Teddington). Contact Mr G Squibb, 108 Teddington Park Road, Teddington, Middlesex. Tel: 01-997 2346.

Herts
ICPUG (Watford). Contact Mr S Rabagliati, c/o Institute of Grocery Distribution, Grange Lane, Letchmore Heath, Watford, Herts.

London
Imperial College Microcomputer Club. Contact Mr T Panton, c/o I.C. Union Office, Prince Consort Road, London SW7 2BB.

National
International Nascom Microcomputer Club, 80 Oakfield Corner, Sycamore Road, Amersham, Buckinghamshire HP6 5EQ. 2000 members.

Isle of Wight
Isle of Wight TRS80 Club. Contact Mr M Collins, 11 Star Street, Ryde. Tel: 0983 614589.

National
Ithaca Audio S100 Users Group, Contact Mr D Weaver, 41 Dore Avenue, North Hykeham, Lincoln LN6 8LN.

London
ITN Computer Club. Contact Mr J Cartwright. Tel: 01-637 2424.

Devon
ITT Club. Contact Mr J D Parker, 41 Gibson Road, Whiterock, Paignton, Devon TQ4 7AQ. Tel: Churston 843964.

Bucks
Iver Computer Club. Contact Mr J Haigh, 141 Leas Drive, Iver, Bucks.

Channel Islands
Jersey Computer Association. Contact Mr M Murphy, P.O. Box 441, St Helier, Jersey, Channel Islands. Tel: 0534 78399 (working hours).

National
Jupiter Ace Users Club. Contact Remsoft, 18 George Street, Brighton BN2 1HR. Tel: 0273 602354.

Aberdeenshire
Kemnay Computer Club. Contact Mr S J Stubbs, 15 The Glebe, Kemnay, Inverurie, Aberdeenshire. Tel: Kemnay 3070.

W. Yorkshire
Kirklees Computer Club. Contact Mr C Townsend, 760/4 Manchester Road, Linthwaite, Huddersfield. Tel: 0484 657299. 24hr.

Lancs
Lancaster & Morecombe Computer Club, Contact Ms S Blackler, 17 Belle Vue Terrace, Greaves Road, Lancs. Tel 0524 33553.

National
Laserbug (BBC National Group), 4 Station Bridge, Woodgrange Road, Forest Gate, London E7 0NF. Tel: 028123064.

W. Yorkshire
Leeds Microcomputer Users Group. Contact Mr D Parsons, 22 Victoria Walk, Horsforth, LS18 4PL. Tel: 0532 585480.

Lincs
Lincoln Computer Club. Contact Mr J Clifford, 448 Newark Road, Lincoln, LN6 8RX. Tel: 0522 2160.

Lincs
Lincolnshire Microprocessor Society. Contact Mr E Booth, Senior Common Room, Bishop Grosseteste College, Newport, Lincoln. Tel: 0522 27347.

Merseyside
Liverpool BBC & Atom Group. Contact Mr N Kelly, 56 Queens Drive, Walton, Liverpool, L4 6SH. Tel: 051-525 2934.

Merseyside
Liverpool ZX User's Club. Contact Mr K Archer, 17 Sweeting Street, Liverpool, L2 4TE. Tel: 051-236 6109.

London
London School Computer Users Club. Burlington Danes School, Dane Building, Du Cane Road, Hammersmith, London W12 UTY.

USER GROUP INDEX

Salop
Ludlow and District Microcomputer Club. Contact Mr D Pauli, 32 High Street, Leintwardine, Craven Arms, Shropshire. Tel: 05473287.

Beds
Luton Computer Club. Contact Mr J P Fletcher, 1, Trowbridge Gdns, Luton, Beds. LU2 7JY.

Manchester
Manchester Acorn User Group. Contact Mr J Ashurst, 192 Verdure Close, Failsworth, Manchester. Tel: 061-681 4962.

Cheshire
Manchester Computer Club. Contact Mr D Wade, 28 Hazel Road, Altrincham, Cheshire WA14 1JL. Tel: 061-941 2486.

Cheshire
Mattel Intellivision TV Game Group. Warrington. Tel: 62215 after 4pm.

National
Medical Micro Users Group. Contact Mr P J V Dixon. MEDICOM, 1-2 Hanover Street, London W1.

Kent
Medway Acorn User Group. Contact Mr C Rutter. c/o St. John Fisher School, Ordnance St., Chatham, Kent. Tel: 0634 42811 (day), 0634 373459 (eves).

Kent
Medway Amateur Computer & Robotics Organisation. Contact Mr L G Mason. 21 The Beeches, Walderslade, Chatham, Kent ME5 0NS. Tel: 0634 63036 (Mr P Cameron).

Merseyside
Merseyside 380Z and BBC Atom Users Group. Contact Mr A Pope. Paal Enterprise, 37 Stuart Road, Crosby, Liverpool L23 0QE

Mersey
Merseyside Microcomputer Group. Contact Mr F Shaw, 14 Albany Avenue, Eccleson Park, Prescot, Merseyside L34 2QW. Tel:051-426 5436.

Mersey
Mersey Nascom Users Group. Contact Mr T Searle, 14 Hawkeshead Close, Maghull, Liverpool L31 9BT.

Mersey
Merseyside TRS-80/Video Genie Users Group. Contact Mr P Tootill, 101 Swanside Road, Liverpool L14 7NL. Tel: 051-220 9733.

London
Metropolitan Police Amateur Computing Club. Contact Mr S Farley. Tel: 01-725 2428.

Sussex
Micro Enthusiasts. Contact Mr G M Dinnage, 16 Malvern Street, Hove, Sussex BN3 3YR.

National
Micromodeller User Association. Contact Mr P Matthews, Philip Morris House, 21 High Street, Feltham TW13 4AD. Tel: 01-751 6388.

Oxford
Microsoc (Oxford Univ. Micro Group). Contact Mr R P Steele, St. John's College, Oxford University.

Sussex
Mid-Sussex Microcomputing Club. Contact Mr J Hayden, 2 Hillary Close, East Grinstead, West Sussex RH19 3XQ. Tel: 0342 24655.

Milton Keynes
Milton Keynes Microcomputer User's Group (MKMUG). Contact Mr B Pain. Tel: 0908 564271.

International
Mini and Microcomputer Users in Education (MUSE). Contact Ms L Boyce, Westhill College Teaching Centre, Woeley Park Road, Birmingham B29 6LL. Tel: 021-471 3723.

Strathclyde
Motherwell College Computer Club. Contact Mr M Singh, Dept. of Elec. Engineering, Dazell Drive, Motherwell ML2 1DD.

Essex
NAMEBUG. Contact Mr N Ballard, 27 Crowhurst Road, Colchester, Essex. Tel: 0206 72899.

Berks
NAS-TUG (Nascom Thames Valley U.G.). Contact Mr M Rothery, 37 Eton Wick Road, Eton Wick, Windsor, Berks. Tel: Windsor 56106.

National
National Colour Genie User's Group. Contact Mr G Hillier, 5a Gregory Street, Lenton, Nottingham NG7 2LR. Tel: Nottingham 783938.

National
National Personal Computer User Ass. Contact The Secretary, NPCUA, 11 Spratling Street, Manston, Ramsgate, Kent.

National
National TI 58/59 User Group. Contact R M Murphy, Dept. of Electronic Engineering, University College, Singleton Park, Swansea, South Wales.

W Midlands
National TRS-80 User Group-Birmingham & West Midlands Area. Contact Mr M Gibbons, 1 New Street, Castle Bromwich, Birmingham B36 9AP. Tel: 021-747 2260.

National
National TRS-80 Users Group. Contact Mr B Pain, 40a High Street, Stony Stratford, Milton Keynes. Tel: 0908 566660/564271.

National
National Westminster Personal Computer Society. Contact P J Moore, National Westminster Bank plc, Trustee & Income Tax Dept., Birmingham Branch, 2nd Floor, 104/106 Colmore Row, Birmingham B3 3AJ. Tel: 021-236 6176 ext 382.

National
National ZX Users' Club. Contact Mr T Hartnell, 44-46 Earls Court Road, London W8 6EJ.

Herts
New Brain User Group. Contact Angela Watkiss, 4 Ninnings Lane, Rabley Heath, Welwyn, Herts AL6 9TD. Tel: Stevenage 812439.

Cheshire
Kinder Peak Computer Club. Contact Mr G M Flanagan, 11 Sundown Close, New Mills, Stockport, Cheshire SK12 3DH. Tel: New Mills 44051.

Tyne & Wear
Newcastle-upon-Tyne Personal Computer Soc. Contact Pete Scargill (Secretary), 21 Percy Park, Tynemouth. Tel: 0632 573905.

Tyne & Wear
North East RML 380Z Users Group. Contact M Hatfield, Computer Unit, Northumberland Building, The Polytechnic, Newcastle-upon-Tyne NE1 8ST. Tel: 0632 26002 ext 268 office hours.

Kent
North Kent Amateur Computer Club. Contact Kevin Viney, 95 Crofton Road, Orpington, Kent BR6 8HU. Tel: Orpington 22443.

Lancs
North Lancashire User Group. Contact John Robinson, 12 Harold Avenue, Blackpool. Also Julian Morgan, Tel: Blackpool 47514.

London
North London BBC Micro Users Group. Contact Dr Leo McLaughlin, Dept. of Chemistry, Westfield College, Kidderpore Avenue, London NW3. Tel: 01-435 0109.

London
North London Hobby Computer Club. Contact Robin Bradbeer, Polytechnic of North London, Holloway Road, London N7 8DB. Tel: 01-607 8344.

Durham
ICPUG (Northeast-Durham). Contact Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham. Tel: 0385 67045.

Cheshire
Northwest Computer Club. Contact John Lightfoot, 13 Ashton Drive, Frodsham, Warrington, Cheshire WA6 7PU. Tel: 0728 31519.

Notts
Nottingham Microcomputer Club. Contact Mr D Harvey, 68 Roseleigh Avenue, Nottingham NG3 6FH. Tel: 0602 608491.

National
Ohio Scientific UK User Group. Contact Tom Graves, 19a West End, Street, Somerset BA16 0LQ. Tel: 0458 45359.

Kent
Orpington Computer User Club. Contact Mr R A Pyatt, 23 Arundel Drive, Orpington, Kent BR6 9JF. Tel: Orpington 20281.

W. Mids
British Osborne Owners' Group. Contact Dr Jonathan Anglesea, Flat 19 Rowan House, Mitton Road, Handsworth, Birmingham B20 2JR.

National
OSI UK User Group. Contact Richard Elen, 12 Bennerley Road, London SW11 6DS.

Oxford
Oxford Personal Computer Club (OPeCC). Contact Len Phelps, Southport Cottage, Sutton Courtenay, Nr. Abingdon, Oxon OX14 4AN. Tel: Sutton Courtenay 438.

London
Paddington Computer Club. Contact Peter Hill. Tel: 01-723 5762.

London
Pascal User Group (Pug). Contact Nick Hughes, PO Box 52, Pinner, Middx HA5 3FE. Tel: 01-866 3816.

National
PDP11 Users Group. Contact Pete Harris, 119 Carpenter Way, Potters Bar, Hertfordshire EN6 5QB. Tel: 0707 52091.

National
PDP8 Users Group. Contact Nigel Dunn, 21 Campion Road, Widmer End, High Wycombe, Buckinghamshire. Tel: 0494 714483.

Mid Glam.
Pencoed Amateur Computer Club. Contact Philip Williams, 38 Bryn Rhedyn, Pencoed, Bridgend, Mid Glamorgan CF35 6TL. Tel: 05473 287.

W. Yorks
Pennine & District Computer Club. Contact Douglas Bryant, 26 Mill Hey, Haworth, West Yorkshire. Tel: 0274 569660.

Perthshire
Perth & District Amateur Computer Society. Contact Alastair MacPherson, 154 Oakbank Road, Perth PH1 1HA. Tel: 0738 29633.

Sussex
PET User Group (Crawley). Contact Richard Dyer, 33 Parham Road, Ilfield, Crawley RH11 0ET.

National
PET Users Education Group. Contact Dr Chris Smith, Dept. of Physiology, Queen Elizabeth College, Campden Hill Road, London W8 7AH.

Cambs.
Peterborough Personal Computer Club. Contact Andrew Pike, 920 Bourges Boulevard, Peterborough PE1 2AN. Tel: 0733 44342 after 5pm.

Devon
Plymouth & District Amateur Computer Club. Contact Stuart Bell, 31 Victoria Place, Plymouth, Devon PL2 1BY. Tel: 0752 559192.

Gwent
Pontypool Computer Club. Contact Graham Loveridge. Tel: Pontypool 2827.

London
Post Office HQ Microcomputer

USER GROUP INDEX

Club. Contact Vernon Quaintance, British Telecom Enterprises, BP&S/CCS2.2, Room 315/317, Cheapside House, 138 Cheapside, London EC2V 6JH. Tel: 01-726 4716. Prestel Page 8008021. Member of ALCC.

National
Powertran Users Club. Contact Mr P L Probetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ. Tel: 01-540 3713.

Lancs.
Preston Area BBC Microcomputer User Group. Contact Mr D Coulter, 8 Briar Grove, Ingol, Preston. Tel: Preston 725793.

National
Program Power. Contact R G Simpson, 5 Wensley Road, Leeds LS7 2LX. Tel: 0532 683186.

Dorset
Purbeck Computer Users Club. 31 North Street, Wareham, Dorset BH20 1AD.

Hants
RAF Odiham Computer Club. Contact c/o Officer I/C, Royal Air Force, Odiham, Nr. Basingstoke, Hants.

Morayshire
RAF Kinloss. Contact Steve Barthorpe, 18 Trenchard Crescent, Kinloss, Forres, Moray IV36 0UP.

National
Research Machines National User Group. Contact c/o Clare Moat, RML, Mill Street, Osney, Oxford OX2 0BW. Tel: 0865 49866.

Lancs
Ribble Valley Computer Club. Contact Ian Thornton-Bryar, 25 Southfield Drive, West Bradford, Clitheroe, Lancs BB7 4TU. Tel: 0200 25933.

London
Richmond Computer Club. Contact Bob Forster, 18a The Barons, St. Margarets, Twickenham, Middlesex. Tel: 01-892 1873 after 7pm.

Essex
Romford Club. Contact Mr D Norden, 138c Church Road, Harold Wood, Romford, Essex.

Lothian
Scottish Amateur Computer Soc. SACS. Contact Mike Anthony, 46 Moredun Park Gardens, Edinburgh EH17 7JR. Tel: 031337 5611.

Lothian
Scottish TRS-80 Users' Group. Contact Dick Mackie (Chairman), 3 Warrender Park Crescent, Edinburgh EH9 1DX. Tel: 031 229 6032.

S. Humber
Scunthorpe & District Microprocessor Society. Contact G Hinch, 21 Old Crosby, Scunthorpe, South Humberside DN15 8PU. Tel: 0724 61076

Kent
Sevenoaks School Computer Club. Contact Mr G Sommerhoff, Technical Centre, Sevenoaks School, Sevenoaks, Kent. Tel: Sevenoaks 456490.

Essex
Sharp MZ80K User Group. Contact Joe Seet, 16 Elmhurst Drive, Hornchurch, Essex RM11 1PE. Tel: 04024 42905.

National
Sharp PC1211 Users Club. Contact Jonathan Dakeyne, 281 Lidgett Lane, Leeds LS17 3AQ.

National
Sharp User Group. Contact Graham Knight, 108 Rosemount Place, Aberdeen, Scotland. Tel: 0224 630526.

National
Sharp User Club. Contact Computer Centre, Yeovil College, Yeovil, Somerset BA21 4AE.

W. Yorks
Shipley College Computer Group. Contact Paul Channell, Yorkshire. Tel: 0274 595731.

National
Silica Atari 400/800 Users Club. Contact Secretary: Richard Hawes, 1-4 The Mews, Hatherley Road, Sidcup, Kent DA14 4DX. Tel: 01-301 1111.

Scotland
Skye and Lochalsh Computer Society. Contact C J Manvell, 25 Breacais Isol, Isle of Skye IV42 8QA.

National
Small Processor User Group. Contact Roger Knight, Dept. of Meteorology, University of Reading, Earley Gate, Whitenights, Reading RG6 2AY.

National
Society of Genealogists. Contact Mr D Hawgood, 26 Cloister Road, London W3 0DE. Tel: 01-993 2897.

Lancs
South Chadderton Computer Club. Contact Mr J Jakeman, 26 Mardle Street, Dorker, Oldham, Lancs. Tel: 061-682 6120.

Essex
South East Essex Computer Society. Contact Mr R Knight, 128 Little Wakering Road, Little Wakering, Southend-on-Sea, Essex. Tel: 0702 218456.

London
South East London Microcomputer Club. Contact Mr P Phillips, 61 Craigerne Road, London SE3. Tel: 01-853 5829.

Northants
South Northants Computer Users Group. Contact Mr S Clark, 83 Watling Street, Towcester, Northants NN12 7AG. Tel: (0327) 52191.

Berks
South Oxford Computer Club. Contact Mr Magnay, 'Ganymede', Wantage Road, Rowstock, Didcot, Oxon OX11 0JU. Tel: Malcolm—(0235) 816949 Paul—(0235) 815305.

S Manchester
South Trafford Microcomputer Club (South Manchester). Contact Mr I White, 16 Leicester Avenue, Timperley, Altrincham WA15 6HR. Tel: 061-969 2080.

S Yorks
South Yorkshire Personal Computer Group. Contact Mr P Sanderson (Chairman), 8 Vernon Road, Totley, Sheffield S17 3QE. Tel: 0742 351895.

Hants
Southampton Amateur Computer Club. Contact Mr P Blitz, 24 Chigwell Solent Close, Chandlers Ford, Eastleigh, Hants. Tel: 04215 69050.

London
Southgate Microcomputer Club. Contact Mr K Pretorious, 15 The Vineries, Resevoir Road, Oakwood, London N14 4BH. Tel: 01-882 2282.

Merseyside
Southport Computer Club. Contact Mr Ian Britstone, 28 Weld Road, Southport, Merseyside. Tel: 0704 64524.

Norfolk
Spectrum Users Group. Contact Mr M Osborne, 8 Elvington, Kings Lynn, Norfolk.

Essex
Springfield Computer Club. Contact Mr S Cousins, 1 Aldeburgh Way, Springfield, Chelmsford, Essex CM1 5PB. Tel: 0245 50155.

Cornwall
St Austell Computer Club and Computer Town. Contact Mr N G Day, 2 Glendale Close, St Austell, Cornwall PL25 3DD.

Essex
Stanway School Computing Club. Contact Mr G Floyd, c/o Physics Dept, Stanway School, Stanway, Colchester, Essex.
School pupils only at the moment.

Cleveland
Stockton Amateur Computer Club. 60 Croft Road, Eaglescliffe, Stockton-on-Tees, Cleveland TS16 0DY. Tel: 0642 784819.

Scotland
Stonehaven Computer Club. Contact Mr R Martin, Belmont House, Belmont Brae, Stonehaven, Kincardineshire, Scotland.

Strathclyde
Strathclyde Computer Club. Contact Mr B Duffy (Secretary), 24 Lomond Drive, Condorrat, Cumbernauld G40NW, Scotland. Tel: (02367) 33800.

Suffolk
Suffolk Microcomputer Club. Contact Mr A L Theobald, 42 Newbury Road, Ipswich, Suffolk IP4 5EX.

London
Sunbury Computer Club. Contact Mr S N Taylor, 8 Priory Close, Sunbury-on-Thames, Middlesex TW16 5AB. Tel: Sunbury 86649.

Surrey
Surrey Microprocessor Society (SUMPS). Contact Mr M Patrick, 28 West Drive, Cheam, Surrey. Tel: 01-642 8362.

W Glam
Swansea & Southwest Wales Amateur Computer Club. Contact Mr P Griffiths, 1 Prescelli Road, Penlan, Swansea SA5 8AF. Tel: 0792 583897.

Staffs
Tame Valley Computer Club. Contact Mr B Overton, 57 Maitland, Glascote Heath, Tamworth, Staffs B79 8JG.

Avon
Tangerine Homebrew. Contact Mr A C L Coates, 35 Mogg Street, St Werburghs, Bristol BS2 9UB. Nascom group.

National
Tangerine Users Group. Contact Mr B Green, 1 Marlborough Drive, Worle, Avon BS22 0DQ BH37JR. Tel: 0934 21315.
Also international section, recently formed for users of Microtan65, and Oric-1.

Shropshire
Telford Computer Club. Contact Mr H D Briggs, 53 Gilpin Road, Admaston, Telford, Shropshire TF5 0BG. Tel: Telford 595959.

Berks
Thames Valley Amateur Computer Club. Contact Mr B Quarm, 25 Roundway, Camberley, Surrey. Tel: Staines 51388 Ext. 253 (day), Camberley 22186 (home).

S Glam
The 81 Club. Contact Mr M Hayes, 54 Oakley Place, Grangetown, Cardiff. Tel: Cardiff 371732.

Staffs
The Amateur Computer Club of North Staffs. Contact Mr J Roll, 16 Hill Street, Hednesford, Staffordshire WS12 5DS. Tel: 05438 4363.

Beds
The Dragons Den. Contact Mr D Buckingham, 83 Neville Road, Limbury, Luton, Beds.

Leics
The Leicester Personal Computer Club. Contact Ms J Olorenshaw, c/o Arden Data Processing, Municipal Buildings, Charles Street, Leicester. Tel: 0533 22255.

London
The SOBAT Computer Club (Leyton). Contact Mr T Kayani, Berridge House, Hillfield Road, London NW6. Tel: 01-556 5423 at weekends.

National
TI 99/4 TIHOME (User Group). Contact Mr P M Dicks, 157 Bishipsford Road, Morden, Surrey. Tel: 01-640 7503.

W Yorkshire
TI/99 4A User Group. Contact Mr I Youldon. Tel: 0532 401408.

Kent
Tonbridge and Tunbridge Wells ACC. Contact Mr R Szatkowski, 1 Cromer Street, Tonbridge, Kent. Tel: 0732 355960.

USER GROUP INDEX

Dorset
TOPIC. Contact Mr D Washford, 1 Alexandra Road, Bournemouth, Dorset BH6 5JA. Tel: 0202 423064 (eves), 0202 671122 (day).

Devon
Totnes & S Devon Computer Club. Contact Mr Frank Watson & Andrew Page, Dart Inst Community Studies, Dart, Totnes, Devon TQ9 6JE. Tel: 0803 862271.

National
Transducer Club. Contact Mr D Stockqueler, 66 Waterloo Road, Penylan, Cardiff. Tel: 0222 495374.

National
Triton User Group. Contact Mr N Stride, Transam Ltd, 12 Chapel Street, London NW1. Tel: 01-402 8137.

National
TRS-80 Level 1 User Group. Contact Mr N Rushton, 123 Roughwood Drive, Northwood, Kirby, Merseyside L33 9UG.

National
TRS-80 Medical and Laboratory Users. Contact Dr N Robinson, The Residency, Northwick Park Hospital, Harrow, Middlesex. Send sae with details of interests.

Lancs
TRS-80 Northwest Group. Contact Mr M Franklin, 40 Cowlees, Westhoughton, Bolton BL5 3EG. Tel: 0942 812843.

London
TRS-80 Users Group London Branch. Contact Mr J Wellsman, 292 Caledonian Road, London N1. Tel: 01-607 0157.

Notts
TRS-80/Genie Users Group (Nottingham). Contact Mr G Hillier, 5a Gregory Street, Lenton, Nottingham NG7 2LR. Tel: Nottingham 783938.

Tyne & Wear
Tyne & Wear BBC User Club. Contact Mr I Waugh, 13 Briardene Drive, Wardley, Tyne & Wear NE10 8AN.

Tyne & Wear TRS-80 User Group. Contact Dr S Tetlow, 3 Highbury Close, Springwell, Gateshead NE9 7PU. Tel: Washington 462532.

Oxford
UCSD Pascal UK Users Group. Contact Mr M Harper, Oxford University Computing Laboratory, Programming Research Group, 45 Banbury Road, Oxford OX2 6PE.

National
UK 101 User Group. Contact Mr A Waters, 9 Moss Lane, Romford, Essex RM1 2QB. Tel: Romford 64954.

Essex
UK Atari Computer Owners Club. Contact PO Box 3, Rayleigh, Essex.

Merseyside
UK DOSPLUS User Group. Contact Mr P Toothill, 101 Swanside Road, Liverpool L14 7NL.

National
UK Intel MDS Users Group. Contact Mr L Hard, c/o S.P.A.C.E. Limited, The Old Coach House, Court Row, Upton-on-Severn, Worcs WR8 0NS. Tel: 06846 3626.

Independent Commodore Products User Group (National). Contact Membership Secretary, 30 Brancoates Road, Newbury Park, Ilford, Essex IG2 7EP.

UK Pilot User Group. Contact Mr A Wood, Wirral Grammar School for Boys, Crosslane, Bebington, Wirral, Merseyside LG3 3QA.

USCD Systems Users Society. Contact Mr J Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants RG24 0QB.

Lancs
ICPUG (Burnley). Contact Mr J Ingham, 72 Ardwick Street, Burnley, Lancashire.

Norfolk
ICPUG (Cromer). Contact J Blair, 7 Beach Road, Cromer, Norfolk.

W Midlands
Walsall Computer Club. Contact Ms A Hunt, 'Lael', 58 Princes Avenue, Walsall, West Midlands WS1 2DH. Tel: Walsall 23875.

London
Wandsworth Computer Club. Contact Mr H Cooke, West Hill Library, West Hill, London SW18. Tel: 01-874 1144.

Osnabruk
Wellington School Computer Club. Contact PC G Pascoe, Wellington School, Osnabruck BFPO 36.

W Herts
West Herts 80 User Group. Contact Mr T Bradbury, 20 Spruce Way, St. Albans.

Kent
ICPUG (Maidstone). Contact Mr R Moseley, Rosemont, Lord Romney Hill, Weavering, Maidstone, Kent. Tel: 0622 37643.

London
West London Personal Computer Club. Contact Mr G Brain, 81 Rydal Crescent, Perivale, Middlesex UB6 8DZ. Tel: 01-997 8986.

W Midlands
West Midlands Amateur Computer Club. Contact Mr J Tracey, 100 Booth Close, Brierley Hill, Kingswinford, West Midlands. Tel: 0384 70097.

West Midlands RML User Group. Tel: 0926 38751.

Surrey
West Surrey Computer Club. Contact Mr C Karney, Paddock Room, Green Man Public House, Burpham, Guildford. Tel: 0483 68121 ext. 497.

Sussex
West Sussex Microcomputer Club. Contact Mr J M Clarke, 31 Hyde Heath Court, Pound Hill, West Sussex. Tel: 0293 884207.

W Yorks
West Yorkshire Microcomputer Group. Contact Mr P Clark, c/o Suite 204, Crown House, Armley Road, Leeds LS12 2ES. Tel: 0532 450667.

S Yorks
South Yorkshire Personal Computer Group. Contact Mr P Sanderson (Chairman), 8 Vernon Road, Totley, Sheffield S17 3QE. Tel: 0742 351895.

Hants
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Merseyside
Southport Computer Club. Contact Mr Ian Britstone, 28 Weld Road, Southport, Merseyside. Tel: 0704 64524.

Norfolk
Spectrum Users Group. Contact Mr M Osborne, 8 Elvington, Kings Lynn, Norfolk.

Essex
Springfield Computer Club. Contact Mr S Cousins, 1 Aldeburgh Way, Springfield, Chelmsford, Essex CM1 5PB. Tel: 0245 50155.

Cornwall
St Austell Computer Club and Computer Town. Contact Mr N G Day, 2 Glendale Close, St Austell, Cornwall PL25 3DD.

Essex
Stanway School Computing Club. Contact Mr G Floyd, c/o Physics Dept, Stanway School, Stanway, Colchester, Essex. School pupils only at the moment.

Cleveland
Stockton Amateur Computer Club. 60 Croft Road, Eaglescliffe, Stockton-on-Tees, Cleveland TS16 0DY. Tel: 0642 784819.

Scotland
Stonehaven Computer Club. Contact Mr R Martin, Belmont House, Belmont Brae, Stonehaven, Kincardineshire, Scotland.

Strathclyde
Strathclyde Computer Club. Contact Mr B Duffy (Secretary), 24 Lomond Drive, Condorrat, Cumbernauld G4 0NW, Scotland. Tel: (02367) 33800.

Suffolk
Suffolk Microcomputer Club. Contact Mr A L Theobald, 42 Newbury Road, Ipswich, Suffolk IP4 5EX.

London
The SOBAT Computer Club (Leyton). Contact Mr T Kayani, Berridge House, Hillfield Road, London NW6. Tel: 01-556 5423 at weekends.

Surrey
Surrey Microprocessor Society (SUMPS). Contact Mr M Patrick, 28 West Drive, Cheam, Surrey. Tel: 01-642 8362.

W Glam
Swansea & Southwest Wales Amateur Computer Club. Contact Mr P Griffiths, 1 Prescelli Road, Penlan, Swansea SA5 8AF. Tel: 0792 583897.

Staffs
Tame Valley Computer Club. Contact Mr B Overton, 57 Maitland, Glascote Heath, Tamworth, Staffs B79 8JG.

Shropshire
Telford Computer Club. Contact Mr H D Briggs, 53 Gilpin Road, Admaston, Telford, Shropshire TFS 0BG. Tel: Telford 595959.

Berks
Thames Valley Amateur Computer Club. Contact Mr B Quarm, 25 Roundway, Camberley, Surrey. Tel: Staines 51388 Ext. 253 (day), Camberley 22186 (home).

S Glam
The 81 Club. Contact Mr M Hayes, 54 Oakley Place, Grangetown, Cardiff. Tel: Cardiff 371732.

Staffs
The Amateur Computer Club of North Staffs. Contact Mr J Roll, 16 Hill Street, Hednesford, Staffordshire WS12 5DS. Tel: 05438 4363.

Merseyside
Wirral Computer Club. Contact Mr G Metcalfe, 24 Marlston Avenue, Irby, Wirral, Merseyside.

Mersey
Wirral Microcomputer Users Group. Contact Mr J Phillips, 14 Helton Close, Nocturum, Birkenhead, Merseyside L43 9HP. Tel: 051-652 0268.

W Midlands
ICPUG (Wolverhampton). Contact J Bowman, 6 The Oval, Albrighton, Wolverhampton, West Midlands.

Worcs
Worcester and District Computer Club. Contact D J Stanton, 55 Vauxhall Street, Rainbow Hill, Worcester WR3 8PA. Tel: 0905 22704.

London
Worcester Park Computer Club. Contact Windsor Road Library. Tel: 337 1609.

Sussex
Worthing & District Microcomputer Club. Contact T M Pearson, 142, King Edward Ave., Worthing. Tel: 0903 206685.

Somerset
Yeovil Computer Club. Contact D G Carrington, 2 Romsey Road, Yeovil, Somerset BA21 5XN.

N Yorks
York Computer Club. Contact K Thomas (Chairman), Green Lea, Ripon Road, Harrogate, North Yorkshire HG1 2BY. Tel: 0904 38239.

USER GROUP INDEX

National
ZX Amateur Radio User Group. Contact Mr P Newman, G4INP, 3 Red House Lane, Leiston, Suffolk IP16 4JZ.

W Midlands
Acocks Green Computer Club. Contact Mr M Bedford-White, 16 Westfield Road, Acocks Green, Birmingham B27 7TL.

National
ZX80/ZX81 Users Club. Contact Mr D Blagden, PO Box 159, Kingston-upon-Thames, Surrey KT2 5UQ.

Warwickshire
Kenilworth Computer Club. Contact Ms J Gedrych, 4 Crackley Hill, Kenilworth CV8 2FP. Tel: Kenilworth 56385.

Suffolk
The Newmarket Home Computer Group. Contact Mr J Smyth, 5 New River Green, Exning, Newmarket, Suffolk. Tel: Exning 8100.

Leics
Hawker Siddley Computer Club. Contact Mr R W Wrathall, 6 Naseby Drive, Loughborough LE11 0WU.

Eire
TI99/4A Users Club. Contact Mrs A Flynn, 53 Georgian Close, North Road, Drogheda, Co. Louth, Eire.

Dyfed
Milford Central Computer Club. Contact Mr H Evans, Milford Central School, Prioryville, Milford Haven, Dyfed. Tel: 043-784571.

Avon
Bensley Nuclear Laboratories (C.E.G.B.) Contact Mr N Walker, 53 Wolfridge Ride, Alveston, Bristol BS12 2PR. Tel: 0454 414262.

N Ireland
Bangor Computer Club (N Ireland). Contact Mr D Blanc, c/o Queen's University, Belfast, Northern Ireland.

Surrey
Carshalton Atari Users Group. Contact Mr P Deegan. Tel: 01-642 5232.

Manchester
Texas TI99 Club (Manchester). Contact T Grimshaw, 21 Allingham Street, Longsight, Manchester. Tel: 061 224 0374.

W Midlands
Birmingham User Group (Atari 400/800). Contact Mr M Ashton, 42 Short Street, Wednesbury, West Midlands.

S. Avon
Nailsea Multi-User Club. Contact Ms V Boyde-Shaw. Tel: 0272 851337.

Leics
Leicester Microcomputing Club. Contact Mr C Clarke. Tel: Leics 673988.

N Manchester
Small Business Computer Users Club (N Manchester). Contact Mr K Wadsworth. Tel: 061-740 7232 after 5pm.

Mid Cheshire
MCC (Mid-Cheshire Computer Club). Contact Mr D Clare. Tel: Winsford 51374.

Hants
Commodore Computer Club (Gosport). Contact Mr B Cox, Bury House, Bury Road, Gosport, Hants. Tel: Fairham 280530.

Essex
Dragon Independent Owners Association. Contact Mr D Bourne, School House, Nevern Road, Rayleigh, Essex.

Essex
Genius Computer Club. Contact 30 Webber House, North Street, Barking, Essex.

Surrey
Atari Computer Enthusiasts (ACE). Contact Mr A Miles. Tel: 01-647 1713.

London
Queens Crescent Computer Club. Tel: 01-485 4551.

Essex
ICPUG (Chelmsford). Contact Mr A G Surridge, 97 Shelley Road, Chelmsford, Essex.

Essex
ICPUG (Basildon). Contact Mr W Green, 151 The Hatherley, Basildon, Essex.

Devon
ICPUG (Devon). Contact Mr M Stibbe, The Lawn, Lower Woodfield Road, Torquay, Devon.

Oxon
ICPUG (Bloxham). Contact Mr J Temple, 'Kirabanda', Rose Bank, Bloxham, Oxon.

Oxon
ICPUG (Witney). Contact Mr I Blyth, 40 Wilmot Close, Witney, Oxon. Tel: Witney 5171 (home), Witney 3671 (work).

W Mids
ICPUG (Birmingham). Contact Mr J A McKain, PPI Limited, 177 Lozells Road, Birmingham. Tel: 021 544 0202.

Dorset
ICPUG (Bournemouth & Poole). Contact Mr D M Shave, 97 Canford Cliffs Road, Poole, Dorset BH13 7EP.

Clwyd
ICPUG (Rhyl). Contact Mr F Jones, 77 Millbank Road, Rhyl, Clwyd. Tel: 0745 54820.

Dyfed
ICPUG (Llandyssul). Contact Mr F J Townsend, The Hill, Rhydowen, Llandyssul, Dyfed SA44 4QD. Tel: 05455 5291.

Lanark
ICPUG (Glasgow). Contact Mr A J Quin, Dept of Environment Studies, Glasgow College of Building & Printing, 60 North Hanover Street, Glasgow G1 2BP Scotland. Tel: 041-332 9969.

Strathclyde
ICPUG (Ayr). Contact Mr J Shankland, 2 Strathdoon Place, Ayr, Strathclyde, Scotland.

London
Lambeth Computer Club. Contact Mr R J Baker, 54 Brixton Road, London SW9 6BS.

Hants
Portsmouth Co-Operative Computer Club. Contact Mr A May, 27 Victoria Road North, Southsea, Hants. Tel: 0705 820339. Other contact: Mr C Penfold, 52 Owen Road, Eastney, Portsmouth, Hants. Tel: 0705 827427.

Lothian
Scottish Dragon Club. Contact Mr D J Anderson, Top Flat, 1 Walker Street, Edinburgh EH3 7JY. Tel: 031-225 5285.

E Sussex
Brighton, Hove & District Computer Club. Contact Mr J Smith, 30 Leicester Villas, Hove, E Sussex BN3 5SQ.

W Yorks
Pocket Computer Users Club. Contact Mr A Faint, 13 Sutherland Avenue, Leeds LS8 1BY.

London
Oric-1 User Group. Contact Mr E Boncrah, 14a Vicars Hill, Ladywell, London SE13 7JH. Tel: 01-690 5408 (eves/weekends).

Derbyshire
National Colour Genie Users Club. Contact Lowe Computers Ltd, Chesterfield Road, Bentley Bridge, Matlock, Derbyshire DE4 5LE. Tel: Matlock 0629 4995/4057.

London
The Sirius User Group. Contact Mr E Hasted, 12 Chesterfield Street, London W1X 7HF. Tel: 01-403 3800 (office), 01-499 1670 (evenings).

Surrey
Atari Computer Enthusiasts (ACE). Contact Mr A P Miles, 8 Cosdach Avenue, Wallington, Surrey SM6 9RA. Tel: 01-647 1713.

Dorset
xFORTH Users Group. Contact Mr D Husband, 2 Gorleston Road, Branksome, Poole, Dorset BH12 1NW. Tel: 0202 764724.

National
Micro-Contact. Contact Mr P Paton, 176 Todmorden Road, Burnley, Lancs BB11 3EU. Tel: 0282 53241.

Surrey
Sutton Library Computer Club. Contact Mr David Wilkins, 22 Chestnut Court, Mulgrave Road, Sutton, Surrey SM2 6LR. Tel: 01-642 3102 (evenings).

National
National MZ80K/A User Group. Contact Mr N Brown, 48 Brander Road, Leeds, Yorkshire LS9 6PR. All enquiries SAE please, stating machine.

National
USR/Group/UK. Contact Mr A J Lazzerinin, Plexus Computers Inc, Langley House, Langley Mill, Notts NG16 4AN. Tel: 07737 66141.

National
British LOGO User Group. Contact Ms P Valley, British LOGO User Group, c/o Shell Centre for Mathematics, University of Nottingham.

Merseyside
The Hardware Exchange. Contact Mr D Edwards, PO Box 13, Birkenhead, Merseyside LS42 4RL.

Nottinghamshire
Worksop Computer Group. Contact Mr Andrews. Tel: Worksop 487327.

Renfrewshire
Bishopton Computer Club. Contact Mr A Law, 10 Dunglass Road, Bishopton, Renfrewshire. Tel: Bishopton 3137.

W Mids
Acocks Green Computer Club. Contact Mr M Bedford-White, 16 Westfield Road, Acocks Green, Birmingham B27 7TL. Tel: 021-707 3100.

Staffs
POT-BUG (BBC Microcomputer User Group). Contact Mr M Forster, 8 St Georges Prave, Hugh Lane, Burslem, Stoke-on-Trent. Tel: Stoke-on-Trent 818499.

Leics
Loughborough Amateur Micro Society (LAMS). Contact Hosegrove Computer Science Dept, Loughborough University.

W Mids
Handsworth/Balsall Heath Computer Club. Contact Mr D Pain, 12 Cannon Hill Road, Balsall Heath, Birmingham B12 9NN.

Staffs
Wolverhampton ZX81/-ZXSpectrum User Group.

W Mids
Coventry Computer Club. Contact Mr J Hewitt, 3a Boswell Drive, Coventry, West Midlands. Tel: Coventry 615543.

Lincolnshire
Skegness Computer Club. Contact Mr J Gordon, 66 Drummond, Skegness. Tel: Skegness (0754) 3327.

