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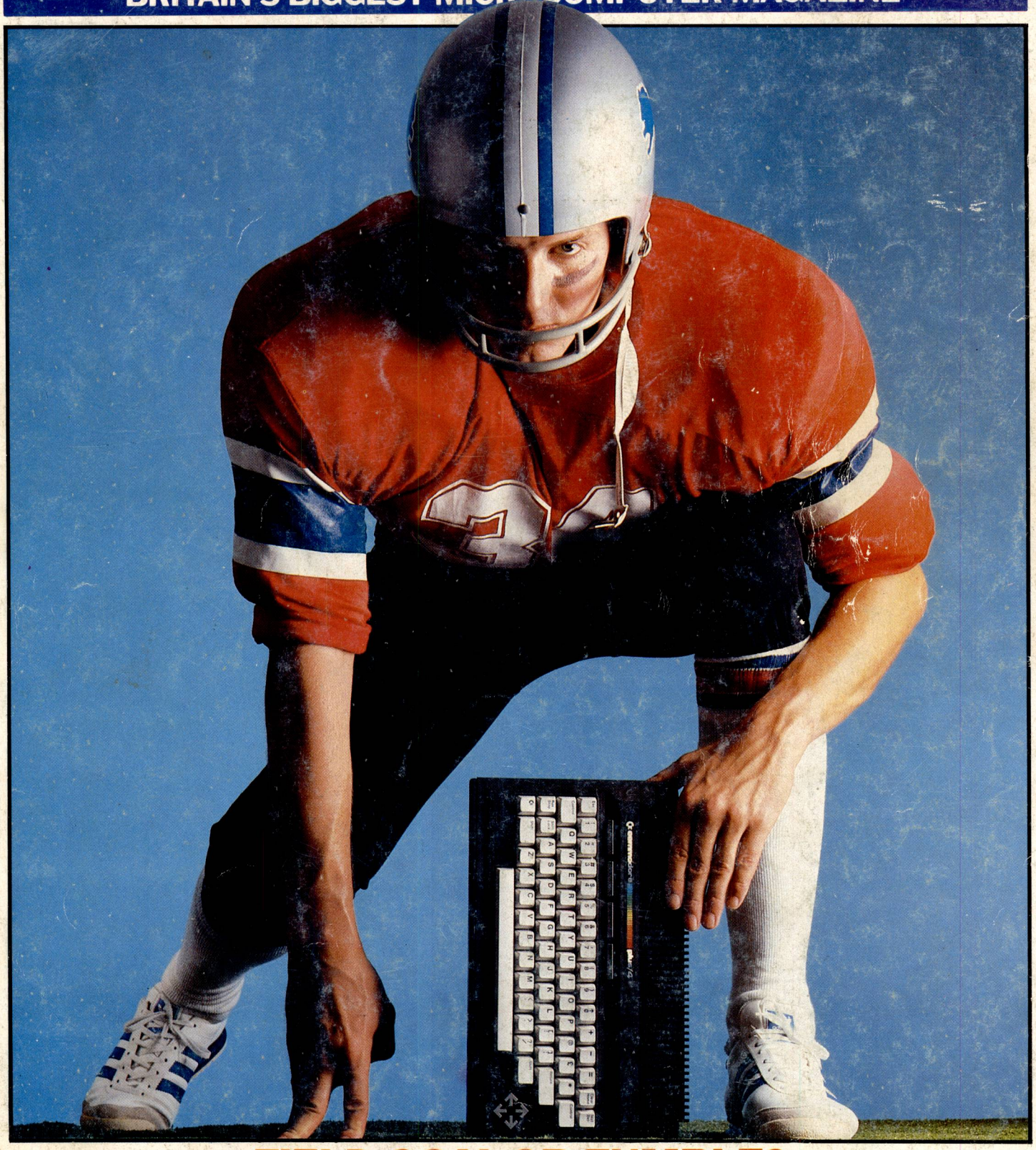

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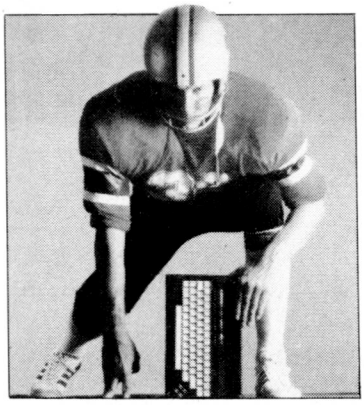