** Due to reasons of space we are unable to include international and overseas user groups this month. These will be listed in the October issue.*


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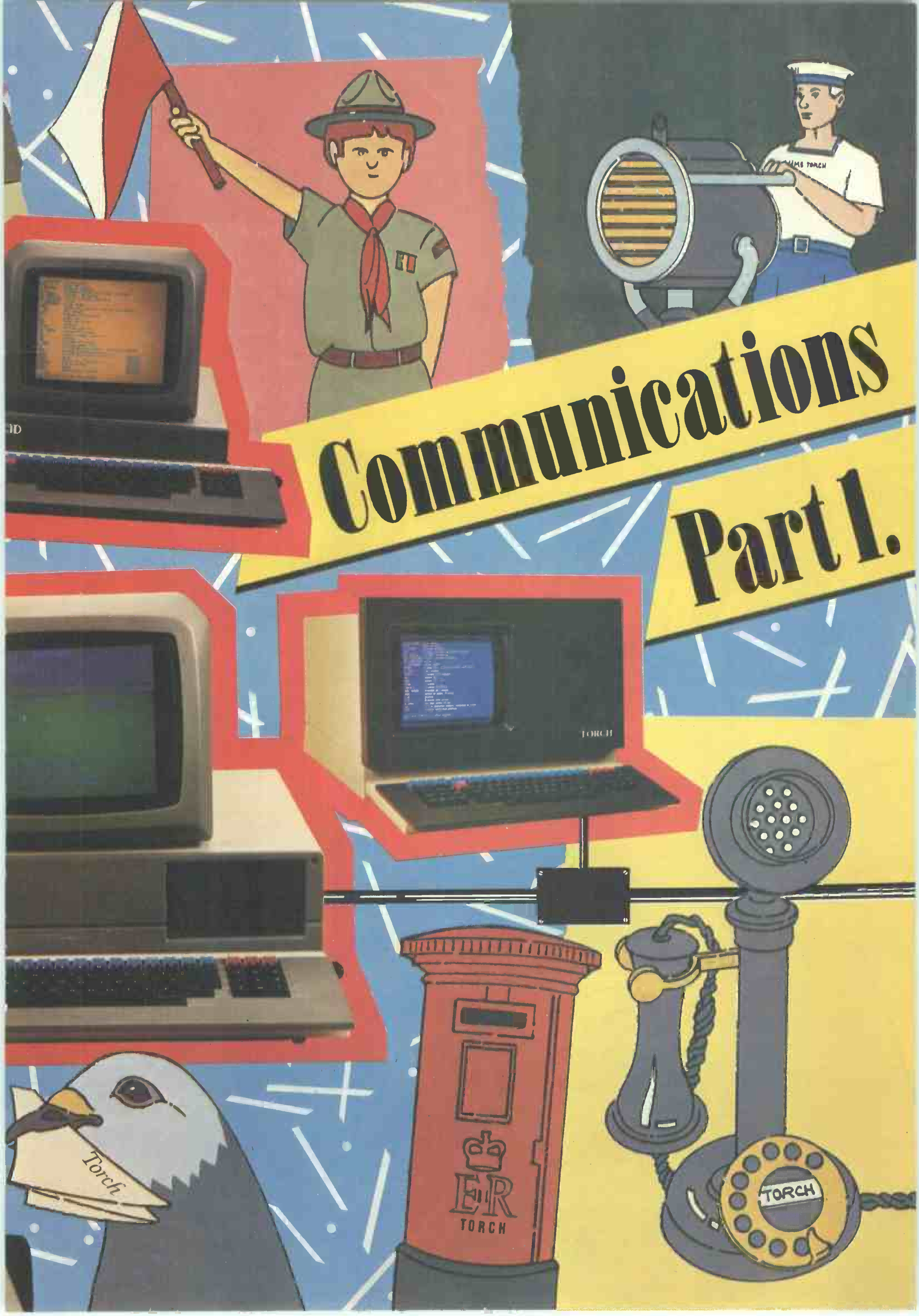
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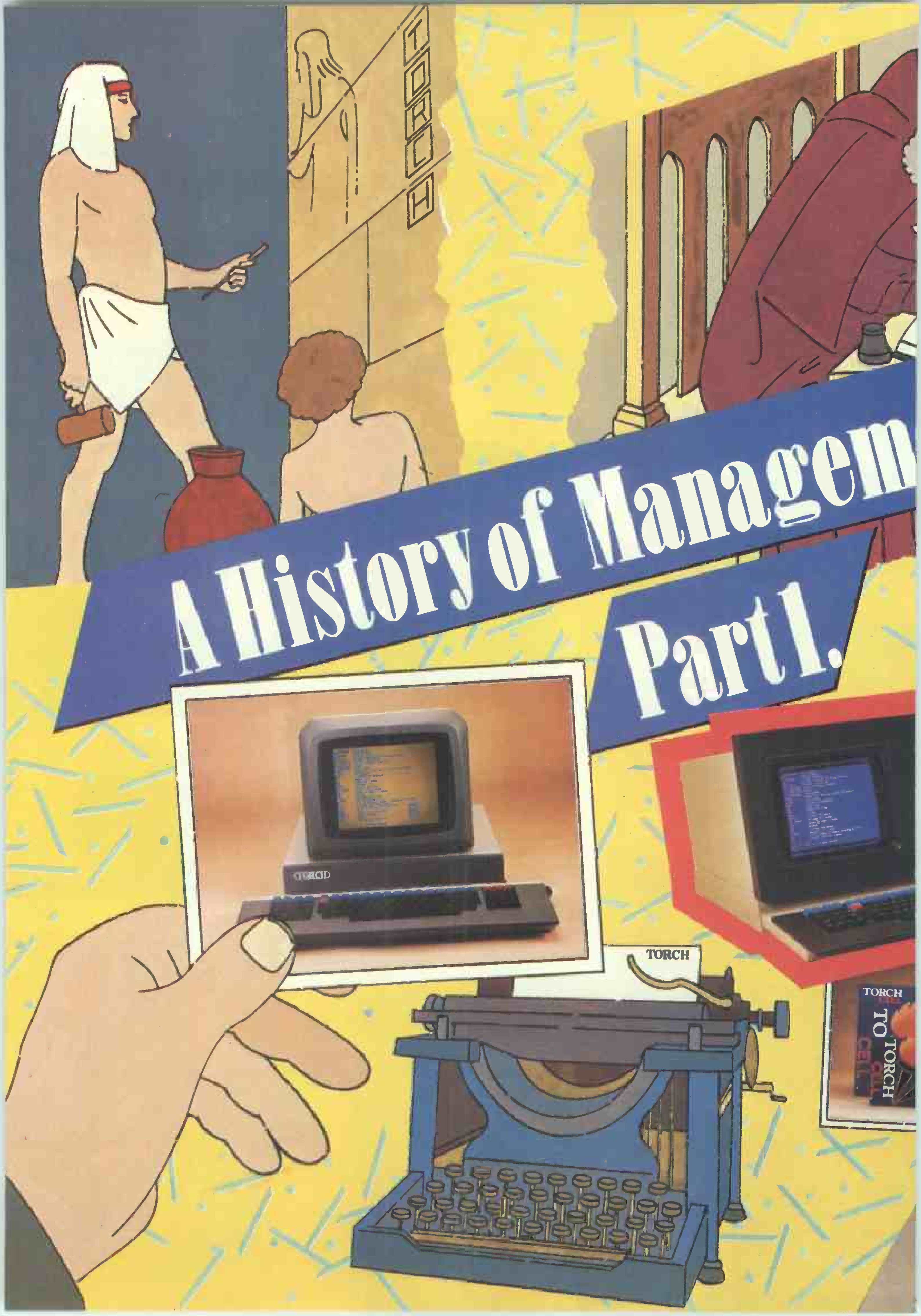

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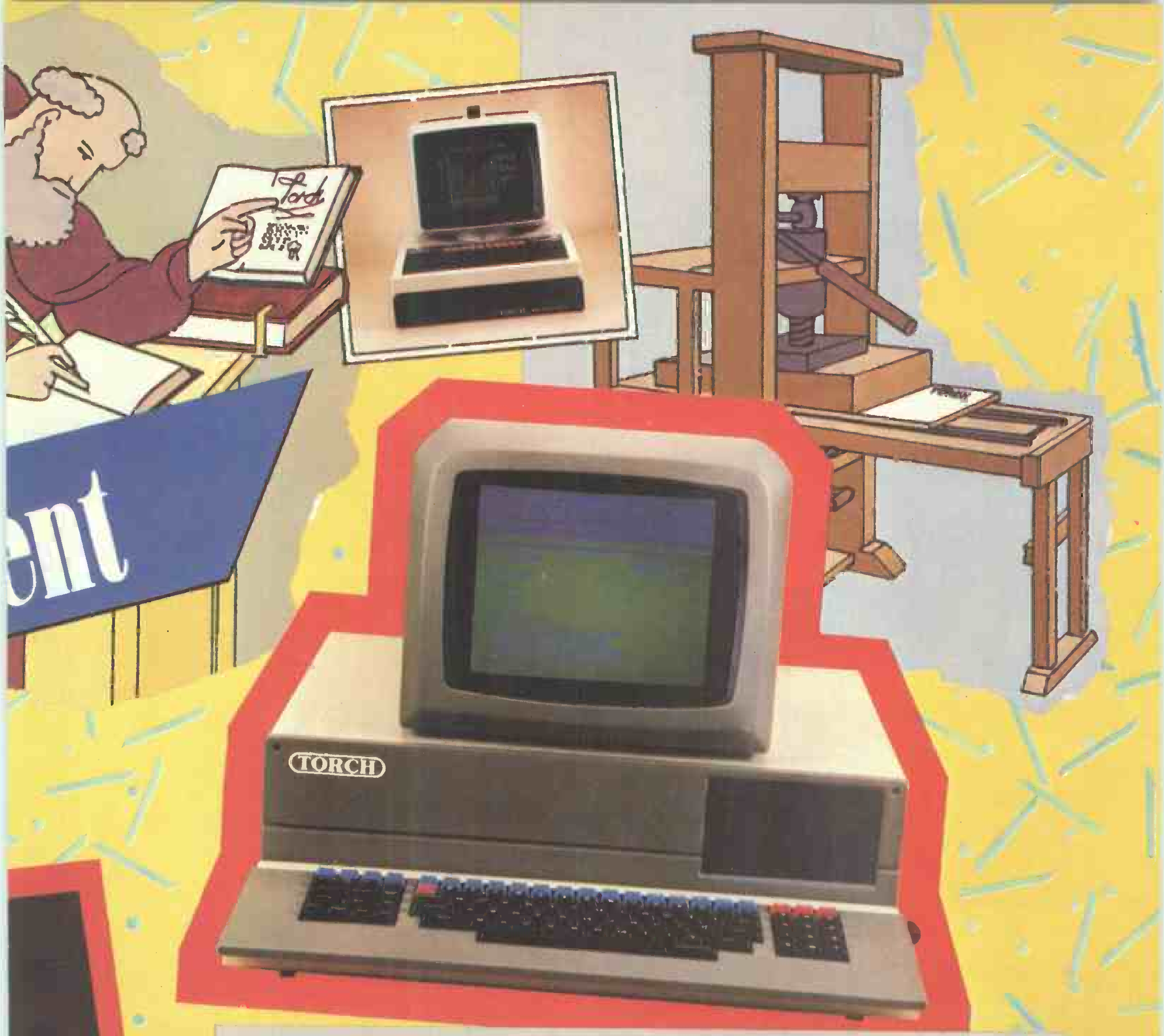


Before we designed our expanded range of business microcomputers, we took a close look into the past – from stone tablets to electric typewriter. Never before have the demands of the businessman been so formidable. Today's manager requires total control over every aspect of his operations – instant information, worldwide communications, immediate response to changes in financial and trading conditions. He needs a total business management system.

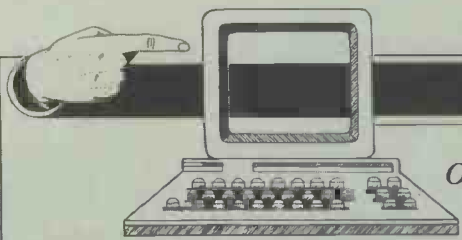
At TORCH, we sell realities not prophecies, and today's reality is a range of hardware and software versatile enough and powerful enough to meet the demands of every business from a compact single-user system up to hundreds of networked machines providing massive processing power for a multi-national corporation.

In 1982, we revolutionised computing with the first fully communicating business micros – our highly acclaimed C-Series models. Our Z80 Disc Pack proved the most effective upgrade for the BBC Model B micro, providing twin 400K disc-drives and a Z80 processor.

We celebrated American Independence Day this year, by giving every British businessman the right to be independent of imported micro technology with our new 700-Series and 300-Series machines. Our 700 models incorporate a third processor – the Motorola 68000 with 288k RAM and able to run under full UNIX SYSTEM 3. Our 300-Series machines are intelligent workstations to utilise TORCHNET Local Area Networking.

We've come a long way from papyrus and quill pens. The TORCH microcomputer system can replace your typewriters and your filing cabinets, your ledgers and your telephones – not to mention your ageing uncommunicative computers. Today, backed by GEC, Britain's largest and most successful trading company, TORCH offers the next step in business management. Welcome to the future.

TORCH
COMPUTERS
Perfectly Made in Britain



IN STORE

Our bi-monthly guide to microcomputing systems. Updates should be sent to: Tracy Dear, PCW, 62 Oxford Street, London W1A 2HG.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 26 (£4500)	AI 09237-70578(19)	64k RAM: Z80A: dual 8" F/D (2.3Mb): 12", 24 x 80 VDU: 2 x RS232 ports: 3 x P/P	CP/M: *MP/M Basic: Cobol: Fortran: Pascal.*	Options: 10Mb H/D £4000. BT 4/81 (S).
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM: Z80A: C: 12", 16 x 40 b&w VDU: 4680 bus: IEE 488: RS232 port.	DOS Basic (16k ROM: *Fortran: Pascal: A: Multi user Basic.*	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5¼" F/D (320k) £895: dual 8" F/D (2 Mb). BT 1/80. (1)
Acclaim (£3650)	Country Computers 0527 29826	64k RAM: Z80: 24x80 VDU: single 5¼" F/D (140k): 5 MB H/D: RS232 port. Option: P/P	CP/M: *Basic: Cobol: Fortran: Pascal*	Various integral H/D options up to 21MB (£4450)
ACT Sirius 1 (£2395)	ACT 021 501 2284 (50)	128-512k RAM: 8088: dual 5¼" F/D (1.2M): 12", 25 x 80 VDU: 2 x RS232 ports: 2 x P/P	CP/M 86: U: Basic 86 *Cobol: Fortran: Pascal*	High res graphics. Options: 10 Mb H/D: dual 5¼" F/D (2.4 M) BT 2/82.(S)
Adler Alphatronic (£1895)	Adler 01-250 1717	48-64k RAM: 8085A: dual 5¼" F/D (1Mb): 12", 24 x 80 VDU: S/P: P/P	CP/M: *Basic: CBasic: Fortran: Cobol*	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Altos ACS 800-2 £2995)	logitek: 0257 426644 (33)	64k RAM; Z80A; dual 8" F/D (1 Mb): 2 x RS232 ports: 2 P/P.	CP/M: *Basic: CBasic: Cobol.*	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 8000-10 (£6675)	As above.	280k RAM: Z80A: single 8" F/D (500k): 10 Mb H/D: 6 x RS232 ports: P/P: network RS422 port: DMA	CP/M: *MP/M: Basic: Cobal: Fortran: APL: Pascal.*	Multi-user/multi-tasking. Up to 4 users. Options: 10 Mb: mag tape backup (S + H).
APL Signet (£1750 or £130pm)	Micro APL: 01-834 2687	64k RAM: Z80A: dual 5¼" F/D (380k): 2 x RS232 ports.	CP/M: APL: *Basic: U: Fortran: Cobol: Algol: Forth*	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Apple (UK) 0442 60244 (200+)	16-48k, RAM: 6502: 8 I/O slots.	OS: Basic: *Pascal: Fortran: Cobol: Pilot*	280 x 192 high resolution graphics: Option: single 5¼" F/D (116k) £349.
Apple III (£2496)	As above	128-256k RAM: 6502B: dual 5¼" F/D (286k): 12", 24x80 VDU: RS232 port: P/P.	SOS: *Basic: Pascal:*	Options: single 5¼" F/D (143k) £384: 5Mb H/D £2256. (E) BT 5/82
Atari 400 (£200 inc VAT)	Atari UK: Slough 33344	16k RAM: 6502: C int: cartridge slot: 24 x 40 TV int: touchpad k/b: Opt: C £50	OS (10k ROM): *Basic (8k ROM). Pilot: A:*	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets. BT 10/80. (I/B).
Atari 800 (£500 inc VAT)	As above.	16-48k RAM: 6502: C int: 2 x cartridge slots: 24 x 40 TV int: Opt: single 5¼" F/D (90k) £300: 16k RAM £65	OS(10k ROM) Basic (8k ROM): *Pilot A: Forth: MBasic* (I/B).	As above. Software & RAM on cartridge modules. Up to 4 disk drives RS232C int £135. BT 10/80
Atom (£120)	Acorn: 0223 245200 (160)	2-12k RAM: 8-16k ROM 6502: Full K/B: C int: TV int: 20 I/O lines: 1 P/P. Options: 80 col printer £199, Prestel adaptor £120.	Basic in 8k ROM: A Cass O/S: *Lisp: Forth*	High resolution graphics on bigger model: Single 5¼" F/D £297 B/ 7/80 (B)
BASF 7120 (£4400)	BASF: 01-388 4200 (12)	88k RAM: 2xZ80A: 3 x 5¼" F/D (480k): 12", 24 x 80 VDU: RS232 port: P/P	DOS: (OAS S) *Ex Basic: Cobol U. A: CP/M*	H/D available. Also 7125 with 960k F/D £4900 and 7130 with single F/D (430k) & 5Mb H/D £6300. Disk controller has own Z80A. BT 9/80
BBC Micro (£299 inc VAT)	BBC Micro Systems 0933 79300	16-32k RAM: 32k ROM 6502: C int: TV int: RS423 port: P/P: Option: single 5¼" F/D (100k) £230	MOS: Basic A: *Pascal Logo: Forth: Lisp*	Video text & second processor int. 32k model with Econet and disk interface £399. BT 1/82 (I)
Bonsai SM3000 (£1995)	Bonsai 01-580 0902	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Pascal: Fortran*	Many floppy and hard disk options. Applications software avail. from Bonsai.
Computers Lynx (£225 inc VAT)	Computers Ltd 0223 315063 (TBA)	48-192k RAM: Z80A; 24x40 TV int: C int: RS232 port	Basic	248 x 256 colour graphics (8 colour). CP/M compatible 5¼" F/D & printer avail soon. (B)
Canon BX-3 (£3000)	Canon 01-680-7700.	32k RAM: 6809: dual 5¼" F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: Basic: A. *Cobol: Pascal*	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5¼" F/D (640k) £1500.
Canon CX-1 (£2500)	As above.	32k RAM: 6809: dual 5¼" F/D (640k): 12", 24 x 80 VDU: 3 x V24 ports: P/P: light pen.	OS: Basic: A: *Cobol: Pascal*	Price includes installation & training. Extensive application support offered. Options: dual 8" F/D (1Mb) £3300.(S)
Canon TX-25 (£1450)	As above.	16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 lps printer. Option: 2 x RS232 port.	Basic: A	Fully integral unit. Cassette is Cannon's own design (8k). Can be used with communications. (S).
Clenlo Pronto (£2825)	Clenlo Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8" F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: CBasic-2: Pearl 1: *U Fortran: Cobol: Pascal*	With 2.4Mb F/D £3105. Also H/D systems with 5-20 Mb H/D & tape drive £5430.

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Cleno Table Top 525 (£1750	As above	64k RAM: Z80 dual 5¼" F/D: 2xS/P	CP/M: MBasic: W/P	Wordstar & Logicalc included in price. Many options
Colour Genie (£200 inc VAT)	Lowe Electronics 0629 2430 (100+)	16-32k RAM: Z80: 16k ROM: C int: 24x40 TV int: Audio port: RS232 port: P/P	ExBasic	160x96 colour graphics. 16k RAM £30. Many options inc joysticks and light pen. F/D avail soon. (B)
Columbia PC (£2800)	Icarus 01 485 5574 (50)	128k RAM: 8088: dual 5¼" F/D (640k): 24x80 VDU: 2xRS232 ports: P/P: 8 expansion slots	MS-DOS: *CP/M 86: Basic: Cobol: Fortran: Pascal*	IBM PC compatible. With integral H/D (5 Mb) £4200 or (10 Mb) £4550 (S)
Comart Communicator (£1895)	Comart 0480 215005 (25)	64k RAM: Z80A: dual 5¼" F/D (780k): 2 S/P: P/P.	CP/M: *MP/M Basic: Cobol: Fortran: Pascal*	With 1.5 Mb F/D £2195. With 4.8 Mb H/D & 790k F/D £2995. Option: 18 Mb H/D. £3895 Also CP100 range with 8086 & 128k-1Mb RAM from £2295. Expandable to multiuser/multitasking. (S).
CommodorePET 16k, & 32k (£550, £695)	Commodore: 0753 79292 (150)	16-32k RAM: 6502: C: 12" 25x40 VDU: IEEE-488 port: Options: dual 5¼" F/D (343k) £695: same but (1018k) £895	O/S: Basic (in 8k ROM): *Forth: Pilot: Pascal: Comal: Lisp: A*	CBM 8032 with 80-col screen (32-96k) BT 12/80. £895 Field service avail. (1).
Commodore Vic 20 (£200 inc VAT)	Commodore: 0753 79292 (150)	5-32k RAM: 6502: Cint: 22 x 23 TV int: S/P: P/P: Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5¼" F/D (170k). BT 9/81(S).
Commodore 500 Series (From £659)	As above	128-896k RAM: 6509: 25x40 TV int: P/P	O/S: Basic: *CP/M: Pascal: Forth: Cobol: Fortran*	High res. 16-colour graphics. Second processor option: Prestel facility avail.
Commodore 700 Series (From £995)	As above	128-896k RAM: 6509: 24x80 VDU: Option: dual 5¼" F/D (1Mb): IEEE-488 port: RS2332C port.	As above	8088 or 280 second processor option Tilt and swivel screen.
Commodore 64 (£299)	As above	64k RAM: 6509: 25x40 TV int: C int: RS232 port: P/P	Basic	Second processor option. 320x200 colour graphics. Option: Joystick: Light pen
Compucorp 625 (£6000)	Compucorp: 01-907 0198 (17)	48-60k RAM: Z80: dual 5¼" F/D (630k): 9". 16x80 VDU: 40 col printer: RS232 port, P/P.	Basic: A: *Fortran: Pascal:* U	IEEE-488 Controller and S100 int. Many applications packages avail. (E).
Compucorp 655/ 665/675/685 (from £5050)	As above	60k RAM:. Z80: Up to 4x5¼" F/D(160k-2.4 Mb): 9", 20x80 or 12" 20x80 or 20" 60x80 VDU: 40-col printer: RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£1975/£3095/ £4495/£6585).	Datron: 0742 585490. Comart: 0480 215005 (25) MicroCentre: 031-556 7354 (18)	64k RAM: Z80: dual 5¼" F/D (390k) on System Zero, System 2 & Z2H: dual 8" F/D (1.2 Mb) on Sys 3: 10 Mb H/D on Z2H: S/P: P/P.	CDOS: *Basic: Cobol: Fortran: RPG II: Lisp: A: W/P: Multi-user Basic. Cromix. CP/M*	System 2 & 3 expandable to Multi-user (max 7) Also 'D' series with 6800/ Z80A dual processor from £3620. Options: dual 8" F/D (996k): 11.2Mb H/D. BT 10/79 (E).
DAI (£595)	Data Applications (UK): 0285 2588 (7)	48k RAM: 8080: C int: 24x60 VDU int: RS232 port: over 20 industrial ints. option: dual 5¼" F/D £595	Basic (ROM): U	Colour graphics up to 255 x 335: 3 notes & noise generator: PAL O/P to TV: Paddle int: H maths option. (1). BT 10/80.
Diablo 3000 (£6250)	Business Computers Ltd: 01-207 3344	32k RAM: 8085: dual 8" F/D (1.3 Mb): 12", 24x80 b&w VDU: 45 cps printer.	DOS: Basic: DACL: A: U.	Selection of business packages included (S).
Digital Micro-systems DMS-3 (£3530)	Digital Microsystems 0734 343885 (14)	64k RAM: Z80A: dual 8" F/D (1.14Mb): 3xRS232 ports: 1xRS422 port: P/P.	CP/M: CBasic: *Cobol: Fortran: Pascal: PL/I*	Expandable to multi-user system with 10-28 Mb H/D. Extensive software avail. (S).
Digital Micro-systems DMS-4 (£4395)	As above	128-512k RAM: Z80A: single 8" F/D (500k): 11 Mb H/D: 4x RS232 ports: P/P.	CP/M: Basic-E: CBasic: *Cobol: Fortran: Pascal.*	Port expander to enable up to 10 workstations under M/PM. Options: 128k RAM £1295: up to 96Mb H/D. (H).
Dragon 32 (£200 inc VAT)	Dragon Data 0792 580651 (50+)	32-64k RAM: 6809E: 16x32 TV int: C int: P/P	Basic	9 colour 256x192 high resolution graphics. Option: Joysticks BT 8/82
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM: 8085: dual 5¼" F/D (1 Mb): 9", 16x64 green VDU: 132 col 165 cps printer: N/P.	O/S: D Basic: *CP/M: CBasic: Micro Cobol.*	Up to 5 work stations: fully integrated system. Options: additional dual 5¼" F/D (1 Mb): 12-24 Mb H/D.(S).
Eagle II, III and IV (from £2350)	Mediatech Bus Syst 01 903 4372	64k RAM: Z80A: dual 5¼" F/D (768k and 1.5Mb) or single 5¼" F/D (784k) with 10Mb H/D: 2xRS232 ports: 2 x P/P	GP/M: CBasic: *Cobol Pascal: Fortran*	Many different configurations available. Full range of applications software
Epson HX20 (£402)	Epson	16-32k RAM: 32k ROM: Twin 6301 CPU: 20x4 LCD: RS232 port: Micro dot matrix printer	E Basic	Display gives 120 x 32 dot graphics. Options: TV int: micro-cassette drive: expansion module. BT 12/82
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM: Z80: 10 Mb-1200 Mb H/D: 6xS/P: 1 P/P.	CP/M: CBasic: *Cobol: Fortran.*	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).
Fortune 32:16 (£4375)	Fortune Systems 01 938 1721	256-512k RAM: MC 68000: dual 5¼" F/D (800k): 12", 25x80 VDU: S/P: P/P	FOS: *CP/M: Basic: Pascal: Cobol: Fortran: C*	Expandable to full multi-user system. High res colour graphics
Gecas 64/2 (£3305)	Grecas Micros 01 629 3758	64k RAM: Z80A: dual 8" F/D (2.4 Mb): S100 bus.	CP/M: Cobol: *Basic Pascal Fortran*	Up to 4.8 Mb F/D. Expandable to multi-user/multitasking system.

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
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C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Gemini Multiboard (£500)	Micro Value 02403 28321(7)	64k RAM: Z80: 25 x 80 VDU int (with Z80): Option: dual 5¼" F/D £690.	CP/M: *Basic Cobol: Pascal Fortran AP/L:*	Modular system. Other options inc ROM board & EPROM programmer. BT 2/82 (H&S).
Gemini Galaxy 2 (£1495)	As above	64k RAM: Z80A: dual 5¼" F/D (800k): 12", 25x80 VDU: RS232 port: P/P: C int	CPM: *Basic: Cobol: Fortran: Pascal: AP/L: A*	Options: dual 5¼" FD (800k): dual 8" F/D (2.4Mb)
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 505189	16-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2xRS232 ports.	OS-9: Flex *Basic: Pascal: A: Dis A: T/E:U*	With dual 8" F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Genie I (£299)	Lowe Electronics: 0629 2430 (N/A)	16k RAM: Z80: 500bps C: 16 x 64 TV int: extra C int: 1 P/P	Basic (12k ROM): *Pascal: A M/A: Fortran*	Options: single 5¼" F/D (184k) £220; dual 5¼" F/D (368k) £375 (I) Also Genie II with numeric keypad and function keys but no cassette (same price as I).
Genie III (£1900)	As above (26)	64k RAM: Z80A: dual 5¼" F/D (1.25 Mb): 24x80 VDU: RS232 port: P/P	NewDOS 80: *CP/MZ: Basic: Cobol: Fortran Pascal*	System complete with business applications software, maintenance contract and choice of printer £3250 (S).
Grundy 8200 (£1850)	M-Tech Comp Serv. 0603 870620	64-256K RAM: Z80A: dual 8" F/D (2MB): 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: Forth: PL/1: Ada*	Various hard disk options up to 26MB
Haywood 9000 Composite (£1795)	Haywood: 01-428 0111. (TBA)	64-192k RAM: Z80A: dual 5¼" F/D (640k): RS232 port: P/P. 15" 28x80 VDU.	CP/M: *Basic: Cobol: Fortran: Pascal: W/P.*	Graphics avail. Expandable to 18 Mb H/D. Networking version planned (H&S)
Haywood Hinet (£7500)	As above	64k RAM: Z80A: dual 8" F/D (2Mb): 11Mb H/D: RS232 port: RS422 port: P/P. 24x80 VDU	CP/M: HiNet: *Basic: Cobol: Fortran: Pascal*	Local area network, up to 32 users. Range of H/D avail. Local disks & printers if required. Work station £2050 (H&S)
HP 75C (£728)	As above	16-24k RAM: 48k ROM: CPU: 32 char display: mag card reader	Basic	8k RAM £142. Video interface £221. Thermal printer £371. (E) BT 11/82
HP 85 (£2013)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM: C.P.U.: 5", 16x32 VDU: C(200k): 64 cps printer: 4 P/P. Options: dual 5¼" F/D (540k) £1610: fusl 8" F/D (2.4 Mb) £4108.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £142. (S).
HP86 (£1314)	As above	80k RAM: C.P.U.: 48k ROM. Options: 12", 24x80 VDU £238: 9", 16x80 VDU £216: 5¼" F/D (207k) £622	ExBasic	Many expansion possibilities including CP/M module (£362), RS232 port (£289) and up to 576k user RAM. 400x240 graphics. BT 10/82 (E)
HP 125 (£2479)	As above	64k RAM: 2xZ80A: 12", 24x80 VDU 2xRS232 ports: HP-1B port. Options: dual 5¼" F/D (500k) £1693	CP/M: Basic: *Cobol Fortran: Pascal*	Integral thermal printer £629, Also available with dual 8" F/D (2 Mb). (S). BT 3/82
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM: Z80: dual 5¼" F/D (320k): 2xS/P: 1 P/P:	CP/M: C/Basic: *Cobol, Fortran.*	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM: Z80: dual 8" F/D (1 Mb): 2xS/P: 1 P/P	CP/M: CBasic: *Cobol: Fortran: MicroCobol*	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Jupiter Ace (£90 inc VAT)	Jupiter Contab,	3k RAM: 8k ROM: Z80A; 24x32 TV int: C int: loudspeaker.	Forth	Has 140 Forth words defined in ROM.
Kemitron K2000 E (£2300)	Kemitron 0244 21817 (3)	64k RAM: Z80A: single 5¼" F/D (150k): 12", 24x80 VDU: 2xS/P: P/P	CP/M: *Basic: Cobol: Fortran Pascal: A*	Extensive range of support cards and industrial interfaces.
Kemitron K3000 E (£3300)	As above	64k RAM: Z80A: dual 8" F/D (2Mb): 2xS/P: P/P	CP/M: MP/M: *Basic: Cobol: Fortran: Pascal: A*	Up to four screens and four printers can be attached. Options: 10Mb H/D.
LSI M-Two (£6000)	LSI Computers 04862 23411 (20)	64-128k RAM: 8085A: dual 8" F/D (1.2 Mb): 12", 24x80 VDU: 60 cps printer	Elsie: *CP/M: Basic: Cobol Fortran: Pascal: A: U*	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S).
LSI M-Three (£1700)	As above	64k RAM: Z80A: dual 5¼" F/D (350k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A*	Option: Dual 8" F/D, 10 Mb H/D (E)
LSI M-four (£2175)	As above	128-256k RAM: Z80B: 8088: dual 5¼" or 8" F/D 3xRS232 ports: RS422 port: P/P 12", 24x80 VDU	MS-DOS: *CP/M-86 Basic Cobol: Fortran: Pascal: MP/M-86*	Operates on either 8-bit or 16-bit applications software. Option: 10 Mb H/D
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM: Z80A: dual 8" F/D (1 Mb): 4xRS232 ports.	CP/M: APL: U: *Basic: Fortain: Cobol: Word-2star Algo: Pascal: Forth.*	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm.
Marinchip M9900 (£4990)	Microprocessor Eng. 0703 775482	128k RAM: 9900: dual 8" F/D (2Mb): 4xRS232 ports.	NOS: Basic: Pascal: W/P: *SPL: Forth: Meta*	Multi-user/multi-tasking OS. Options: H/D up to 120 Mb.
Micro Trainer 1 (£650)	Hewart: 0625 22030 (N/A)	16-32k RAM: 6800/6809: 10" 16x24 VDU: 2xC int: Opt: dual 5¼" F/D (160k) £595: 8k RAM £17.	Basic: A: *Pascal: PL/M: W/P*	SS50-based system. Graphics avail. Int card with real time clock £17. (I).
Millbank Sys 10 (£2395)	Millbank: 01-891 4691(6).	65k RAM: Z80: dual 5¼" F/D (700k): 12", 24x80 VDU: 2x RS232 ports: RS449 port: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal: PLI: W/P.*	12-month warranty. Main-frame comm. package. Maintenance contracts. Options: 1.6 Mb F/D. 5-50 Mb H/D. (S&H)
Munroe EC8800 (£2150)	Fi-Cord Int. 061 445 7716	128k RAM: Z80A: single 5¼" F/D (320k): 3xRS232 ports: P/P	Munroe Multitasking System: *CP/M: Basic: Cobol: Fortran: Pascal*	High res colour graphics. Option: single 5 ÷ " F/D. (320k). £495

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Munroe OC8820 (£2990)	As above	128k RAM: Z80A: dual 5¼" F/D (640k): 9", 24x80 VDU: 3xRS232 ports: P/P	As above	5MB H/D avail soon. BT 4/82.
Nascom 3 (£549)	Lucas Logic 0926 59411	48-60k RAM: Z80: dual 5¼" F/D (700k): RS232 port: P/P.	Basic: *Pascal: A: CP/M: Cobol Fortran*	Options dual 5¼" F/D (700k) £685: 48k RAM £130.
NEC PC 8001 (£599)	IBR 0734 664111	32k RAM: Z80A: P/P Option: dual 5¼" F/D (326k) £699	Basic N: (24k ROM) *CP/M: Fortran: Cobol: Pascal.*	Colour monitor £359 (low res) or £579 (high res) both 12", 25x80 many expansion units avail. (E) BT 6/81
Newbrain Model A (£199)	Grundy: 0223 350355 (TBA)	32k-2 Mb RAM: Z80A: Nat 420: 2xC int: TV int: 2xV24 ports.	CBasic (29k ROM): A.	Graphics. Battery or mains. Options: ½ Mb RAM £450. Also Model AD £299.(E).
North Star Horizon (£1975)	Comart: 0480 215005. (25) Trader Comp. 01-328 3484 (60)	32-64k RAM: Z80A: dual 5¼" F/D (360k): 15", 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: *Cobol: Fortran: Pascal.*	Options: 5-18 Mb H/D, Multi-user.
North Star Advantage (£2195)	As above	64k RAM: Z80A: dual 5¼" F/D (720k): 12", 24 x 80 VDU: S/P.	GDOS: CP/M: *CBasic: MBasic: Fortran: Cobol: Pascal*	Price includes business graphics & demo software.
Oki if 800 (£3000)	Encotel. 01 686 9687	64k RAM: Z80A: 2k ROM: dual 5¼" F/D (768k): 12", 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge.	Basic: A: *CP/M Cobol: Fortran:*	Fully integral unit. Graphics. Options: dual 5¼" F/D (560k): RS232 port: PP. (1). BT 10/81
Olivetti M20 (£2395)	Olivetti 01 785 6666	128k-512k RAM: Z8001: 2-8k ROM: dual 5¼" F/D (640k): RS232 port; P/P	Basic: *PCOS: A*	Alternative 8086 processor board to run CP/M86 & MS-DOS. Options: 11 Mb H/D (integral): printer £738. (S) B/T 9/82
Onyx C8000 (£6875)	Onyx Dist Ltd: 09066-5432 (TBA)	64k RAM: Z80: 12 Mb Cartridge: 10 Mb H/D: 4 S/P: P/P	CP/M: *MP/M Oasis: Unix: Fortran: Pascal: W/P*	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis.(E) BT 3/81.
Oric 1 (£100 inc VAT)	Oric Products Int 0990 27641	16-48k RAM: 6502A: 28x40 TV int: C int: S/P: P/P: Loudspeaker	Basic (16k ROM): *Forth*	With 48k RAM and Forth on cassette £170 inc VAT. 240x200 colour graphics. Micro disk and modem avail soon. Viewdata compatible.
Osborne 1 (£1250)	Osborne 0908 615274(40)	64k RAM: Z80A: dual 5¼" F/D (200k): 5", 24x52 VDU: RS232 port: P/P	CP/M: W/P: *Cobol Fortran: Pascal* CBasic: MBasic: Wordstar: Mailmerge: Supercalc *Forth*	Integral system in weatherproof carrying case. Will run on battery pack. Option: dual 5¼" F/D (400k). BT11/81.
Oscar (£2560)	IDS Ltd: 0908 313997(30)	64k RAM: Z80: dual 5 ¼ F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: *Basic: Pascal Fortran: Cobol: W/P:A*	Also avail. with dual 5" F/D(1.6Mb) £2905 and 8" F/D(2 Mb) £3380. Advanced video board. S&H).
Panasonic JD 800M, JD850M (£3300, £4350)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	64k RAM: 8085A: 4k PROM: dual 8" F/D JD800M (500k): JD850M (2 Mb): 12", 24x80 VDU: 3xRS323 ports. P/P	CP/M: Basic: A *Micro-Cobol.*	Option: 8.4 Mb H/D £2725 (up two). BT3/80(S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01-554 6222	64k RAM: MCP 1600: 2x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code: no interpreter needed. Available with dual 8" F/D (2 Mb) £3900.
Pasca 640 (£1900)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM: Z80A: dual 8" F/D (512k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A: W/P: U*	Maintenance contracts avail. Option: 5-20 Mb H/D. (S) BT 5/18
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5¼" F/D (140k): 12", 24x80 VDU: RS232 port.	PDOS: UCSD p-system: *Pascal: Basic Fortran:A.*	With 48k RAM, Pascal and Basic £3300: BT 12/81.(S).
Position 900 (£1950)	Position Comp. 09252 29741 (10)	64-512k RAM: 6809: 4xRS232 ports: IEEE-488 port: 1200 band C: dual 5¼" F/D (720k)	OS-9: Basic 09: *Pascal: C: A: Cobol: U FLEX O/S*	Supports 4 users, expandable to 8. Networking allows 28 users on 7. Options dual: 5¼" F/D (1.4 Mb): 5-40 Mb H/D (E)
Position 9000 (£1536)	As above	64-512k RAM: 6809: 4xRS232 ports: IEEE-488 port: 1200 band C.	OS-9: Basic 09: *Pascal C: A: Cobol: U*	240x240 high res colour graphics. Viewdata compatible. Disk options as above. Supports 5 users. Networking allows 35 users on 7 systems (E) BT 10/82.
Prince (£3045)	Digico: 04626 78172 (50)	64k RAM: 3xZ80A: dual 5¼" F/D (800k): 2xRS232 port: P/P 12", 25x80 VDU	CP/M: *Basic: Pascal: Fortran: Cobol: W/P:A:* T/E:U	High res graphics. Options: single 5¼" F/D (400k) £600: dual 8" F/D(2 Mb) £2000 5-10Mb H/D. Rentals avail. (S).
Quantum 2000 (£2250)	Quantum Comp Sys 0532 458877	64k RAM: Z80A: dual 8" F/D (2.4Mb): 12", 24x80 VDU: C int: P/P	CP/M *Basic: Cobol: Fortran: Pascal: A*	Many expansion boards avail inc high res colour graphics. Option: 5-10Mb H/D.
Rair Black Box 3/30 (£3750)	Rair: 01-836 6921 (N/A)	64-512k RAM: 8085: dual 5¼" F/D (500k): 6 Mb H/D: 2xRS232 ports.	CP/M: Basic: Cobol: Fortran: M/A	64k RAM expansion £500. 256k RAM £1250. Up to 16 RS232 ports.
Research Machines 380Z (£1867)	Research Machines: 0865 249866 (N/A)	32-56k RAM: Z80A: dual 5¼" F/D (300k) RS232 port. P/P.	ExBasic: A: T/E: U: *CP/M: Fortran: Cobol: Algol: Pascal.*	High res colour graphics. Many possible systems. With 56k RAM & dual 8" 'FD (1 Mb) £3347.
Research Machines Link 480Z (£560)	As above	32-64k RAM: Z80A: C: 2xS/P: P/P	Basic: T/E	High res colour graphics. Network station.

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Sage II (£2870)	TDI 0272 742796	128-512K RAM: 68000: single 5¼" F/D (320k): VDU int: RS232 port: P/P	UCSD p-System: Pascal Basic: Fortran: M/A	Price includes 1 year service. With 512k RAM and dual 5¼" F/D (1MB) £4594 BT 2/83
SEED System 1 (£1900)	Strumech: 05433 78151 (5)	32-56k RAM: 6800: various disk options: 12", 24 x 80 VDU: RS232 port: P/P	DOS: Basic: *M/A: CBasic: A: T/E*	Graphics. PROM programmer Also system 19 multi-user (£3000). (E)
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-48k RAM: Z80: C: 10" 24 x 40 VDU: Option: dual 5¼" F/D (289k) £695	Basic. A. *CP/M: Pascal: Fortran: Forth*	Graphics: loudspeaker. BT 10/79 (B)
Sharp MZ80A (£549)	Sharp Electronics (UK) Ltd 061 205 2333 (22)	48k RAM: Z80: 25x40 VDU: C: P/P. Options: single 5¼" F/D £400: dual 5 ÷ " F/D £590: RS232 port	Basic: *CP/M: A: Pascal: Fortran: Cobol*	Expansion unit needed for disks (£100) Low res (80x50) graphics. Loudspeaker Numeric pad (B)
Sharp MZ-80B (£1095)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	B[illegible]: *A: Pascal: FDOS*	High res graphics. Options: dual 5¼" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC1500 (£150)	As above	3-11k RAM: CPU: 16k ROM: 26 char LCD:	Basic	Full system with dual cassette int. and miniature four colour plotter £375. RS232 port avail. soon. (B). BT 6/82
Sharp PC3201 (£2995)	As above *CP/M: Cobol*	64k RAM: Z80A: dual 5¼" F/D (500k): C int: 12", 25 x 80 VDU: 70 1pm printer.	DOS: U: Basic: *CP/M: Cobol*	Various expansion cards avail. BT 7/81 (I&B)
Sharp PC1251 (£80)	As Above	3k RAM: 8-bit CPU: 24 char LCD	Basic (24k ROM)	Portable. Printer/cassette unit £100 BT 2/83
Sig/Net 100ZS (£1299)	Shelton 01 278 6273 (5)	64k RAM: Z80A: dual 5¼" F/D (400k): 2xRS232 ports	CP/M: *Basic: Cobol Fortran: Pascal*	Various disk options, up to 16 Mb H/D
Sinclair ZX81 (£50 inc VAT)	Sinclair: 0276 66104 (300+)	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port.	Basic (8k ROM).	Advanced 4-chip design. Printer now avail. BT 6/81
Sinclair ZX Spectrum (£125 inc VAT)	Sinclaire 0276 685311	16-48k RAM: Z80A: 16k ROM: T.V. int: C int	Basic	Options: 32k RAM £60. RS232 port and microdrive disks avail soon. BT 6/82
Smoke Signal Chieftan (£1800)	Windrush 0692 40[illegible]189: (TBA)	32-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2 x RS232 port.	DOS: *68/FLEX: Basic: Fortran: Cobol: A: Disc A: Pascal: U.*	With daul 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H).
Sorcerer (£790)	EMG 0293 519211 (27)	48k RAM: Z80: RS232 port: 1 P/P: S100 connector. 30x64 VDU int. N/P.	O/S: Basic (ROM): *A: Algol: Fortran: MBasic: ExBasic: 80. Pascal: W/P.*	High-resolution graphics capability: user programmable character set, Option: single 5¼" F/D (316k) £600 Video disk unit (1.5Mb) £1890
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 07917 64686 (10)	48k RAM: Z80: 8k ROM dual 5¼" F/D (245k): 24 x 64 green VDU: RS232 port: N/P	O/S: Basic: *A: Fortran: Pascal.*	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M[illegible] Mk II-VI (£4078)	As above	64k RAM: Z80: 8k ROM: dual 5" F/D (700k): 12", 24 x 80 green VDU: RS232 ports: S100 bus: N/P	*O/S:* Ex Basic: *CBasic: Multi-User Basic: Fortran: Cobol*	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3140)	Digital Data: 01-573 8854	96-1056k RAM: 8085 A-2: dual 5¼" F/D (280k): 12", 24 x 80 VDU: 2 x RS232 ports: Option: Up to 106 Mb H/D	Mikados, Comal: Pascal: A.	Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1750)	Icarus: 01-485 5574 (45)	64k RAM: 2 x Z80: dual 5¼" F/D (320k): 12" 25 x 80 VDU: 2 x RS232 port.	CP/M: A: *Basic Cobol: Fortran APL: Pascal*	Limited graphis, Mainframe int avail. With 676k F/D £2090, 1.5Mb £2345. With 5Mb H/D & single 338k F/D £3950. BT 8/80. (S&H)
SWTPc/09 (£3850)	SWTP Ltd 0733 234433	64k RAM: 6809: dual 5¼" F/D (1.5MB) 2 S/P: P/P: 12", 24 x 80 VDU	Flex O/S: Basic: A: T/E	Expandable to 768k RAM
SWTPc S/09 (£7000)	As Above	128k RAM: 6809: dual 8" F/D (2.5MB) 2 S/P: 1 P/P	Uniflex O/S: *Cobol: Basic: Fortran: C. Pascal: A: Pilot: Forth.*	Up to 80MB H/D. Multi-user, multi-tasking, up to 18 users
System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24 x 80 VDU: 2 x RS232 port: P/P	CP/M: *Basic: Fortran: Pascal; Cobol: PL/1: W/P*	12 month warranty. Maint. contracts. Applications packages avail. Choice of high level language in price. (E)
Tandberg EC10 (£3250)	Tandberg: 0532 774844 (N/A)	64k RAM: 8080 A: single 8" F/D (250k): 12" 25 x 80 VDU: 7 x RS232 ports: printer int	CP/M: Ex Basic (24k) *Multi-user Basic: Pascal: Cobol:* A: U:	Up to 7 terminals. Includes V28 comms port. (S&H)
Tandy PC-2 (£179 inc VAT)	As above	3-11k RAM: CPU: 16k ROM: 26 char LCD	Basic:	System with dual cassette int. and miniature four colour plotter £338 inc VAT. RS232 port aval. soon. (B)
Tandy TRS-80 Model 1 (£174)	Tandy: 0922 648181 (200)	16-48k RAM: Z80: C: 12", 16 x 64 VDU: RS232: P/P	Basic (12k ROM): A.	Fully expandable. Option: single 5¼" F/D (175k) £320 (up to 4). Many extras available. 32k RAM £260. (I)
Tandy TRS-80 Model II (£2347)	As above	64k RAM: Z80: single 8" F/D (500k) 12" 24 x 80 VDU: 2 x RS232 port: P/P	Basic *M/A Fortran: Cobol* 3-32 Mb H/D	Option: single 8" F/D (500k) £782 (subsequent £391, up to 4). 8-32Mb H/D
Tandy TRS 80 Model 3 (£434-£1477)	As above	See Model 1 Levels I and II		Fully integral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81

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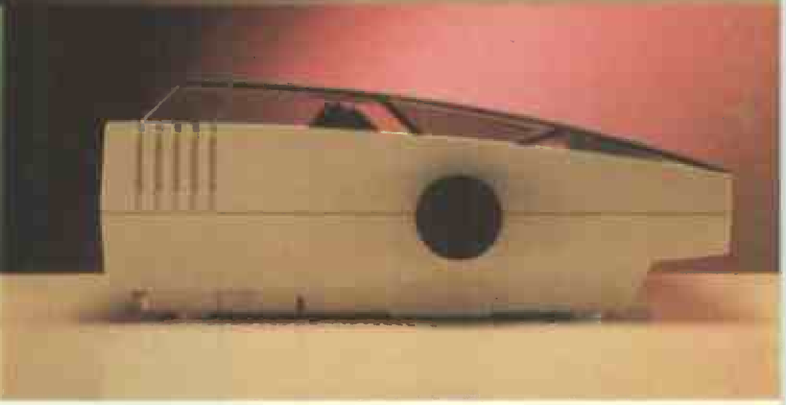
THE MT80. SHAPED BY EXPERIENCE



You are looking at the sleek, ultra modern lines of the latest dot matrix printer from Mannesmann Tally; the people who probably have more experience in computer printers than just about anyone.

The MT80 is a high quality, low cost 80 column, 80 cps printer that will complement any of today's micros in looks and quality; in either the home or the office.

It has been designed with industry-compatible interfaces in hardware and software.