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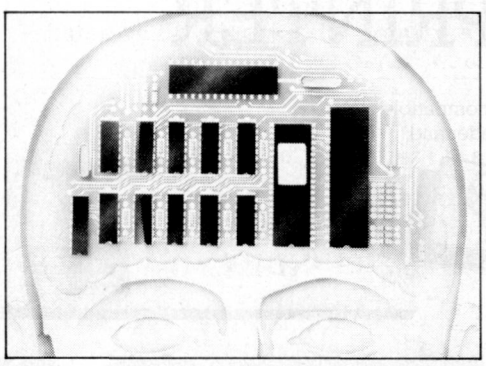

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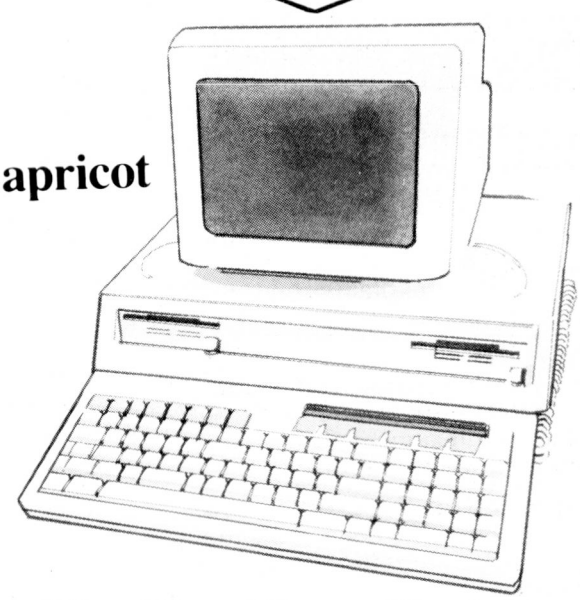

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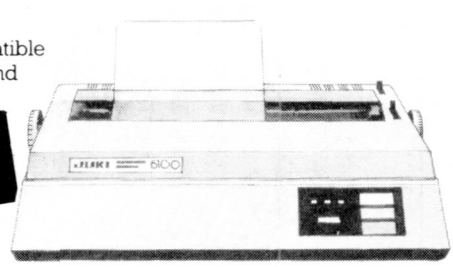

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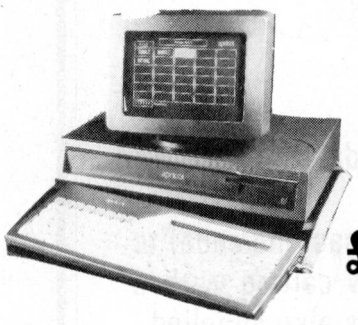

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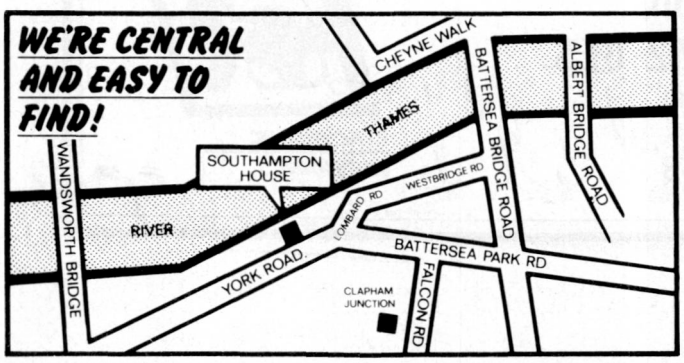

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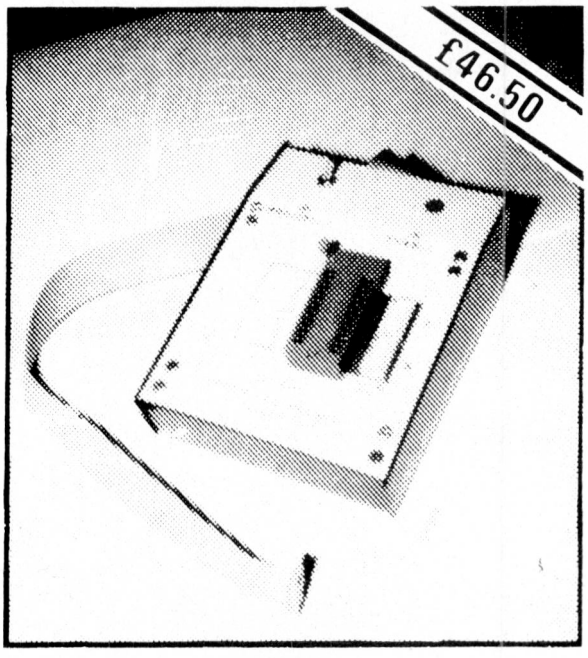