Experience tells us exactly what you want from a printer – The MT80 has dual density dot addressable and line graphics. An easy change, long life cassette ribbon. It can handle both tractor-fed fanfold and single sheet paper. There is a unique quick tear facility giving you a clean cut along the entire width of the paper. And it even has an optional sound reduction kit for those of you who like to hear yourselves think.

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Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Tandy TRS-80 Colour (£209)	As above	16-32k RAM: 6809: 8-16k ROM: C: 16 x 32 TV int: RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £261 (I). BT 9/81.
Tandy TRS-80 Model 16 (£3651)	As above	128-512k RAM: Z80A 68000: dual 8" F/D (1-2Mb): P/P: 2xRS232 port.	TRSDOS: A: *Cobol Basic*	Will run all Model II software. System with single 5¼ F/D (600k) and 8Mb H/D £5911. Options: 8Mb H/D £2173 (up to four): 640x240 high res graphics: Multi-user system avail. soon. (S)
Tele Video TS800 (£3100)	Colt 01-577 2686	64k RAM: Z80A: dual 5¼" F/D (700k):P/P: S/P: 24x80 VDU: 80 cps printer.	CP/M: *Basic: Cobol: Fortran: Pascal*	Fully expandable to local area network with 16 users. 8 and 16 bit versions avail. and full set of application software. (S)
Terodec PBM-1000 (£4020)	Terodec: 0734 664343 (40)	80k RAM: Z80A: single 5¼" F/D (819k): 6Mb H/D:2xS/P: P/P	CP/M CP/Net CBasic: *Fortran: Pascal: Cobol*	System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £5995 (S&H)
TI 99/4A (£199 inc VAT)	TI: 0234 67466 (TBA)	16-48k RAM: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 tones & noise: P/P.	OS: Basic.	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5¼" F/D (92k each): Speech Synthesiser.
Torch (£12795)	Torch Comp. 0223 841000 (30)	64k RAM: Z80A: dual 5¼" F/D (800k): 12", 24x80 colour VDU: RS232 port: P/P: Modem	CPN: BBC Basic:	O/S is CP/M compatible. With 21MB HD and single F/D £5495. B/T 1/83
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A)	24k RAM: Z80: single 5¼" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: *Basic: Fortran: Pascal: Cobol:*	Options: single 5¼" F/D (190k) £155: single 5¼" F/D (370k) £285: 16k RAM £162: 3 Mb H/D £1450: 20 Mb H/D £2970 (S&H)
Tuscan Starter Kit (£299)	As above	8k RAM: Z80: Cint: 56-key K/B Options: Case £110: 5 x S100 sockets £20: TV int £3.50	8k Basic	Fully assembled version £499 BT 1/81 (H&S)
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Vector System 2800 (£4600)	As above	56k RAM: Z80A: dual 8" F/D (2.4 Mb): 3 S/P: 2 P/P	As above	High-res graphics. Many Options. Fully expandable to 5005 multi-user system (max 5) £5400.
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Xerox 820 (£1845)	Business Comp Sys 01 207 3344	64k RAM: Z80: single 5¼" F/D (162k): 12", 24 x 80 VDU: 2 x RS232 ports: P/P	Monitor: *CP/M: Basic: Cobol: Fortran: Pascal.*	With 8" F/D (500k) £2250. CP/M £95. BT 1/82 (S+H)
Zenith WH-11A (£2673)	Zenith Data Systems 0452 29451 (TBA)	LSI 11: 16-32k RAM: 25 x 80 VDU: S/P: P/P.	*O/S: Basic, Fortran:* A: U.	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £1717 (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM: Z80: single 5¼" F/D (102k): 12" 24 x 80 b&g vdu: RS232.	*Basic: A: HDOS: CP/M: MBasic: CBasic: Fortran.*	3 x 5¼" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Thames Systems: 084421 5471 (N/A)	64k RAM: Z80: dual 8" F/D (600k): RS232 port: MCZ1/20A only 1 P/P: Option: 10 Mb H/D £7100	RIO: *O/S: Cobol: Basic: Fortran: Pascal: M/A: U.*	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol, up to 5 terminals with 40 Mb H/D. (S&H).

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● Apple Europlus computer, twin disk drives, Epson MX-80IIIF/T printer, BMC monitor, complete tabs, business system payroll, purchase sales and nominal ledgers. 5 months, little used, £1,500 ono. Tel: Sandwich 612869 (Kent).

● DAI 48k, 16 colours, improved keyboard, and user mags, £525 ono. Tel: 01-670 5909 (Dulwich).

● Olivetti Praxis 35 typewriter (easily convertible to computer printer), excellent quality daisywheel, £200; also Texas T159 programmable calculator with 3 ROMs, (maths, statistics, electronics), + manuals, £100. Tel: Bristol 48663 eve.

● BBC Model B, hardly used, £370. Texas 810 printer, £500. £40 worth of software, £20. Will accept an offer for the lot. Tel: Flitwick (0525) 717337.

● Tandy TRS-80 LII, 16k num. keypad, green screen, monitor. CTR-80A cassette recorder, still boxed, hardly used, much software, Chess, Arcade games and Adventures, £200 ono. Tel: Byfleet (09323) 41387.

● Acorn Atom, fully expanded, floating point, ROM, PSU, all leads and manuals + additional programming books: "Getting Acquainted With Your Acorn", "Acorn Atom Magic Book", £185. Tel: 01-907 5608.

● ZX81 + 16k + amazing Fuller professional keyboard and £45 of software, including Defender, Invaders, Star Trek etc. All leads, manuals, books supplied, bargain for £90. Tel: Steve on 01-859 2360.

● Atari bargains: Jumbo, Jet Pilot cartridge, £23.50; Galactic Chase cassette, £12.50; both in excellent condition. Tel: 0793 750620, ask for Rob.

● Acorn Atom, 12k RAM, 12k ROM inc. FP, separate 5amp 5V regulated power supply, manual, some software inc. Chess and Space Invaders, £140 only. Tel: 01-876 7199 6.30pm to 9pm.

● Wanted — secondhand business software for Apple and CP/M, like dBase II, Wordstar, Visicalc, Visischedule payroll, Project Planning and other utilities. Tel: 06-116688 or write: Peter Andersen, 41 Naesbyvej, 8270 Hoejbjerg, Denmark.

● Sharp PC1211 including printer and cassette interface with spare paper etc, not used much, bargain, £100. Tel: Graham on 021-421 5372 after 7pm.

● Sharp PC1500, almost new. Tel: Graham on 021-421 5372 after 7pm.

● Casio FX702P, hardly used, bargain, £50. Tel: Graham on 021-421 5372 after 7pm.

● CP/M maker for Atari 400/800, encased with power supply. Provides RS232 parallel, standard, Atari disc interfaces, 64k, connects up to 4 (mixed) drives software included CP/M 2.2, £390. Tel: Luton 32752.

● Teac dual cased 100k disc drives, still under guarantee, complete with cable, utilities disc and manual for BBC micro, £220 ono. Tel: 0782 314053 after 6pm.

● Lynx 48k. Hardly used, unwanted gift, boxed, as new with manual, etc. £180. Tel: 0273 35909 (Brighton) any day after 6pm.

● TRS80 LII, 16k. As new, all leads and manuals + books, games: Galaxy Invasion, etc. £210 ono. Tel: Harpenden (05827) 61239.

● Newbrain model AD with manual, £200. Sanyo high resolution green monitor, 12in non-reflecting screen £95. Both with under 10 hours use. Tel: Bristol 690345. J.C. Aitken, 47 Elm Close, Littlestoke, Bristol.

● ZX Spectrum 48k. Excellent condition, complete with ZX printer, professional case, sound amplifier and about 20 games +

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mags. For only £215 ono. Tel: 01-771 2377 (Mr. Whitney after 8pm).

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● Video Genie EG3003 16k, new keyboard, integral cassette, VU meter. Excellent condition, hardly used. Complete with original manuals, leads, box, some programs (Space Invaders, Scrambler, etc), £210. Tel: 0945 582432 after 5pm.

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● Sharp MZ-80K 48k 18 mths old, includes books, user notes, joystick and Epson printer card. software value £400+ Available at £60 ono. Computer to first offer of £240. Tel: 0908 677508.

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● VDU 80x24, faulty keyboard, working on receive, good monitor £30. Faulty 8086 board, 64k RAM, serial ports, similar 8088 board, £20 each. Full of chips other boards, £5. Tel: 0274 487235.

● TRS-80 L2 with new monitor, cassette, sound, hi-res graphics (384x192), many books, manuals, very large software collection. Value £1,000+. Accept £390 ono. Computer without software £340. Tel: Long Eaton (06076) 68602.

● Aculab floppy tape unit for VIDEO-GENIE. Complete with cover, manual, notes, 20 wafers, various lengths, and word processor programme. £60 (Securicor delivery). Nicholls Tel: 01-670 8605.

● 16k VIDEO GENIE. Excellent condition original and extra manuals, additional soundbox, software worth over £70 including Asteroids, Backgammon, Pontoon, £200 ono. Tel: Tony Owers, Alton 63103 after 5.30 p.m. or weekends.

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● TRS 80, L2, 16k numeric keypod CTR 80 cassette TRS 80 line printer VII. All leads, cables, manuals little used and in mint condition £375. Tel: Wilmslow 520652.

● Sharp MZ-801. Excellent condition. Boxed. Xtal Basic, Knight's Commander. Machine Code. 50 programs, manuals, £325 ono. Epson TX-80B, soundproof box, excellent condition £175 ono. Tel: 097 883 3502 eve.

● Philips G7000 video system with 8 cartridges inc. Space Monster, Cosmic Conflict, Freedom Fighters, Club newsletters VGC. Boxed £95 ono Sinclair ZX-80, manual, games £15 ono. Tel: 097-883 3502 eve.

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● Sharp MZ80A 48k one year old. Accept £415. Also available, Disk Basic. Floppy Interface, printer I/O card, expansion unit. Prices on application. Tel: Corsham 714589 (24 hr.).

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● VIC 20 users. If you are interested in exchanging software with a German group contact: Carsten Dietrich. Werderstr' 38, 3150 Peine, West Germany. Tel: 05171 6500.

● TRS-80 model 1, level II 16k. Boxed, as new, some software, £100. Tel: Garston 77491 after 6 o'clock.

● Sharp PC3201 CP/M2·2. Business computer screen printer, twin disks (560k), 112k RAM, 32k ROM, Worstar, Calcstar, Stock Control, C Basic. As new £3,500. Value only £1,900. Tel: Chorley (02572) 78531.

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● TRS80 LII 16k. expansion interface (32k. RS232/. TEAC single disc drive, H14 printer (RS232, full ASCII). disc software including Pascal, APL80 £750 ono or will split. John (eve) Bristol (0272) 43482.

● Sharp MZ80K 48k RAM software Basic, Assembler, Disassembler, Chess, Space Invaders, Knights, Fortran. Complete with manuals, dust cover, excellent condition. Can deliver London area. £280. Tel: 01-361 1947.

● 48k expansion for VIDEO GENIE (under keyboard). Little used. With full fitting instructions and connections. Cost new £48, will accept £20. Tel: Longfield (04747) 5165.

● Selectric KBD printer (ex 2741) with hardware/software interface for Z80 micro +P10. Previously IBM maintained. V. good condition, with some manuals, sensible offers. Tel: Ian on Ips (0473) 831353.

● Sharp MZ80K 48k. Good condition, including Basic and 5 software cassettes with manual £225. Tel: 01-698 7614.

● Sharp MZ80K 48k. Hardly used. House purchase forces sale. Ex condition, some software. Can deliver Essex or Kent. £300 Rayleigh 779984. Std code 0268.

● Apple II Europlus 48k with disk drive (DOS 3·3). RS232 interface, Hewlett Packard printer and software £750 ono. Also Applesoft toolkit £15 and Graforth Language £35. All with manuals. Tel: 01-883 0812.

● Sharp MZ80-P6 printer + interface card and connecting cable for MZ80-B computer. Perfect condition. Tel: Ken Gaston after 8 p.m. or weekends on 01-549 3108 £230 ono. Will deliver within reasonable area.

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● PET 32k 3032 with 3040 dual disk drive and 3022 tractor printer. Two systems available with some business software, £850 each system. Mr Sherwin Tel: Rugby (0788) 810908 eve or weekend only.

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● Commodore 4022 printer, good condition, £200. Tel: Bordon (Hants) (04203) 4261.

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● Sharp MZ-80K, 48k, excellent condition. dustcover, extended Basics. Forth. M/C. Code WrdPro, many games. books. newsletters, MX-80, graphics chips and interface, over 40 cassettes, £300. Tel: 0525 376011 (after 6pm).

● UK 101, 8k with Cegmon, Basic 5 and toolkit, 16/32 lines, 300/600 Baud, Runs at 2M HZ. All cased. Variety of software, £150 ono. Tel: Harlow 443022.

● TRS-80 model 1, LII 16k, hardly used, Lots of games, all leads and manuals. Tape instruction course, IQ builder, £260 ono. Tel: Richey, 01-570 0958 after 6.30pm.

● Sirius 128k, 1.2MB. hardly used, surplus to requirements, 9 months guarantee remaining, £1,900 + VAT. Tel: Harlow (06284) 73074.

● Aculab floppy tape unit, + 15 wafers. No interface required plugs straight into VIDEO GENIE. Have gone to disk so going cheap at £70 ono. Tel: Bonnet, Kings Langley 65324.

● Tangerine mini-rack, Micron, 8k, RAM, 15k ROM. Basic, toolkit, Tanbug. Xbug, ASCII, keyboard, hex keypad, games keypad, Chunky graphics, 4 manuals, Microtan companion book. Much software, £250 ono. Tel: 01-668 3326

● Colour NASCOM-2 48k with disk, Polydos, disk Basic, Pascal, Assembler, Polytext, AVC gives 8 colours, 782x256, cased with numeric keypad, fan, speaker, £200+ of software. £1,075 or offer. Tel: 0763 61482.

● PET 32k Commodore cassette, Bags of software, little used, ideal for business, home or school, £450. Tel: Colin, Slough, 72674, or write Colin Payne, 113 Holmedale, Wexham, Slough SL2 SR3.

● DRAGON 32. All leads and manuals, + portable tv, Chess cartridge and cassette recorder, Price new £311 + only £220. Tel: Fairseat (0732) 822498 after 5pm.

● VIC 20 computer, computer unit, Jelly Monsters and Cloudburst cartridges and lots of software. £100 ono. Tel: Biggin Hill 73861.

● APPLE kit, colour card, £50, Omnivision, £100, modular £7, paddles £5, desktop plan £55, Visicalc utilities £25, library boxes £1.50. 3.3 £18, Pascal £45, Billing, 19 St Lawrence, Ashburton, Devon.

● TRS-80 model III, 48k. Dual Teac 175k disk drives. Also editor assembler and Accel 3 disk basic compiler. All excellent condition, worth £1,600. Serious offers over £1,000 considered. Tel: (0734) 666104 (Reading).

● Sharp M280K 48K, excellent condition. Several Basics, Pascal, Forth and many games. Also NDPRO, ZEN and compatible disassembler, ROM and ZEN listings. With manuals, bargain, £260. Tel: Cheltenham (0242) 23091.

● Pet2001, 32K, new ROM with over 100 programs, mags and listings. I need the money fast, so selling cheap! Only £265 ono—for more details telephone 01-554 9548.

● Sharp MZ80K High Resolution Board, fitted reset switch, lots software, business games, utilities, Pascal, Forth etc, £275, no offers. Also Seiko, Sharp Interface, £40. Telephone David on (0253) 56361 evenings.

● Software for TR80 and Video Genie; compilers for Cobol, Basic, Fortran, Forth and Pascal; others include Visicalc, Edas, Scripsit and numerous games, many books. Telephone for list, Hull (0482) 867349.

● AIM 65 develelopment system, 20K ROM, 36K RAM, 24V Lambda and 5V cased PSUs Pettite and NDU interfaces. Full documentation cost £768, bargain at £250. Tel: 01-366 8820.

● ATARI 400 4 weeks old, Basic language, Atari recorder, Defender, Asteroids cassettes, joystick, portable television. Sell the lot £250 or swap for M2 80A or M2 80K. Tel: Garboldisham 430 home, Thetford 3192 work.

● Sharp MZ-80K, 48k + interface box P3 printer and 320×200 hi-res board, Over £200 of software, including various business programs only £850 the lot. Tel: Andrew Hutchinson, Letchworth 3744.

● TRS 80 model I, L2, 16k computer with lower case modification, battery operated soundbox. VDU cassette recorder and software included £230. Tel: Charles Joyce on Rowlands Castle 2788 (STD 070541).

● Commodore 80/96 business micro with disk drives and leads. Tel: Mike, 01-888 4946 after hours, 01-482 2283 work.

● Hewlett Packard HP-10C, calculator, as new, bought in error, £50. Tel: Maldon (0621) 53359 eves/wknds.

● SPECTRUM 16k manuals, leads, boxed, tape recorder £20. Included Software Arcadia Golf, Penetrator, Planetoids, Scramble, Nite-Flight, Hungry Horace, Go Skiing, GFZ, Avenger, Escape, worth £200, excellent condition, £110 ono, bargain. Tel: Rob, 01-440 1635.

● PET 3008, new ROM, large keyboard, green screen, external C2N cassette deck, 3022 tractor printer, books, some software, cables, etc, excellent condition, £550

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ono. Tel: Phil, 021 743 0560 Birmingham.

● UK 101, cased 8k RAM + extended monitor, £75. Professional VDU. S.E. labs, model 1088 with good keyboard, V.24 serial interface, 17 lines×64 chars. Supporting technical documents, £100. Tel: Rochdale 354291.

● Osborne, 1 MK2. As new and still under guarantee, complete with manual and software including Wordstar wordprocessing + extra programs, bargain, £795 + VAT. Tel: 01-904 4450. Wembley.

● Pluto colour graphics card by IO Research, Extended command ROM, See manufacturers advert July PCW, Retail price including VAT £500+, will sell £320. Tel Morden, 01-542 0873.

● Saturn 32k Ramcard software, manuals etc. Boxed £95 for Apple II for expanded Visicalc, Pascal etc. Tel: 0494 33333, ext 165, 02814 2792 eves.

● WATANABE WX 4731, plotwriter for sale, 4-colour Intelligent A3 plotter/printer with parallel interface for Apple II, manuals, £1,400. Tel: 01-853 0289.

● PET/CBM 3032k, + 2 cassette decks. + various manuals, excellent condition, £325 ono. Tel: Edinburgh (031) 667 0553.

● VIC 20, C2N cassette, Arfon expansion, 3k super and 8k memory, joystick, VIC Revealed, Watson assembler, games, tapes, cost £400+ will accept £295. Tel: Leek 372208 after 6pm.

● 9980A Texas Instruments, 16 Bit CPU, + support chips 9901, 9902, TMS 2716 Eprom. EX Equipment but guaranteed OK, £15 per set Inc postage. 18 Pilgrims Way. Gilesgate. Durham.

● ZY 81 16k printer, 7 cassettes. learning lab books. price £100. Tel: 38-47824 after 7pm. Keith Purcell, 139 Manor Road, Erith Kent D8A 2AQ.

● PET 32K, large keyboard, external cassette player, 2001 series needs new home, £450 with £150+ games, software, including Microchess. Star Trek. etc free. Tel: Barry, Stevenage 813984.

● APPLE II 'Step By Step 2' course in basic programming unused, includes 96 page manual. 4 disks. 4 C60 audio cassettes, £30 ono. Tel: Keir, 0268 43079 eves.

● PET 32k model 4032+ cassette deck, toolkit, various software, manuals, and CBM guide. £350 ono. Tel: Colne (0282) 863248 after 6pm.

● ATARI 800 48k, 410 recorder, 822 printer. joysticks, invitation to programming, one and two conversational French, music, computer various games. Total valve £850, will accept £600 ono. Tel: Minehead 5330 eves.

● Atari 400 with program recorder and Basic cartridge. Many books, magazines, manuals. 4 game cartridges, Lots of extras. including joysticks, Cost £450+, sell for £350 ono. Tel: 0375 672077.

● Sharp MZ80A perfect condition, one year old, Extended Basic + Defender, £375. Low price for fast sale. Tel: 0383 720549 after 5.30pm.

● Sharp MZ80K 48k RAM, personal computer, complete with video monitor, cassette deck, software, Basic tape and manual. Still under warranty, superb condition. Can deliver anywhere in UK. within hours, £270 ono. Tel: 01-892 2730.

● PET 32k. model 3032 new ROM, large keyboard. toolkit, assembler/disassembler. resident, 3600 Baud tape system, cassette decks (soundbox), dust cover, 4 manuals. Chess, Adventure, etc, £450 ono. Tel: Lowestoft 64160.

● Urgently needed — someone to help repair my ailing UK101. Tel: Leeds 734419 eves.

● Sharp MZ80A, as new condition, All manuals. software, some additional programmes and tapes. In original carton, £425 ono. Tel: Radnage (Bucks) (024-026) 2229 eves.

● Sharp MZ-80K/A games addicts, new software to help numb your minds, Stomper, Alien Egg, Cycloids. Proteus-1, All at £6.00 exactly. For details. sae: Image 18 Florence Road, New Cross. London SE14.

TRANSACTION FILE ADVERTISEMENT FORM

All Transaction File ads must be submitted by readers on this form or a photo-copy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £2.50. Make cheques or POs payable to Personal Computer World. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to help you by printing your ad very clearly. Send form to: Transaction File PCW, 62 Oxford Street, London W1A 2HG.

Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

ACC NEWS

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.

Micro-robotics on the move

Good news for all micro-robotics enthusiasts! The ACC is running a second national conference on the subject of amateur robotics (including micro mice and mobile arms). It will be held in London during mid November, and further details will be given in next month's ACC news.

Two years ago, the ACC held the first national micro-robotics conference at Imperial College. Over 80 people participated, including enthusiastic amateurs, designers, manufacturers and representatives from various interested bodies. A follow up was requested, either in the form of a study group or a second conference.

The group got together again at the Earls Court Computer Fair in June this year (wonderful how these exhibitions cause the old faithful to meet up to hatch their plans) and agreed to launch a second event with two main objectives:

1. A platform for state of the art designs and information exchange
2. Practical help for amateur micro-robotics enthusiasts (for example, developing bulk buying groups to cut component costs).

They thought that interest would come mainly from the micro mouse people and those interested in mobile arms, but that the conference would also be aimed at those with other robotic interests. These would include, on the software side, artificial intelligence, voice input and output, pattern recognition and 'expert' systems. There will be a number of features in 'ACCumulator' on this subject — send your contributions to Leon Heller, 8 Morris Walk, Newport Pagnell, Bucks.

To avoid disappointment, write (or telephone) *now* to get your name on the mailing list for the conference: Vernon Gifford, 111 Selhurst Road, London SE25 6LH, tel: 01-653 3207. He would also be interested in any topics you would like to hear or talk about or any offers of demonstrations. Vernon (who ran the previous conference) is coordinating the early preparations for this one, but he would like to hand on to somebody who could look after the ACC's micro-robotics role, both in conferences and convening a study group. Anybody interested?

Communications

This subject persists in the news. We are still waiting for some proper standards to emerge in the field of computer communications at the protocol level, but at least the electrical signals are well defined for communication over telephone lines. All you require (in principle at least) is a modem (MODulator-DEModulator) to connect the telephone to your RS232 signals. If your friend also has one, and the baud rates and parity specifications are the same, then providing you've got all your pins 2 and 3 (on the RS232 D connector) connected right at both ends, you should be able to communicate data over the phone.

The ACC and the National TRS-80 Users group are holding a joint workshop in London on the subject of building modems. In particular, it is planned to look at the Maplin modem design along with some software to use with it. This is hoped to include a general communications program written in the 'C' language. The meeting will be on Sunday 9 October at the Emil Woolf Accountancy College, Marylebone Lane, off Baker Street, London. For more information on this event, contact Brian Pain, on 0908 564271.

Shows

I hope to see some of you at the *PCW* show at the end of this month. The ACC will be there as usual, along with our computer club database; this allows us to put people in touch with their local clubs — typically we introduce one person to a club every minute of the show. So if you want to meet more interested people, come along to the ACC stand and ask about your local club. Of course, if your club doesn't tell us of its existence, then we can't tell other people about it, can we?

Incidentally, if you'd like to have printed material about your club to be available on the ACC stand (or you have a poster you would like us to try and display), then contact David Annal (address below). If you're desperate for a stand for your club, it might be worth

ACC NEWS

contacting David immediately, in case there are any cancellations.

The June show in Earls Court was quite successful from the hobbyist point of view. Many clubs were represented (wasn't yours? . . . contact David Annal, 142 Windermere Road, London SW16 5HE for a stand at the next exhibition) and the ACC database was in great demand. The show itself seemed to divide quite sharply into two camps, the small business system market and the computer games business.

Club spot

Are you a member of Micronet? Do you want to get involved in creating your own pages on Prestel at no cost other than phone charges? Remember that you can get involved (via your computer club or the ACC) in Club Spot 800. Club Spot lives at page *8008# on Prestel, and editing facilities can be available to people with Micronet adaptors or any full alpha terminal. If you want more information, drop me a line.

Now comes the time that I go dipping into my post bag to bring out the news from clubs around the country. If you would like any (interesting?) information about your club to find its way into this column, then write to me at the address below (NB my address has changed since July) and I'll give you a mention. Believe it or not, some of your potential members do read this page . . .

Ms Valerie Clark of 4 Charlton Grove, Wallasey, Merseyside, writes to me to talk of a club in a library in the area. Her ideas were still speculative when the letter to me was written, but why not drop her a line if you're interested and in the area.

She mentions that there is a problem in getting adequate computer books to be stocked in the public libraries in Wirral. This seems to be mainly because many librarians are not fully *au fait* with the computer business and are therefore frightened off buying any books at the selection meetings. She hopes that by involving library staff (as well as 'ordinary people') in a computer club, they may set sufficient interest to ensure that this vital area of knowledge is given adequate cover.

The Birmingham & Region Apple Group (BRAG — good acronym) has sent me a handout advising me not to PINE-APPLE (it gets worse!) but instead to contact Mel Golder (021-426 2275) or Mike Bayliss (021-743 7197). It claims to dispense or cover Information — Displays — Books — Disks — Talks — Systems — Hardware — Software — Games — Advice.

Mrs Ann Flynn, of 53 Georgian Close, North Road, Drogheda, Co Louth, Eire, writes to tell me of her interest in forming a local club, possibly mainly aimed at the TI 99/4a. If you live near her, why not drop her a line. She may be prepared to allow fans of other computers to 'play' too.

*Want more information about the ACC or anything in this column? Or have you anything to report? Then write to me: Rupert Steele, 17 Lawrie Park Crescent, London SE26 6HH.

NETWORK NEWS

Peter Tootill gives his monthly summary of what's new in the telephone networking world

Liverpool Mailbox is now the first UK bulletin board to start running 24 hours a day, and in case you missed the new phone number, it's 051-428 8924.

Mailbox-80 Stourport has a new number (03843) 73873. Phone the operator for details of system times.

The long awaited new modem chip from AMD, the AM7910, seems to be becoming available at last. It is a multi-mode device that requires only a power supply and a couple of other components to make a fully fledged modem handling various standards, including V21 (normal UK 300 baud standard), V23 (covering Prestel) and their US equivalents. The chip is expensive, (around £60) but if you need more than just a V21 modem, it offers excellent value for money. I expect that by the time you read this, modems using the chip will be well on the way if not already on the market, although I understand that supplies of the chip are very limited at present. I will give further details of any such modems when I receive them.

Maplin modem: There are apparently a couple of component changes to the modem. Recent kits should include details, but if you're not sure details from Maplin, or most bulletin boards seem to have them on somewhere.

By 'commercial' I mean systems that are run by commercial organisations rather than individual hobbyists. As always I should be pleased to receive corrections, updates and the like, either via Liverpool Mailbox, or *PCM*.

Systems which are Free at least in part.

DISTEL. Tel: (01) 683 3311. Run by Display Electronics (new and surplus electronic and computer equipt, components, etc). The system provides information about stock lines, credit card sales, and some message facilities. 300 baud only at present. Cost: free.

REWTEL. Tel: (0277) 232 628. Run by Radio and Electronics World, the publishing side of Ambit (electronics components suppliers). Information on stock lines, some message facilities, credit card sales, the latter only for subscribers. 300 baud only at present. Cost: limited areas free, remainder £10 annual subscription.

MAPTEL. Tel: (0702) 552 941. Run by Maplin (electronic components and microcomputers). Provides information on stock levels, credit card sales to existing customers only. 300 baud only. Cost: free.

PRESTEL. Subscribers only: Prestel consists of a database made up of individual pages provided by many different organisations (not by Prestel itself). 1200/75 baud service at local call rates for a large percentage of potential users. 300 baud service on London telephone number only, at present. Cost: domestic subscribers £5.00 per quarter and no time charges outside peak periods, 80 per cent of pages are free. Business users: £15 per quarter and 5p/minute up to 6pm and Saturday mornings, no time charges outside these hours (time charges also apply to domestic users). Information: tel: Freefone 2296.

MICRONET 800. An organisation providing information within the Prestel database specifically aimed at microcomputer users. Service details as Prestel. Cost: £50-£75 joining fee (covers acoustic coupler and software — for a limited range of machines at present) and £8 per quarter on top of normal Prestel charges. Information: Micronet 800, 8 Herbal Hill, London EC1R 5JB. Tel: (01) 837 3699.

The following are fully fledged commercial systems aimed at business users:

TELECOM GOLD. Info from: Julie Ireland, 42 Weston Street, London SE1 3QD. Tel; (01) 403 6777.

COMET. Message handling system giving user facilities for leaving and retrieving messages: costs £30 per month. Info from: John Douglas, BL Systems Limited, Grosvenor House, Prospect Hill, Redditch, Worcs. Tel: (0527) 28515.

TBBS, London . . . Tel: (01) 348 6518* **System Operator:** John Newgas. Hours: Mon-Fri 10pm-1am; weekends 2pm-1am

CBBS North East . . . **System Operators:** Trevor Smith & Malcolm Piper. Hours: Tel: (0207) 43555, 2.30pm-9am daily; tel: (0207) 32447, 7pm-midnight CCITT standards; midnight-8.30am Bell 103 (US) standards.

Mailbox-83, Stourport . . . Tel: (03843) 73873* **System Operator:** Jim Roden. Hours: Call Operator for times.

Forum-80 Hull . . . (Forum-80 HQ) Tel: (0482) 859169. **System Operator:** Fred Brown. International electronic mail, library for up/down loading software.

Forum-80 Users Group, Pet Users section shopping list system. Hours: 7 days a week midnight to 8am; Tues/Thurs 7-10pm; Sat/Sun 1-10pm; nights, midnight-8am, US (Bell 103) standards.

Forum-80 London . . . Tel: (01) 902 2546. **System Operator:** Victor Saleh. Electric mail, library for downloading. Hours: Tues/Fri/Sun 7-11pm.

CBBS London . . . Tel: (01) 339 2136. **System Operator:** Peter Goldman. Facilities: electronic mail, program downloading. Hours: Sun 5-10pm.

Forum-80 Milton . . . (TRS-80 Users Group 80-Nett) Tel: (0908) 613004. **System Operators:** Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system. Hours: 7 days a week 7-10pm.

Mailbox-80 Liverpool . . . Tel: (051) 428 8924. **System Operator:** Peter Tootill. Electronic mail, downloading, TRS-80 information. Hours: 24 hours daily.

ACC . . . members bulletin board. Tel: (0908) 44262. **System Operator:** Peter Whittle.

University Research Computer . . . Sweden. Tel: 010-468 23660. Guests use password '66,66' for access.

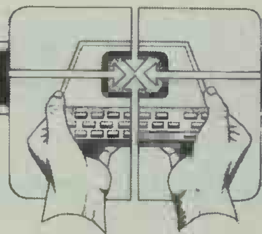
Elfa . . . Sweden. Tel: 010-468 7300706.

Rewtel . . . (Radio & Bulletin board). Tel: (0277) 232628. 24 hours service 7 days a week. Packed with useful and interesting information, etc. Subscription fee £10 p.a. Non-subscribers may have eight mins free. Hardware required: 300 baud full duplex. Standard page: 64 characters by 16 inches.

Bettisfield Remote CP/M . . . Tel: (094) 875378. **Systems Operator:** Jim Eccleston. Hours: 1-4pm & 7-11pm daily. Restarts 8 September.

The above information is correct and current, to the best of my knowledge, but I would be pleased to receive corrections and updates, either via Liverpool Mailbox, or to 7 Stockville Road, Liverpool L18 3EJ.

* Ring back system — dial the number, let phone ring once and then ring back.



CTUK! NEWS

*For further information on Computer Town UK! see 'CTUK' News' or Prestel page *800803*

Tony Cartmell
54 Foregate Street
Worcester WR1 1DX

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

Peter J Kiff
2 Ranelagh Grove
St Peter's in Thanet
Broadstairs
Kent CT10 2TE

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear NE8 1TL

Andrew Stoneman
135 Birchdale Avenue
Newcastle-Upon-Tyne
Tyne & Wear

Derek Knight or Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
Middx

Christopher Bates
Ashford Main Library
Church Road
Ashford
Kent

Paul Maddison
Gardenways
Chilworth Towers
Chilworth
Southampton SO1 7JH

Chris Cooper
110 Church Road
Hanwell
London W7

Brian Taylor
Tonbridge Area Library
Avebury Avenue
Tonbridge
Kent

Ray Skinner
62 Central Avenue
Billingham
Cleveland TS23 1LN

E N Ryan
15 Queens Square
Eastwood
Nottingham NG16 3BJ

Philip Joy
130 Rush Green Road
Romford
Essex

Derrick Daines
18 Cuttings Avenue
Sutton-in-Ashfield
Notts

Patrick Colley
52 Queensway
Caversham Park Village
Reading
Berks RG4 0SJ

J M A Kilburn
(Headmaster)
Shawfield Norden
Community Middle School
Shawfield Lane
Norden
Rochdale L12 7QR

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

B J Candy
9 Oakwood Drive
Gloucester GL3 3JF

Roger Shears
181 Woodmill Lane
Bitterne Park
Southampton SO2 4PY

Chris Woodford
31 Hopley Road
Anslow
Burton-on-Trent
Staffordshire

Peter Herring
Ordnance Road Library
Ordnance Road
Enfield
Middx

Mike Perry, Steve Collas or
Dave Lee
The Library
Ealing Road
Wembley
Middx HA0 4BR

Lyn Antill
1 Defoe House
Barbican
London EC2

Peter Jarvis
c/o Health Dept
Corporation of London
Guildhall
London EC2

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

Peter Stone or
Alan Strangman
Computing and Maths Dept
The Polytechnic
Wulfruna Street
Wolverhampton WV1 1LY

J G Batch
Central Library
Clapham Road
Lowestoft NR32 1DR

John Byfield
Moonrakers
The Rutts
Bushey Heath
Herts WD2 1LH

Robin Bradbeer
Polytechnic of
North London
Holloway Road
London N7

Derek Moody
2 Victoria Terrace
Dorchester
Dorset DT1 1LS

Pam Pollicott
South Ruislip Library
Victoria Road
South Ruislip
Middx

Rex Shipton
17 Woodlands Avenue
Eastcote
Middx

Susan Kelly
Head of Reference Services
PO Box 4
Civic Centre
Harrow
Middx

Andrew Holyer
10 Masons Road
Mannings Heath
Horsham
Sussex RH13 6JP

R L Saunders
14 St Nicholas Mount
Hemel Hempstead
Herts

Brigitte Gordon
18 Purbright Crescent
New Addington
Croydon CR0 0RT

Richard Powell
22 Downham Court
South Shields
Tyne & Wear

Peter Earthy
46 High Street
Church Stretton
Shropshire SY6 6BX

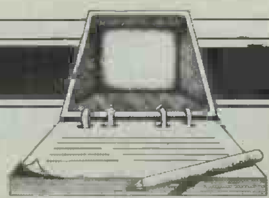
Alan Sutcliffe
4 Binfield Road
Wokingham
Berks RG11 1SL

Alan Porten
14 Foxmede
Rivenhall End
Witham
Essex

David Sharp
5 Bridgenhall Road
Enfield
Middx

Keith Taylor
Carter Hydraulic Works
Thornbury
Bradford BD3 8HG

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS



DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

London	(Cunard Int Hotel) Acorn User Exbn. Contact: Computer Market Place, 01-930 1612	25-28 Aug
Leeds	(Mercury Hotel) ZX Computer Fair. Contact: Computer Shows (Northern), (0532) 460644	28 Aug
Leeds	(Dragona Hotel) Computer Open Day Exbn. Contact: Couchmean Communications, 01-778 1102	1 Sept
London	(Heathrow Penta Hotel) Video Software Show. Contact: Link House Magazines, 01-686 2599	11-13 Sept
Surrey	(Sutton Library) Sutton Computer Fair. Contact: Peter Smithson, 01-661 5027	16-17 Sept
USA	Int Peripheral Equipment + Software Exbn. Contact: Cahners Exposition Group, (0483) 38085	20-22 Sept
London	(Barbican) Personal Computer World Show. Contact: Montbuild, 01-486 1951	29 Sept-20 Oct

PROGRAMS

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs to PCW please include the following:-
(a) A cassette or disk of the program
(b) A listing on plain, white paper (typewritten if no printer available).
(c) Comprehensive but brief documentation.
(d) A suitable sae if your would like your materials to be returned after use.

Please mark (a), (b) and (c) with your name, address, program title, machine (state minimum RAM where appropriate) and — if possible — a daytime phone number. All programs must, please, be fully debugged. Programs are paid for at the rate of £40 per page of published listing, plus a £100 bonus for the Program of the Month. Send contributions to: Surya, PCW Programs, 62 Oxford Street, London W1A 2HG.

I'll do my best to acknowledge receipt of programs as quickly as possible, but following this acknowledgement it will usually be some time before a decision can be made, so please be patient! Generally speaking, programs which are rejected for any reason are returned fairly quickly, so 'no news . . .'

You'll no doubt have noticed some strange-looking symbols alongside this month's Programs. Looking through some of the responses to the Reader Survey, it seems that most people are primarily interested in one class of program, be it games, utilities or whatever. With this is mind, we've decided to help you identify programs quickly using the following symbols:

- *Games*
- *Scientific/mathematic*
- *Business*
- *Educational/Computer Aided Learning*
- *Toolkit/utilities*

Of course, not all programs will fit into one of these categories, so these have not been given a symbol.

BBC Balloon

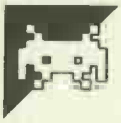
by A Roe

BBC 'Balloons', published in the June issue, will only run under the 0.1 OS in the form given. To enable it to run under the 1.0 and 1.2 OS, you should make the following amendments:-

```
390 MOVE480,448:PRINT"GAME OVER":TIME=0:REPEAT UNTIL TIME>=300
550 IFINKEY(-72)ANDINKEY(-25) SOUND1,-10,200,1:PROCballoon:XPOS%=XPOS%-32:YPOS%=YPOS%+32:GOTO640
560 IFINKEY(-72)ANDINKEY(-73) SOUND1,-10,200,1:PROCballoon:XPOS%=XPOS%-32:YPOS%=YPOS%-32:GOTO640
570 IFINKEY(-57)ANDINKEY(-73) SOUND1,-10,200,1:PROCballoon:XPOS%=XPOS%+32:YPOS%=YPOS%-32:GOTO640
580 IFINKEY(-57)ANDINKEY(-25) SOUND1,-10,200,1:PROCballoon:XPOS%=XPOS%+32:YPOS%=YPOS%+32:GOTO640
590 IFINKEY(-57)ANDXPOS%>=960ANDYPOS%<=224 GOTO640
600 IFINKEY(-25) SOUND1,-10,200,1:PROCballoon:YPOS%=YPOS%+32:GOTO640
610 IFINKEY(-73) SOUND1,-10,200,1:PROCballoon:YPOS%=YPOS%-32:GOTO640
620 IFINKEY(-57) SOUND1,-10,200,1:PROCballoon:XPOS%=XPOS%+32:GOTO640
630 IFINKEY(-72) SOUND1,-10,200,1:PROCballoon:XPOS%=XPOS%-32
```

PROGRAMS

```
 970 FORI%=1024TO32STEP-32

1020 MOVEX%,I%:PRINTSPC(SPACES%);:X%=X%+(SPACES%*32)

1040 MOVEX%,I%:PRINTSTRING$(CROSS%,'*');:X%=X%+(CROSS%*32)

1060 IFLIFE%<3 GCOLO,1:FORI%=1TO4-LIFE%:MOVE1088+(I%*32),192:PRINT;MINI$;:NEXT

1110 GCOLO,2:MOVE32,992:PRINT'BONUS':GCOLO,0:MOVE32,928:PRINTSTRING$(4,CHR$242):GCOLO,2:MOVE32,928:
PRINT;BONUS%

1120 GCOLO,1:MOVE1088,96:PRINT'START'

1130 GCOLO,0:MOVE1088+(LIFE%*32),192:PRINT;MINI$:GCOLO,2

1350 GCOLO,0:MOVE1120,192:PRINT;MINI$:GCOLO,2

1750 IFYPOS%>HIGHT% HIGHT%=YPOS%:SCORE%=SCORE%+(50*LEVEL%):IFFREEF%=1ANDSCORE%>=10000 LIFE%=LIFE%-1
:SOUNDO,1,0,75:MOVE1088+(LIFEX*32),192:PRINT;MINI$:FREEF%=0

1760 IFNSWINGS%>A GCOLO,0:MOVE32,928:PRINT;BONUS%:GCOLO,2:BONUS%=BONUS%-20:MOVE32,928:PRINT;BONUS%:
A=10:NSWINGS%=0
```



Atari No-Trons

by Martin Stiby

'No-Trons' is an arcade-type game for the Atari 400 with a games paddle (*NB*: paddle, not joystick). You have a gun at the bottom of the screen and a target at the top. You control the gun, using the paddle, and the computer controls the target. In between the two, a number of No-Trons glide happily across the screen from right to left. Your job is to blast the living daylights out of the lovable little creatures. If more than one No-Tron manages to reach the same point on the left-hand side of the screen, your score is displayed and the game restarts.

There are a number of skill levels available, selected by twiddling the paddle and then hitting the fire button at the beginning of the game. The higher the skill level, the faster the pace.