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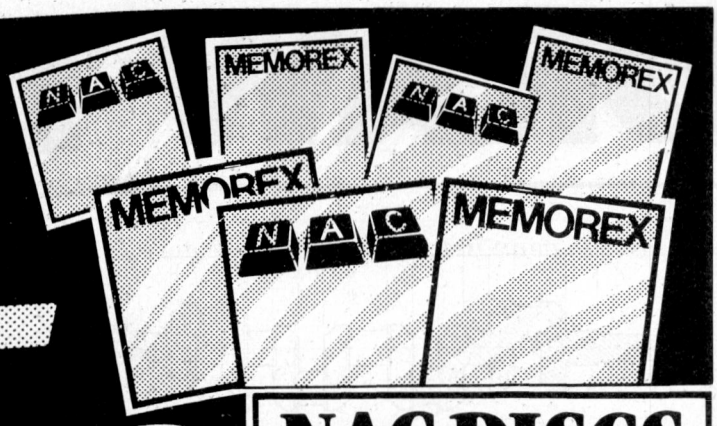

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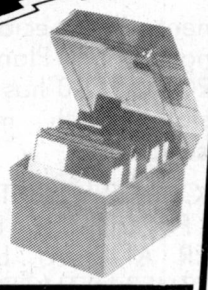

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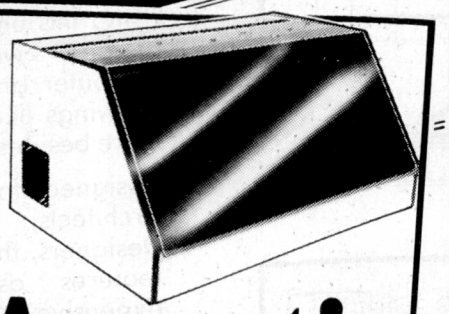

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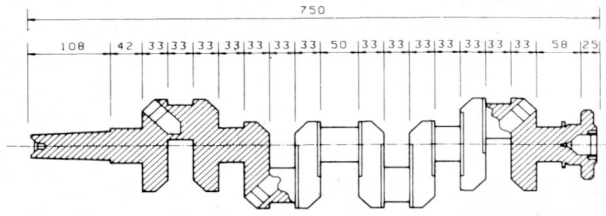

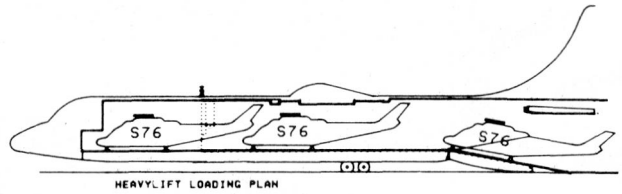

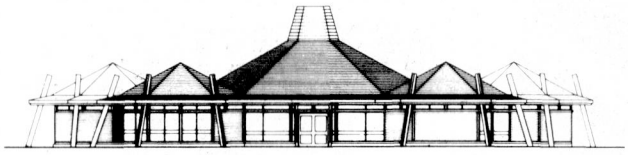

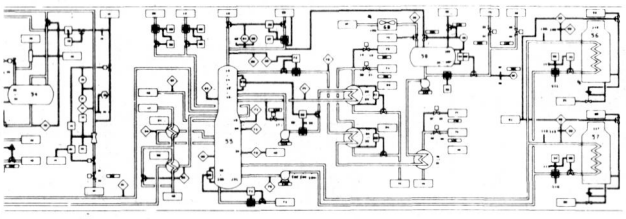

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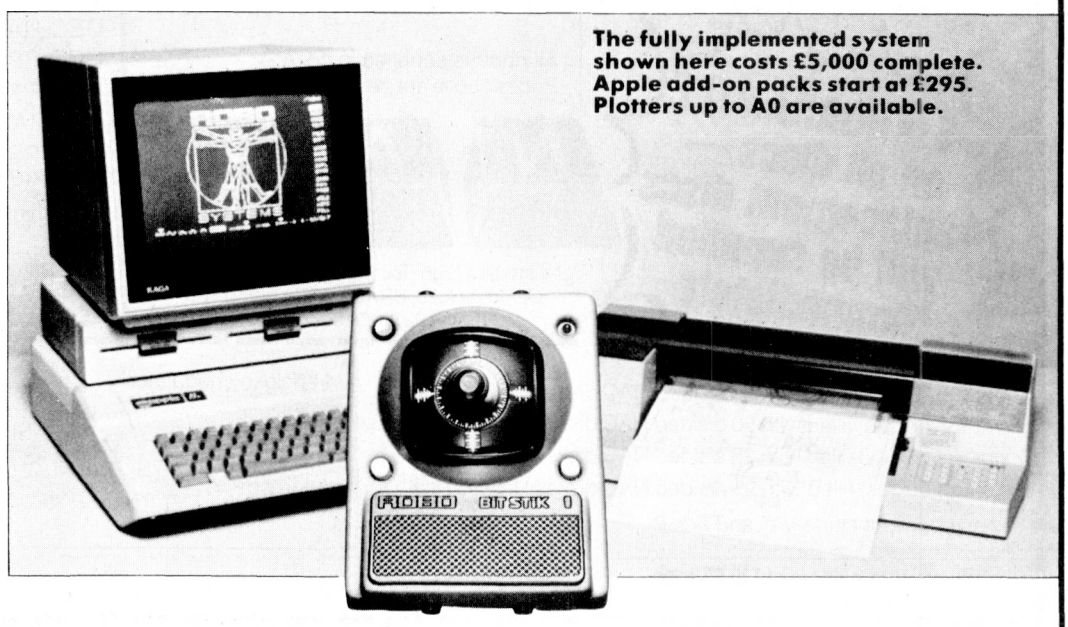

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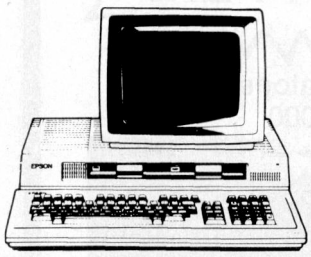

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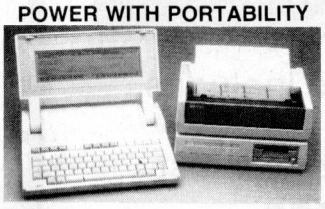

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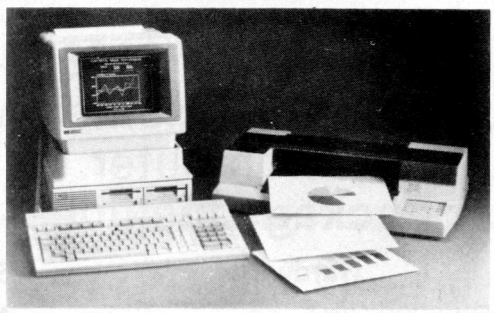
The HP 150 Personal Computer, with HP Touch



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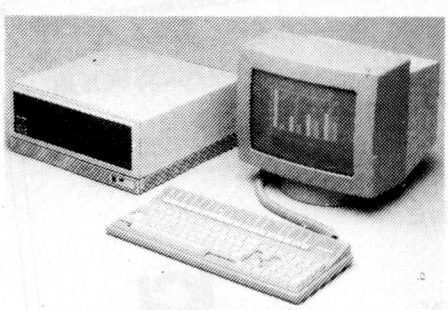
OLIVETTI M24 PERSONAL COMPUTER



The new Olivetti M24 personal computer is operationally compatible with IBM PC.

This means it can handle all the most popular software. But it handles it faster.

The M24 also has many other unique features including a higher resolution screen with 16 shades of grey. A modular format that provides greater expandability.

***From* £1,595 + VAT**

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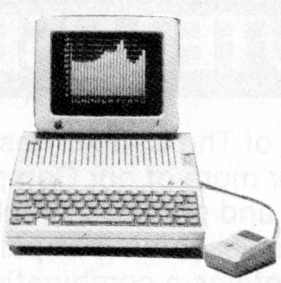