The number of POKES and data statements make the game all but impossible to modify for readers without a paddle. As our referee puts it: 'They will be really up the creek, as it were!' Thank you, Phil. Don't call us . . .

```
0 GOTO 1000
100 X=USR(1536):ON X-1536 GOTO 200,500,400
200 SOUND B,50,4,15:POKE 712,48:COLOR 1:M=PEEK(1789):N=PEEK(1791):PLOT M,79:DRAW
TO N,A:COLOR A:PLOT M,79
210 DRAWTO N,A:POKE 712,A:SOUND B,A,A,A:IF PEEK(53252)=A THEN  GOTO C
220 POKE 1787,A:M=PEEK(1785):POKE 1785,225:FOR P=14 TO A STEP -2:SOUND B,P,8,15-
P:POKE 704,P:POKE D,M-4
230 POKE 53256,B:FOR P1=B TO 30:NEXT P1:POKE D,M:POKE 53256,A:FOR P1=B TO 30:NEX
T P1
240 NEXT P:POKE 712,A:SOUND B,A,A,A:POKE D,225:POKE 53278,A:SC=SC+(175-M):GOTO C
400 POKE D,225:POKE 1787,A:POKE 1785,220:FOR P=5 TO 70 STEP 2:POKE 707,P:SOUND B
,P,12,15:SOUND 2,P-5,12,15
410 NEXT P:SOUND B,A,A,A:SOUND 2,A,A,A:POKE 707,182:M=PEEK(1741)+R1:FOR P=M TO M
+5:POKE P,A:NEXT P
420 POKE 53278,A:GOTO C
500 POKE D,225:POKE 1787,A:POKE 1785,220:POKE 53249,A:POKE 53250,A:POKE 53251,25
5:GRAPHICS 2:POKE 710,18
510 POKE 756,226:POKE 708,A:POKE 709,88
520 PRINT #6;"__"
530 PRINT #6;"| \|  /\ /\/\ |"
540 PRINT #6;"|_/|  |_|| | ||"
550 PRINT #6;"| \|  r-| | ||"
560 PRINT #6;"| /|_| || | |"
570 PRINT #6;"—  —"
580 FOR P=82 TO 94:POKE 709,P:POKE 712,P-2:POKE 708,P-2:SOUND A,P-82,8,P-79:NEXT
 P
590 FOR P=94 TO  82 STEP -B:POKE 709,P:POKE 712,P-2:POKE 708,P-2:SOUND A,P-82,8,
P-79:NEXT P:POKE 708,A
600 POKE 709,90:POKE 712,A:SOUND A,A,A,A:PRINT " IN LEVEL ";Z;" YOUR SCORE WAS "
;SC:PRINT:GOTO 2900
1000 R=PEEK(106)-32:POKE 54279,R:POKE 53277,2:POKE 708,110:GRAPHICS 0:POKE 710,1
8:R=R*256:R1=R+910
1500 FOR P=R+516 TO R+891:POKE P,0:NEXT P:FOR P=1 TO 6:READ P1:POKE R+742-2,P1:P
OKE R+777+P,P1:NEXT P:POKE 1790,99
1510 DATA 127,127,42,42,20,20
1520 POKE 705,120:POKE 706,90:POKE 704,8:POKE 53278,0:POKE 1785,225:POKE 707,182
:R=R/256+2:A=0:B=1:C=1000
1530 D=53248
1600 FOR P=1536 TO 1783:READ P1:POKE P,P1:NEXT P:FOR P=B TO 7:READ P1:POKE P1,R:
NEXT P
```

MICROMART

MICROMART

PROGRAMS

```
1610 DATA 104,173,112,2,24,106,56,141,255,6,169,175,237,255,6,141,2,208,238,252,
6,173,252,6,56,233,120,208,42
1620 DATA 169,0,141,252,6,169,1,24,109,254,6,141,254,6,141,1,208,56,233,175,240,
15,173,254,6,56,233,61
1630 DATA 208,12,169,1,141,35,6,208,5,169,255,141,35,6,169,4,45,120,2,208,34,173
,251,6,56,233,5,240,26,238,251,6
1635 DATA 169,131,56,237,255,6,141,255,6,169,1,133,212,173,254,6
1640 DATA 56,233,44,141,253,6,96,238,250,6,173,250,6,56,233,255,208,122,169,0,14
1,250,6,206,249,6,173,249,6
1650 DATA 56,233,40,208,5,169,2,133,212,96,169,8,56,237,12,208,208,5,169,3,133,2
12,96,173,249,6,141,0,208
1660 DATA 173,10,210,201,200,144,16,238,205,6,169,77,56,237,205,6,208,23,206,205
,6,208,18,201,55,176,14
1670 DATA 206,205,6,169,0,56,237,205,6,208,3,238,205,6,162,30,169,24,157,15,34,1
57,19,34,169,60,157,16,34
1680 DATA 157,18,34,169,255,157,17,34,169,0,157,14,34,157,20,34,138,109,249,6,14
1,192,2,141,0,210,76,1,6
1690 DATA 1746,1749,1754,1757,1762,1767,1770
2000 PRINT "●●●●●●●●●●●●●● NO-TRONS ●●●●●●●●●●●●●"
2020 PRINT "●●●●●●●●●●● by Martin Stiby ●●●●●●●●●●●"
2040 PRINT "          You are working  in an atomic-"
2050 PRINT  "physics laboratory, studying a new and"
2060 PRINT "dangerous form of anti-matter, called"
2070 PRINT "no-trons. Suddenly the machine"
2080 PRINT "holding the no-trons malfunctions. If"
2090 PRINT "any escape to the outside, the lab"
2100 PRINT "will be annihilated."
2110 PRINT " There is a Green-screen set up, which"
2120 PRINT "will stop a no-tron, but only once in"
2130 PRINT "the same place. As well as this there"
2140 PRINT "is a semi-automatic pro-tron ray gun."
2150 PRINT "The gun consists of two guiding-bases"
2170 PRINT "The bottom  one is moved by the lab"
2180 PRINT "computer, while the top one, you move."
2190 PRINT "When the trigger is pressed, the ray"
2200 PRINT "will fire between these two points ;"
2210 PRINT "neutralising any no-tron in its way."
2220 PRINT " Only five shots at each no-tron are"
2230 PRINT "available. The later the no-tron is"
2240 PRINT "hit, the more points you get. Use the"
2250 PRINT "paddle to change levels :"
2900 POKE 752,B:PRINT "(Press trigger to start)  LEVEL :     ";
2920 IF PTRIG(A)=A THEN 2920
2930 Z=INT(PADDLE(A)/22.9): PRINT "←";Z;:IF PTRIG(A)=B THEN 2930
2940 POKE 1562,150-Z*10:POKE 1656,255-Z*20.5:GRAPHICS 23:POKE 708,110:POKE 559,4
2
2950 SOUND A,A,A,A:POKE 53761,134:FOR P=9092 TO 9211:POKE P,255:NEXT P:POKE 5325
1,50:POKE 53278,A:SC=A:GOTO C
```

Spectrum Almanac

by Stephen Jack

'Almanac' is an astronomical program for the ZX Spectrum. The listing below just fits into the 16k machine.

For any date between 1980 and 2000, the program will calculate the time of sunrise and sunset (in both Local and Greenwich Mean Time), together with the sun's longitude, right ascension (RA) and declination. The program aims at an accuracy of +/– 10 (temporal) minutes; our referee checked this with the Meteorological Office in Birmingham and the dates he checked seemed to be within this limit.

Thanks to Mike Bedford-White for his modifications to the input and print routines.

```
Data for the date of 19 5 1983

Sun's longitude        57.4775 deg
Sun's mean R.A.        3.7141 hrs
Sun's mean DEC.        19.709 deg
Sunrise local time     4.1195 hrs
Sunset local time      19.7753 hrs
Time of sunrise GMT    3.9862 hrs
Time of sunset GMT     19.6419 hrs

  10 DEF FN f(f)=(INT (f*10000))
/10000
  20 CLEAR
  30 POKE 23609,15
  40 REM INTRODUCTION
  50 LET M8=1.0168601
  60 LET RAD=PI/180
  70 LET DEG=180/PI
  80 LET E=.016718
  90 LET X=.835608
 100 LET CON1=.0657098
 110 LET CON2=.99727
 120 CLS
 130 PRINT ''
 140 PRINT "This program will ca
lculate for"
 150 PRINT '"you the time of sun
rise and"
 160 PRINT '"sunset anywhere in
the world"
 170 PRINT '"after you give the
computer"
 180 PRINT '"some simple informa
tion."
 190 PRINT
 200 PRINT "After an input pleas
e press the"
 210 PRINT 'TAB 5; FLASH 1;"ENTE
R"; FLASH 0;" key."
 220 PRINT ''"To carry on please
press ENTER"
 230 PRINT '"To leave the progra
m press the"
 240 PRINT "  SPACE bar."
 250 BEEP .25,20
 260 LET ANS=CODE INKEY$
 270 IF ANS=13 THEN GO TO 300
 280 IF ANS=32 THEN GO TO 2560
 290 GO TO 260
 300 CLS
 310 REM USER INPUT
 320 PRINT ''
 330 INPUT "Please give the year
you want to"'"start with.It mus
```

PROGRAMS

```
t be between"'"1980 & 2000 A.D.
";YEAR
 370 IF YEAR>2000 THEN GO TO 400
 380 IF YEAR<1980 THEN GO TO 420
 390 GO TO 450
 400 PRINT '"The year you gave i
s too big."
 410 GO TO 430
 420 PRINT '"The year you gave i
s too small."
 430 PRINT "Please try again."
 440 GO TO 320
 450 LET Y=YEAR
 460 GO SUB (Y-1980)*10+1170
 470 INPUT "Please type in the m
onth you"'"wish e.g. for April e
nter 4. ";MONTH
 500 LET MONTH=INT MONTH
 510 IF MONTH<1 THEN GO TO 540
 520 IF MONTH>12 THEN GO TO 540
 530 GO TO 570
 540 PRINT '"The month you have
tyned in is"
 550 PRINT '"incorrect.Please tr
y again."
 560 GO TO 470
 570 INPUT "Please give the date
you wish."'DATE
 590 IF DATE<1 THEN GO TO 620
 600 IF DATE>31 THEN GO TO 640
 610 GO TO 670
 620 PRINT '"The date you gave i
s too small."
 630 TO 650
 640 PRINT '"The date you gave i
s too large."
 650 PRINT '"Please try again."
 660 GO TO 570
 670 REM TO CALCULATE NO OF DAYS
 SINCE JANUARY 0.0 OF YEAR IN QU
ESTION
 680 LET YEAR1=YEAR/4
 690 LET YEAR2=INT YEAR1
 700 LET YEAR3=YEAR1-YEAR2
 710 IF YEAR3=0 THEN GO TO 740
 720 LET YEAR4=63
 730 GO TO 750
 740 LET YEAR4=62
 750 IF MONTH>2 THEN GO TO 790
 760 LET P1=(MONTH-1)*YEAR4/2
 770 LET P2=INT P1
 780 GO TO 860
 790 LET P3=MONTH+1
 800 LET P4=P3*30.6001
 810 LET P5=INT P4
 820 LET P6=P5-YEAR4
 830 LET P2=P6
 840 REM MORE USER INPUT
 850 INPUT "Please give your'e l
atitude."'"Negative for South of
 the"'"Equator ",LAT
 880 IF LAT>90 THEN GO TO 910
 890 IF LAT<-90 THEN GO TO 930
 900 GO TO 960
 910 PRINT '"Your latitide is to
o large."
 920 GO TO 940
 930 PRINT '"Your latitude is to
o small."
 940 PRINT '"Please try again."
 950 GO TO 850
 960 INPUT "Please give longitud
e."'"Negative for East of Greenw
ich. ";LONG
 990 IF LONG>180 THEN GO TO 1020
1000 IF LONG<-100 THEN GO TO 104
0
1010 GO TO 1070
1020 PRINT '"Your longitude is t
oo large."
1030 GO TO 1050
1040 PRINT '"Your longitude is t
oo small."
1050 PRINT '"Please have another
 go."
1060 GO TO 950
1070 REM END OF USER INPUT
1080 LET P7=P2+DATE
1090 LET D1=P7+Y5: REM NO OF DAY
S SINCE EPOCH IE JAN 0.0 1980
1100 LET N=360/365.2422*D1
1110 IF N>360 THEN LET N=N-360
1120 IF N>360 THEN GO TO 1110
1130 LET M=N+278.83354-282.59640
3
1140 IF M<0 THEN LET M=M+360
1150 REM ROUTINE TO SOLVE KEPLER
'S EQN.
1160 LET M1=RAD*M
1170 LET E1=1E-6
1180 LET M2=M1
1190 LET M3=SIN M2
1200 LET M4=M2-(E*M3)-M1
1210 IF ABS M4<E1 THEN GO TO 127
0
1220 LET M5=COS M2.
1230 LET M6=M4/(1-E*M5)
1240 LET M2=M2-M6
1250 GO TO 1190
1260 REM END OF ROUTINE
1270 LET M9=M2/2: REM THIS IS E/
2
1280 LET E2=TAN M9
1290 LET E3=M8*E2
1300 LET E4=ATN E3
1310 LET E5=E4+E4: REM TRUE ANOM
ALY IN RADS
1320 LET E6=DEG*E5
1330 LET L=E6+282.596403
1340 IF L>360 THEN LET L=L-360
1350 IF L<0 THEN LET L=L+360
1360 REM L IS SUNS ECLIPTIC LONG
ITUDE
1370 CLS
1375 PRINT "Data for the date of
",date;" ";month;" ";year
1380 PRINT '"Sun's longitude ";
TAB 20;FN f(l);" deg"
1390 REM TO CALCULATE RIGHT ASCE
NTION&DECLINATION OF THE SUN
1400 GO SUB 2180
1410 LET L=L+.985647
1420 LET RA1=A4
1430 LET DEC1=L9
1440 GO SUB 2180
1450 LET RA2=A4
1460 LET DEC2=L9
1470 LET RA=RA1
1480 LET DEC=DEC1
1490 GO SUB 2450
1500 LET ST1r=LSTr
1510 LET ST1s=LSTs
1520 LET RA=RA2
1530 LET DEC=DEC2
1540 GO SUB 2450
1550 REM END OF ROUTINE
1560 REM ROUTINE TO CALCULATE TI
MES OF SUNRISE & SUNSET IN TERMS
 OF LOCAL & GREENWICH TIMES
1570 LET ST2r=LSTr
1580 LET ST2s=LSTs
1590 LET Tr=(24.07*ST1r)/(24.07+
ST1r-ST2r)
1600 LET Ts=(24.07*ST1s)/(24.07+
ST1s-ST2s)
1610 LET d=(DEC1+DEC2)/2
1620 LET PSI=ACS (SIN (RAD*LAT)/
(COS (RAD*d)))
1630 LET y=ASN (SIN (RAD*x)/SIN
PSI)
1640 LET Dt=240*y/COS (RAD*d)
1650 LET Dth=Dt/3600
1660 LET Tr=Tr-Dth
1670 LET Ts=Ts+Dth
1680 LET K=P7*CON1
1690 LET K1=K-P8
1700 IF K1<0 THEN LET K1=K1+24
1710 LET To=K1
1720 LET Tr=Tr-To
1730 IF Tr<0 THEN LET Tr=Tr+24
1740 LET Tr=Tr*CON2
1750 LET Ts=Ts-To
1760 IF Ts<0 THEN LET Ts=Ts+24
1770 LET Ts=Ts*CON2
1780 LET XX=LONG/15
1790 PRINT '"Sun's mean R.A.";TA
B 20;FN f((RA1+RA2)/2);" hrs"
1800 PRINT '"Sun's mean DEC.";TA
B 20;FN f(d);" deg"
1810 PRINT '"Sunrise local time"
;TAB 20;FN f(Tr);" hrs"
1820 PRINT '"Sunset local time";
TAB 20;FN f(Ts);" hrs"
1830 LET Tr=Tr-XX
1840 LET Ts=Ts-XX
1850 PRINT '"Time of sunrise GMT"
;TAB 20;FN f(Tr);" hrs"
1860 PRINT '"Time of sunset GMT"
;TAB 20;FN f(Ts);" hrs"
1865 PRINT #0;"Press ""c"" To CO
PY to Printer"'"Any other Key to
carry on": PAUSE 0: IF INKEY$="c
" OR INKEY$="C" THEN COPY
1866 CLS
1870 PRINT #0;"press ""y"" To re
run the program"'"Any other Key
ends the program": PAUSE 0: IF I
NKEY$="y" OR INKEY$="Y" THEN GO
TO 120
1920 GO TO 2560
1930 PRINT '"You have made a mis
take in your"
1940 PRINT "typing. Please heve
another go."
1950 GO TO 1870
1960 REM DATA
1970 LET Y5=0: LET L2=23.4418841
8: LET P8=17.411472: RETURN
1980 LET Y5=366: LET L2=23.44175
377: LET P8=17.361677: RETURN
1990 LET Y5=731: LET L2=23.44162
372: LET P8=17.377592: RETURN
2000 LET Y5=1096: LET L2=23.4414
9367: LET P8=17.393506: RETURN
2010 LET Y5=1461: LET L2=23.4413
6362: LET P8=17.409421: RETURN
2020 LET Y5=1827: LET L2=23.4412
3321: LET P8=17.359625: RETURN
2030 LET Y5=2192: LET L2=23.4411
0316: LET P8=17.375539: RETURN
2040 LET Y5=2557: LET L2=23.4409
731: LET P8=17.391453: RETURN
2050 LET Y5=2922: LET L2=23.4408
4305: LET P8=17.407368: RETURN
2060 LET Y5=3288: LET L2=23.4407
1264: LET P8=17.357573: RETURN
2070 LET Y5=3653: LET L2=23.4405
8259: LET P8=17.373487: RETURN
2080 LET Y5=4018: LET L2=23.4404
5253: LET P8=17.389402: RETURN
2090 LET Y5=4383: LET L2=23.4403
2248: LET P8=17.405316: RETURN
2100 LET Y5=4749: LET L2=23.4401
9207: LET P8=17.255521: RETURN
2110 LET Y5=5114: LET L2=23.4400
6202: LET P8=17.371435: RETURN
2120 LET Y5=5479: LET L2=23.4399
3196: LET P8=17.387349: RETURN
2130 LET Y5=5845: LET L2=23.4398
0191: LET P8=17.403263: RETURN
2140 LET Y5=6210: LET L2=23.4396
715: LET P8=17.353486: RETURN
2150 LET Y5=6575: LET L2=23.4395
4145: LET P8=17.369382: RETURN
2160 LET Y5=6940: LET L2=23.4394
1139: LET P8=17.385279: RETURN
2170 LET Y5=7306: LET L2=23.4392
8134: LET P8=17.401211: RETURN
2180 LET L1=RAD*L
2190 LET L3=SIN (RAD*L2)*SIN L1
2200 LET L8=ASN L3: REM SUNS DEC
 IN RADS
2210 LET L9=DEG*L8
2220 LET A1=TAN L1
2230 LET A2=(COS (RAD*L2)*a1)
2240 LET R1=ATN A2
```

```
2250 LET R2=DEG*R1
2260 LET R3=L/90
2270 LET R=R2+360
2280 LET R4=INT R3
2290 LET R5=R/90
2300 LET R6=INT R5
2310 LET R7=R6-R4
2320 IF R7=0 THEN GO TO 2370
2330 IF R7=1 THEN GO TO 2380
2340 IF R7=2 THEN GO -TO 2390
2350 IF R7=3 THEN GO TO 2400
2360 IF R7=4 THEN GO TO 2410
2370 LET A3=R: GO TO 2420
2380 LET A3=R-90: GO TO 2420
2390 LET A3=R-180: GO TO 2420
2400 LET A3=R-270: GO TO 2420
2410 LET A3=R-360
2420 LET A4=A3/15
2430 IF A4>24 THEN LET A4=A4-24
2440 RETURN
2450 REM ROUTINE TO CALCULATE LO
CAL SIDERAL TIMES OF SUNRISE &SU
NSET
2460 LET H1=TAN (RAD*-LAT)*TAN (
RAD*DEC)
2470 LET H2=ACS H1
2480 LET H=DEG*H2/15
2490 LET LS1=24+RA-H
2500 IF LS1>24 THEN LET LS1=LS1-
24
2510 LET LSTr=LS1
2520 LET LS2=RA+H
2530 IF LS2>24 THEN LET LS2=LS2-
24
2540 LET LSTs=LS2
2550 RETURN
2560 CLS
2570 PRINT "To use this program
again type"
2580 PRINT "RUN and then press E
NTER key."
```

BBC Text Formatter

by Des Fisher

'Text Formatter' is a text justification and formatting program for the BBC Model B with a printer available. Nine commands offer a variety of facilities including full justification, automatic page numbering, centering, indentation and variable line-spacing.

Text is entered in the form of DATA statements in lines 2430 onwards. Justification and formatting commands are embedded in the data with the text. Since the program works by string manipulation and not by printer control codes, it should work with any printer.

The nine commands available are:-

.JUSTOFF — switches off justification (on by default)
.JUSTON — switches on justification
.CENTRE — centres next line
.INDENT — indents next line
.PARA — create new paragraph
.SKIPx — print x blank lines
.NEWPAGE — move to new page
.LSPCx — set line-spacing to x (1=normal, 2=double; 1 by default)
.END — 'end-of-file' marker

When printing, the display can be halted by a key depression regardless of the printer status. A second key press restarts the display. If you have indicated that you do not have a printer on-line, the display will automatically wait for a key press after each screen.

The procedure INIT in lines 610-780 defines the initial values of things like the page width, page length, margins and so on. These can be easily changed to suit your requirements.

The program is generally well-structured and extremely easy to read (and thus modify), since the author has made liberal use of REM statements.

The listing below includes some sample text (DATA statements in lines 2340 to 3450 inclusive). You could, of course, cut down the time needed to type in the program by leaving out these lines since you will need to delete them anyway, but they do give a nice demonstration of the program's output.

With a number of recursively defined procedures, the program is specific to the BBC machine. The structure of the program and plentiful comments, however, should help owners of other machines to translate it.

Although a useful program in its own right. 'Text Formatter' would really come into to its own as part of a fully-fledged word processor. Someone is in fact working on this as I write and the result will be included in *PCW* Programs shortly.

END

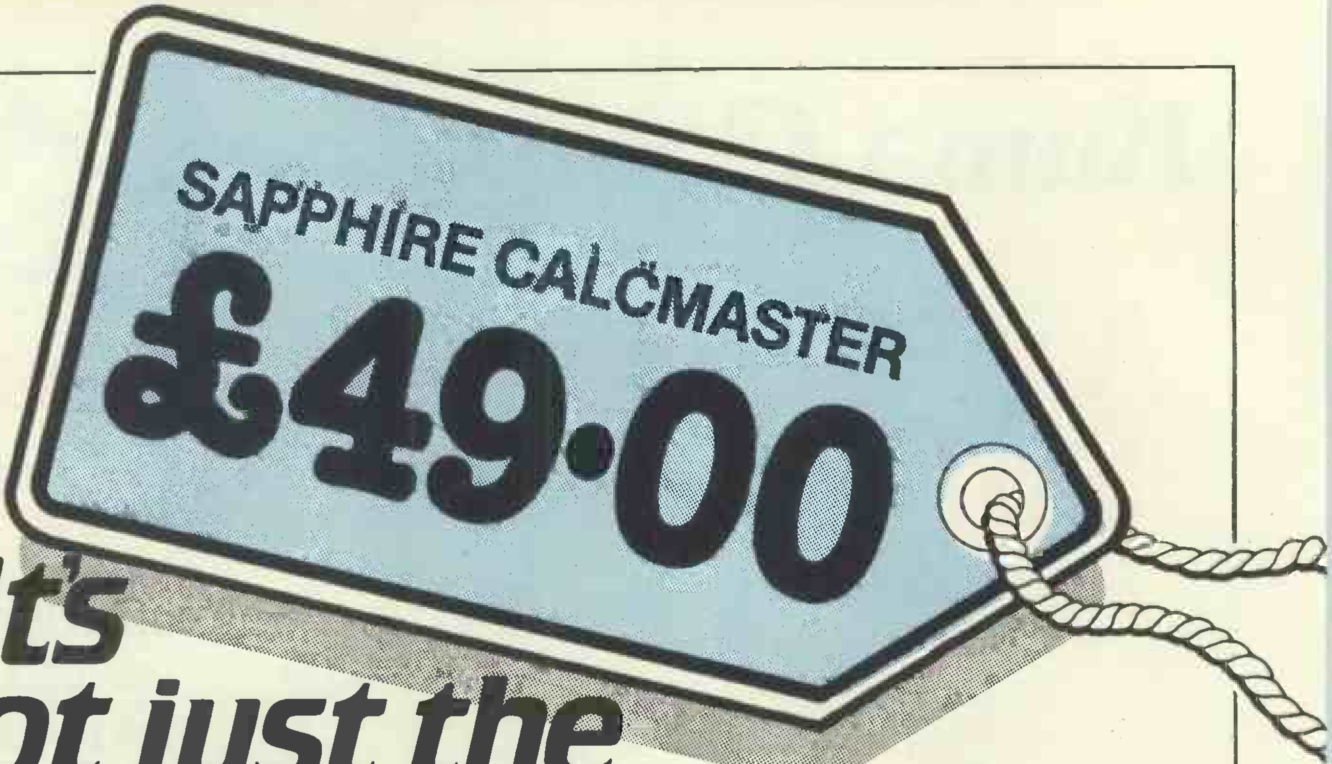
```
 10 REM WORD7              1983
 20 REM A simple word processor
 30 REM des fisher  Harlow(0279) 22450
 40
 50  MODE 7:PROCintro
 60
 70  cop%=0
 80  REPEAT
 90      cop%=cop%+1:PROCinit
100      REPEAT
110          REPEAT
120              line$=nx$:READ nx$
130              PROCsetiflg
140            UNTIL iflg=FALSE OR nx$=".END."
150          IF iflg=TRUE AND nx$=".END." THEN 290
160            REPEAT
```

PROGRAMS

```
170              IF store$<>"" THEN PROCstore
180              PROCinc:A=LEN(line$)
190              IF A<=L% AND just=FALSE THEN 260
200                IF just=FALSE THEN PROCstop
210                PROCsflg:A=LEN(line$)
220                IF sflg=TRUE AND A<L% THEN 260
230                  PROCjust
240                  IF LEN(line$)=L% THEN 260
250                    store$=line$:GOTO 270
260              PROCprint
270              PROCstoreproc:A=LEN(store$)
280            UNTIL A=0 OR A<=L% AND sflg=FALSE
290      UNTIL nx$=".END."
300    IF printer=FALSE THEN A=INKEY(3E3)
310    IF J%=pl% THEN 330
320      REPEAT:PRINT:J%=J%+1:UNTIL J%=pl%
330    RESTORE
340  UNTIL cop%=copies
350 VDU 3
360 END
370
380
390 REM ** PROCEDURES **
400 REM  intro,init,setiflg(skip,newpage),
410 REM  store,inc(stop),skip(page),sflg,
420 REM  just(up,dwn),up,dwn,print(page),storeproc,
430 REM  stop,newpage(page),page,linemin.
440
450  DEF PROCintro
460   printer=FALSE:copies=1
470   PRINT''"DO NOT SELECT PRINTER IF NOT CONNECTED"
480   INPUT"PRINTER ON  (Y/N)",A$:A$=LEFT$(A$,1)
490   IF A$<>"Y" AND A$<>"y" THEN 560
500     printer=TRUE
510     INPUT"HOW MANY COPIES",copies
520     IF copies=0 THEN copies=1
530     IF copies<10 THEN 560
540       INPUT"ARE YOU SURE  (Y/N)",A$:A$=LEFT$(A$,1)
550     IF A$<>"Y" AND A$<>"y" THEN 510
560   CLS
570   IF printer=TRUE THEN VDU 2:REM Printer on
580  ENDPROC
590
600
610  DEF PROCinit
620   pw%=40:REM pagewidth
630   pl%=25:REM pagelength
640   pskip%=3:REM No of lines skipped at page bottom
650   lm%=1:REM lefthand margin
660   rm%=1:REM righthand margin
670   I%=3:REM No of spaces indented
680   P%=1:REM starting page no
690   lspc%=1:REM start line spacing
700   J0%=2:J%=J0%:REM start line no
710   FOR I=1 TO J%:PRINT:NEXT
720   L%=pw%-lm%-rm%:REM line length
730   M%=pl%-pskip%:REM No of lines/page
740   store$="":line$=""
750   just=TRUE:updwn=TRUE
760   centre=FALSE:iflg=FALSE:indent=FALSE:npg=FALSE:sflg=FALSE:skip=FALSE
770   READ nx$
780  ENDPROC
790
800
810  DEF PROCsetiflg:REM  (skip,newpage)
820   IF LEN(line$)>9 THEN 1040
830    IF LEFT$(line$,1)<>"." THEN 1040
840     iflg=TRUE
850     A$=LEFT$(line$,5):A=LEN(line$)-6
860     IF A$<>".LSPC" THEN 910
870       lspc%=VAL(MID$(line$,6,A))
880       IF lspc%=1 OR J%=2 THEN 900
890         PROCskip(lspc%-1)
900       ENDPROC
910     IF line$<>".PARA." THEN 950
920       indent=TRUE
930       IF (M%-J%)<1+lspc% THEN PROCnewpage
940       ENDPROC
950     IF A$<>".SKIP" THEN 990
960       skip%=VAL(MID$(line$,6,A))
970       PROCskip(skip%)
980       ENDPROC
990     IF line$=".JUSTOFF." THEN just=FALSE:ENDPROC
1000     IF line$=".JUSTON." THEN just=TRUE:ENDPROC
1010      IF line$=".INDENT." THEN indent=TRUE:ENDPROC
1020       IF line$=".CENTRE." THEN centre=TRUE:ENDPROC
1030        IF line$=".NEWPAGE." THEN PROCnewpage:ENDPROC
1040          iflg=FALSE
1050 ENDPROC
1060
1070
1080 DEF PROCstore
1090  line$=store$+" "+line$:store$=""
1100 ENDPROC
1110
```

PROGRAMS

```
1120
1130 DEF PROCinc:REM  (stop)
1140  IF indent=FALSE THEN 1160
1150    line$=STRING$(I%," ")+line$
1160  IF centre=FALSE THEN ENDPROC
1170    IF LEN(line$)>L% THEN PROCstop
1180    A=(L%-LEN(line$))/2
1190    line$=STRING$(A," ")+line$
1200 ENDPROC
1210
1220
1230 DEF PROCskip(X):REM  (page)
1240  FOR K%=1 TO X:PRINT:PROCpage(1):NEXT
1250 ENDPROC
1260
1270
1280 DEF PROCsflg
1290  sflg=FALSE:A$=LEFT$(nx$,5)
1300  IF nx$=".INDENT." THEN sflg=TRUE
1310  IF nx$=".END." THEN sflg=TRUE
1320  IF nx$=".JUSTOFF."THEN sflg=TRUE
1330  IF nx$=".CENTRE." THEN sflg=TRUE
1340  IF nx$=".PARA." THEN sflg=TRUE
1350  IF nx$=".NEWPAGE."THEN sflg=TRUE
1360  IF centre=TRUE THEN sflg=TRUE
1370  IF A$=".SKIP" THEN sflg=TRUE
1380  IF A$=".LSPC" THEN sflg=TRUE
1390 ENDPROC
1400
1410
1420 DEF PROCjust:REM  (up,dwn)
1430  IF LEN(line$)<=L% THEN ENDPROC
1440    K%=LEN(line$)
1450    REPEAT
1460        REPEAT:K%=K%-1:UNTIL MID$(line$,K%,1)=" "
1470      UNTIL LEN(LEFT$(line$,K%-1))<=L%
1480    store$=RIGHT$(line$,LEN(line$)-K%)
1490    line$=LEFT$(line$,K%-1)
1500    IF LEN(line$)=L% THEN ENDPROC
1510      updwn=NOT updwn
1520      IF updwn=TRUE THEN PROCup ELSE PROCdwn
1530 ENDPROC
1540
1550
1560 DEF PROCup
1570  REPEAT
1580      K%=I%:A%=LEN(line$)
1590      REPEAT
1600          REPEAT:K%=K%+1:UNTIL MID$(line$,K%,1)=" " OR K%=A%
1610          IF K%=A% THEN 1640
1620            line$=LEFT$(line$,K%)+" "+RIGHT$(line$,A%-K%)
1630            A%=LEN(line$):K%=K%+1
1640        UNTIL A%=L% OR K%>=A%
1650    UNTIL A%=L%
1660 ENDPROC
1670
1680
1690 DEF PROCdwn
1700  REPEAT
1710      K%=LEN(line$)+1
1720      REPEAT
1730          K%=K%-1
1740          REPEAT:K%=K%-1:UNTIL MID$(line$,K%,1)=" " OR K%=I%+1
1750          IF K%<>I%+1 THEN line$=LEFT$(line$,K%)+" "+RIGHT$(line$,LEN(line
$)-K%)
1760          A%=LEN(line$)
1770        UNTIL A%=L% OR K%<=I%+1
1780    UNTIL  A%=L%
1790 ENDPROC
1800
1810
1820 DEF PROCprint:REM  (page)
1830  A=INKEY(2)
1840  IF A<>-1 THEN VDU 7:A=INKEY(3E3)
1850  PRINT;SPC(lm%);line$
1860  line$=""
1870  IF lspc%=1 THEN 1910
1880    FOR K%=1 TO lspc%-1
1890        PRINT
1900      NEXT
1910  PROCpage(lspc%)
1920 ENDPROC
1930
1940
1950 DEF PROCstoreproc
1960  indent=FALSE:centre=FALSE
1970  A=LEN(store$)
1980  IF A=0 THEN ENDPROC
1990    A$=RIGHT$(store$,1)
2000    IF A$<>" " THEN ENDPROC
2010      REPEAT
2020          store$=LEFT$(store$,A-1)
2030          A=LEN(store$)
2040        UNTIL RIGHT$(store$,A)<>" "
2050 ENDPROC
```



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PROGRAMS

```
2060
2070
2080  DEF PROCstop
2090   PRINT line$:PRINT"xxLINE TOO LONGxx"
2100   STOP:REM xxxxxxxxxxxxxxxxxxxxxx
2110  ENDPROC
2120
2130
2140  DEF PROCnewpage:REM  (page)
2150   IF J%=M% THEN ENDPROC
2160     pstore%=P%
2170     REPEAT
2180         PRINT:PROCpage(1)
2190       UNTIL P%>pstore%
2200  ENDPROC
2210
2220
2230  DEF PROCpage(X%)
2240   J%=J%+X%
2250   IF J%<M% THEN ENDPROC
2260    IF iflg=FALSE AND nx$=".END." THEN ENDPROC
2270      P%=P%+1
2280      IF printer=FALSE THEN A=INKEY(3E3)
2290      REPEAT
2300          PRINT:J%=J%+1
2310        UNTIL J%=pl%
2320      PRINT TAB(pw%-7);"page ";P%
2330      FOR I=1 TO J0%-1:PRINT:NEXT
2340      J%=J0%
2350  ENDPROC
2360
2370
2380
2390 REM xxxxxxxxxxxxxxxx
2400 REM xxxxx DATA xxxxx
2410 REM xxxxxxxxxxxxxxxx
2420
2430 DATA".SKIP8.",".CENTRE."
2440 DATA"WORD7- A SIMPLE WORD PROCESSOR"
2450 DATA".CENTRE.",".SKIP1."
2460 DATA"des fisher   1983"
2470 DATA".SKIP6."
2480 DATA"Press any key to continue."
2490-DATA".NEWPAGE.",".PARA."
2500 DATA"Text entered as DATA"
2510 DATA"statements at the end of this programme is"
2520 DATA"displayed in a format determined by certain KEYWORDS."
2530 DATA".SKIP1.",".PARA."
2540 DATA"These KEYWORDS are also entered as DATA statements."
2550 DATA"They are listed on the next page."
2560 DATA".NEWPAGE.",".JUSTOFF."
2570 DATA"The KEYWORDS are:"
2580 DATA".LSPC2."
2590 DATA"  .JUSTOFF. Turns justification off"
2600 DATA"  .JUSTON.  Turns justification on"
2610 DATA"  .CENTRE.  Centres next line"
2620 DATA"  .INDENT.  Indents next line"
2630 DATA"  .PARA.    Creates new paragraph"
2640 DATA"  .SKIPx.   Skips x lines"
2650 DATA"  .NEWPAGE. Moves to a newpage"
2660 DATA"  .LSPCx.   Sets linespacing to x"
2670 DATA"  .END.     Marks end of file"
2680 DATA".JUSTON.",".LSPC1.",".PARA."
2690 DATA"Justification is when the text is set out so the left and right hand"
2700 DATA"margins are straight lines. This text is justified."
2710 DATA".PARA."
2720 DATA".JUSTON. turns the justification on. It is on when you start."
2730 DATA".PARA."
2740 DATA"Things look weird ifaveryveryverylongword occurs"
2750 DATA"with a short line length."
2760 DATA".PARA."
2770 DATA"Line length is determined by page width, and margin widths."
2780 DATA"These may be set in PROCinit."
2790 DATA".PARA."
2800 DATA"They, along with page length and the number of lines skipped at the"
2810 DATA"bottom of a page, will have to be tinkered with to make the"
2820 DATA"text look right on a printer or in a differant mode."
2830 DATA".NEWPAGE.",".PARA."
2840 DATA".JUSTOFF. will turn the"
2850 DATA"justification off for tables and such like, for example."
2860 DATA".JUSTOFF.",".LSPC1.",".SKIP1."
2870 DATA"hhhhhhh   hhhhhhh    iiiiiii"
2880 DATA" hhhhh     hhhhh      iiiii"
2890 DATA"  hhh       hhh        iii"
2900 DATA"  hhh       hhh        iii"
2910 DATA"  hhh       hhh        iii"
2920 DATA"  hhh       hhh        iii"
2930 DATA"  hhh       hhh        iii"
2940 DATA"  hhhhhhhhhhhhh        iii"
2950 DATA"  hhhhhhhhhhhhh        iii"
2960 DATA"  hhh       hhh        iii"
2970 DATA"  hhh       hhh        iii"
2980 DATA"  hhh       hhh        iii"
2990 DATA"  hhh       hhh        iii"
3000 DATA"  hhh       hhh        iii"
```

MICROMART

PROGRAMS

```
3010 DATA" hhhhh     hhhhh       iiiii"
3020 DATA"hhhhhhh   hhhhhhh    iiiiiii"
3030 DATA".JUSTON."
3040 DATA".CENTRE. centres the next line."
3050 DATA".CENTRE.",".SKIP1."
3060 DATA"A CENTRED HEADING"
3070 DATA".SKIP1."
3080 DATA"If the line to be centred is longer than the line width"
3090 DATA"you will get the error message:"
3100 DATA".SKIP1.",".CENTRE."
3110 DATA"**LINE TOO LONG**"
3120 DATA".SKIP1."
3130 DATA"and the programme will stop. This will also occur if the"
3140 DATA"unjustified line you ask to be printed is too long."
3150 DATA".SKIP1.",".INDENT."
3160 DATA".INDENT. will indent the next line by three spaces."
3170 DATA"The number of spaces is set by the variable I% in PROCinit."
3180 DATA".PARA."
3190 DATA".PARA. also indents the next paragraph but checks to see if"
3200 DATA"there is room to print two lines. If not it moves to"
3210 DATA"a newpage before starting the new paragraph."
3220 DATA".SKIP2.",".PARA."
3230 DATA".SKIPx. will skip x lines, eg .SKIP3."
3240 DATA".SKIP3."
3250 DATA"If necessary .SKIPx. will create a newpage and continue, eg .SKIP14."
3260 DATA".SKIP14."
3270 DATA".NEWPAGE. will force a newpage like this!"
3280 DATA".NEWPAGE."
3290 DATA".LSPCx. will change the line spacing to x. This paragraph"
3300 DATA"is single spaced but the next is double spaced."
3310 DATA".PARA.",".LSPC2."
3320 DATA"The command .END. is needed at the end of your data"
3330 DATA"to prevent error messages appearing on the print out."
3340 DATA".LSPC1.",".PARA."
3350 DATA"The programme only waits"
3360 DATA"at the bottom of a page if the printer has NOT been selected."
3370 DATA".PARA."
3380 DATA"The display can be halted at any point, regardless"
3390 DATA"of printer status, by pressing any key."
3400 DATA"Any key will also restart the display."
3410 DATA".PARA."
3420 DATA"Now you know all about it howsabout something sizzling like:"
3430 DATA".JUSTOFF."
3440 DATA"      'As he ripped the thin silk from"
3450 DATA".END."
```

TRS-80 Genie Multi-Maths

by Barrie Snell

'Multi-Maths' is a menu-driven mathematical calculation program for the 16k TRS-80 and Video Genie.

The program is intended to be of use to anyone needing to carry out a significant number of assorted calculations. Although it doesn't do anything that couldn't be done on a programmable calculator, it has the advantage of holding thirteen routines on memory as well as offering annotated input and output, of course. As well as being a useful program to the more mathematically-inclined, some of the routines will doubtless come in handy for inclusion in other programs.

The thirteen options offered by 'Multi-Maths' are:-

A .... Circle finder
B .... Combinations
C .... Factorials
D .... Logarithms
E .... Least squares curve fitting
F .... Permutations
G .... Pythagorean triplets
H .... Polynomial evaluation
I .... Quadratic equations
J .... Rational fractions
K .... Statistics
L .... Simultaneous linear equations
M Spearman's coefficient of rank correlation

Most of the above should be self-explanatory, but to briefly run through them . . .

*Circle finder requests coordinates of three points. It then calculates the radius and centre of the circle passing through them (assuming the points do not lie on a straight line).

*Combinations calculates the number of possible combinations of n objects taken in groups of r. The largest number of objects the routine can handle is 33.

*Factorials calculates the factorial of any given positive integer. The routine is fairly fast, taking about fifteen seconds to find the factorial of 1000 (compare that with the speed of a scientific calculator!). For values up to 3199, the routine tells you roughly how long you'll have to wait; for values larger than this, it tells you to 'prepare for a long wait.'

*Logarithms calculates, as you'd expect, the logarithm of any positive number to any given (positive) base.

*Least squares curve fitting fits an equation of degree 1, 2, 3, 4, 5 or 6. You can enter up to 50 coordinates in the form 'x,y'. The routine will request the degree of polynomial — 1 fits a straight line, and, generally, the higher the order of polynomial the better the fit (assuming a straight line fit isn't appropriate). Higher orders of equation, of course, require more data than lower orders.

*Permutations calculates the number of permutations of n objects taken in groups of r. As for combinations, the maximum number of objects is 33.

*Pythagorean triplets calculates all possible whole number values of primitive pythagorean triangles, giving the two sides and hypotenuse. 'Primitive' means that having found 3-4-5, the routine doesn't waste time looking for multiples like 6-8-10, 30-40-50 and so on.

*Polynomial evaluation calculates the value of any given polynomial with the constant term, variable × and coefficient of × being entered by the user.

*Quadratic equations calculates the real or complex roots of X1 and X2 when given the coefficient of the X squared term, coeficient of X term and the constant.

*Statistics requests a set of numeric data which it sorts into ascending order. It then calculates the arithmetic and geometric means, the median, sum of values, minimum and maximum, range, mid-range, variance and standard deviation.

*Spearman's coefficient of rank correlation attempts to find correlations between two given sets of data. This is a standard technique used to test the validity of data.