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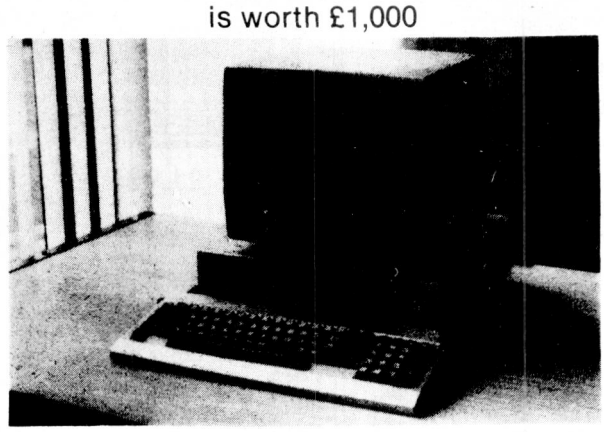

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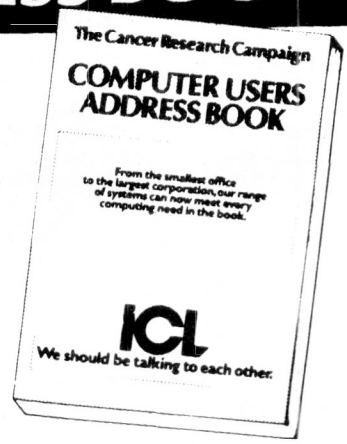

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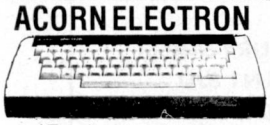
ACORN ELECTRON



AT under £174, the Acorn Electron is the first micro in its price range to use BBC BASIC, the leading computer language in British schools.

It has many features you won't find on microcomputers costing much more. And its colour graphics have the highest resolution of any home computer.

So whether you're interested in programming or using the constantly-expanding range of software, it's the ideal first-time home computer.

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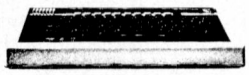


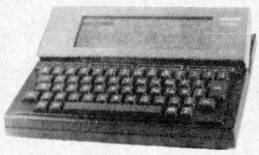
£320

The chances are that your children already know the BBC Micro. Because it's the microcomputer which is being ordered by the majority of British schools.

The same machine forms the heart of the BBC's massive computer literacy project.

It also has a wide range of accessories which give it truly professional capabilities. And there's an even wider range of software, covering games, educational programs and business programs.

THE OLIVETTI M10



CPU: 80C85 8 bit CMOS, 8k expandable to 32k

The M10 is useful in business and professional applications and in the home. Typical areas of activity include:

- ☐ Office administration: maintenance of records
- ☐ secretarial activities: word processing, filing telephone calls, etc.
- ☐ telecommunications for stock broking or sales
- ☐ electronic mailing
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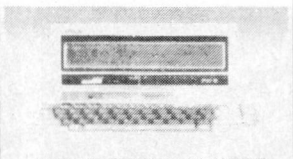

THE EPSON PX-8 offers the performance of a desktop computer.

Measures 297mm wide × 216mm deep × 47mm high, weighing just 2.3kg.

It packs 64 KB of dynamic RAM memory & an 80 × 8 character LCD with a microcassette & RAM disk for data storage.

It is supported by a very wide range of peripherals.

THE PX-8 can access company & national data banks, and it can handle complex data processing and analysis projections, reports, scheduling, correspondence and electronic mail.

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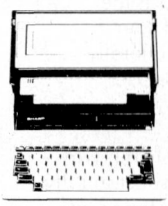

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Sharp's amazing new PC 5000 business computer has unlimited potential. For instance, you can use it as an executive word processor or Database management System. Use it to plan budgets and taxes and forecast your cash flow. Or use it for time and project planning, communications to other computers and electronic mail facilities.

Thanks to its 128k byte bubble memory you can even use it on the move. Find out more about the amazing PC 5000 portable business computer — Telephone 01-938 1588, ext 46.

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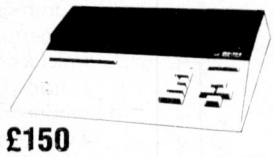

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PC-1251 Computer	£64
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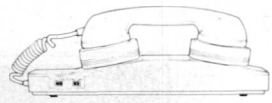
THE EPSON CX21 ACOUSTIC COUPLER



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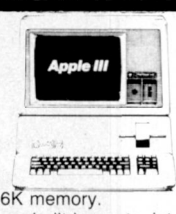

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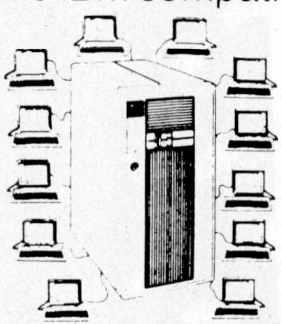