It's a great pity that 'Multi-Maths' wasn't written in modular form. Admittedly, TRS-80 Basic doesn't exactly go out of its way to encourage structured programming, but a modular structure would have made it easy for readers to borrow routines for inclusion in their own programs. As it is, the program tends to jump about a little. Still, I have no doubt that both the program as a whole and a number of the routines in it will prove useful. In order to save memory for data entry, the program is highly-compressed and has no REM statements, so care should be taken when typing it in.

```
4 CLS:PRINT"                DO YOU WANT :-";:PRINT"
 A .. CIRCLE FINDER
 B .. COMBINATIONS
 C .. FACTORIALS
 D .. LOGARITHMS TO ANY BASE
 E .. LEAST SQUARES CURVE FITTING
 F .. PERMUTATIONS
 G .. PYTHAGOREAN TRIPLETS
 H .. POLYNOMIAL EVALUATION";
6 PRINT"
 I .. QUADRATIC EQUATIONS
 J .. RATIONAL FRACTIONS
 K .. STATISTICS
 L .. SIMULTANEOUS LINEAR EQUATIONS
 M .. SPEARMAN'S COEFFICIENT OF RANK CORRELATION":PRINT:PRINT"       TYPE A LETT
ER FROM A TO M";
8 A$=INKEY$:IFA$<"A"ORA$>"M",8 ELSE ON ASC(A$)-64 GOTO
   34,90,64,76,156,92,18,50,116,10,202,128,226
10 CLS:CLEAR:PRINT"RATIONAL FRACTIONS":PRINTSTRING$(18,45):
  PRINT"
  GIVES  FRACTIONAL APPROXIMATIONS OF A DECIMAL NUMBER":PRINT:
  INPUT"INPUT THE NUMBER  ";A:B=A:D=1:E=1:FORG=1TO11:K=INT(A):
  J=D:D=K*D+C:C=J:J=F:F=K*F+E:E=J
12 IFA=KORB=D/FTHENPRINT:PRINTD"/"F;:GOTO14ELSEA=1/(A-K):NEXTG:
  PRINT:PRINTD"/"F:GOTO16
14 PRINT"   EXACT TO THE LIMITS OF THE COMPUTER"
16 PRINT:GOSUB222:IFX=1,4ELSE10
18 CLS:CLEAR:DEFINTA-Z:PRINT"PYTHAGOREAN TRIPLETS":
  PRINTSTRING$(20,45):PRINT"
 THIS WILL DISPLAY ALL WHOLE NUMBER VALUES FOR THE TWO SIDES ANDTHE HYPOTENUSE O
F RIGHT-ANGLED TRIANGLES.

  THEY ARE CALLED 'PRIMITIVE' BECAUSE NONE IS A MULTIPLE OF";
20 PRINT"
 ANOTHER.
  FOR INSTANCE, THE WELL-KNOWN 3,4,5 TRIANGLE IS
CALCULATED, BUT THE PROGRAM DOESN'T WASTE TIME AND EFFORT IN
FINDING ONE WITH SIDES OF 6,8,10  OR  30,40,50 .":PRINT:PRINT"
          PRESS ANY KEY TO SET IT RUNNING.":A$=INKEY$
22 A$=INKEY$:IFA$="",22ELSECLS
24 B$="SIDE 1         SIDE 2         HYPOTENUSE      TRIPLET NO.
======        ======         ==========":D=2:K=1:E=0:F=1:PRINTB$
26 A=D*D-F*F:B=2*D*F:C=D*D+F*F:PRINT@112,K;:
  PRINT@(E+2)*64,A,B,C:K=K+1:E=E+1:IFE<10,30
```

MICROMART

PROGRAMS

```
  ELSEPRINT@832,"   PRESS  'E'  TO END  OR  'C'  TO CONTINUE"
28 A$=INKEY$:IFA$="E",4ELSEIFA$="C" CLS:PRINTB$:E=0ELSE28
30 F=F-2:IFF<=0 THEN D=D+1:F=D-1:GOTO26ELSEJ=F:H=D
32 N=INT(H/J);G=H-(J*N):
  IFG<>0 H=J:J=G:GOTO32ELSEIFJ<>1,30ELSE26
34 CLS:CLEAR100:PRINT"CIRCLE FINDER":
  PRINTSTRING$(13,45);:PRINT"
  YOU ENTER THE X AND Y CO-ORDINATES OF THREE POINTS WHICH DON'TALL LIE ON A STR
AIGHT LINE AND I WILL GIVE THE RADIUS AND THE
X AND Y CO-ORDINATES OF THE CIRCLE WHICH PASSES THROUGH THEM"
36 PRINT"
   SOMETIMES A DIVISION-BY-ZERO ERROR WILL OCCUR.
  WHEN THIS HAPPENS, SIMPLY CHANGE ONE OF THE VALUES OF THE X
  ORDINATES THAT ARE EQUAL, BY 0:00001 . "
38 PRINT"   IF A DIVISION-BY-ZERO ERROR STILL PERSISTS THEN THE
  THREE POINTS ALL LIE ON A STRAIGHT LINE."
40 A$="ENTER THE FIRST POINT ":B$="ENTER·THE SECOND POINT ":
  C$="ENTER THE THIRD POINT ":X$="X CO-ORDINATE  ";
  Y$="Y CO-ORDINATE  ":PRINT:PRINTA$;X$;:INPUTX1:PRINTA$;Y$;:
  INPUTY1:PRINT:PRINTB$;X$;:INPUTX2:PRINTB$;Y$;:INPUTY2:PRINT
42 PRINTC$;X$;:INPUTX3:PRINTC$;Y$;:INPUTY3:P=X2-X1:Q=X2+X1:
  R=Y2-Y1:S=Y2+Y1:T=X3-X1:U=X3+X1:V=Y3-Y1:W=Y3+Y1
44 A=(P*Q+R*S)/(2*P):B=(T*U+V*W)/(2*T):C=R/P:D=V/T:
  Y=(B-A)/(D-C):X=B-D*Y:R=SQR((X3-X)[2+(Y3-Y)[2):CLS
46 PRINT"THE CIRCLE WHICH PASSES THROUGH THE POINTS :-":PRINT:
  PRINT"X1 = ";X1,"Y1 = ";Y1:PRINT"X2 = ";X2,"Y2 = ";Y2:
  PRINT"X3 = ";X3,"Y3 = ";Y3:PRINT:PRINT"HAS A RADIUS OF "R:
  PRINT:PRINT"WITH ITS CENTRE LOCATED AT":
  PRINT"X = ";X,"Y = ";Y
48 GOSUB222:IFX=1,4ELSECLS:GOTO40
50 CLS:CLEAR100:PRINT"POLYNOMIAL EVALUATION":
  PRINTSTRING$(21,45)
52 PRINT@192,CHR$(30):
  PRINT@192,"ENTER THE HIGHEST POWER OF X IN YOUR EQUATION  ";:
  INPUTN:IFN<=0ORN<>INT(N)THENPRINT@320,"NOT A VALID ENTRY":
  GOTO52ELSEPRINT@320,CHR$(30);:DIMA(N+1):N=N+1
54 A$="ENTER COEFFICIENT OF X TO THE POWER ":J=N-1:FORI=1TON-1:
  PRINTA$;J;"  ";:INPUTA(I):J=J-1:NEXT:
  PRINT"ENTER THE VALUE OF THE CONSTANT TERM     ";:INPUTA(N)
56 PRINT:
  PRINT"WHAT IS THE VALUE OF X TO INSERT INTO THE EQUATION ";:
  INPUTX:C=A(1):FORI=2TON:C=C*X+A(I):NEXT:CLS:PRINT:
  PRINT"YOUR POLYNOMIAL HAS THE VALUE":PRINT:PRINTC:PRINT:
  PRINT"FOR X =  "X:PRINT
58 PRINT"
  WANT ANOTHER X WITH THE SAME POLYNOMIAL < 'Y' OR 'N' > ? "
60 A$=INKEY$:IFA$="",60ELSEIFA$="Y" CLS:GOTO56ELSEIFA$="N"       PRINT:PRINT"
WANT TO TRY A NEW POLYNOMIAL < 'Y' OR 'N' > ?":
  GOTO62ELSE60
62 A$=INKEY$:IFA$="N",4ELSEIFA$="Y",50ELSE62
64 CLS:CLEAR:PRINT"FACTORIALS":PRINTSTRING$(10,45)
66 PRINT@128,CHR$(30);:INPUT"ENTER THE NUMBER ";X:IFX<0THEN
  PRINT@256,"MUST BE POSITIVE";CHR$(30):GOTO66
  ELSEPRINT@256,CHR$(30):IFX<>INT(X)THEN
  PRINT@256,"YOU NEED EULER'S 'GAMMA' FUNCTION.  TRY AGAIN.":
  GOTO66ELSEPRINT@256,CHR$(30):B=1
68 Y=1E5:Z=1E-5:IFX=0ORX=1THENB=1:GOTO74ELSEIFX<500,72
  ELSEIFX<600 S=10 ELSEIFX<1000 S=15 ELSEIFX<1500 S=30
  ELSEIFX<3200 S=60 ELSE PRINT"PREPARE FOR A LONG WAIT":GOTO72
70 PRINT@256,"WAIT FOR ABOUT"S"SECONDS"
72 FORC=2TOX:B=B*C:IFB<YTHENNEXTC:GOTO74ELSEB=B*Z:A=A+5:NEXTC
74 PRINT@256,CHR$(30);:PRINT:PRINT" "X"FACTORIAL =":PRINT:
  PRINTB"TIMES 10 TO THE POWER"A:GOSUB222:IFX=1,4ELSE64
76 CLS:CLEAR:PRINT"LOGARITHMS TO ANY BASE":PRINTSTRING$(22,45)
78 PRINT@192,CHR$(30);:PRINT@192,"INPUT THE NUMBER ";:INPUTN:
  IFN<=0THENPRINT@320,"  MUST BE POSITIVE":GOTO78
80 PRINT@320,CHR$(30);:PRINT@320,"ENTER THE BASE   ";:INPUTB:
  IF B<=0THENPRINT@448,"  MUST BE POSITIVE":GOTO80ELSE
  IF B=1THENPRINT@448,"  THE RESULT IS INFINITY":GOTO88
82 L=LOG(N)/LOG(B):PRINT@448,CHR$(30);:
  PRINT@448,"THE LOGARITHM OF"N" TO THE BASE"B" = "L:PRINT:
  PRINT"IN OTHER WORDS":PRINT
84 IF L<0 THEN F$="1 /":L=ABS(L) ELSE F$=""
86 PRINTF$;B"RAISED TO THE POWER "L" = "N
88 GOSUB222:IFX=1,4ELSE76
90 CLS:CLEAR100:PRINT"COMBINATIONS ";:XX=1:GOTO94
92 CLS:CLEAR100:PRINT"PERMUTATIONS ";:XX=2
94 PRINT"OF 'N' OBJECTS  TAKEN 'R' AT A TIME":
  PRINTSTRING$(48,45)
96 PRINT@128,CHR$(30):PRINT@128,"HOW MANY OBJECTS ";:INPUTN:
  IFN<1ORN<>INT(N)ORN>33THEN
  PRINT@256,"MUST BE WHOLE POSITIVE NUMBER LESS THAN 34":GOTO96   ELSEPRINT@256,
CHR$(30)
98 PRINT@256,CHR$(30):PRINT@256,"NUMBER OF OBJECTS IN GROUP ";:
  INPUTR:IFR<1ORR<>INT(R) PRINT@384,"MUST BE A WHOLE NUMBER";     CHR$(30):GOTO9
8ELSEIFR>N
  PRINT@384,"NUMBER IN GROUP CAN'T BE GREATER THAN NUMBER OF OBJECTS":GOTO98ELSE
PRINT@384,CHR$(30);
100 X1=N:GOSUB114:Z=X3:X1=N-R:GOSUB114:Y=X3:X1=R:GOSUB114:
   W=X3:ON XX GOTO 102,106
102 C=Z/Y/W:IFC=1 P$=" IS ":E$=""ELSEP$=" ARE ":E$="S"
104 PRINT"THERE";P$;C" COMBINATION";E$:GOTO110
106 P=Z/Y:IFP=1 P$=" IS ":E$=""ELSEP$=" ARE ":E$="S"
108 PRINT"THERE";P$;P" PERMUTATION";E$
110 IFN=1 Z$=""ELSEZ$="S"
```

PROGRAMS

```
112 PRINT"OF"N"OBJECT";Z$;" TAKEN"R"AT A TIME":GOSUB222:
    IFX=1,4ELSE ON XX GOTO 90,92
114 X3=1:FORJ=1TOX1:X3=J*X3:NEXTJ:RETURN
116 CLS:CLEAR:PRINT"QUADRATIC EQUATIONS":PRINTSTRING$(19,45)
118 PRINT@192,"ENTER COEFFICIENT OF X SQUARED TERM ";:INPUTA:      IFA=0 PRINT@3
20,"NOT A QUADRATIC,  TRY AGAIN";:GOTO118ELSE
   PRINT@320,CHR$(30):
   PRINT@320,"ENTER THE COEFFICIENT OF THE X TERM ";:INPUTB:
   PRINT@448,"ENTER CONSTANT ";:INPUTC
120 B=B/A:C=C/A:IFC=0THENR1=0:R2=-B:GOTO124ELSED=B*B-4*C:
   IFD=0THENR1=-B/2:R2=R1:GOTO124ELSEX=SQR(ABS(D)):
   IFD>0THENR1=(X-B)/2:R2=-(X+B)/2:GOTO124ELSER=-B/2:J=X/2:
   CLS:PRINT"ROOTS ARE COMPLEX":PRINT
122 PRINT"X1 = "R" +"J" I":PRINT:PRINT"X2 = "R" -"J" I":GOTO126
124 CLS:PRINT"ROOTS ARE REAL":PRINT:
   PRINT"X1 = "R1:PRINT:PRINT"X2 = "R2
126 GOSUB222:IFX=1,4ELSE116
128 CLS:CLEAR100:PRINT"SIMULTANEOUS LINEAR EQUATIONS":
   PRINTSTRING$(29,45);:PRINT"
 YOU'LL BE ASKED FOR CERTAIN DATA ABOUT THE EQUATIONS.";:PRINT"
  IF THE SYSTEM OF EQUATIONS WAS :-":PRINT
130 PRINT" 2 X1 +  3 X2  - 4 X3  = 11":
   PRINT" 5 X1 -  23 X2  + 12 X3  = 4":
   PRINT" 7 X1 + 28 X2  + 13 X3  = 120":PRINT"
  THEN YOU WOULD ENTER 3 IN REPLY TO 'HOW MANY EQUATIONS ?'":
 PRINT"2 IN REPLY TO 'A(1,1) ?',  3 IN REPLY TO 'A(1,2) ?',";
132 PRINT"
 -4 IN REPLY TO 'A(1,3) ?', AND 11 IN REPLY TO 'B(1) ?',  AND SO ON FOR THE OTHE
R TWO EQUATIONS.":PRINT:
  PRINT"   PRESS ANY KEY TO CONTINUE":A$=INKEY$
134 A$=INKEY$:IFA$="",134ELSECLS:DEFINTI,J,K,L,N
136 PRINT@64,CHR$(30):PRINT@64,"HOW MANY EQUATIONS ";:INPUTN:
   IFN<1 PRINT@192,"NOT A VALID ENTRY, TRY AGAIN":GOTO136ELSE
   IFN>16 PRINT@192,"MUSTN'T BE GREATER THAN 16      ":GOTO136
   ELSEPRINT@192,CHR$(30):DIMA(N,N),B(N),C(N)
138 FORJ=1TON:FORK=1TON:PRINT"A ("J","K") = ";:INPUTA(J,K):
   NEXTK:PRINT"    B ("J") = ";:INPUTB(J):PRINT:NEXTJ
140 IFN=1ANDA(1,1)=0,154ELSEIFN=1THENC(1)=B(1)/A(1,1):
   GOTO150ELSEFORK=1TON-1:I=K+1:L=K
142 IFABS(A(I,K))>ABS(A(L,K))THENL=I:IFI<NTHENI=I+1:GOTO142ELSE
   IFL=KTHENI=K+1:GOTO146
144 FORJ=KTON:D=A(K,J):A(K,J)=A(L,J):A(L,J)=D:NEXT:
   D=B(K):B(K)=B(L):B(L)=D:I=K+1
146 IFA(K,K)=0THEN154ELSED=A(I,K)/A(K,K):A(I,K)=0:
  FORJ=K+1TON:A(I,J)=A(I,J)-D*A(K,J):NEXT:
  B(I)=B(I)-D*B(K):IFI<NTHENI=I+1:GOTO146ELSENEXT
148 IFA(N,N)=0THEN154ELSEC(N)=B(N)/A(N,N):
   FORI=N-1TO1STEP-1:D=0:FORJ=I+1TON:D=D+A(I,J)*C(J):IFA(I,I)=0
   THEN154ELSEC(I)=(B(I)-D)/A(I,I):NEXTJ,I
150 CLS:PRINT"THE SOLUTION SET IS :-":PRINT:
   FORI=1TON:PRINT" X "I" = "C(I),:NEXT
152 GOSUB222:IFX=1,4ELSECLS:CLEAR:GOTO136
154 CLS:PRINT@400,"NO SOLUTION IS POSSIBLE":GOTO152
156 CLS:CLEAR100:PRINT"
 LEAST SQUARES CURVE FITTING, INTERPOLATION AND EXTRAPOLATION":
 PRINTSTRING$(61,45);:PRINT"
  YOU CAN FIT AN EQUATION OF DEGREE 1, 2, 3, 4, 5, OR 6 TO ANY    NUMBER OF PAIR
S OF DATA POINTS UP TO A MAXIMUM OF 50 PAIRS.";
158 PRINT"
   IF YOU CHOOSE A DEGREE 1 EQUATION THEN THE PROGRAM WILL GIVE THE BEST STRAIGH
T LINE FIT THROUGH THE DATA POINTS, AND THIS IS 'LINEAR REGRESSION'.  HIGHER ORD
ER EQUATIONS GENERALLY FIND A
BETTER FIT IF A STRAIGHT LINE SOLUTION ISN'T APPROPRIATE"
160 PRINT"
  ENTER THE DATA POINTS IN PAIRS. FIRST ENTER THE X CO-ORDINATE, THEN A COMMA, A
ND THEN THE Y CO-ORDINATE.":PRINT@910,"PRESS ANY KEY TO CONTINUE":A$=INKEY$
162 A$=INKEY$:IFA$="",162ELSECLS
164 PRINT@64,CHR$(30):PRINT@64,
 "HOW MANY PAIRS OF DATA POINTS ARE YOU ENTERING ";:
 INPUTNP:IFNP<2ORNP>50ORNP<>INT(NP)THENPRINT@192,"INVALID ENTRY" :GOTO164ELSEPRI
NT@192,
 "TYPE A COMMA BETWEEN THE X AND Y VALUES BEFORE PRESSING THE     'ENTER' KEY"
166 DIMX(NP),Y(NP),A(7,7),B(7),C(7),P(12):DEFINTI,J,K,L
168 FORJ=1TONP:INPUT"   X , Y  =  ";X(J),Y(J):NEXTJ:CLS
170 PRINT@64,CHR$(30):PRINT@64,
  "DEGREE OF POLYNOMIAL TO BE FITTED ";:INPUTD:
  IFD<1ORD<>INT(D)THENPRINT@192,"INVALID ENTRY, TRY AGAIN":
  GOTO170ELSEPRINT@192,CHR$(30):IFD>6THENPRINT@192,
  "MUSTN'T BE MORE THAN 6":GOTO170ELSEPRINT@192,CHR$(30)
172 IFD>=NPTHENPRINT"
NOT ENOUGH DATA PAIRS FOR THAT DEGREE OF EQUATION. ENTER AGAIN."  :GOTO170ELSEPR
INT@256,CHR$(30):D2=2*D:N=D+1:FORJ=1TOD2:P(J)=0:  FORK=1TONP:P(J)=P(J)+X(K)[J:NE
XTK,J:P(0)=NP:B(1)=0:FORJ=1TONP:  B(1)=B(1)+Y(J):NEXTJ:IFN=1,176
174 FORJ=2TON:B(J)=0:FORK=1TONP:B(J)=B(J)+Y(K)*X(K)[(J-1):
   NEXTK,J
176 FORJ=1TON:FORK=1TON:A(J,K)=P(J+K-2):NEXTK,J:GOSUB194
178 CLS:PRINT"  POWER OF X      COEFFICIENT
  ----- -- -      -----------":FORJ=1TON:
  PRINT"   "J-1,C(J):NEXT
180 Q=0:FORJ=1TONP:Q=Q+Y(J):NEXT:M=Q/NP:T=0:G=0:FORJ=1TONP:Q=0:
   FORK=1TON:Q=Q+C(K)*X(J)[(K-1):NEXTK:T=T+(Y(J)-Q)[2:
   G=G+(Y(J)-M)[2:NEXTJ:IFG=0THENT=100:
   GOTO182ELSET=100*SQR(1-T/G)
182 PRINT"
  PERCENT GOODNESS OF FIT OF POLYNOMIAL TO THE DATA = "T"%":
```

PROGRAMS

```
  PRINT:PRINT"0 % = USELESS,   90 % = FAIR,    100 % = PERFECT":  PRINT@974,"PRE
SS ANY KEY TO CONTINUE";:A$=INKEY$
184 A$=INKEY$:IFA$="",184
186 CLS:PRINT"
   DO YOU WANT TO :-":PRINT"
   < A >  INTERPOLATE OR EXTRAPOLATE ON THE DATA
    < B >  TRY TO FIT ANOTHER DEGREE EQUATION TO THE SAME DATA
     < C >  NEITHER OF THESE":A$=INKEY$
188 A$=INKEY$:IFA$="A",190ELSEIFA$="B"THENCLS:GOTO170ELSE
   IFA$="C",4ELSE188
190 CLS:PRINT"
   ENTER THE VALUE OF X FROM WHICH YOU WANT TO DETERMINE THE
 VALUE OF Y  ";:INPUTZ:PRINT:YZ=0:FORK=1TON:YZ=YZ+C(K)*Z[(K-1):
  NEXTK:PRINT" FOR X = "Z"      Y = "YZ:PRINT:PRINT"
     ANY MORE DATA  < 'Y' OR 'N' >  ?":A$=INKEY$
192 A$=INKEY$:IFA$="Y",190ELSEIFA$="N",186ELSE192
194 IFN=1THENC(1)=B(1)/A(1,1):RETURNELSEFORK=1TON-1:I=K+1:L=K
196 IFABS(A(I,K))>ABS(A(L,K))THENL=I ELSEIFI<NTHENI=I+1:GOTO196
   ELSEIFL=KTHEN I=K+1:GOTO198ELSEFORJ=KTON:Q=A(K,J):
   A(K,J)=A(L,J):A(L,J)=Q:NEXTJ:Q=B(K):B(K)=B(L):B(L)=Q:I=K+1
198 Q=A(I,K)/A(K,K):A(I,K)=0:FORJ=K+1TON:A(I,J)=A(I,J)-Q*A(K,J):    NEXTJ:B(I)=B(
I)-Q*B(K):IFI<NTHENI=I+1:GOTO198ELSENEXT
200 C(N)=B(N)/A(N,N):FORI=N-1TO1STEP-1:Q=0:FORJ=I+1TON:
   Q=Q+A(I,J)*C(J):C(I)=(B(I)-Q)/A(I,I):NEXTJ,I:RETURN
202 CLS:CLEAR100:PRINT"STATISTICS":PRINTSTRING$(10,45):PRINT
204 PRINT@192,CHR$(30):PRINT@192,
   "HOW MANY ITEMS OF DATA ARE YOU GOING TO INPUT  ";:INPUTN:
   IFN<2ORN<>INT(N)THENPRINT@320,"  NOT VALID, TRY AGAIN":
   GOTO204ELSEPRINT@320,CHR$(30)
206 DIMA(N):SU=0:M=1:NM=N-1:FORJ=1TON:PRINT"   DATUM "J" =  ";:
   INPUTA(J):M=M*A(J):SU=SU+A(J):NEXTJ:AV=SU/N:
   MN=(ABS(M)[(1/N))*(SGN(M))
206 DIMA(N):SU=0:M=1:NM=N-1:FORJ=1TON:PRINT"   DATUM "J" =  ";:
   INPUTA(J):M=M*A(J):SU=SU+A(J):NEXTJ:AV=SU/N:
   MN=(ABS(M)[(1/N))*(SGN(M))
208 GOSUB218:RA=A(I)-A(N):MA=A(1):MI=A(N):MR=(A(1)+A(N))/2:Q=0:
   FORI=1TON:D=A(I)-AV:Q=Q+D[2:NEXTI:VA=Q/(N-1):ST=SQR(VA)
210 CLS:PRINT"THE STATISTICS ARE AS FOLLOWS :-":
   PRINTSTRING$(33,45):PRINT"
  ARITHMETIC MEAN = "AV:PRINT"  GEOMETRIC MEAN = "MN:
  PRINT"  MEDIAN = "ME:PRINT"  SUM OF VALUES = "SU:
  PRINT"  MAXIMUM = "MA:PRINT"  MINIMUM = "MI
212 PRINT"  RANGE = "RA:PRINT"  MID-RANGE = "MR:
   PRINT"  VARIANCE = "VA:PRINT"  STANDARD DEVIATION = "ST:
   PRINT@896,
 " PRESS 'S' TO REVIEW THE DATA IN SORTED ORDER OR 'D' TO INPUT   ANOTHER DATA S
ET";
214 A$=INKEY$:IFA$="S",216ELSEIFA$="D",202ELSE214
216 CLS:PRINT"SORTED DATA FROM LEFT TO RIGHT":PRINT:
   FORI=NTO1STEP-1:PRINTA(I),:NEXT:GOSUB222:IFX=1,4ELSE202
218 FORI=1TONM:IP=I+1:M=I:FORJ=IPTON:IFA(M)>=A(J)THEN220ELSEM=J
220 NEXTJ:T=A(I):A(I)=A(M):A(M)=T:NEXTI:D=N/2:ID=INT(D):
   IFD=IDTHENMED=(A(ID)+A(ID+1))/2:RETURNELSE
   IFD<IDTHENMED=A(ID):RETURNELSEMED=A(ID+1):RETURN
222 X=2:PRINT@960,CHR$(30);:PRINT@960,
  "    ANY MORE DATA  < 'Y' OR 'N' >";:GOSUB224:IFA$="N"THENX=1:   RETURNELSERET
URN
224 A$=INKEY$:IFA$="",224ELSEIFA$="Y"ORA$="N" RETURNELSE224
226 CLS:PRINT"SPEARMAN'S COEFFICIENT OF RANK CORRELATION":
   PRINTSTRING$(42,45);:PRINT"
THIS GIVES A MEASURE OF HOW WELL TWO SETS OF DATA FIT TOGETHER"
228 PRINT"
  FOR EXAMPLE, IF ONE SET WAS THE HEIGHTS OF CHILDREN AND THE
OTHER SET WAS THEIR AGES, THEN YOU WOULD EXPECT A CLOSE
RELATIONSHIP TO EXIST BETWEEN THE TWO SETS OF DATA.";
230 PRINT"
  ON THE OTHER HAND, IF ONE SET WAS INCHES OF RAINFALL FOR
CERTAIN MONTHS, AND THE OTHER CONTAINED THE NUMBER OF PEOPLE WHOBOUGHT COMPUTERS
 DURING THOSE MONTHS, THEN YOU WOULDN'T EXPECT
ANY CLOSE RELATIONSHIP BETWEEN THE TWO SETS OF DATA.";
232 PRINT"
  BEWARE OF SPURIOUS CORRELATION.  FOR EXAMPLE, THE NUMBER OF
RADIO LICENCES TAKEN OUT DURING THE YEARS 1920 AND 1940, AND THENUMBER OF PEOPLE
 ENTERING LUNATIC ASYLUMS DURING THOSE YEARS,
SHOWS A VERY CLOSE CORRELATION."
234 PRINT"            PRESS ANY KEY TO CONTINUE";:A$=INKEY$
236 A$=INKEY$:IFA$="",236
238 CLS:CLEAR100:PRINT"
  DO YOU WANT THE HIGHEST VALUE IN EACH SET TO BE RANKED FIRST, AS IN MARKS IN A
N EXAM WHERE THE PERSON WHO GOT 98 OUT OF 100   WOULD COME FIRST, AND THE PERSON
 WHO GOT 82 WOULD BE RANKED
SECOND, ET. CETERA.,"
240 PRINT"
  OR DO YOU WANT THE LOWEST VALUE IN EACH SET RANKED FIRST, AS
IN THE CASE, SAY, WHERE THE PERSON GETTING THE FEWEST NUMBER OF
PENALTY POINTS WOULD BE RANKED FIRST.":PRINT:
  PRINT"    TYPE  'H'  OR  'L'":A$=INKEY$
242 A$=INKEY$:IFA$="",242ELSEIFA$<>"H"ANDA$<>"L",238ELSECLS:
   PRINT"MEANINGFUL RESULTS ARE NOT POSSIBLE WITH LESS
 THAN 5 ITEMS IN EACH DATA SET."
244 PRINT@192,CHR$(30):
   PRINT@192,"HOW MANY ITEMS OF DATA IN EACH SET ";:INPUTN:
   IFN<5ORN>50ORN<>INT(N)THENPRINT@320,"BETWEEN 5 AND 50.":
   GOTO244ELSEPRINT@320,CHR$(30):DIMA(N),B(N),C(N),D(N),E(N)
246 IFP=0THENPRINT:PRINT"ENTER FIRST SET OF VALUES"ELSEPRINT:
```

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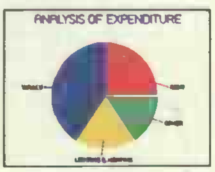

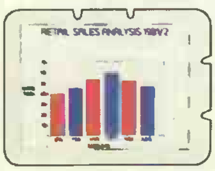

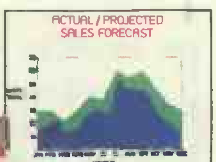

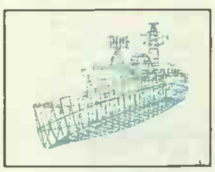

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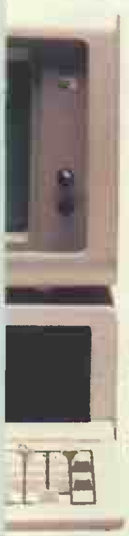

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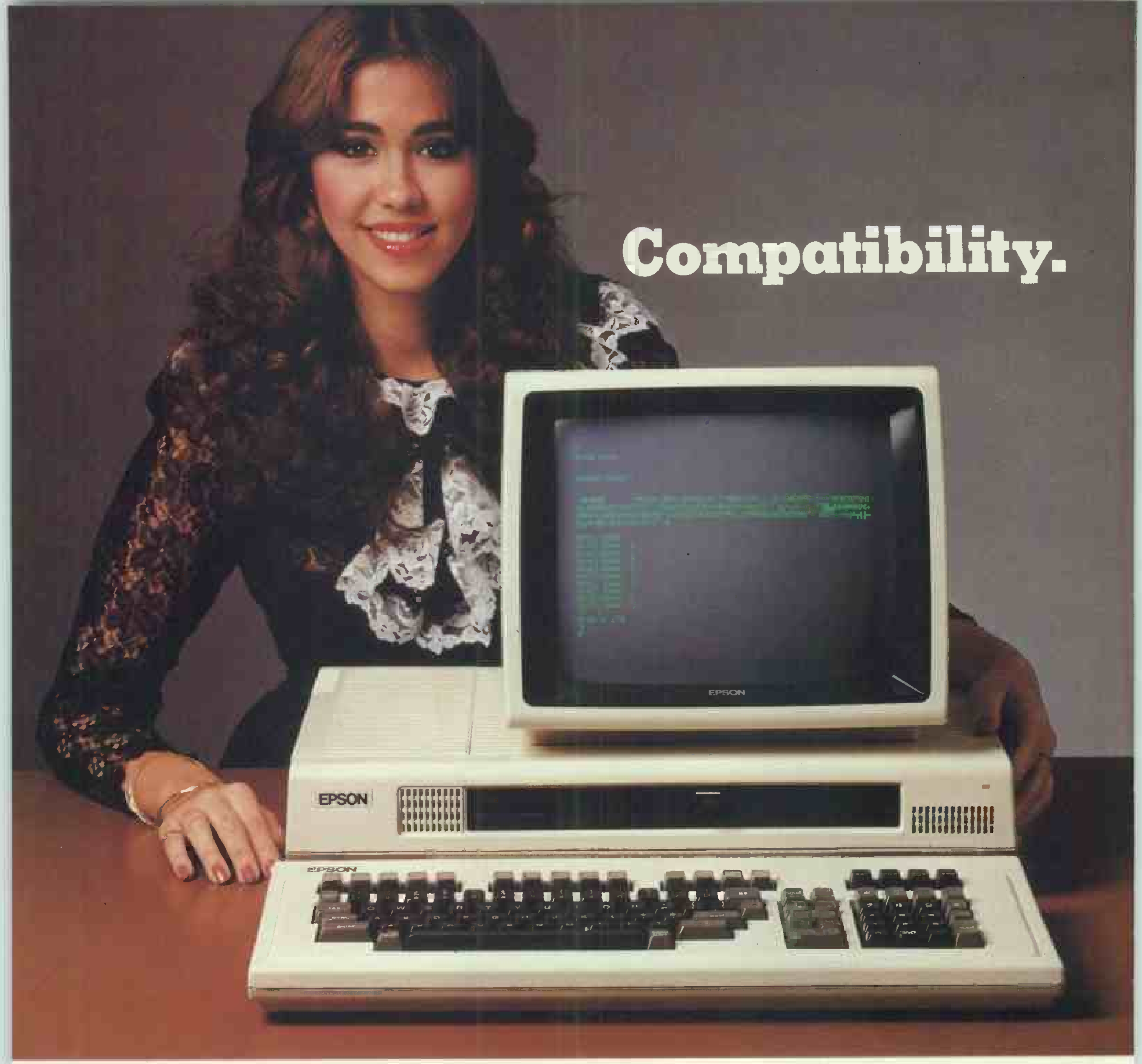
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```
   PRINT"ENTER CORRESPONDING SECOND SET OF VALUES"
248 PRINT:FORJ=1TON:PRINT"    DATUM"J" = ";:INPUTA(J):NEXT:
   FORJ=1TON:FORK=1TON:IFA(J)>A(K)THENS=S+1:NEXTKELSENEXTK
250 IFA$="H"THENE(J)=N-S:S=0:NEXTJELSEE(J)=S+1:S=0:NEXTJ
252 IFP=1,254ELSEFORJ=1TON:C(J)=E(J):D(J)=A(J):NEXT:P=1:GOTO246
254 FORJ=1TON:B(J)=(C(J)-E(J))[2:X=Z+B(J):Z=Z+B(J):NEXT:
   CC=1-((6*X)/(N[3-N)):CLS:PRINT"CORRELATION COEFFICIENT IS":
   PRINTTAB(30)CC
256 PRINT:PRINT"
  -0.1    OR  +0.1     =  NO CORRELATION
  -0.5    OR  +0.5     =  LITTLE CORRELATION
  -0.7    OR  +0.7     =  FAIRLY GOOD CORRELATION
  -0.8    OR  +0.8     =  GOOD CORRELATION";
258 PRINT"
  -0.85   OR  +0.85    =  VERY GOOD CORRELATION
  -0.9    OR  +0.9     =  SIGNIFICANT CORRELATION
  -0.95   OR  +0.95    =  HIGHLY SIGNIFICANT CORRELATION
  -1      OR  +1       =  PERFECT CORRELATION":
   GOSUB222:IFX=1,4ELSE238
```

Program of the Month

MZ-80K Directory

by Frank Rooney

'Directory' is an extremely versatile database program for cassette-based MZ-80K systems. It is fully-compatible with all the popular dialects of Sharp Basic, including the SP-5025 supplied with the machine, but is particularly suited to Speedbasic. Under Speedbasic, data is read/written at approximately three times the speed of Basic SP-5025.

The format of the database is almost entirely user-defined, the user selecting the filename, number of fields per record, maximum field length and the name of each field. All records are automatically indexed as they are entered.

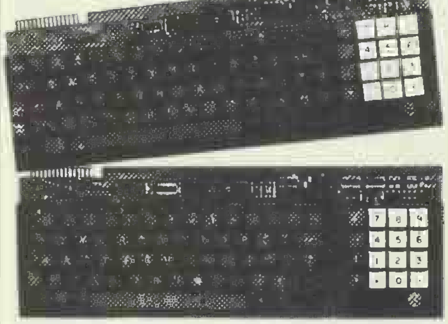
On running the program, you are presented with a title page and two options: (1) create a new file, or (2) load a file from tape. Option (2) requests the filename, asks you to insert the approximate data tape and then searches for the specified file. Selecting option (1) takes you through a simple setting-up procedure to determine the format of your file. When this information has been entered, you then move into the main menu shown in the screen photo above. The dangerous options are (8) and (9). Option (8) (Clear file) deletes your file and file-format from memory and re-runs the program. Option (9) (Exit Program) deletes everything — including the program — and passes you back to Basic.

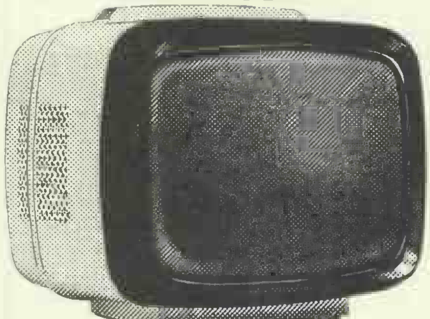
The other options should all be fairly self-explanatory. Option (1) allows you to add new data to the file currently held in memory; (2) performs an alphanumeric sort on same; (3) allows you to edit and/or interrogate the file (of which, more later); (4) allows you to delete a specified record; (5) steps through the file, displaying either the whole of each record or just the first field; (6) prints either the whole file or selected entries, and includes a special routine for labels; and (7) saves the data to cassette as a named file. The main menu also keeps a running tab on remaining available memory.

Option (3), as mentioned above, is the search option. Where the index number is known, you can simply enter this to effect a high-speed, indexed search. Otherwise, you enter the content of the first field (a surname, for example), and the program carries out a sequential search on this field. If it is unable to find an exact match, it will attempt to find entries with a similar spelling. It will still locate 'John Smith', for example, if you ask it for 'Jonathan Smith' or 'John Smitt'. This is an extremely useful feature if you're unsure of a spelling.

The printer-control codes employed in the very flexible print routine in lines 1670-2790 were written for the Epson MX80 FT III printer. You will, of course, have to change these if you are using a different printer and the REM statements in lines 1690-1720 should provide you with the necessary information.

'Directory' cannot be compared to a disk-based system. Relying on low-speed data transfer and sequential searches, it is obviously slow when large amounts of data are involved (though at least it can't give a 'Bdos' error!). It is, however, surprisingly fast for what it is. Incidentally, if you are



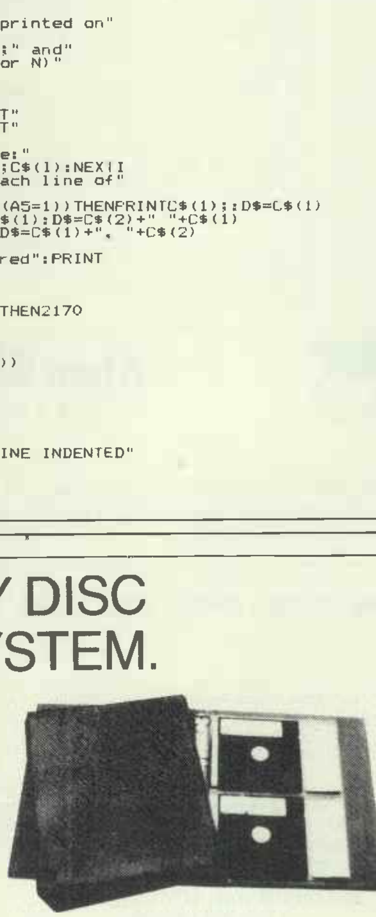


PROGRAMS

used to disk-based systems, don't forget to save your data before coming out of the program: unlike most disk systems, 'Directory' will neither remind you nor do it for you!

```
10 REM ■■■■■■ DIRECTORY ■■■■■■
20 REM ■■ F.R.ROONEY - 5/83 ■■
30 REM ■■■■■■■■■■■■■■■■■■■■■■■■
80 GOTO2940
90 REM ■■■■■■■■ SORT ■■■■■■■■
100 PRINT"■Sorting..."
110 POKE8805,X3:POKE8806,X4
120 S=1:SL(1)=1:SR(1)=EN
130 Q=SL(S):R=SR(S):S=S-1
140 X=Q:J=R:X$=N$(1,INT((Q+R)/2))
150 IFN$(1,X)<X$THENX=X+1:GOTO150
160 IFX$<N$(1,J)THENJ=J-1:GOTO160
170 IFX>JTHEN210
180 FORI=1TON
190 O$(I)=N$(I,X):N$(I,X)=N$(I,J):N$(I,J)=O$(I):NEXTI
200 X=X+1:J=J-1
210 IFX<=JTHEN150
220 IFX>=RTHEN240
230 S=S+1:SL(S)=X:SR(S)=R
240 R=J
250 IFQ<RTHEN140
260 IFS<>0THEN130
270 GOTO440
280 REM ■■■■■■■■ READ DATA TAPE ■■■■■■■■
290 PRINT"■";:INPUT"Enter FILENAME: ";F$
300 PRINT"■■Place DATA TAPE in machine"
310 PRINT"■ Press <SPACE> when ready"
320 GETA$:IFA$=" "THEN340
330 GOTO320
340 PRINT:ROPENF$
350 INPUT/TN,L:DIMC$(N):FORI=1TON:INPUT/TC$(I):NEXTI
360 DIMN$(N,255),O$(N),D$(255),W$(255)
370 INPUT/TEN:FORX=1TOEN
380 FORI=1TON:INPUT/TN$(I,X):NEXTI
390 NEXTX:CLOSE:GOTO410
400 DIMN$(N,255),O$(N),D$(255),W$(255)
410 P$=LEFT$(SP$,L-2)
420 L$="<"+LEFT$(LL$,L)+">"
430 REM ■■■■■■■■ MENU ■■■■■■■■
440 D1=0:D2=0:D3=0
450 PRINT"■────────────────────────────────────"
460 PRINTF$;TAB(27);EN;" ENTRIES"
470 PRINT"────────────────────────────────────■"
480 PRINT"■    Press <1> to ENTER DATA"
490 PRINT"■          <2> to SORT DATA"
500 PRINT"■          <3> to CHECK/ALTER DATA"
510 PRINT"■          <4> to DELETE DATA"
520 PRINT"■          <5> to SCREEN-LIST"
530 PRINT"■          <6> to PRINT-OUT"
540 PRINT"■          <7> to SAVE FILE"
550 PRINT"■          <8> to CLEAR FILE"
560 PRINT"■          <9> to EXIT PROGRAM":USR(62)
570 PRINT"■■Memory left:";SIZE;"■"
580 GETA:IFA=0THEN580
590 ONAGOTO610,100,1260,1190,1420,1730,2810,2900,2920
600 REM ■■■■■■■■ ENTER DATA ■■■■■■■■
610 IFEN>254THENPRINT"■FILE FULL":USR(62):FORDL=1TO2000:NEXTDL:GOTO440
620 X=EN
630 X=X+1
640 PRINT"■Enter <-> if no entry is required"
650 PRINT"■Entry No.";X
660 FORI=1TON
670 POKE4466,2+2*I:PRINTC$(I);":":PRINT"■";L$
680 POKE4466,3+2*I:INPUT" ";N$(I,X)
690 IFN$(I,X)="-"THENN$(I,X)=""
700 IFN$(I,X)="0"THENEN=X-1:GOTO440
710 IFLEN(N$(I,X))>LTHENPOKE4466,3+2*I:PRINTSPC(39):GOTO670
720 POKE4466,4+2*I:PRINTSPC(39)
730 NEXTI
740 PRINT"■  Is all the above correct ? (Y or N) ":USR(62)
750 GETA$:IFA$="Y"THEN780
760 IFA$="N"THENGOSUB1280:PRINT"■":GOTO780
770 GOTO750
780 PRINT"■ Are there any more entries ? (Y or N)";USR(62)
790 GETA$:IFA$=""THEN790
800 IFA$="Y"THEN630
810 IFA$="N"THENEN=X:GOTO440
820 GOTO790
830 REM ■■■■■ SEARCH ■■■■■
840 PRINT"■Enter ENTRY NUMBER or ";C$(1)
850 PRINT"■<0> to return to DIRECTORY■"
860 INPUT" ";DT$:PRINT:IFDT$="0"THEND1=0:D2=0:GOTO440
870 AD=ASC(LEFT$(DT$,1)):IF(AD<49)+(AD>57)THENGOSUB960:RETURN
880 X=VAL(DT$):IFX>ENTHEN840
890 IF(D1=0)*(D3=0)THENRETURN
900 PRINT"Entry No.";X:PRINT:FORI=1TON:PRINTN$(I,X):NEXTI:D1=0
910 IFD2=0THENRETURN
920 PRINT"■Is this the entry requested ? (Y or N)"
930 GETA$:IFA$="Y"THENRETURN
940 IFA$="N"THEN840
950 GOTO930
960 V=0:X=1
970 IFN$(1,X)=DT$THENV=V+1:H(V)=X
980 IFX>ENTHENX=EN:GOTO1000
990 X=X+1:GOTO970
1000 IFV=0THEN1070
1010 IFV=1THENX=H(V):D1=0:GOTO890
1020 PRINT"■No.■":FORX=1TOV:P=H(X)
1030 PRINTP;" ";N$(1,P);", ";N$(2,P):NEXTX:PRINTSL$
1040 INPUT"Enter No. (0 if NONE): ";X:IFX=0THEN840
1050 IFX>ENTHENPRINT"■";SPC(40);"■■":GOTO1040
1060 GOTO890
1070 PRINT"■NO SUCH ENTRY FOUND"
1080 POKE8805,114:POKE8806,34
1090 X=1
1100 IFLEFT$(N$(1,X),3)=LEFT$(DT$,3)THENV=V+1:H(V)=X
1110 IFX>ENTHENX=EN:GOTO1130
1120 X=X+1:GOTO1100
1130 IFV=0THENUSR(62):GOTO840
1140 PRINT"■Perhaps the spelling is wrong"
1150 PRINT"SIMILAR entries are:■":IFV>1THEND1=0:GOTO1020
1160 FORDD=1TO1000:NEXTDD:D1=0
```