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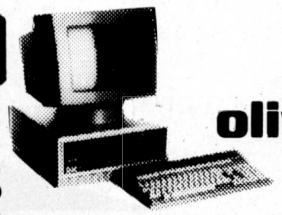

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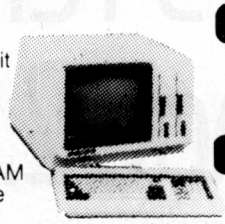

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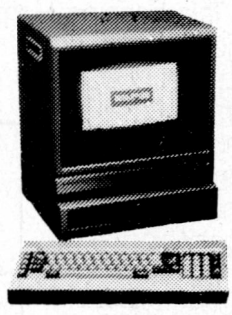

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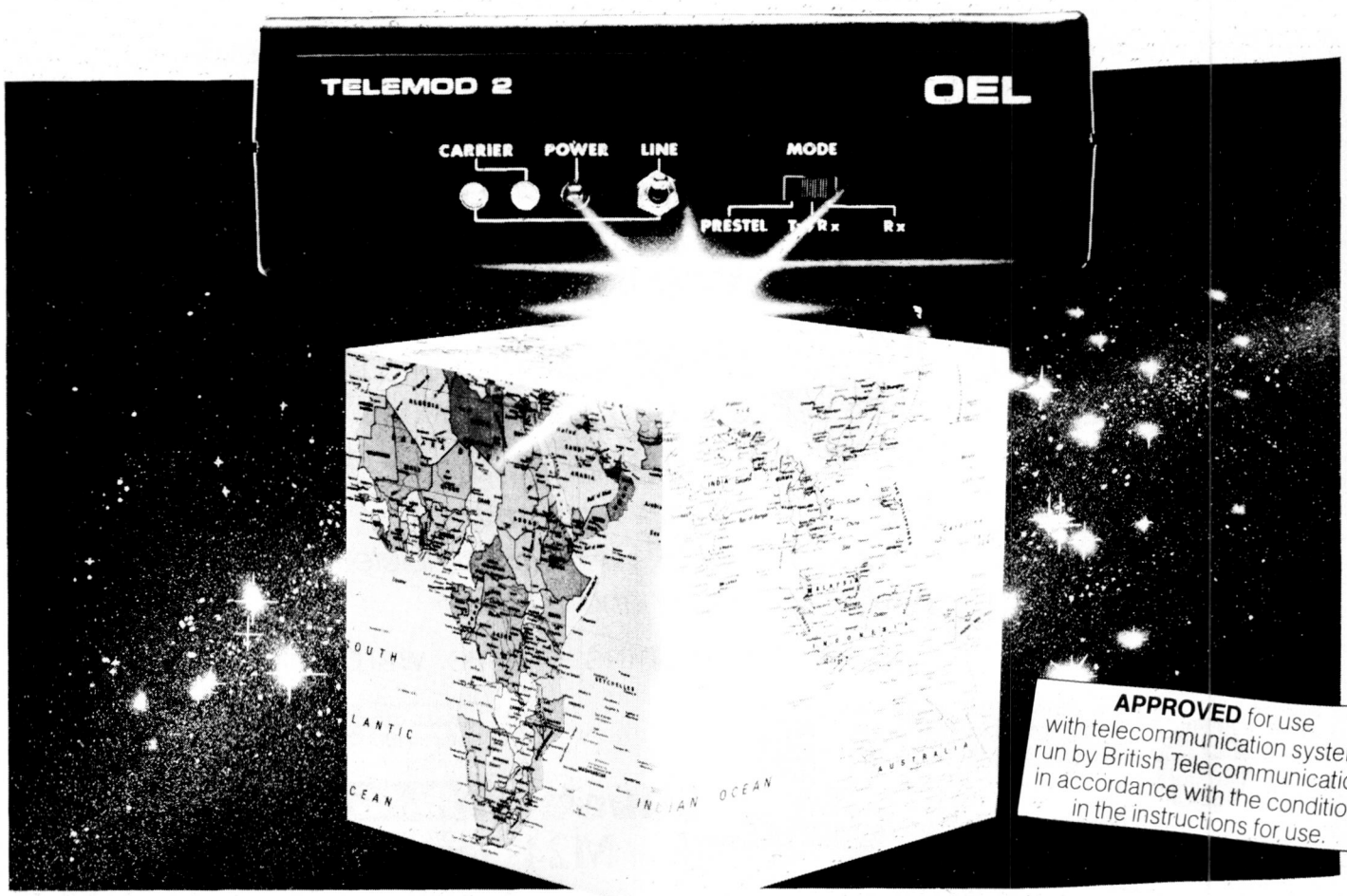