```
1170 X=H(V):GOTO890
1180 REM ■■■■■ DELETIONS ■■■■■
1190 D1=1:D2=1:D3=1:GOSUB840
1200 PRINT"■Just a moment....."
1210 G=X:FORI=1TON:N$(I,G)="":NEXTI
1220 FORX=GTOEN:FORI=1TON
1230 N$(I,X)=N$(I,X+1):NEXTI:NEXTX
1240 EN=EN-1:GOTO1190
1250 REM ■■■■■ ALTER DATA ■■■■■
1260 GOSUB840
1270 GOSUB1280:GOTO1260
1280 PRINT"■   ←";P$;"→"
1290 FORI=1TON:POKE4466,I:PRINTI;" ";N$(I,X):NEXTI
1300 PRINTSL$
1310 PRINT"Enter no. of line to CHANGE (0 if O.K.)"
1320 GETI$:IFI$=""THEN1320
1330 IFI$="0"THENRETURN
1340 I=VAL(I$):IFI=0THEN1320
1350 PRINT"■  (Enter <-> if BLANK LINE required)   "
1360 PRINT"■        Press <CR> when corrected"
1370 POKE4466,I:INPUT">■■";N$(I,X)
1380 IFN$(I,X)="-"THENN$(I,X)=""
1390 N$(I,X)=LEFT$(N$(I,X),L)
1400 GOTO1280
1410 REM ■■■■■ SCREEN-LIST ■■■■■
1420 PRINT"■Press <1> to list ";C$(1);" only"
1430 PRINT"■       <2> for FULL listing"
1440 GETA:IF(A=0)+(A>2)THEN1440
1450 PRINT"■Press <1> for CONTINUOUS listing"
1460 PRINT"■       <2> for SINGLE-STEP listing"
1470 GETB:IF(B=0)+(B>2)THEN1470
1480 INPUT"■Enter STARTING NO. ";C
1490 IF(C<1)+(C>EN-1)THEN1480
1500 IFB=2THEN1530
1510 PRINT"■Press <SPACE> to STOP or RESTART"
1520 PRINT"      <0> to return to DIRECTORY":FORDD=1TO1000:NEXTDD
1530 PRINT"■";:FORX=CTOEN:PRINT"Entry no.";X:PRINT"————————————"
1540 PRINTN$(1,X):IFA=1THEN1560
1550 FORI=2TON:PRINTN$(I,X):NEXTI
1560 IFB=2THEN1600
1570 GETB$:IFB$="0"THEN440
1580 IFB$=" "THENFORDD=1TO500:NEXTDD:GOTO1600
1590 GOTO1650
1600 IFB=2THENPRINT"■Press <SPACE> for next entry"
1610 GETA$:IFA$=" "THEN1640
1620 IFA$="0"THEN440
1630 GOTO1610
1640 IFB=2THENPRINT"■";
1650 PRINT:NEXTX
1660 GOTO440
1670 REM ■■■■■ PRINTOUT ■■■■■
1680 REM For EPSON MX80 FT3 printer
1690 REM ■@=initialise ■0=ignore perforations ■2=line spacing for labels
1700 REM ■E=emphasised print ■F=cancel
1710 REM ■=condensed print   ■=cancel
1720 REM ■=large print       ■=cancel
1730 PRINT"■";:A1=0:A2=0:A3=0:A4=0:A5=0:A6=0
1740 FORI=1TOEN:W$(I)="":D$(I)="":NEXTI
1750 DIMB$(8),B(8):FORI=1TO8:B$(I)="":B(I)=0:NEXTI
1760 PRINT"Press <1> to printout ALL ENTRIES"
1770 PRINT"■       <2> to printout SELECTED ENTRIES"
1780 GETA1:IF(A1<1)+(A1>2)THEN1780
1790 PRINT"■Press <1> to print LABELS"
1800 PRINT"■       <2> to print FANFOLD"
1810 GETA2:IF(A2<1)+(A2>2)THEN1810
1820 IFA2=1THEN1970
1830 PRINT"■Press <1> for SINGLE FIELD per line"
1840 PRINT"■       <2> for TWO FIELDS per line"
1850 GETA3:IF(A3<1)+(A3>2)THEN1850
1860 IFA3=1THEN2360
1870 PRINT"■The fields for ";F$;" are:■"
1880 FORI=1TON:PRINTI;" - ";C$(I):NEXTI
1890 PRINT:FORI=1TONSTEP2
1900 PRINT"Line";I;": Enter FIELD NO.: ";
1910 GETB(I):IF(B(I)<1)+(B(I)>N)THEN1910
1920 PRINTC$(B(I)):IFI+1>NTHEN1960
1930 PRINT"Line";I;": Enter FIELD NO.: ";
1940 GETB(I+1):IF(B(I+1)<1)+(B(I+1)>N)THEN1940
1950 PRINTC$(B(I+1)):NEXTI
1960 GOTO2360
1970 PRINT"■A MAXIMUM of 8 lines can be printed on"
1980 PRINT"each label."
1990 PRINT"■Do you want to print ";C$(1);" and"
2000 PRINTC$(2);" on the SAME line ? (Y or N)"
2010 GETA4$:IFA4$="N"THENA4=1:GOTO2070
2020 IFA4$="Y"THENA4=2:GOTO2040
2030 GOTO2010
2040 PRINT"■Press <1> for ";C$(1);" FIRST"
2050 PRINT"■       <2> for ";C$(2);" FIRST"
2060 GETA5:IF(A5<1)+(A5>2)THEN2060
2070 A7=0:PRINT"■The fields in ";F$;" are:"
2080 PRINT:FORI=1TON:PRINT"Field";I;": ";C$(I):NEXTI
2090 PRINT"■Enter the field NUMBER for each line of"
2100 PRINT"the label:"
2110 PRINT"■Line 1: ";:IF(A4=1)+((A4=2)*(A5=1))THENPRINTC$(1);:D$=C$(1)
2120 IF(A4=2)*(A5=2)THENPRINTC$(2);" ";C$(1):D$=C$(2)+" "+C$(1)
2130 IF(A4=2)*(A5=1)THENPRINT", ";C$(2):D$=C$(1)+", "+C$(2)
2140 PRINT
2150 PRINT"Enter <-> if BLANK LINE required":PRINT
2160 FORI=2TO8:PRINT"Line";I;": ";
2170 GETB$(I):IFB$(I)=""THEN2170
2180 IFB$(I)="-"THENB(I)=0:GOTO2200
2190 B(I)=VAL(B$(I)):IF(B(I)=0)+(B(I)>N)THEN2170
2200 PRINTC$(B(I)):A7=A7+1:NEXTI
2210 IFA7>8THEN2070
2220 PRINT"■Line 1: ";D$
2230 FORI=2TO8:PRINT"Line";I;": ";C$(B(I))
2240 NEXTI
2250 PRINT"■Is this O.K. ? (Y or N)"
2260 GETA$:IFA$="N"THEN2070
2270 IFA$="Y"THEN2290
2280 GOTO2260
2290 PRINT"■Press <1> for NORMAL FORMAT"
2300 PRINT"■       <2> if you want LAST LINE INDENTED"
2310 PRINT"■           to the RIGHT"
2320 GETA6:IF(A6<1)+(A6>2)THEN2320
2330 IFA1=1THENGOSUB2740
2340 IFA1=2THENGOSUB2600
```

PROGRAMS

```
2350 IFA2=1THEN2460
2360 PRINT"ELoad fanfold paper and align top of form"
2370 GOSUB2770
2380 PRINT/P"3@R3E";F$;"E3F":FORX=CTOEN
2390 IF(A1=2)*(W$(X)="")THEN2450
2400 PRINT/P
2410 IFA3=1THENFORI=1TON:PRINT/PN$(I,X):NEXTI:GOTO2450
2420 FORI=1TONSTEP2
2430 PRINT/PN$(B(I),X);" ";:IFN<I+1THENPRINT/P:GOTO2450
2440 PRINT/PN$(B(I+1),X):NEXTI
2450 NEXTX:GOTO440
2460 PRINT"ELoad tractor-feed labels and align label":GOSUB2770
2470 PRINT/P"3@3032";
2480 FORX=CTOEN
2490 IF(A1=2)*(W$(X)="")THEN2590
2500 IFA4=1THEND$(X)=N$(1,X)
2510 IFA5=1THEND$(X)=N$(1,X)+", "+N$(2,X)
2520 IFA5=2THEND$(X)=N$(2,X)+" "+N$(1,X)
2530 IFLEN(D$(X))>32THENPRINT/P"3";:REM Too long for label - condense print
2540 PRINT/PD$(X):IFLEN(D$(X))>32THENPRINT/P"E";
2550 FORH=2TO7:PRINT/PN$(B(H),X):NEXTH
2560 IFA6=2THENPRINT/PSPC(32-LEN(N$(B(8),X)));
2570 PRINT/PN$(B(8),X)
2580 PRINT/P
2590 NEXTX:GOTO440
2600 PRINT"ESELECTED PRINTOUT"
2610 PRINT"_________________"
2620 PRINT"3As each entry is displayed:"
2630 PRINT"3Press <1> if REQUIRED"
2640 PRINT"3       <SPACE> if NOT REQUIRED"
2650 GOSUB2740
2660 FORX=CTOEN
2670 PRINT"EEntry no.";X:PRINT:PRINT:FORI=1TON:PRINTN$(I,X):NEXTI
2680 GETW$(X):IFW$(X)=""THEN2680
2690 IFW$(X)="0"THEN440
2700 IFW$(X)=" "THENW$(X)="":GOTO2730
2710 IFW$(X)="1"THEN2730
2720 GOTO2680
2730 NEXTX:RETURN
2740 INPUT"3Enter entry STARTING NUMBER: ";C
2750 IF(C<1)+(C>EN-1)THEN2740
2760 RETURN
2770 PRINT"3    Press <S> to START PRINTING"
2780 GETA$:IFA$="S"THENRETURN
2790 GOTO2780
2800 REM ■■■■■■■■ SAVE DATA ■■■■■■■■
2810 PRINT"EPlace blank DATA TAPE in machine"
2820 PRINTTAB(15);"33<---------------->RR"
2830 INPUT"Enter FILEMANE: ";F$:F$=LEFT$(F$,16):PRINT
2840 WOPENF$
2850 PRINT/TN,L:FORI=1TON:PRINT/TC$(I):NEXTI
2860 PRINT/TEN:FORX=1TOEN
2870 FORI=1TON:PRINT/TN$(I,X):NEXTI
2880 NEXTX:CLOSE:GOTO440
2890 REM ■■■■■ CLEAR FILE ■■■■■
2900 RUN
2910 REM ■■■■■ CLEAR PROGRAM ■■■■■
2920 POKE8805,114:POKE8806,34:POKE6347,44:PRINT"E":LIMITMAX:NEW
2930 REM ■■■■■ TITLE & INITIALISE ■■■■■
2940 PRINT"E333"
2950 PRINT"   [illegible]
2960 PRINT"   [illegible]
2970 PRINT"   [illegible]
2980 PRINT"   [illegible]
2990 PRINT"   [illegible]
3000 PRINT"33";TAB(12);"F.R.Rooney - 1983"
3010 POKE6347,124:M=12:DIMSL(M),SR(M),H(100):X=0:EN=0
3020 LL$="----------------------------------------"
3030 SL$="________________________________________"
3040 SP$="                                        "
3050 REM ■■■■■ M/C SORT DATA ■■■■■ ×=CHR$(124)
3060 DATA121×213×245×205×174×34×205×15×24×241×145×48×1×175×129×71×227×205
3070 DATA1×24×235×205×1×24×120×176×40×8×26×190×35×19×32×2×16×248×245×8×214
3080 DATA176×40×26×61×40×23×61×40×25×61×40×22×61×40×24×61×40×21×61×40×23×61
3090 DATA40×25×241×48×32×24×25×241×32×22×24×25×241×56×17×24×6×241×56×17×24
3100 DATA10×241×40×7×24×10×241×56×7×24×232×17×30×22×24×3×17×25×22×205×26×24
3110 DATA225×205×123×35×195×91×34
3140 X1=48:REM MEMORY SIZE
3150 X2=(X1+4)*1024-111:LIMITX2:FORI=X2TOX2+110:READMC:POKEI,MC:NEXTI
3160 X4=INT(X2/256):X3=INT(X2-256*X4+.5)
3170 POKE8805,X3:POKE8806,X4
3180 PRINT"33333   Press <1> to CREATE NEW FILE"
3190 PRINT"3         <2> to LOAD FILE from TAPE0":USR(62)
3200 GETA:IF(A=0)+(A>2)THEN3200
3210 IFA=2THEN290
3220 REM ■■■■■ SET UP NEW FILE ■■■■■
3230 PRINT"EEnter FILENAME:":PRINT"3<---------------->RR":USR(62)
3240 INPUT" ";F$:F$=LEFT$(F$,16)
3250 PRINT"33Enter NUMBER of FIELDS (2-9):";
3260 GETN:IFN<2THEN3260
3270 PRINTN:DIMC$(N)
3280 POKE4466,5:INPUT"Enter MAX field LENGTH (4-37):";L
3290 IF(L<4)+(L>37)THENPOKE4466,5:PRINTSPC(39):GOTO3280
3300 FORI=1TON
3310 POKE4466,5+2*I:PRINT"3";TAB(22);"<-------------->RR"
3320 PRINT"Enter NAME of FIELD";I;":";:INPUT" ";C$(I)
3330 NEXTI
3340 PRINT"EFilename: ";F$:FORI=1TON
3350 PRINT"3 Field";I;": ";C$(I):NEXTI
3360 POKE4466,24:PRINT"     Is the above O.K. ? (Y or N)0":USR(62)
3370 GETA$:IFA$="Y"THEN400
3380 IFA$="N"THEN3230
3390 GOTO3370
```

Atom Ghost Maze

by A S Whittington

'Ghost Maze' is a version of Pacman (can I say that without being sued?). The idea, if anyone out there has never played a version of the game, is to dash madly round

PROGRAMS

a maze eating dots and being chased by muncher-monsters. If you eat an asterisk on your travels, you then have a random amount of time (usually not very long) in which to catch and eat a muncher-monster. You score points for eating dots, stars and monsters. If you manage to eat all six monsters, you score bonus points and are awarded an extra life.

If you get into trouble, you can unleash one of your 'monster-muncher-sensing zapper missiles'. But you should use these sparingly since you have only a limited number and their use costs you valuable points.

The player has a good deal of control over the game, selecting the number of lives, skill level and number of 'zapper missiles' available — each being in the range 1–10.

The graphics are unremarkable but adequate, and the sound effects are good. The skill range is wide — ranging from simple to virtually impossible.

A word of explanation is required when it comes to entering lines 280 to 360 inclusive. The underline characters should be entered as grey blocks. Since these blocks are not directly accessible through the keyboard, you have to be a little bit clever. When you've entered everything up to and including line 270, enter the following line as a direct command:

FOR A=0TO 31; A?8100= FF; NEXT A

This will produce a line of 32 grey squares halfway down the screen. Type '280 P."' then use the cursor keys to position the cursor over the first grey square. Now use the COPY key to enter the appropriate number of squares. You'll have to keep repositioning the cursor so that you don't run out of squares, of course. It all sounds more complicated than it actually is!

```
10DIMQ7;$Q="G.20";?16=Q;?17=Q&£FFFF/256;G.30
20P.$7;G.200
30GOS.j;GOS.w;?£80=100;?£81=250;LI.VVO;Y=0;B=£20
40P.$12'"          ==================";
50P."        G-H-O-S-T M-A-Z-E"'"          ==================";'
60P."       (C) A.WHITTINGTON"'"                  1983"'''
70P."           PRESS ANY KEY"'';LI.£FFE3;P.$12
80?£80=50;?£81=256;LI.VVO;P."      ---**** SCORES ****---"''
90P."        '          1 POINT"'"          *          10 POINTS"'
100P."        £          100 POINTS"''
110P."  -50 POINTS FOR USING ZAPPER"''
120P.''"           PRESS ANY KEY"';LI.£FFE3;P.$12
130?£80=160;?£81=200;LI.VVO
140P."   ---*** CONTROL KEYS ***---"''
150P."        [?]..........RIGHT"'"        [>]...........LEFT"'
160P.'"    L/R CURSOR CONTROL....UP"'
170P."    U/D CURSOR CONTROL..DOWN"''
180P."    SPACE BAR.........ZAPPER"''
190P."           PRESS ANY KEY"'';LI.£FFE3
200P.$12;?£80=210;?£81=150;LI.VVO
210IN."NUMBER OF LIVES="C;Z=0;L=C;IFL>10 ORL<1 G.210
220IN.'"SKILL LEVEL (1 TO 10) "F
230IFF>10 ORF<1 G.220
240IN.'"HOW MANY SUPER-GALACTIC"'"MUNCHER-SENSING ZAPPERS "M
250IFM<0 ORM>10 G.240
260P.'"PRESS ANY KEY TO START GAME"';LI.£FFE3
270J=0;@=0;A=242;V=A
280P."________________________________"
290P."*'''''''_*''''''''''''*_''''''''*___'____'''_''______''_''''"
300P."____'__'_''''''_'''''''''''''_''''''_'__'_'____'____''''''''"
310P."____'____'_'__'_'_'''''''''''____'''''''''''_'_'__'_'_''''''''"
320P."___ ___''''''''_'_'__'''_'____'''_££££££_''____'_''''_"
330P."_'_'_''''''''''___ ___''''''''_'_'__'_'_'''''''''''____''''''''"
340P."''''_'_'__'_'_'____'____''''''''____'____'_'__'_''''''''_''''''''"
350P."''''''''_''''''''_'__'_____''''_''________'_''_''''____'__*''''''''"
360P."''_*''''''''''''''*_''''''''''*______________________________"
370P."SCORE=";?£E1=0;E=1
380S=A.R.%446;IFS?£8000=£FF ORS?£8000=£20 ORS?£8000=£23 G.380
390S?£8000=£0F;U=£20
400D=A.R.%(((F*10)+30)-1)+1;IFJ=247;G.z
410IFA=236 U=£20;GOS.m
420GOS.l;IF A.R.%(40-(F/10))=4 E=1
430IFE=1 H=£23
440IFE=0 H=£A3;G.510
450IF(V%32)-(S%32)<0 ANDD>30 GOS.e
460IF(V%32)-(S%32)>0 ANDD>30 GOS.f
```

PROGRAMS

```
470IF(V/32)-(S/32)<0 ANDD>30 GOS.g
480IF(V/32)-(S/32)>0 ANDD>30 GOS.h
490IFS=V GOS.i
500G.560
510IF(V%32)-(S%32)<0 ANDD>30 GOS.f
520IF(V%32)-(S%32)>0 ANDD>30 GOS.e
530IF(V/32)-(S/32)<0 ANDD>30 GOS.h
540IF(V/32)-(S/32)>0 ANDD>30 GOS.g
550IFS=V GOS.k
560LI.£2800
570IF?£82=31 GOS.c
580IF?£82=30 GOS.d
590IF?£82=7 GOS.b
600IF?£82=6 GOS.a
610IF?£82=0 GOS.v
620G.400
630aS=S-32;IFS?£8000=£FF S=S+32;R.
640IFS?£8000=£2A;GOS.u
650IFS?£8000=£27;GOS.r
660S?£8000=£0F;T=S+32;T?£8000=B;B=£20;R.
670bS=S+32;IFS?£8000=£FF S=S-32;R.
680IFS>446 S=S-32;R.
690IFS?£8000=£2A;GOS.u
700IFS?£8000=£27;GOS.r
710S?£8000=£0F;T=S-32;T?£8000=B;B=£20;R.
720cS=S+1;IFS?£8000=£FF S=S-1;R.
730IFS?£8000=£2A;GOS.u
740IFS?£8000=£27;GOS.r
750S?£8000=£0F;T=S-1;T?£8000=B;B=£20;R.
760dS=S-1;IFS?£8000=£FF S=S+1;R.
770IFS?£8000=£2A;GOS.u
780IFS?£8000=£27;GOS.r
790S?£8000=£0F;T=S+1;T?£8000=B;B=£20;R.
800jP=£2800;P.$21;[;JSR£FE71;STY£82;RTS;];P.$6;R.
810eV=V+1;IFV%32=31 V=V-1;R.
820O=V?£8000;V?£8000=H;V=V-1;V?£8000=U;V=V+1;U=0
830IFU=£2A GOS.o
840R.
850fV=V-1;IFV%32=0 V=V+1;R.
860O=V?£8000;V?£8000=H;V=V+1;V?£8000=U;V=V-1;U=0
870IFU=£2A GOS.o
880R.
890gV=V+32;IFV>446 V=V-32;R.
900O=V?£8000;V?£8000=H;V=V-32;V?£8000=U;V=V+32;U=0
910IFU=£2A GOS.o
920R.
930hV=V-32;IFV<32 V=V+32;R.
940O=V?£8000;V?£8000=H;V=V+32;V?£8000=U;V=V-32;U=0
950IFU=£2A GOS.o
960R.
970iF.X=1TO100;GOS.s;V?£8000=R.;N.;L=L-1;S?£8000=£0F
980IFL=0 G.x
990IFU=£FF B=U
1000IFU=£2A ORU=£27 J=J+1
1010V=A;V?£8000=£23;U=£20;R.
1020kF.X=1TO100S.2;GOS.t;V?£8000=R.;Z=Z+2;GOS.l;N.
1030IFU=£FF B=U
1040IFU=£2A ORU=£27 J=J+1
1050S?£8000=£0F;E=1;H=£23;A=A-1;V=A;U=£20;R.
1060zP.$8$8$8$8$8$8
1070F.A=0TO1024;A?£8000=£51;?£80=(A/2);?£81=5
1080LI.VVO;N.;IFF<10 F=F+1
1090G.270
1100xF.X=0TO7000;N.;@=0
1110P.$12''"YOU HAVE BEEN M-U-N-C-H-E-D"''C" TIMES"''"SCORE
1120P.Z''
1130IFZ>=Y Y=Z;P."A NEW RECORD !"'';G.1150
1140P."HIGH-SCORE = "Y''
1150P. "PRESS ANY KEY FOR ANOTHER GAME"'''';LI.£FFE3;P.$12
1160G.210
1170vIFM<1 R.
1180M=M-1
1190F.X=0 TO 9;V?£8000=£A1;?£80=150;?£81=75;LI.VVO
1200V?£8000=£21;?£80=250;?£81=100;LI.VVO;Z=Z-5
1210IFZ<0 Z=0
```

New TRS-80™ Model 4

16K Cassette-Based Model 4 **£749** Inc. VAT
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Super Features. Including a full 80-column by 24-line display for word processing and large spreadsheets, a built-in high resolution green screen monitor, numeric keypad, parallel interface and dual 5¼" disk drives, a new keyboard with control, caps. and three function keys, and compatability with Model III TRSDOS, LDOS and CP/M plus programs that put thousands of applications at your disposal.

Model 4 Upgrades

64K RAM Kit For Disk Model 4. Expands internal memory from 64K to 128K. Installation required (not included).
26-1122 .... £99.95

RS-232C Interface Board. Installation required, (not included).
26-1148 .... £79.95

Microprocessor: Advanced Z-80A 8-bit. **Clock Speed:** 4 MHz. **Memory:** 14K ROM, 64K RAM-expandable to 128K. **Keyboard:** 70-key typewriter style with control key, 3 programmable function keys (F1, F2, F3), caps key and 12-key datapad. **Video Display:** 80 characters by 24 lines (Model 4 mode), 64 x 16 (Model III mode), or double-wide 40 or 32 characters per line. Upper and lower case and reverse video. Memory mapped with high-resolution 12" green monitor, includes 96 text, 64 graphics and 96 "special" characters. **Sound:** Obtainable from BASIC with sound command including tone and duration. Toggled "keyclick" filter. **Disk Drives:** One or two built-in double density 184K 5¼" drives. **Operating System Compatability:** TRSDOS 6.0, TRSDOS 1.3, LDOS, CP/M Plus (available soon). **Programming Language:** New Advanced Microsoft BASIC with CHAIN, COMMON and more. **Input/Output Interfaces:** Cassette operation at 500/1500 baud selectable under ROM BASIC. Parallel printer interface with TRSDOS print spooler. Model III/4 Input/Output bus. **Dimensions:** 12½ x 18⅞ x 21½". **Power:** Integrated power supply, 240v AC, 50 Hz.

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CPM is available. What more to say except that Digital Research now give their blessing to SAGE with their CPM68K system. This comes complete with a 'C' compiler and will allow UNIX software to be compiled and run under the CPM environment.

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```
1220GOS.1;N.
1230V?£8000=U;U=£20
1240E=1;H=£23;A=A-1;V=A;R.
1250wP.$21;DIMVV4,P-1;L=£B002
1260[;:VV0 LDA L;LDY £81;:VV1 LDX £80;:VV2 DEX;BNE VV2
1270EOR @4;STA L;DEY;BNE VV1;RTS;];P.$6;R.
1280u?£80=150;?£81=500;LI.VV0;Z=Z+10;E=0;H=£A3;J=J+1;O=V?£8
1290V?£8000=H;R.
1300r?£80=255;?£81=30;LI.VV0;Z=Z+1;J=J+1;R.
1310s?£80=X;?£81=X-20;LI.VV0;R.
1320t?£80=A.R.%80+8;?£81=10;LI.VV0;R.
1330lP.Z" ";K=2;IFZ>9 K=K+1;IFZ>99 K=K+1;IFZ>999 K=K+1
1340F.T=1TOK;P.$8;N.;K=1;R.
1350mF.X=1TO100;Z=Z+1;GOS.1;?£80=X;?£81=9;LI.VV0;N.;L=L+1
1360F.X=1TO6;N=X+236;N?£8000=£23;?£80=(X*10);?£81=0
1370LI.VV0;N.;A=242;V=A;R.
1380oIFE=1 R.
1390E=1;?£80=100;?£81=50;LI.VV0;R.
```

Apple Text Maker

by Colin Davies

'Text Maker' is a disk utility routine for a 48K Apple 11+ running Apple DOS.

The routine is used to turn programs and subroutines stored on disk into text files. Although text files occupy approximately a third more disk space than Basic program files, they have two advantages. The first is that text files can be EXECuted; this enables programs and routines to be merged. The second advantage is that you can edit programs stored in this form on a word processor. I've written programs in WordStar on several occasions, and the superior editing facilities make programming a lot easier.

When you've typed in the routine, run it. Enter the destination slot and drive when prompted, and 'Text Maker' will helpfully store itself as a locked text file called 'STORE'. To use the routine, simply EXECute STORE. This will append 'Text Maker' to the program currently stored in memory. 'Text Maker' will then run itself, ask you for a filename, destination drive and slot and store the program in memory (minus itself) as a text file under the filename given. Finally, it switches back to the original logged drive and deletes itself from RAM. All very neat.

The routine assumes you have 48K RAM and that there is a 'HELLO' file present on the work disk; if you store your HELLO programs under a different filename, you'll have to amend line 63998 accordingly.

'Text Maker' occupies the fourteen highest available line numbers: that is, 63986-63999. These line numbers, therefore, must be avoided in your own programs.

```
63986 N$ = "STORE":N = 1: GOTO 63988
63987  HOME : INPUT "ENTER FILENAME ";N$
63988  PRINT : INPUT "DESTINATION SLOT ";DS
63989  PRINT : INPUT "             DRIVE ";DD
63990 SS =  PEEK ( - 18953) / 16
63991 SD =  PEEK ( - 18952):D$ =  CHR$ (4)
63992  PRINT D$"OPEN "N$",S"DS",D"DD: PRINT D$"UNLOCK "N$: PRINT D$"DELETE
       "N$
63993  PRINT D$"OPEN "N$: PRINT D$"WRITE "N$
63994  POKE 33,30: IF  NOT N THEN 63996
63995  LIST 63987,: PRINT "RUN 63987": GOTO 63997
63996  LIST 0,63986: PRINT "HOME"
63997  PRINT D$"CLOSE "N$: IF N THEN  PRINT D$"LOCK "N$
63998  PRINT D$"VERIFY HELLO,S"SS",D"SD
63999  TEXT : HOME : DEL 63986,63999
```

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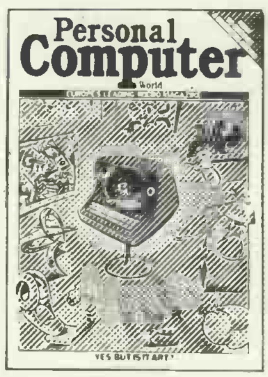
June 1980
Benchtest: Tandy TRS-80 Model II/Benchtest: Sintrom Periflex 630/48/Staff case study/Checkout: Softy Intelligent EPROM Programmer/Checkout: Exatron Stringy Floppy/Practical examples of the IEEEE-48 bus use/Programs: Naming Nascom files/380Z Pictures/Fuel tank calculations — PET/PET large numerals/PET tank battle/Basic string handling



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Benchtest: Microwriter/Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon Benchtest: Raannd SP1

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Benchtest: Transam Tuscan/Realtime control using trains — part 1/Recover from a data tape disaster/PET Music Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram

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Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 43C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing, PET Bouncy.

Volume 4 No 5
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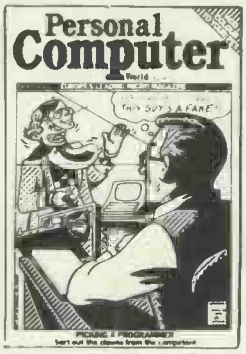
Benchtest: Pascal 640/WP Benchtest: Magic Wand/PET colour/Low-cost digital tape system/Using calculator printers on micros/Apple music-making/Multi-user Benchtest: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.



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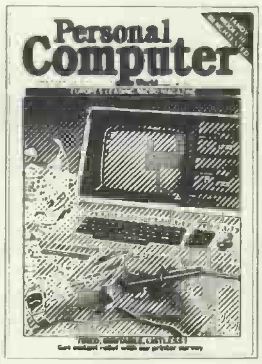

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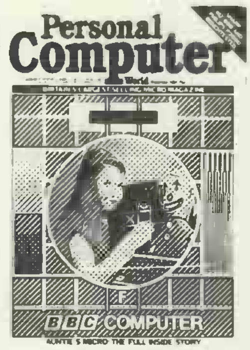
Benchtest: Tandy Model III/Viewdata update/WP Benchtest: Spellbinder/Printer survey/Microholism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.



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Benchtests: Sharp MZ-80B Philips P2000/School network/BBC Micro inside story/'Turtle' Graphics for Apple/Forth language/Curve fitting/Calc corner: HP14C review/Programs: PET Fantasy, ZX81 Battleships and cruisers.

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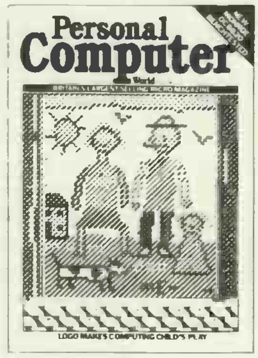
Benchtests: Texas Instruments 99/4A, Hewlett-Packard 125/Choosing a Database/Compsoft DMS Reviewed/Screenplay (new series)/Calc Corner: Hewlett-Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks, Nascom Business Documents, MZ-80K Race Chase, ZX81 Graphplot.



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Benchtest: Olivetti M20/Word Processor Benchtest: Select for NEC/Database Benchtest: Aquila/Checkouts: Microwriter Revisited, E40 Data Compression/Screenplay: ZX81 Pt II/DIY Logo/P for Perfect/Beeb Colour Hi Res/RS232/Calc Corner:

HP15 and 16C reviewed/Programs: Video Genie Extended Basic, ZX81 Alphabetising, PET File Comparison, BBC Music Player, PET Virus, BBC Radar, PET German Game, TRS-80 Cardshuffler.

Vol 5 No 10
October 1982
Benchtests: HP-86; Positron 9000/Database Benchtest; Personal Pearl/3D Graphics for BBC Computer/Hashing Techniques/Designing your own Database/CP/M-86 v MSDOS/Clock-Calendar Card for Apple II/Calc Corner: hints for Sharp PC122/Programs: ZX81 Star Trek; PET Knockout; PET Trains.

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Benchtest: Epson HX-20/Database Benchtests comparison/Pluto Board/Walters 100 printer/Motorola MC68000/Ada/Intelligence test for computers/ European Micro Chess Championship/Computer Scrabble/Spectrum books/Calc Corner — complex arithmetic on Sharp PC1211/Screenplay — TRS-80 Colour Computer/Programs — PET Firebird/Teepee Textpro/PET Search and Rescue/Atari Colour Selector.

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Benchtests: Corvus Concept, Camputers Lynx/Database Benchtest: DataPrism/Which Spreadsheet? — Prophet II/IBM 9000 Instrumentation Computer/Apple Word Handler/Networks — Part II/ZX81 Graphics Module/Sharp MZ-80K Enhancements/Micro Chess — the Conchess range/Screenplay — Atari 800/Portable Computer World — hex listings for Casio fx602p and Sharp PC1211/Programs: Atari Animation/Chinese Horoscopes/PET Patience.

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— VisiCalc/Occam/Logo/ Lisp/Accountancy Aid/ Financial Director/ Crossword Magic/Cross Figures/Spectrum/Screenplay — Jupiter Ace and Oric-1/Compact Disc/Micro Chess/Programs: BBC Balloon/Apple VAT/MZ-80K Trains/Oric-1 Titles/Commodore 64 Sprite Editor/Spectrum Blaster.

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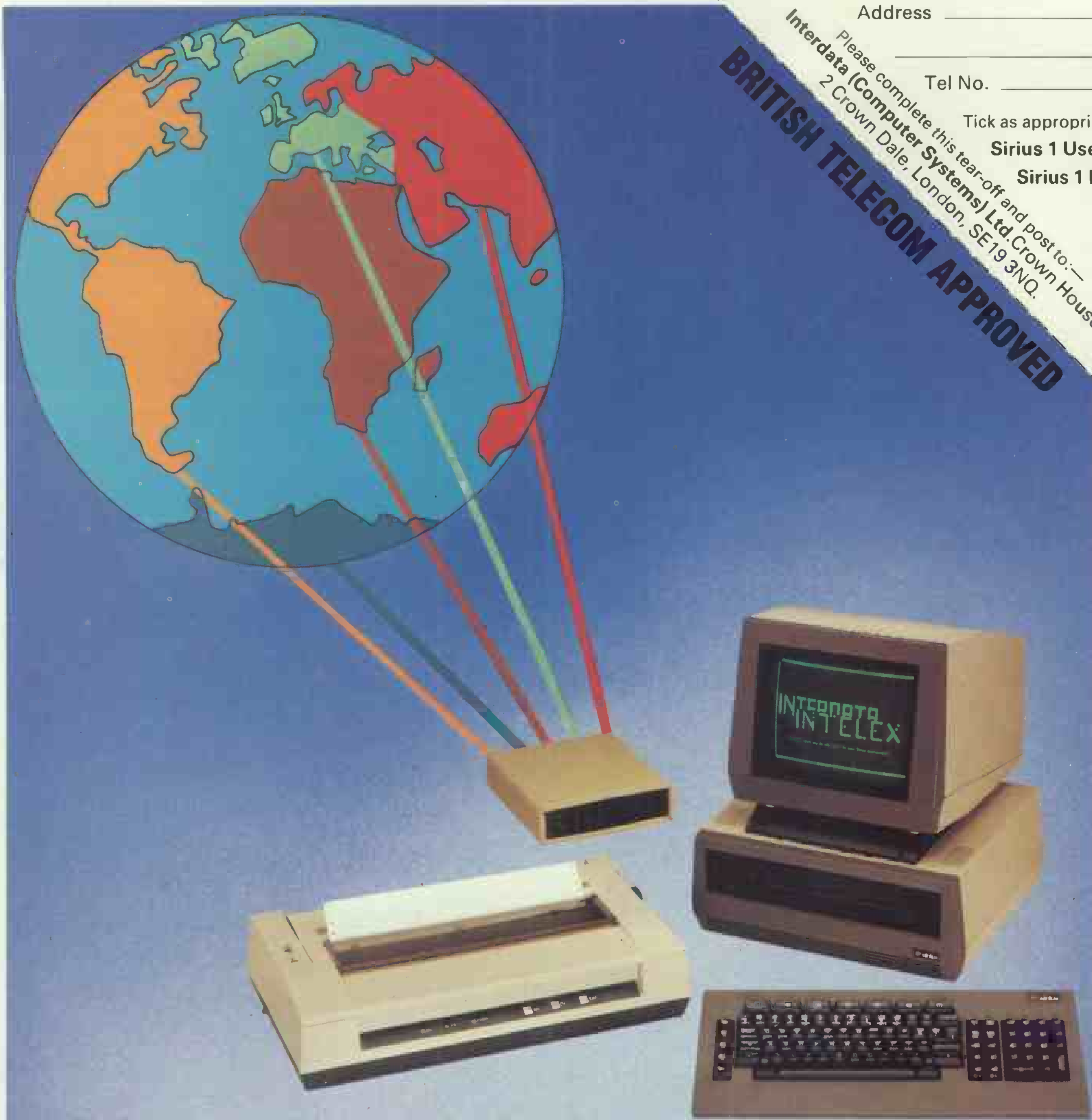
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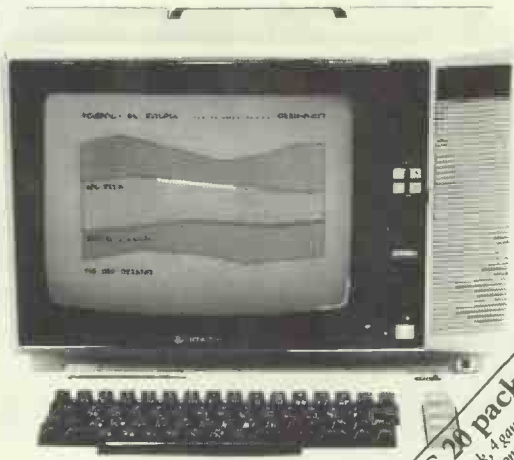

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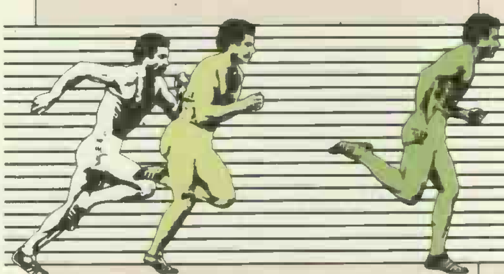

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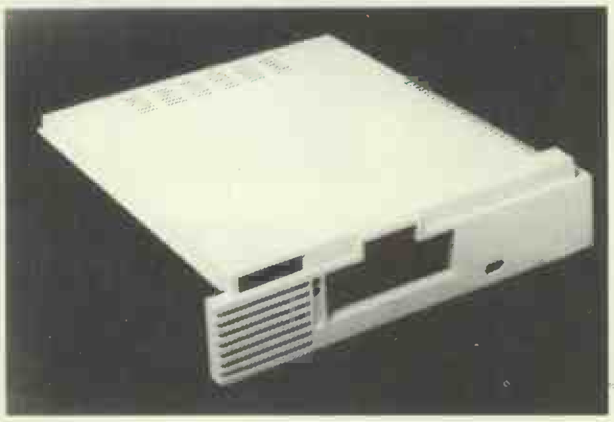

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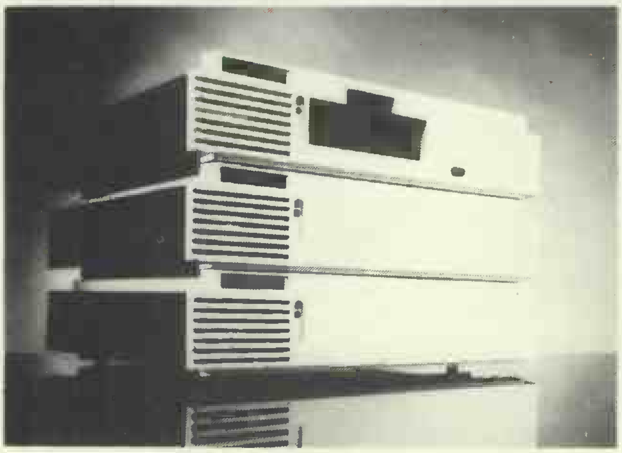

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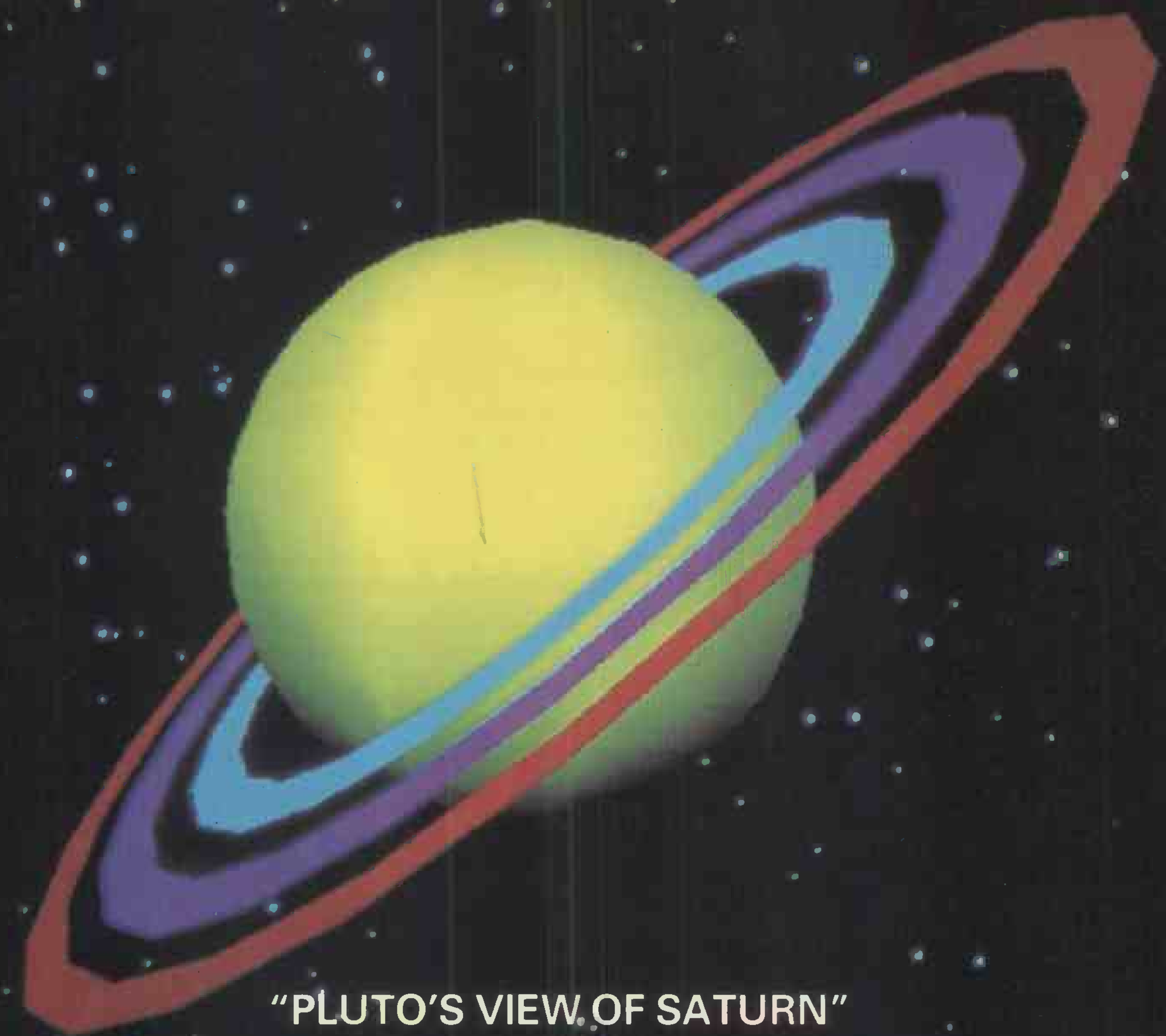

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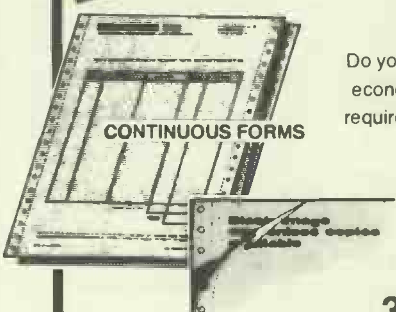

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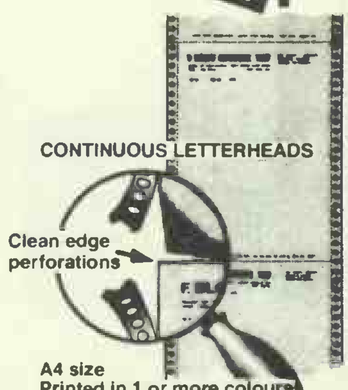

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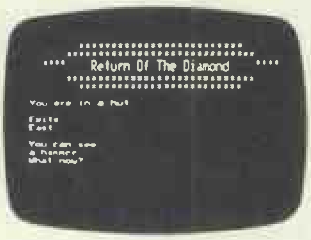

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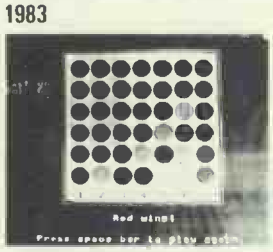

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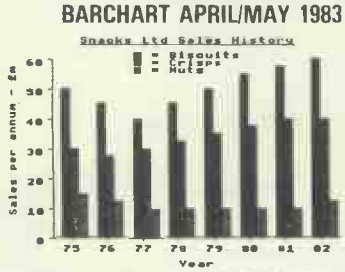

Magazine programs now available on cassette to members at £3.50 inc: VAT & p&p—see April/May issue for details.

February Issue: *Program Features:* BEEBMAZE—Find your way through the random maze, guided by 3D views from inside the maze—an excellent game. FIVE-DICE—A Beeb implementation of YAHTZEE (R), a novel dice game. Also a listing of WINDY FIELD—a creation from Acornsoft, SPIROPLOT screen doodler, and a complete memory display program in a user key. Plus Machine Code Screen Dumps for the Epson and Seikosha Printers; articles on USING FILES, IDEAS ON ANIMATION (Including a Rotating Cube program), an Introduction to the Use of Procedures, a Survey of Books on the BBC Micro, and a Roundup of Disc System Hints. PLUS a variety of HINTS, TIPS AND INFO, including a single VDU command to perform a SIDEWAYS SCROLL.

March Issue: Program Features: Life (32K), Artillery Duel (16K/32K), Square Dance. 3D Rotation (will rotate any object). Printers for the BBC micro —Review of Epson, Seikosha, Tandy and Olivetti. What to do with the new Operating System, Disc Formatter Program, and full Disc instruction set, Newcomers article on Text and Graphics Windows. PLUS How to get a new Operating System ROM and a special deal on Wordwise (members only).

April/May Issue Special Anniversary Issue—Contains index to the whole of BEEBUG Volume 1. Music Composer—create complex 3 part harmonies with this synthesiser Program. **Colour bar chart generator program.** Beeb implementation of the **Connect-Four Game.** Invasion—a 16k. Plus **Review of Tape Recorders for the Beeb;** a Basic Program Editor, which lists variables and procedures, and executes Find and Replace in a Basic Program; **Reviews of Acornsoft Games** and the **Torch Z80 Disc Pack.** Disc Menu Program. Newcomers introduction to Mode 7. How to save the unsavable; and a routine to print Double Height Characters in all modes.

June Issue: Program Features: 'Return of the Diamond' A 16k adventure game, 'hedgehog' a well implemented 'frogger' type game, and **Ellipto.** Create your own off the shelf sound effects with **Sound Wizard.** Plus articles on **Using Files, Rotating and Expanding Characters, Using Printers, and How to multi-program the User Keys.** Reviews of **The Hobbit Floppy Tape System, Adventure Games, and a Comparative Review of Wordwise and View.** Plus **FX Call Update, Disc Program Auto-relocator, Wordwise Update,** and more **BBC Book Reviews.**

July issue: Games: Robot Attack (32k) and Anagrams, a 16k word game. Watching the Beeb at work—a sample program to show your micro at work. An introduction to discs—what are they and are they worth getting. Balloons —a coloured animation. Make your micro speak like Kenneth Kendal. Bad Program Lister—lists programs even when the computer pronounces them 'bad'. Reviews of Epson and Seikosha's new printers. Five books of programs reviewed, plus more software reviews. Using Files Part 4. A full disc sector editor program—to read and retrieve lost disc files, and how to modify Acornsoft's Planetoid. Plus hosts of useful hints.

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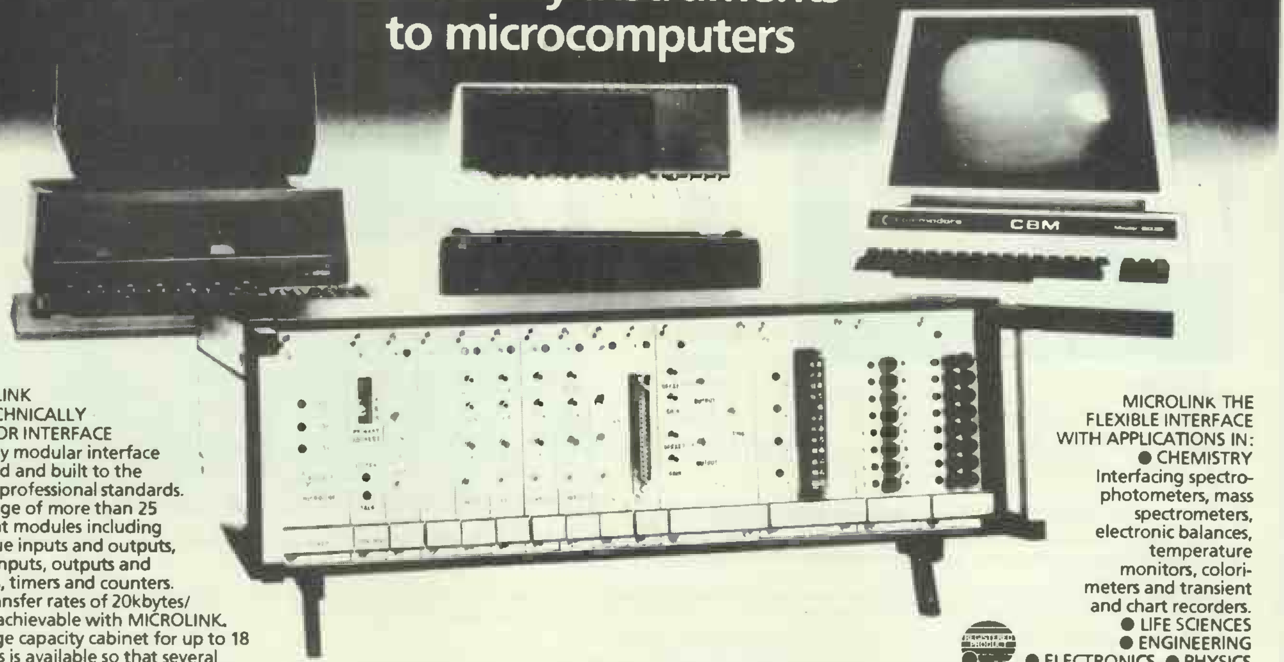

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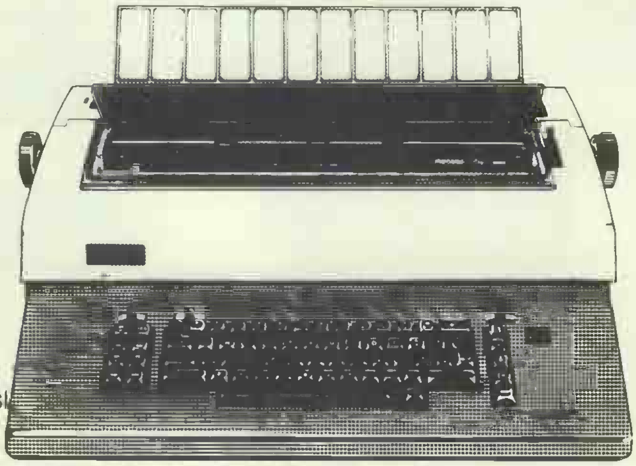

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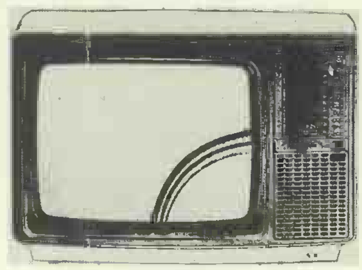

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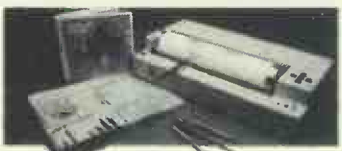

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Visiplot	135.00	155.25
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Applewriter II	83.00	97.75
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Super Text 40/80	114.00	131.10
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Zardax (40/80 & inc form letter)	139.00	159.85
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Epson FX-80 (160 cps & prop. spacing)	399.00	458.85
Epson MX100FT-3	449.00	516.35
Mannesmann Tally MT120 L (160 cps)	525.00	603.75
Strobe Graphics Plotter	545.00	626.75
Sweet P Plotter	585.00	672.75
Nec 8023 (100 cps & prop. spacing)	339.00	389.85
TEC1500-25 (25 cps daisy wheel)	599.00	688.85
Tec Starwriter F10-40cps	1099.00	1263.85
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Aristocard Parallel	69.00	79.35
Aristocard Serial	75.00	86.25
Asynch Serial I/Face (7710A)	119.00	136.85
Bufferboard	99.00	113.85
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Videx Inverse Eprom	18.45	21.22
Videx Utility Disc (inc font editor etc)	27.00	31.05
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Visicalc preboot disc (80 col with videx)	32.00	36.80
Vision-80 (incs softswitch & inverse)	185.00	212.75
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Digitek Colour Card	79.00	90.85
D.M.S. R.G.B. Colour Card	88.00	92.00
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Microvitec colour monitor	275.00	316.25
Microvitec colour card (use with above)	35.00	40.25
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Digitizer II	189.00	217.35
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Bright-Line Modulators

Types V8, V8/S, V8/SX to interface Apple Computers to UK TV sets.

Bright-Line Modulator cards allow you to make full use of your computer's colour and graphics capabilities. The V8/S offers the additional feature of high-quality sound through your TV set loudspeaker.

Features:
- Easy installation with clear and simple instructions.
- Full 8Mhz bandwidth for maximum picture definition.
- Complete with co-ax lead and polarised connector.
- Display clarity suitable for 80 column text.
- Modulators with sound option are pre-aligned.
- Made in UK.

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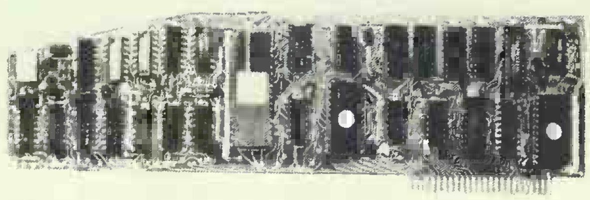
★ The built in communications software driver gives your Apple the ability to be used as a true interactive intelligent terminal to mainframe computers or communications facilities. Fully compatible with CCS serial cards and Apple communication cards etc.

★ The Vision 80 typeface is of an attractive appearance and is highly legible due to its large 9 x 11 character font.

VISION-80



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Z80 card U-micro (card only)	83.00	95.45
Z80 card Microsoft (New Softcard)	199.00	228.85
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Apple Pilot	80.00	92.00
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Forth II (Integer only)	45.00	51.75
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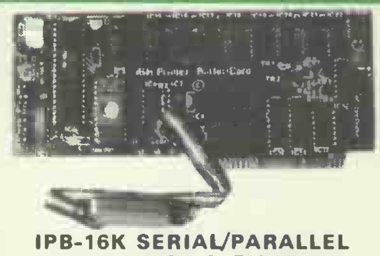

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Bright-Line V8 – Colour* modulator card £21.73 + VAT.
Bright-Line V8/S – Colour* modulator with sound £30.43 + VAT.
Bright-Line V8/SX – Colour* with programmable sound P.O.A.
* Apple][,][+, B&W only

Specification:

Tuning	Channel 36
Video Bandwidth	8Mhz
Sound Carrier	6Mhz FM with pre-emphasis
Power consumption	12v at 20 A max
Dimensions	80 x 110 x 20mm
Mounting Details	Vacant slot, or adhered to casing

CARD AVAILABLE

★ It supports all Applesoft commands including the text Window i.e. Home,Text,GR,HGR,HGR 2,Tab etc. It has inverse and normal display i.e. Highlight and Lowlight in CP/M and Pascal.

★ It is possible to change the cursor character to either a block cursor or an underscore cursor. The speed of cursor blink can be altered and it is also possible to re define the character set with your own personalised font.

★ The card comes complete with demonstration/utilities disc and is simple to install. It also includes a comprehensive users manual.

★ Totally compatible with Apple plus, and Apple //e. It works with Pascal and CP/M and some of the many software packages it supports are, Wordstar 3.0, Applewriter II, Letter Perfect, Format 80, Zardax, Executive Secretary, Magic Window, Visicalc, and Multiplan (CP/M or DOS).

★ The Vision 80 can accommodate two character sets, a normal and an alternative and it is possible to produce your own alternative character set and toggle between the two.

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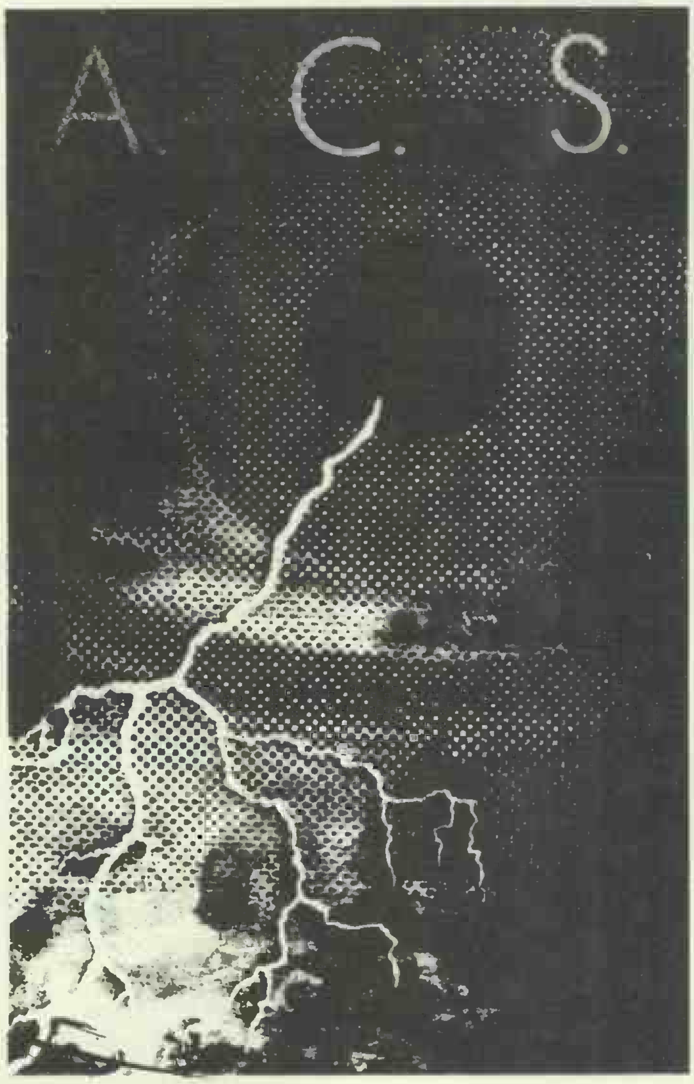

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Two recent introductions for the Commodore range are Non VAT Accounts and Database programs in the proven 'Solid State' series.

Non VAT Accounts is aimed at small businesses and clubs who need to keep financial records but are not large enough to be VAT registered. It caters for a full 12 month period and allows up to 50 entries per month.

The Database has 255 pages with up to 10 entries per page. Other features include search, print, browse, calculate, sort and print summary. Also when a file becomes too big, it can be split into two.

Both programmes are a cassette based (lots of disk ones are on the way) and cost £24.50 - vat each.

MSDOS Forth

Kuma is well known as a centre for the Forth language and would like to let all Sirius owners know that as well as CPM 86, Kuma Forth is now available under MS DOS as well.

HX Terminal Software.

Desk Master 5 has now been released. It's the editing terminal which allows you to prepare messages off-line before talking to your bureau or electronic mail box.
The cost is £39.50 - VAT.

Epsom HX 20 Book.

Because of our contribution in the area of soft ware to the HX 20, Kuma has been appointed as distributors by the publishers for the new book called 'Getting Started with the HX 20'. This will be very helpful for people who have only just bought HX 20's and want a hand getting the best out of it.

Update to Spreadsheet Calculator on M-Z 80 A& K

The cassette based Sharp Spreadsheet Calculator called Calc 3.1 has now been updated to 3.2. The improvements include a more elegant display, faster calculations, and more available memory for the spreadsheet. So send your tape in with £5.00 for the update.

Low Cost WP Unit.

Kuma have a special package deal for a word processing unit based on the SHINWA CP 80 printer and the Sharp MZ 80 A for less than £750.00. So phone 0628 71778 to get the details straight away.

Special Offers.

During August and until September 14th Kuma have special offers on hardware and soft-ware, so phone in to get the details.

Electronic Mail.

For those people who wish to contact Kuma using electronic mail boxes, the addresses are as follows.

For the British Leyland Comet Service, the address is " Kuma." For Telecom Gold, the address is "KUM ØØ1."

P.C.W.Show.

Kuma will be exhibiting at the P.C.W. show in the Autumn, so please come along and visit our stand. We'll be most pleased to see our existing customers and every body else who is interested in our products.

Book from Kuma.

Kuma is publishing its first book called 'MZ80A and MZ80K Explained'.

This is a detailed description of these excellent Sharp computers, giving details of both its instruction and its machine code software architecture. A must for someone who wishes to know how their MZ 80K or MZ 80A works.
The cost for this is £5.95.

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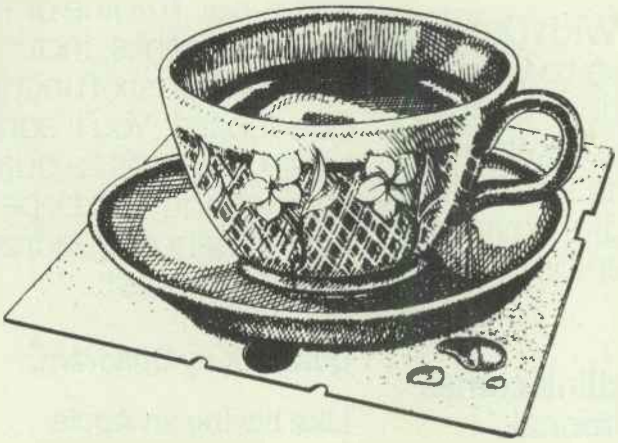

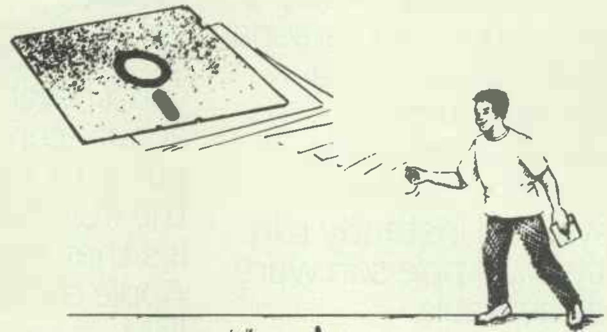

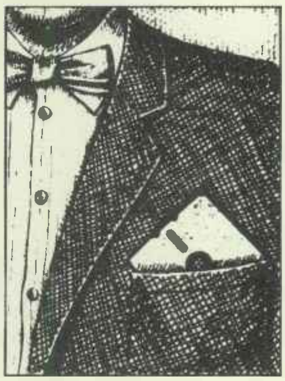

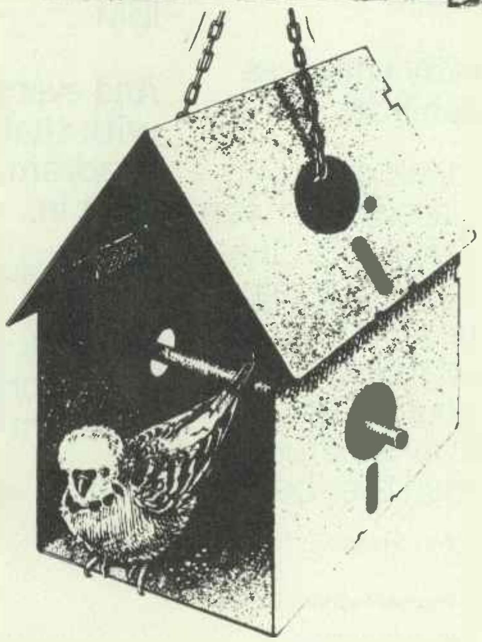

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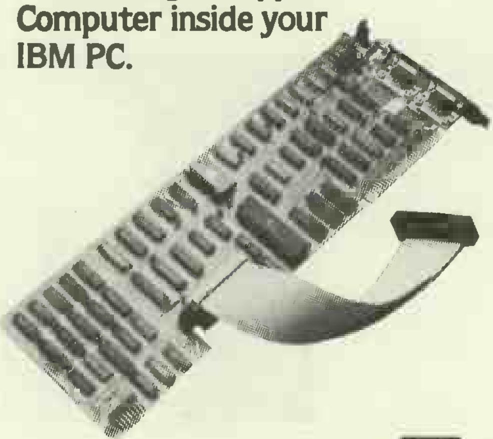

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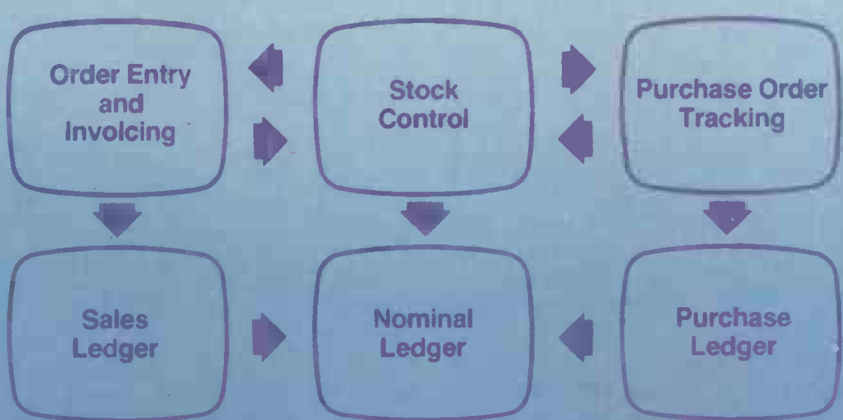

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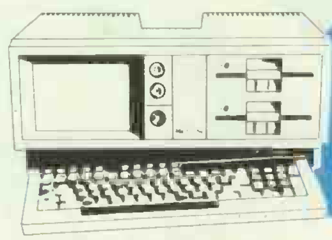

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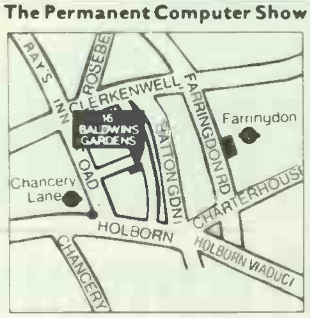

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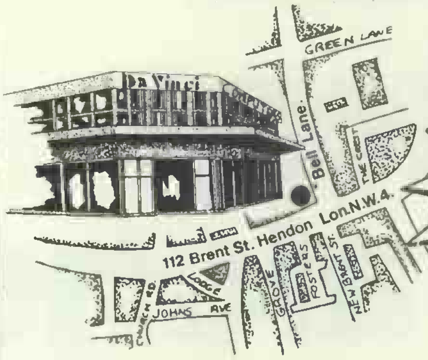

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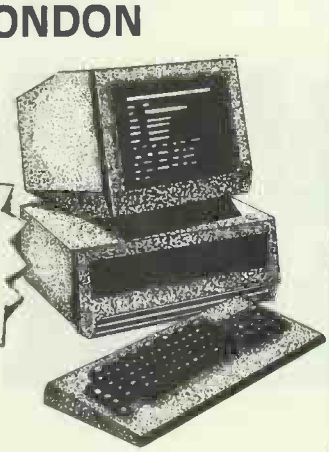

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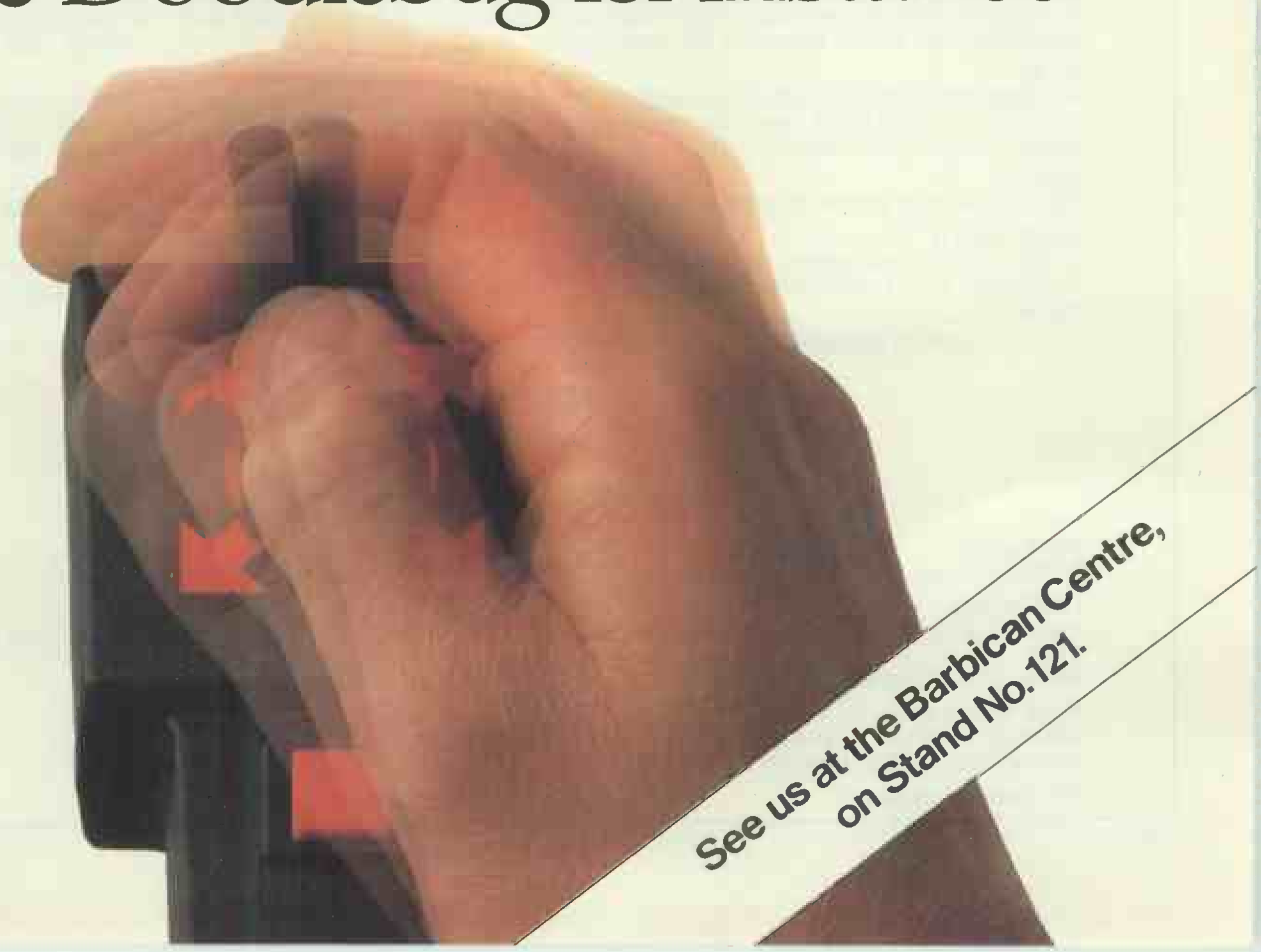

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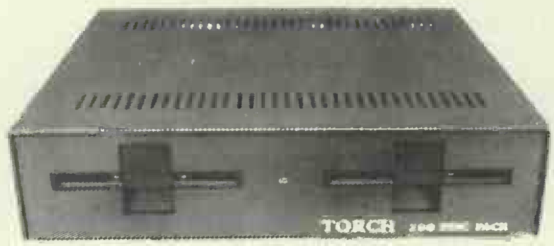

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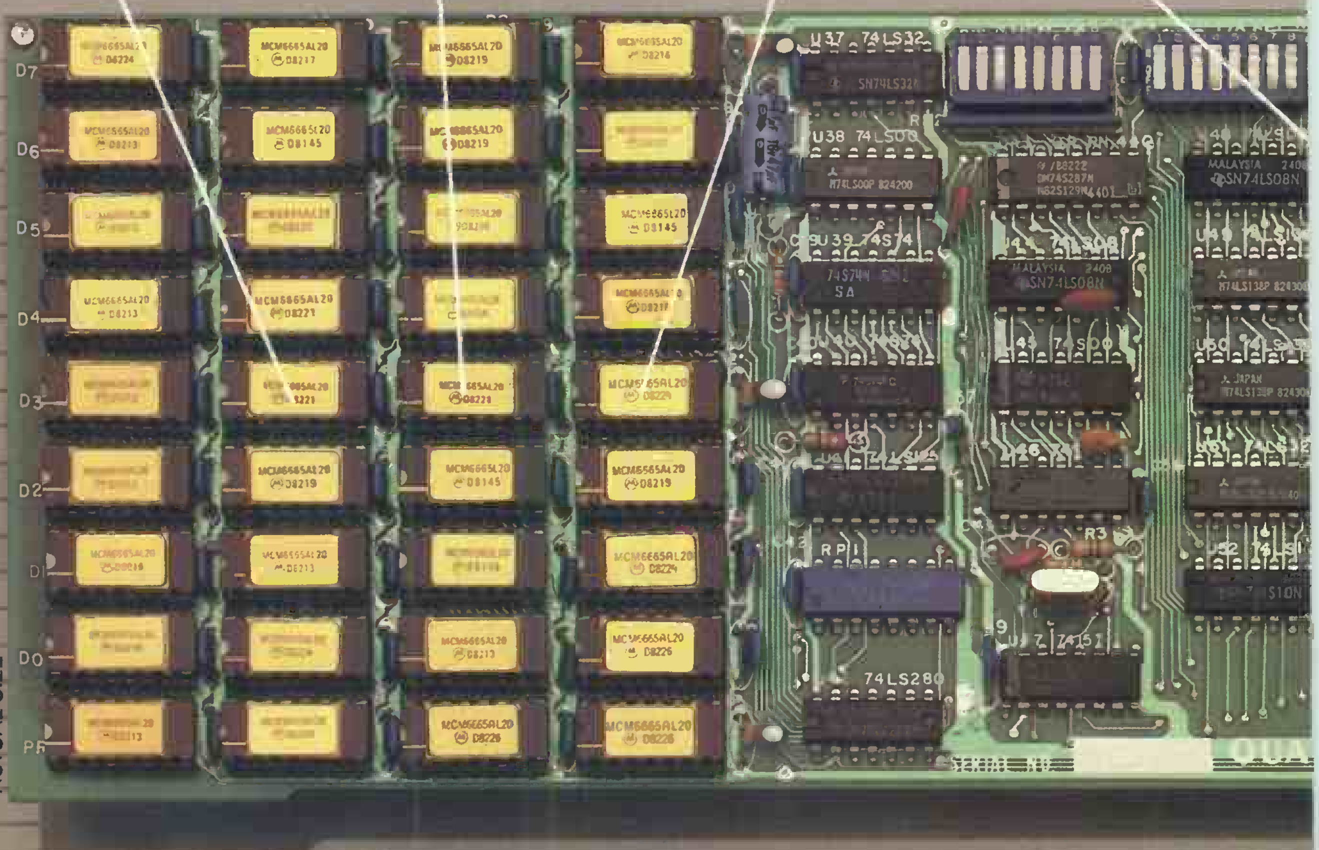

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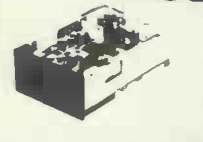

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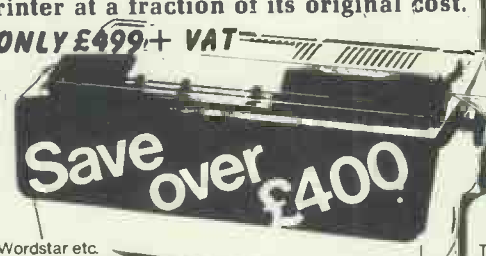

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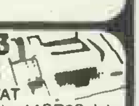

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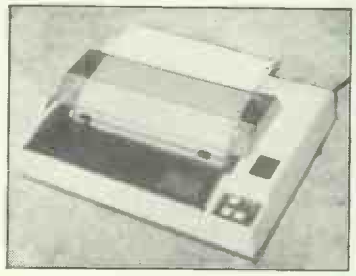

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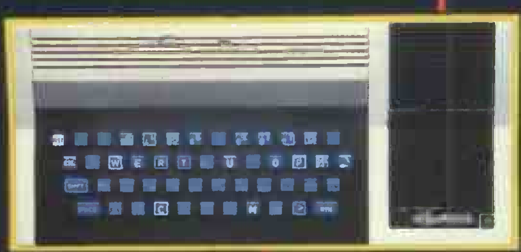

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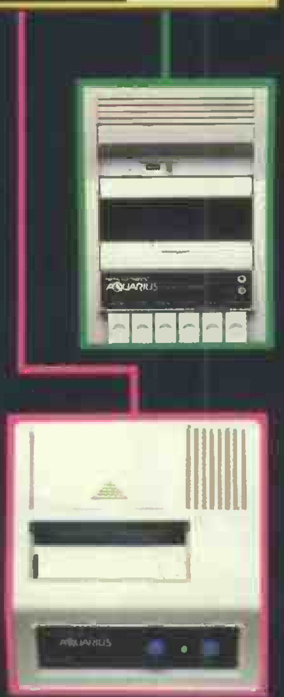

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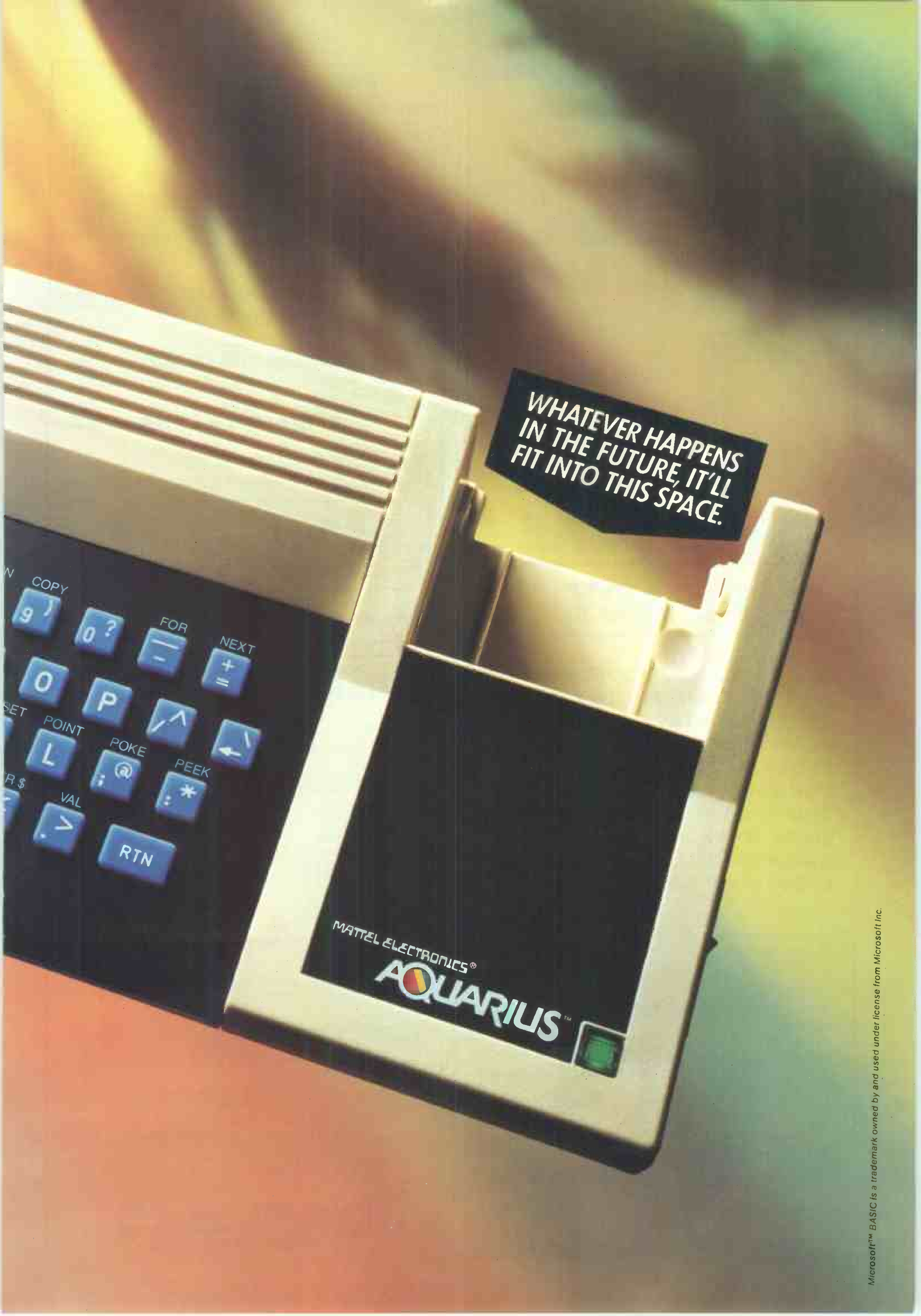
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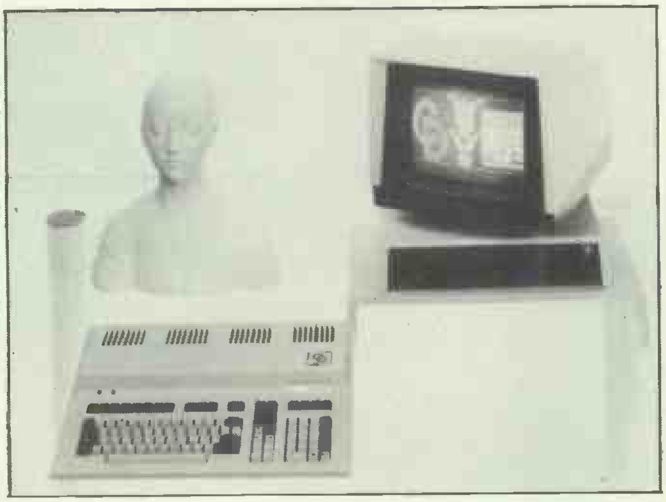

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Due to rapid expansion, The Byteshops – Britain's leading specialist microcomputer chain and part of the Comart Group – are looking for extra key personnel for their business computer centres. Applicants unless stated, should have a minimum of two years experience in the microcomputer industry. We offer excellent salaries and conditions with genuine prospects of advancement as we operate a policy of promoting from within. Interviews will be conducted locally, but write or telephone in the first instance to:

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PACE

THE NEW AMCOM DISC FILING SYSTEM

This amazing new disc filing system adds greater flexibility to your BBC Computer. It has two distinct modes which auto select on booting the system.
Mode zero is the standard mode which retains compatibility with presently available software.
Mode one, the extended mode, allows for sixty-three file names per disc, over 100% increase on the existing DFS, and also permits the file names to be up to fifteen characters in length providing much greater scope for meaningful file names. In both models page is set at &1500. This gives 10% more usable memory than Acorn's DFS, in modes 0, 1 and 2.
If you already have a Disc interface fitted, it is very easy to upgrade, you simply remove the DFS Eprom and replace it with the Amcom DFS Eprom, if not, then it is possible to purchase an entire Disc interface kit (consists of 11 I.C's). With this DFS no track cutting is required, and soldering is unnecessary.

NINE NEW COMMANDS ARE NOW AVAILABLE

*Clear	Quickly and easily erases an entire disc
*Format	Formats drive 0 to 3 in either 40 or 80 tracks
*OPT2,n	Alters the number of sectors per track to n
*OPT3,n	Alters the number of tracks per disc to n
*OPT5,n	Sets the start address of the DFS buffer (see OPT7)
*OPT6,n	Provides control over which part of the file spec. will be displayed ie. only display directory and program length, or just display drive and load address etc
*OPT7,n	Sets the length of the DFS buffer
*OPT8,n	Allows 80 track drives to read 40 track diskettes
*SYS	Selects either Acorn mode or Extended mode

There is a built-in formatter which will format in either forty or eighty tracks in both modes of operation. This formatter also allows for user definable parameters to be included for the development of software protection.
With this disc filing system a user definable buffer can be used while compacting the disc. This will enable disc compacting to be carried out without overwriting any programme in memory. Alternatively a new disc may be formatted without any resident programme being overwritten.
This DFS also allows for the use of wildcard characters, using either the # symbol for a single wildcard and the * character for multiple wild characters. (e.g. CHAIN "P*" could be used to chain a programme called PRINTER as long as there are no other files whose names begin with P).
Has many friendly features such as assisting in transfer of cassette files to disc. This DFS is totally compatible with Econet etc., and is complete with a utilities disc and comprehensive manual. The utilities disc contains many useful programmes including machine language printer screen dumps in all modes, including High Res. (Epson & NEC 8023). It also has a nibble editor to scan discs, read data, edit them, and then write back to the disc.
Also included is an eight way DIL switch which may be used to select the start up options these are:

Link 1,	Determine if the system starts up in 40 or 80 tracks.
Link 2,	Select Acorn or Extended mode at start up.
Link 3 & 4,	Selects type of drive, i.e. Shugart, Canon, etc.
Link 5,	Select auto-boot or not, on "break".
Link 6-8,	Select screen mode on start up, i.e. mode 0 to 7 etc.

AVAILABLE NOW DIRECT FROM PACE OR CONTACT YOUR LOCAL DEALER Comes complete with disc, manual 8-way dil switch and full fitting instructions. Disc filing system: £34 inclusive of VAT or as complete disc interface kit (inc DFS): £95 inclusive of VAT.

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SYNC — Separate SYNC ON RGB.
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S/S 80 Track	£24.95 for 10		
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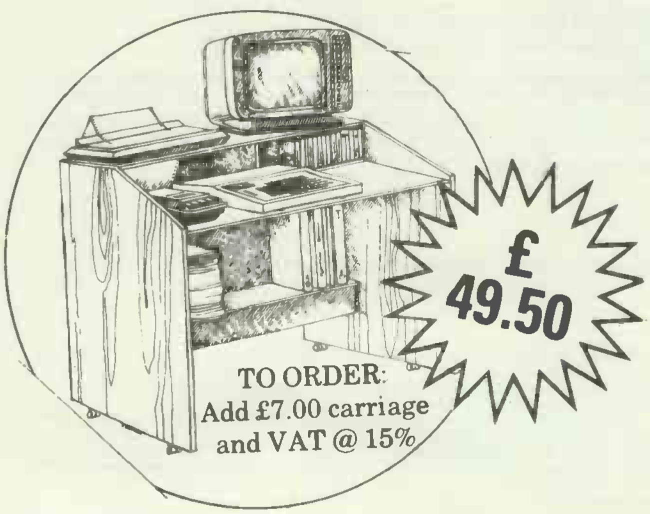

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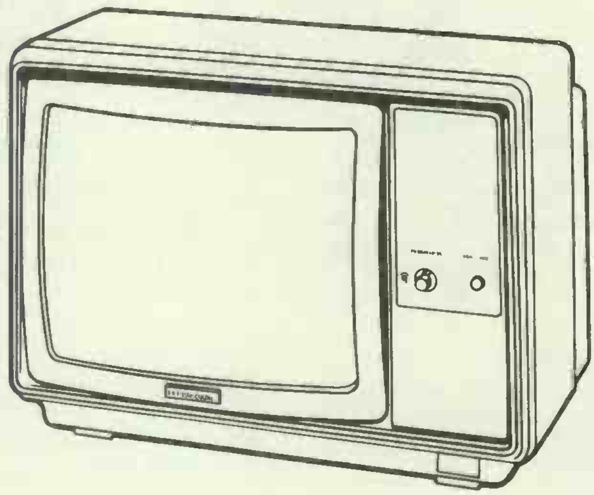

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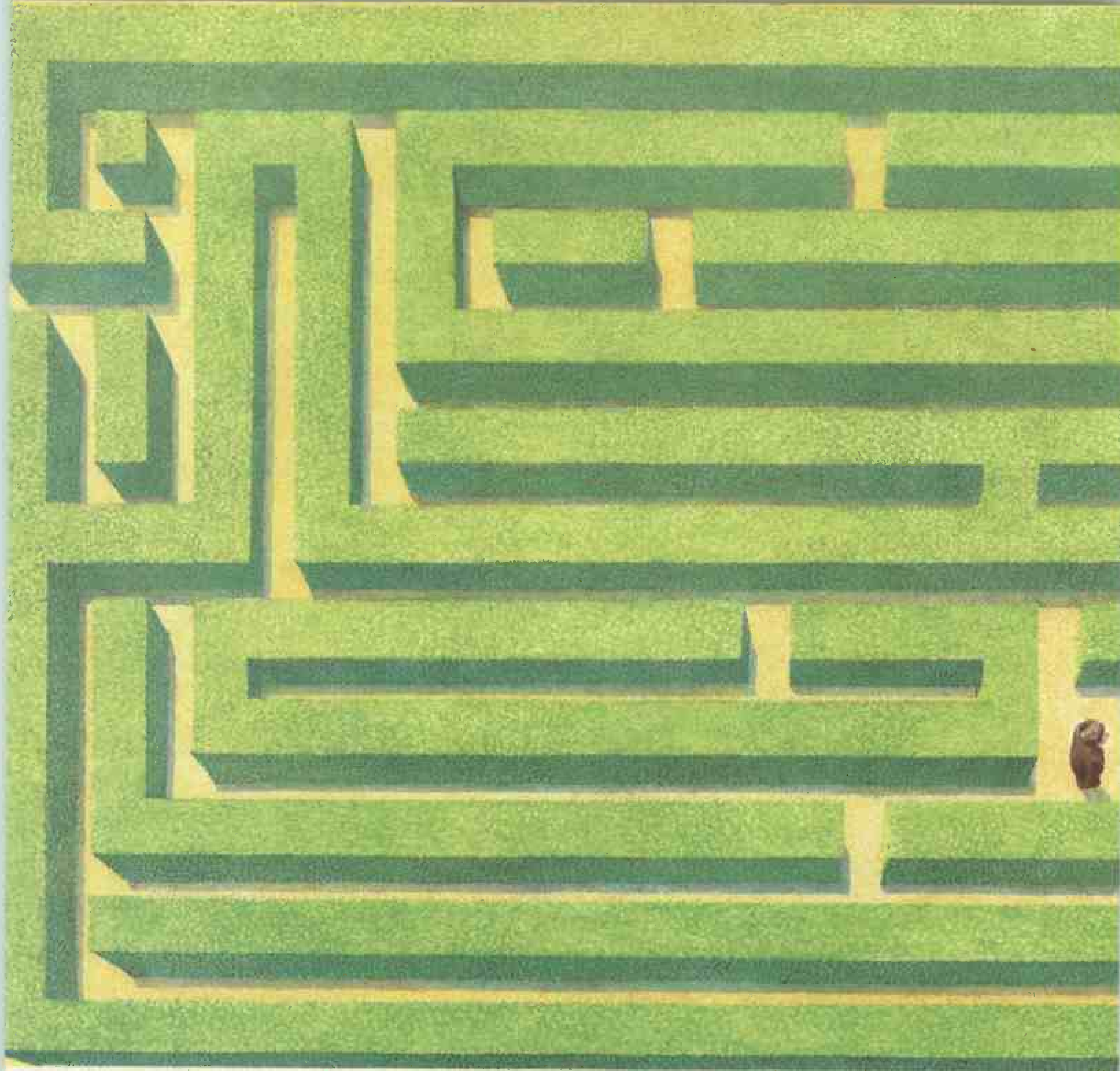

If you're confused about which microcomputer system is *exactly* right for your office, let Rank Xerox be your guide.

Today, with so many systems available, it makes sense to deal with just *one* company who can supply all your microcomputing needs – the hardware, and specifically tailored software.

The advantage: total compatibility. There's no shopping around for compatible equipment (printers, disc drives, etc.); just look for the Xerox name. You'll find it on every item you require to quickly establish a cost-effective microcomputer system.

Also, Rank Xerox offer you the "Helpline" service. As its name suggests, we don't just provide you with the right microcomputer system for your business, we also help you through those first vital stages of operation. Any questions, just call us and our specialists will work with you on a telephone link. No charge.

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Powerful microcomputers designed to help you manage your business better

Not just power, but simplicity, too. And compactness. Keyboards and controls have been more thoughtfully designed to make working with Xerox microcomputers easier and more comfortable.

The new Xerox 820 II range, for example, has all the built-in memory and operating power you could possibly need. It's CP/M* based with 8-bit or 16-bit versions. You could select the advanced 820 II HRG, with on-screen graphics for plans, graphs and so on.

For extremely powerful word processing and microcomputing together in one complete system, there's the Xerox 823.

And remember, these are *expandable* systems that grow as your business needs grow. At the same time, they're *adaptable* systems, with many disc drive and printer options to suit your requirements.

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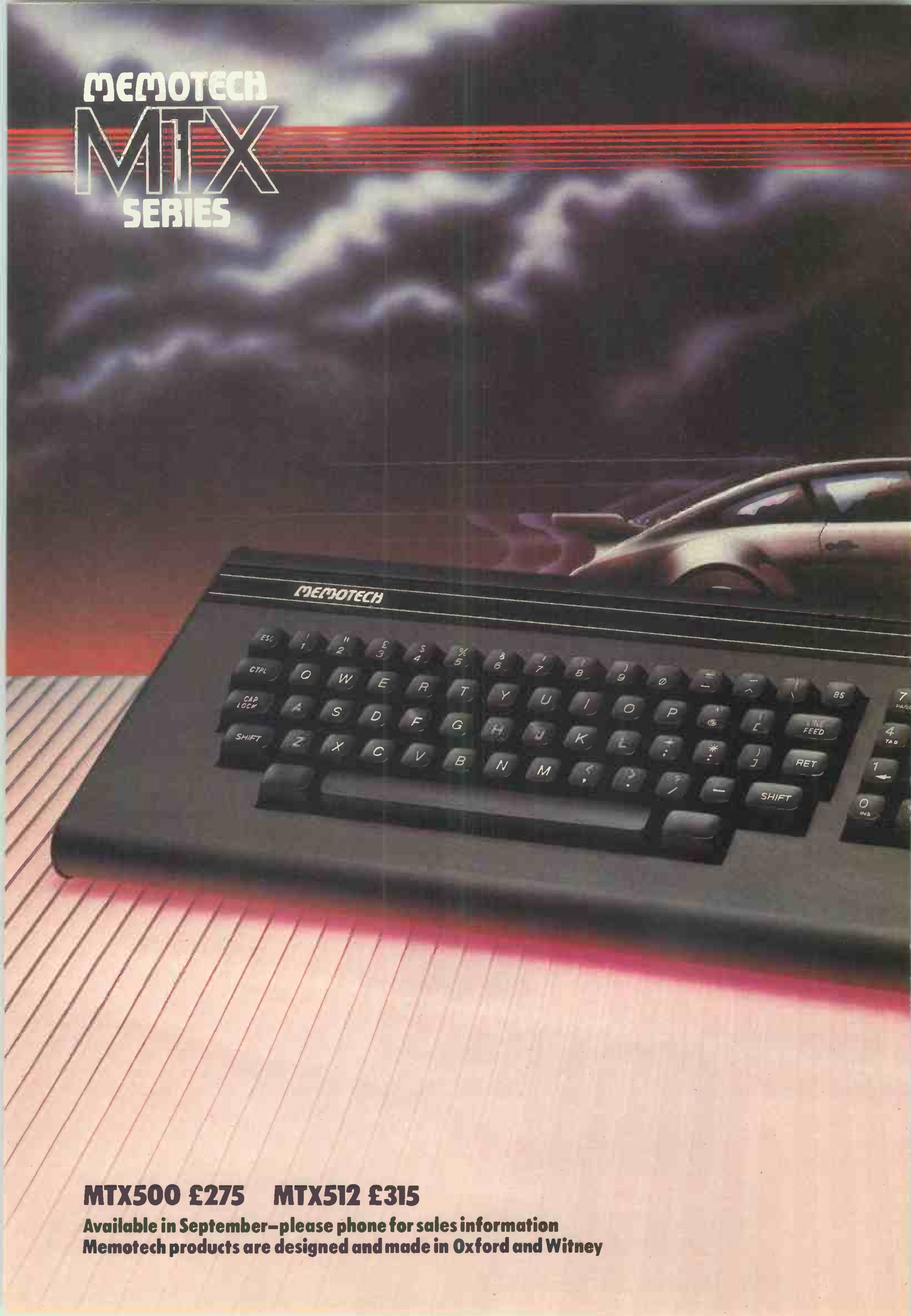
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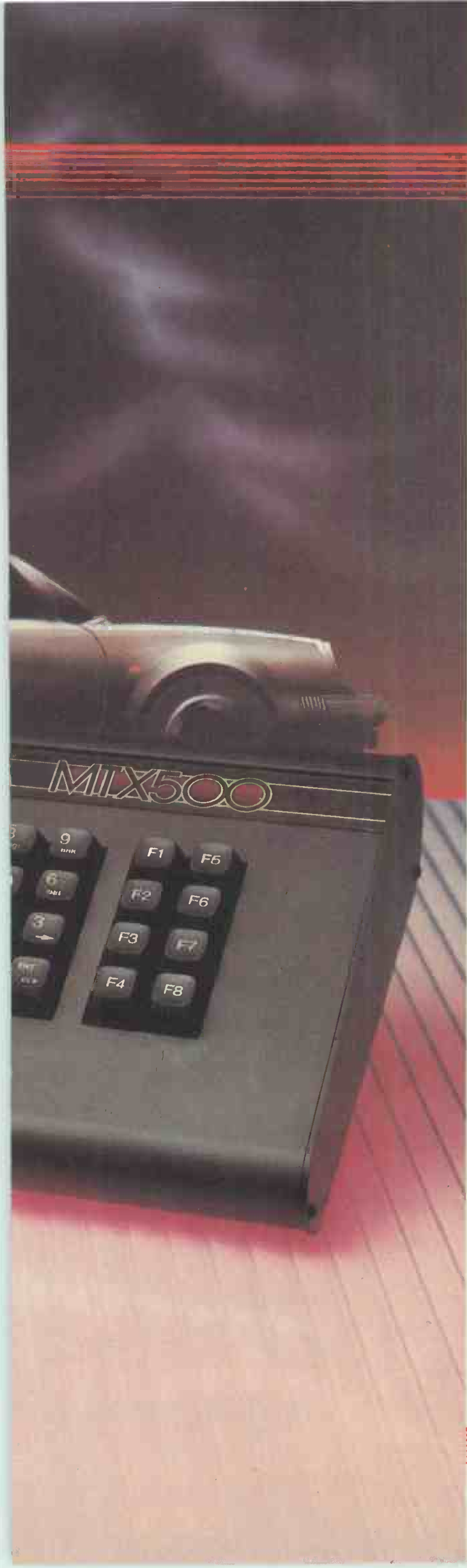

The All-Purpose System

The MTX Series

The MTX Series is a new departure in micro-computer technology. Whether your needs as a user are for personal programming, games playing, scientific or process control, educational or business use the MTX Series is already capable or very easily adaptable to almost every application. Glance through the standard features below — you'll see what we mean.

Software

The MTX's 16k ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, LOGO type commands, and NODDY. ROM routines include an ASSEMBLER/DISASSEMBLER with screen display of the Z80 CPU registers, memory and program, which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to define sections of the screen to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

Hardware

The MTX500 has 32k of user RAM as standard (64k on the 512), expandable to 512k plus 16k of dedicated video RAM. Sixteen colours, 40 column text, 256 x 192 high resolution graphics with all sixteen colours available, and easily moveable user defined graphics (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 3 voice sound with hifi output plus a dedicated games cartridge port.

Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight function keys and separate numeric pad.

The Disc Based System

The MTX series has been produced with performance and expandability uppermost in the design team's thoughts. When expanded to Disc level the computer supports the following facilities, which will be available in October:

- *80 column video board*
- *5¼" floppy discs*
- *5¼" hard discs*
- *CP/M 2.2, enabling the widely available range of CP/M based software*
- *Memotech Silicon discs — multiples of 256K of fast RAM expandable to 8m bytes*
- *Colour Wordstar*
- *A/D and D/A converters*
- *Networking*

MTX

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Telex: 892395

Italics identify new products and new versions.

* *Different price when under this operating system. Please phone for details.*

1 Operating Systems

		£
CP/M V2.2	Digital Research	115
CP/M-86	Digital Research	197
CP/NET	Digital Research	141
MP/M V2.0	Digital Research	321
CP/M PLUS	Digital Research	241
CONCURRENT CP/M-86	Digital Research	257
MP/M-86	Digital Research	477

2 High Level Languages

ADA	Supersoft	200
C	Supersoft	184
C	Digital Research	440
BCD (For C COMPILER)	Supersoft	200
C BCD	Supersoft	284
LISP	Supersoft	100
BASIC COMPILER	Supersoft	200
BASIC-80 V5.21	Microsoft	241
BASIC COMPILER V5.3	Microsoft	272
FORTRAN-80 V3.44	Microsoft	344
FORTRAN	Supersoft	284
RATFOR	Supersoft	67
FORTRAN-RATFOR	Supersoft	334
FORTH	Supersoft	134
TINY PASCAL	Supersoft	57
CBASIC	Digital Research	85
CBASIC COMPILER	Digital Research	347
PL/1	Digital Research	367
CIS COBOL	Micro Focus	425
LEVEL-2 COBOL	Micro Focus	965
CORAL-66	Micro Focus	825
COBOL-80 V4.60	Microsoft	516
muLISP/muSTAR V2.12	Microsoft	138
muMATH/muSIMP V2.12	Microsoft	180
PASCAL MT	Digital Research	229
SPEED PROGRAMMING PACKAGE	Digital Research	131
PASCAL MT · WITH SPP	Digital Research	327

3 Low Level Languages

MAC	Digital Research	69
MACRO-80 V3.44	Microsoft	138
PASM	Phoenix Software Associates	95
RASM-86	Digital Research	147

4 Utilities/System Tools

DIAGNOSTICS II	Supersoft	84
DISK DOCTOR	Supersoft	67
SYSTEM CHECKER	Supersoft	50
DISK-EDIT	Supersoft	67
UTILITIES I	Supersoft	40
UTILITIES II	Supersoft	40
THE OPERATING GUIDE	Decision Systems	45
BT-80	Digital Research	184
DESPOOL	Digital Research	35
SID	Digital Research	63
XLT86	Digital Research	105
ZSID	Digital Research	72
dUTIL (FOR DBASE-II)	Fox & Geller	72
CLIP	Keele Codes	80
SPOOLER	KLH Systems	92
ANIMATOR	Micro Focus	225
FILESHARE	Micro Focus	250
FTNUMB	Micrology	50
PLINK	Phoenix Software Associates	95
BUG	Phoenix Software Associates	95
PDEVELOP	Phoenix Software Associates	253
PLINK-2	Phoenix Software Associates	242
DISKORG	Slogger Software	50
LEVEL - 2 ANIMATOR	Micro Focus	475
DISKMAN	Slogger Software	65
DISKED-2	Slogger Software	65
DISKTOOLS-1 (DISKMAN & DISKORG)	Slogger Software	90
DISKTOOLS-2 (DISKTOOLS-1 & DISKED-2)	Slogger Software	145

5 Sorting

SUPERSORT	Micropro	145
MSORT V1.012	Microsoft	134

6 Code Generators

THE LAST ONE	D.J. 'A1' Systems	330
QUICKCODE (FOR DBASE-II)	Fox & Geller	203
QUICKSCREEN (FOR MBASIC)	Fox & Geller	115
QUICKSCREEN (FOR CBASIC)	Fox & Geller	115
FORMS-2	Micro Focus	110
PEARL-3	Pearl International	295
AUTOCODE	Stemmos	220
LEVEL-2 FORMS-2	Micro Focus	110

7 Telecommunications/Conversions

		£
BSTAM	Byrom Software	131
BSTMS	Byrom Software	131
BISYNC-80/3780 (EBCDIC)	Micro Integration	525
BISYNC-80/3780 (ASCII)	Micro Integration	525
BISYNC-80/3270 (BSC)	Micro Integration	525
BISYNC-80/HASP	Micro Integration	975
REFORMATTER CP/M ⟷ IBM	Microtech Exports	164
REFORMATTER CP/M ⟷ DEC	Microtech Exports	164
BACSCOPY	Comley Computer Services Ltd	150
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ICL CO3 EMULATION (Bulk)	Synchro Systems Ltd	600
ICL CO3 EMULATION (Interactive & Bulk)	Synchro Systems Ltd	900
TERM II	Supersoft	134

8 Word Processing/Text Editing/Editors

TEX V3.0	Digital Research	63
PARAGRAB	Focus	75
WORDSTAR	Micropro	295
MAILMERGE	Micropro	145
WORDSTAR & MAILMERGE	Micropro	390
SPELLSTAR	Micropro	145
WORDMASTER	Micropro	90
EDIT-80 V2.02	Microsoft	83
LEXICON (WORD ANALYSIS)	Microtek	200
PEDIT	Phoenix Software Associates	95
PMATE	Phoenix Software Associates	131
CORRECTOR	Supersoft	167
STAR EDIT	Supersoft	150

9 Databases/Data Management Systems

dBASE - II	Ashton Tate	438
dGRAPH	Fox & Geller	203
ADDRESS BOOK	Decision Technology	90
RESCUE	MBS	295
SELECTOR-V	Micro-Ap	360
DATASTAR	Micropro	175
PERSONAL PEARL	Pearl International	190
INFOSTAR	Micropro	295
PERSONAL DATA BASE	Supersoft	84
SUPERFILE (SINGLE-USER)	Southdata	485
SUPERFILE (MULTI-USER)	Southdata	710
CONVERT	Southdata	45

10 Accounting/Business Applications

TYPING MASTER (BASIC VERSION)	Anthony Ashpitel	50
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PADMEDE ACCOUNTANTS SYSTEM	Padmede Computer Services	399

11 Financial Modelling/Problem Solving

MATHSPACK	MPI Ltd	120
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CALCSTAR (APPLE II)	Micropro	136
MULTIPLAN	Microsoft	189
SAPPHIRE MARS	Sapphire Systems	395
LINEAR & GOAL PROGRAMMING	Electronic Accounting Services	200
SCRATCH PAD	Supersoft	197
STATS-GRAPH	Supersoft	134
THE OPTIMIZER	Supersoft	134
QSTAT	Pivotal Software	185
PROFITPLAN	Chang Labs	140
MICROPLAN	Chang Labs	345
QSTAT	Pivotal Software	185

12 Games

FLIGHT SIMULATOR	Microsoft	37
NEMESIS	Supersoft	30
DUNGEON MASTER	Supersoft	30

ORDER INFORMATION

When ordering CP/M software please specify the format you require. All software items are subject to VAT. Manuals, when purchased separately, are not subject to VAT. Please add £3.75 (plus VAT) for postage and packing for the first item purchased, and then £1.15 for each extra item. For overseas please add £6.50 per item and then £1.50 for each extra item required. Most software in this advertisement is available from stock and a 72 hour return service is thereby offered on most prepaid orders. These details and prices are all current as of June 1983. (Telephone at time of purchase to confirm latest prices.) All payments must be in Sterling and drawn against a U.K. bank. MAIL ORDER - TELEPHONE ORDER - VISIT

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FORMATS

A1 - 8" SINGLE SIDED SINGLE DENSITY

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APPLE CP/M-80 16 Sector	RR
Blackhawk Micropolis Mod II	Q2
British Micros Mimi	RK
CDS Versatile 4	Q2
Comart Communicator CP50	P2
Comart Communicator CP100	P2
Comart Communicator CP200	P2
Comart Communicator CP500	P2
Compal-80	Q2
Cromemco System 2 SS SD	R6
Dec Rainbow	N6
Dec VT 180	RV
Direct 48TPI DS DD	R2
Exidy Sorcerer CP/M-80	Q2
Facit 96TPI SS DD	N5
Future 32:16	C4
Hitachi 16000	C2
IBM PC-DOS SS DD	C1
IBM PC-DOS DS DD	C2
IBM CP/M-86 SS DD	C3
IBM CP/M-86 DS DD	C4
ICL-PC	RE
Industrial Microsystems 5000	RA
Intertec Superbrain SS DD	RK
Intertec Superbrain QD	RS
ITT 3030	NA
ITT 3030 (96TPI)	NA
Miracle	N9
Multi-Tech 1	Q2
Multi-Tech 2	Q2
Nascom (Gemini Drives SS DD)	R3
Nascom (Gemini Drives DS SD)	R7
Nascom-Lucas	N1
NEC PC8001	R5
NCR/M5DS	RB
North Star Advantage	P2
North Star Horizon SS SD	P1
North Star Horizon SS DD	P2
North Star Horizon QD (Other CP/M)	P2
Nylac Micropolis Mod II	
Olivetti M20 CP/M-86	Q2
Osborne-I	C3
Osborne I DSDD	RP
Orion CP/M-86 SS DD	RC
Orion CP/M-86 DS DD	N7
Rade 1000 SS DD	N8
Rade 1000 DS DD	RL
Rair Black Box	RM
Research Machines 5.25in	RE
Robotron 5	RN
SD Systems 5.25in	N3
	R3
Sharp MZ-80B	R9
Sharp MZ-3500	R9
Sharp PC-3201	R8
Sirius I (CP/M-86)	D1
Sirius I (MS-DOS)	D2
Shelton Signet	RK
Televideo DS DD	S5
Texas Instruments Professional	C2
Tiger 96TPI SS SD	N4
Torch	N2
Toshiba T200	SF
Tycom Microframe	C2
Vector MZ	Q2
Vector Systems B	Q2
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Wordplex	R4
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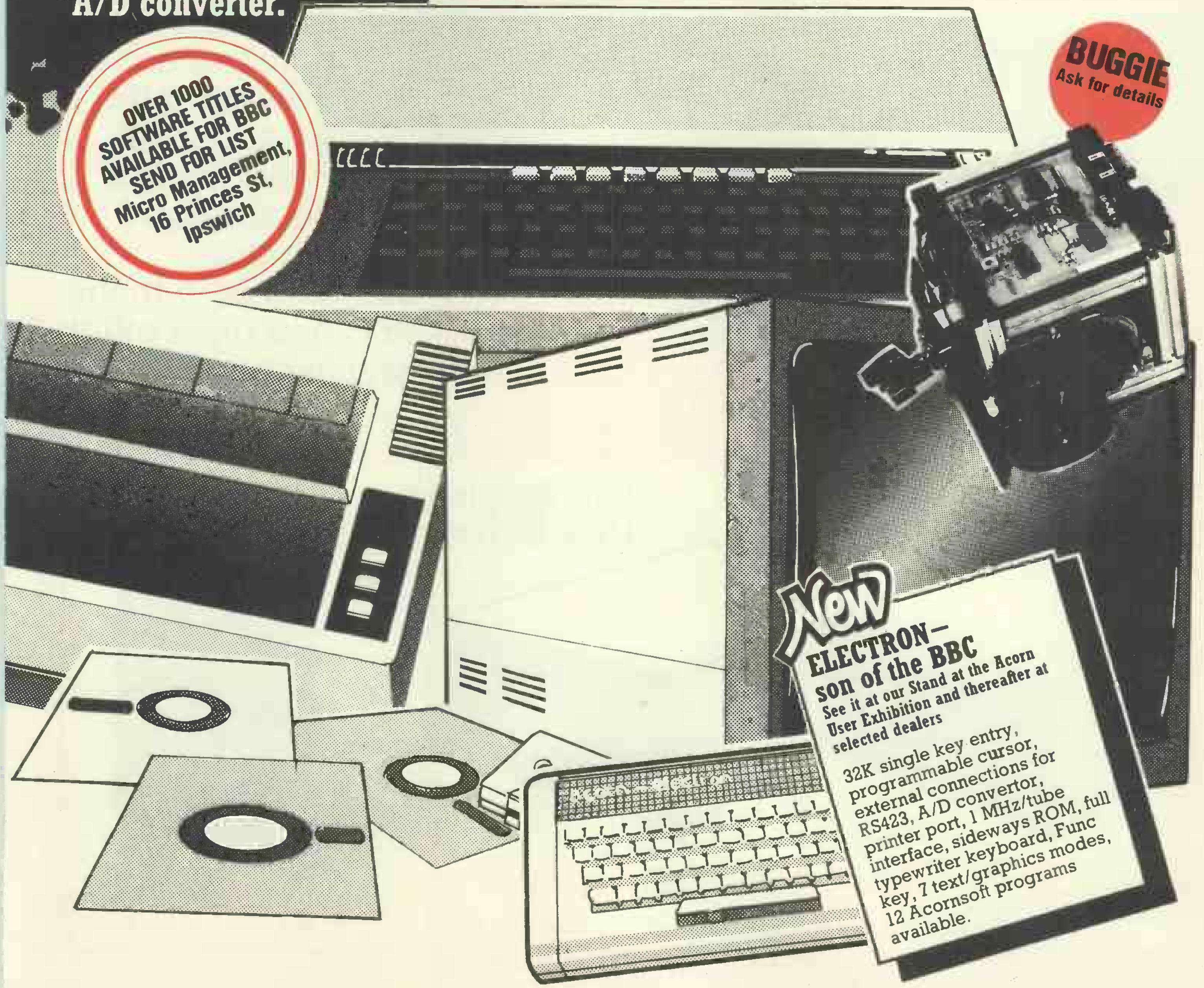

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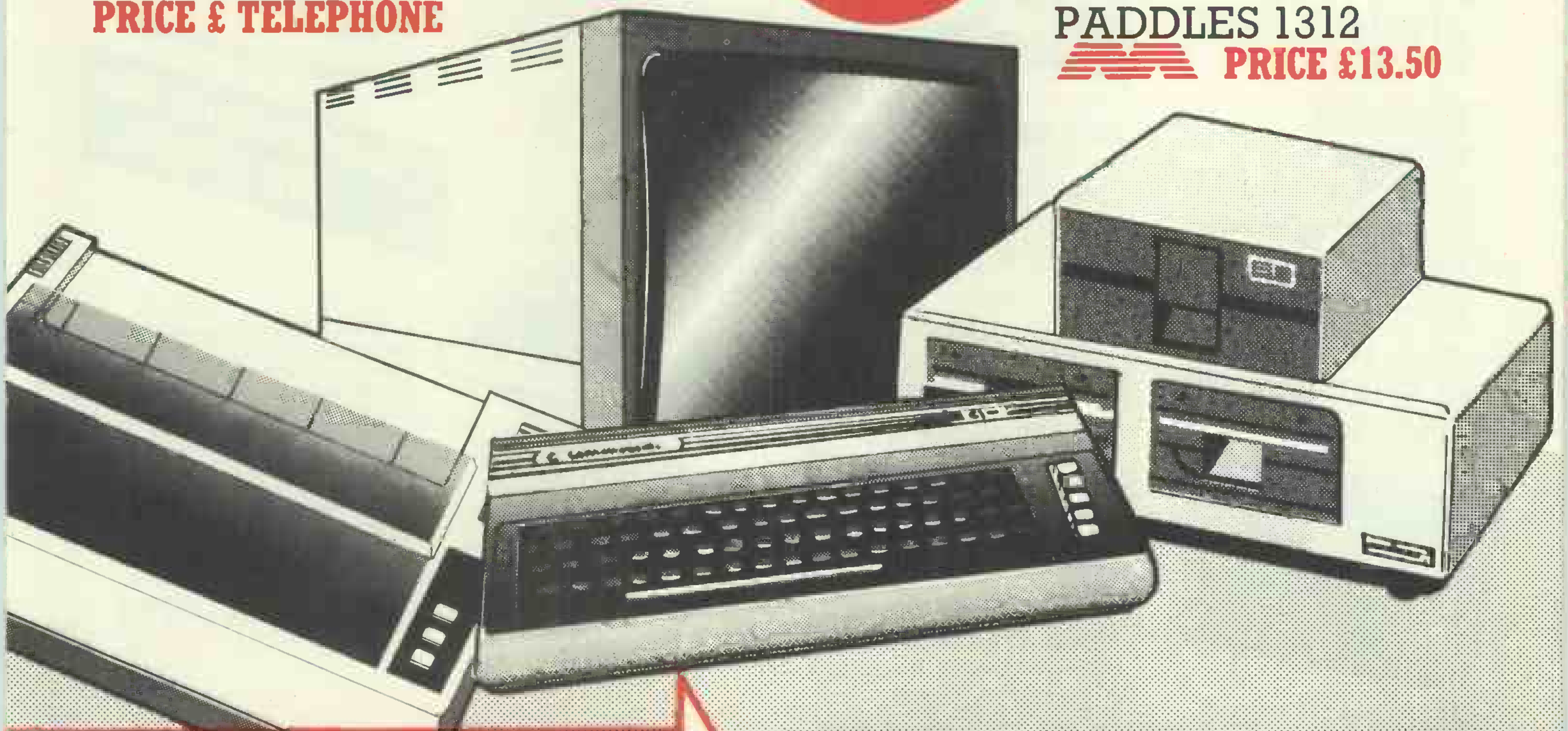

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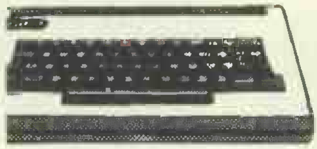

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48K standard, expandable to 192K, colour, 57 key typewriter keyboard, CP/M compatible, serial port, high resolution graphics 265 × 248, digital/analogue sound converter, RGB/UHF composite video, RS232/parallel, cassette.

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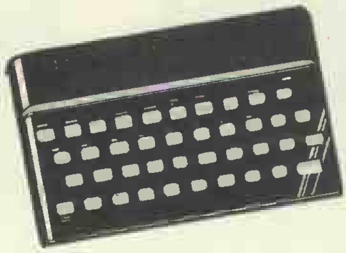

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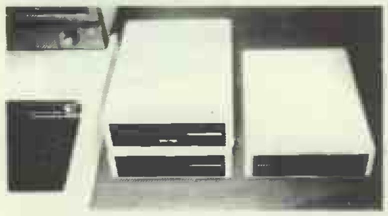

These drives are supplied ready cased with all the necessary cables, formating program and user disk system guide.

There are some useful utilities included, e.g. Epson Screen Dump Program, Memory Dump, Free, Duplicate, Merge and Relocate. Power consumption of these drives is very low (0.2A typ. at +12V, 0.4V typ. at +5V per drive). Power is taken from the BBC computer.

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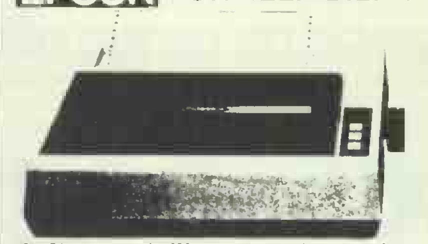

EPSON FX80: 80 column, 160 CPS, normal, italic and elite characters, 256 user definable characters, superscript, subscript, 11 x 9 matrix, bi-directional logic seeking, hi-res bit image printing (960 x 8 dots/line), friction and pinfeed, 9 international character sets, Centronic parallel interface.

FX80 PRICE .... £379 + VAT = £435.85

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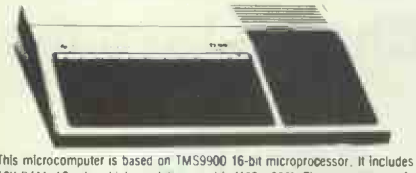

This microcomputer is based on TMS9900 16-bit microprocessor. It includes 16K RAM, 16 colour high resolution graphic (192 x 256). The screen display is 32 characters, 24 lines TI-BASIC. Full-size keyboard. For Software there are about 1000 programs to choose from. There are a lot of peripherals available, e.g. Disk Drives, Disk Interface, Speech Synthesizer, Extra RAM, Additional Language (PASCAL, TI-LOGO, ASSEMBLER).

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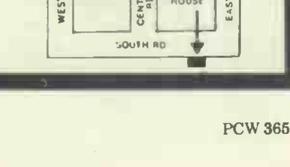

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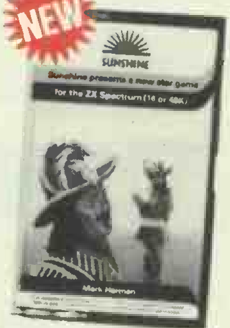

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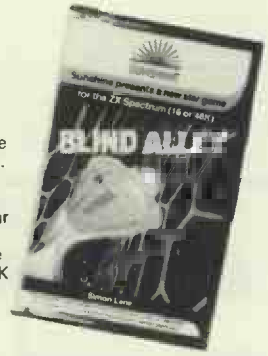

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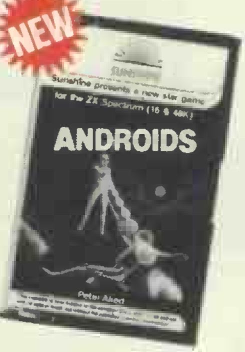

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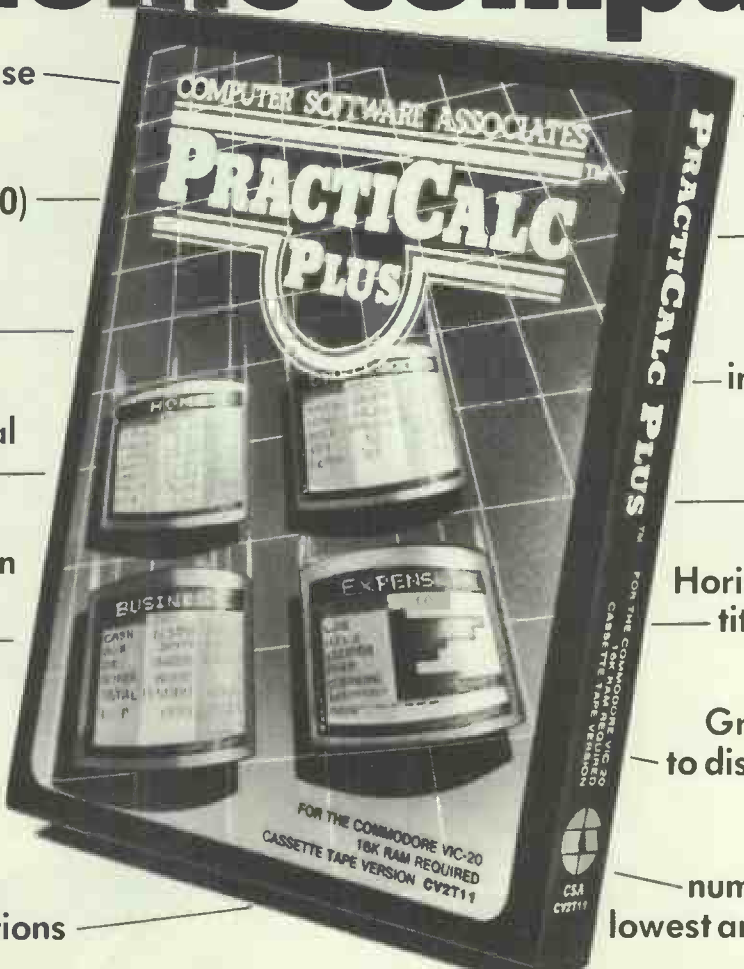

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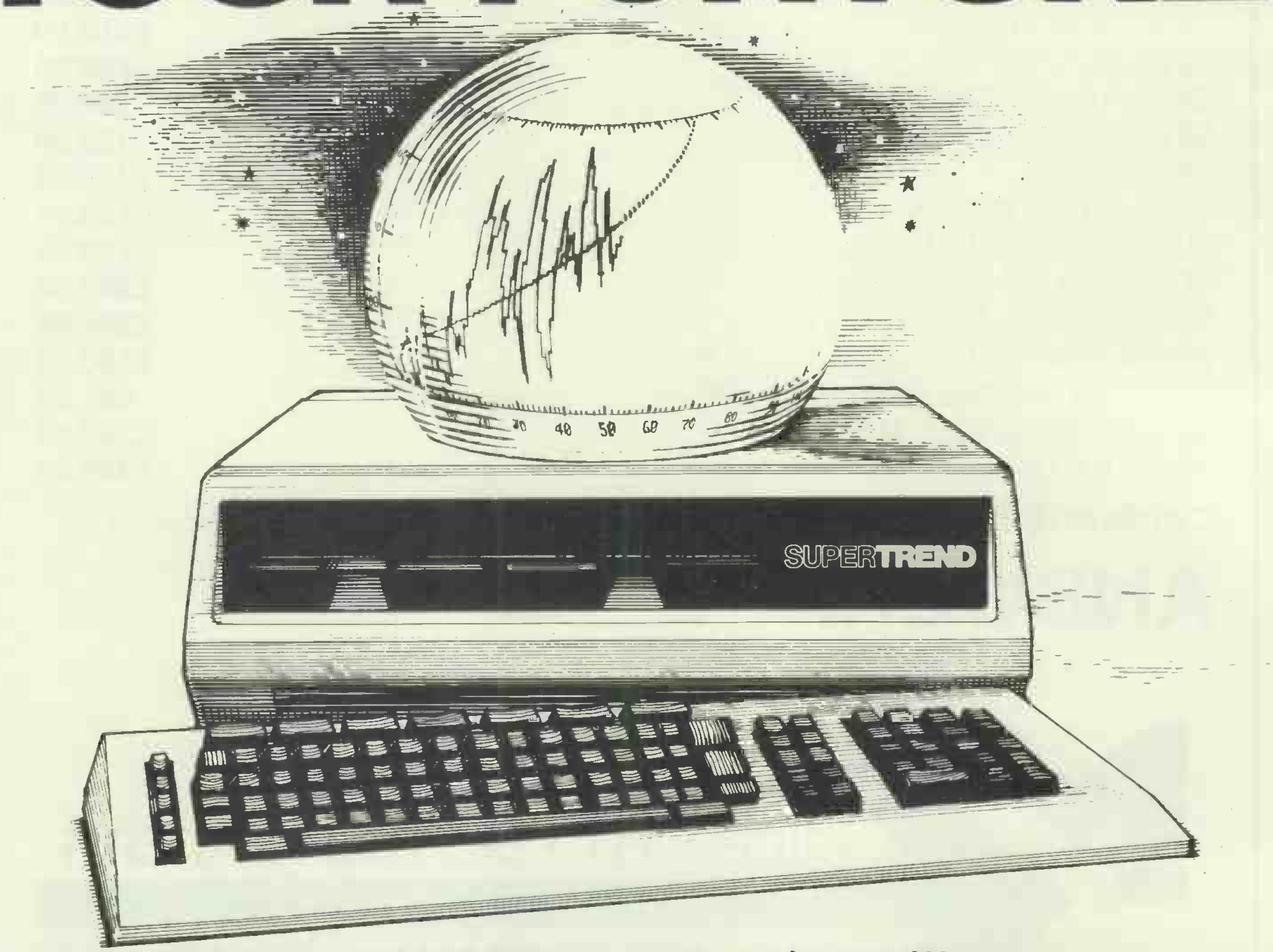

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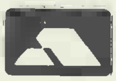

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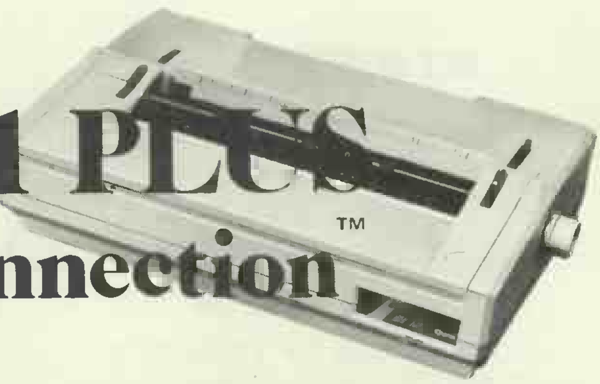

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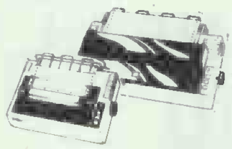

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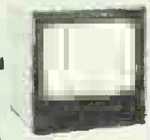

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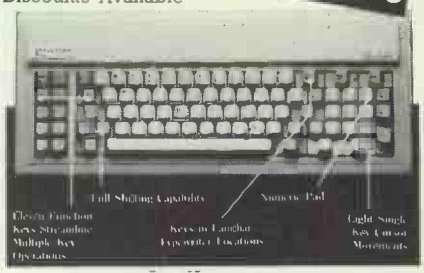

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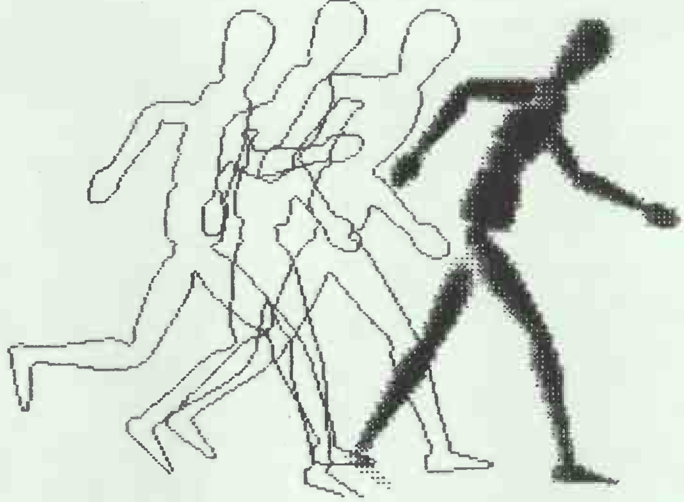

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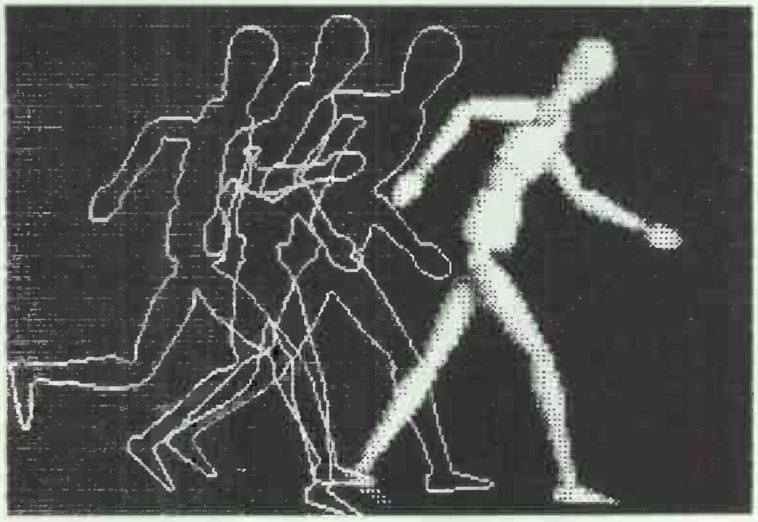

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ADVERTISERS INDEX

CHIP CHAT

The launch of ACT's Apricot recently had an element of surprise for all the white-hot technocrats who attended. This was a cake modelled to look just like ACT's new piece of leading-edge technology. It even came as a separate screen, computer and keyboard! Rumours are abroad that ACT is about to go into the bakery business... And on the subject of launches, Data General chartered Concorde to fly to New York for the launch of an integrated office microsystem. This was instead of shelling out to organise a separate launch in each European city. One wonders: is it cost-effective?... And *still* on the subject of launches, Torch Computers allegedly paid William Woollard (of Tomorrow's World fame) £4000 to speak at the recent launch of the 68000-based Super Torch. That probably wasn't cost-effective... Regular readers of this august page will no doubt remember the reference, a couple of issues ago, to HELP, a fitness program which used those appalling instruments, skinfold calipers (shock, horror, probe, etc), as a sort of perverse peripheral device. Those who have a deep and heartfelt respect for that most English of qualities, decency, will no doubt prefer the 'tone up at the terminals' guide, produced by Verbatim Corporation in California, to help flabby operators improve their chances of competing in the Olympic Games next year. Naturally, this guide is in response to yet another report on eyestrain, backstrain... which are associated with VDUs. Members of the *PCW* team who discussed this contemporary hobbyhorse reckon the manual typewriter to be a far worse cause of all sorts of strain than a mere VDU... What was very odd about the communiqué which related to this fitness guide is this: it included a photo of a suitably attractive young lady looking generally fit and ready to go — in some appropriate exercising pose. According to the caption enclosed with the photo she goes by the name of Denis Katnich, and she is a Los Angeles physilogist — Chip Chat reckons she is actually Denise and is a physiologist — we hope... Software Arts, the creator of Visicalc, has sold copies of that very same illustrious spreadsheet to the value of $25 million (we wonder if they used Visicalc to forecast this). How ironic, then, that it should be presented with the same sum again from International Computer Programs, Inc, at its 1983 executives' conference. This huge sum of money was actually an award for Visicalc's achieving over $1 million in sales. Somehow it seems that Software Arts doesn't need the money — what about using it to support Ethiopia, SA?... The star of ITV's Ultra Quiz, to go on show nationwide as from 9 July, will undoubtedly be an Epson QX-10 (no, not Miss World). This machine will help astrologer Russell Grant to predict, at the beginning of each round, which of the 2000 morons chasing round the world after one £10,000 prize will get chucked out. Epson's training manager will be on hand to offer explanations as to why the computer makes its particular predictions. Let's hope he will have been trained in the art of diplomacy if the machine predicts everything wrong... Hewlett-Packard is a funny organisation. One of its big publicity 'things' is the 'Hewlett-Packard Service to Sailing', which seems strikingly inappropriate. In fact, the crew of Victory '83 — Britain's challenger in this year's America's Cup races, will be using an HP120. While one might be forgiven for believing the use for this machine to be the steering of the boat; one would be wrong. It's to be used for inventory control. What a let-down! All the same, yachtsmen will be using the profitable HP-41CV to check navigational calculations — wouldn't a Husky be better?... At the same time, though, that ol' HP-41CV gets everywhere! It's in use by astronauts on the shuttle as well... Not only this, but the press release which told this little story also managed — Lord knows how — to include a passage about HP's new factory in Bristol. It did this quite sneakily and without a break of any discernible degree in the text. Publicity moves in mysterious ways.

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BLUDNERS

The author of Apple VAT, published in the June issue, has written to say that there is a rather drastic error in the program: it doesn't clear the previous (input) totals before calculating the output totals! To improve instantly the financial standing of your business, add the following line:

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7425 FOR I=1 TO 3: TT(I)=0: NEXT I
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Gremlins made their presence felt in two of the Benchtests in last month's issue. In his review of the Sord M5, Steve Mann stated that the basic package included two games 'joypads' — certainly, the review machine came complete with the joypads and the packaging seemed to indicate that these were standard issue. However, this may well not be the case. The price war at the cheaper end of the home computer market seems to be hotting up, and dealers are vying with each other to offer the best deal, so it would be as well to check with your local retailer to see whether he will offer the joypads free of charge. Observant readers will have noticed that the M5 Benchtest omitted the Benchmark timings — the review was done in a great hurry and the machine had to be returned before the Benchmark timings had been done. We will certainly include these figures in our next Benchmark summary.

In his review of the Tandy Model 100, Dick Pountain based his conclusions on the mistaken belief that the 24k model sold for £495. In fact, as was stated in the 'Prices' section, the 8k version retails at £499 while the 24k Model 100 will set you back £649. Readers should bear this in mind when pondering Pountain's pontifications.

This month's final bludner concerns a letter from Mr G J Suggett, in which he discussed cross-figure puzzles and included an example from *Games and Puzzles* magazine. We printed the clues for this example, but managed to omit the grid on which the answers are entered. For the cross-figure freaks out there, we print the missing diagram here — for the clues, see 'Cross Figures', page 110, August *PCW*.

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