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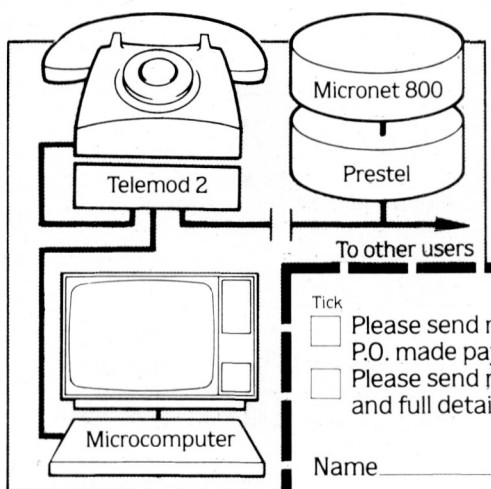

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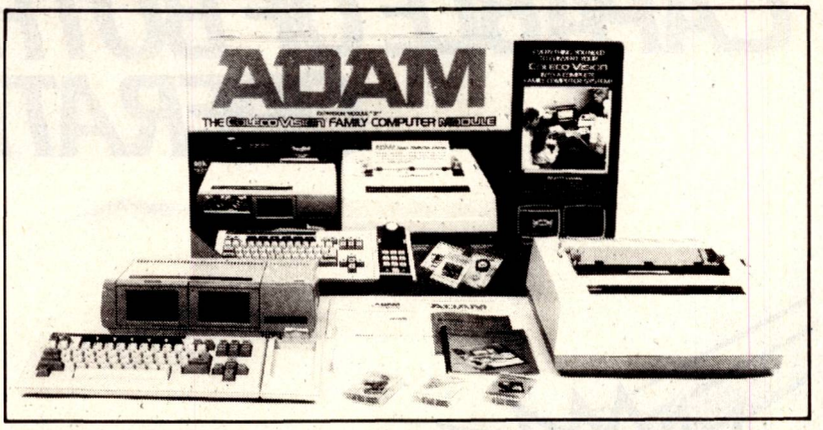

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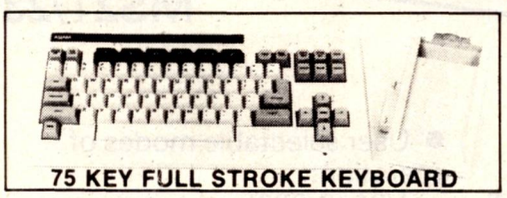

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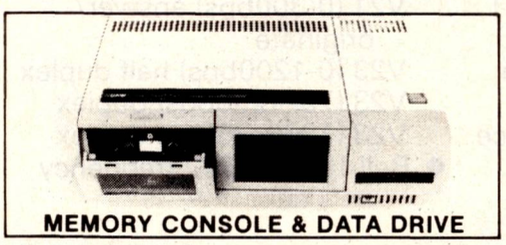
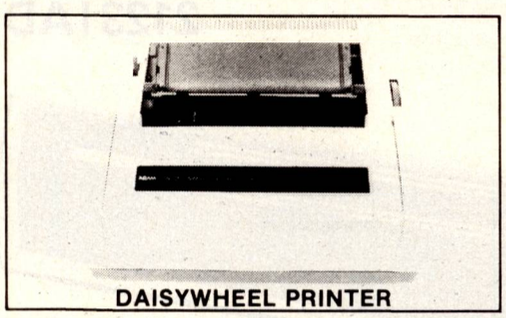


MEMORY CONSOLE & DATA DRIVE



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MEMORY CONSOLE/DATA DRIVE: *The heart of the Adam system is the 40K ROM and 64K RAM memory console which combines with the 32K ROM and 16K RAM in Colecovision to give you a total of 72K ROM (including 24K cartridge ROM) and 80K RAM (expandable to 144K). Built into the memory console is a digital data drive which accepts Adam's digital data packs, a fast and reliable mass storage medium that is capable of storing 256K of information, that's about 250 pages of double spaced text! The console is also designed to accomodate a second optional digital data drive.*

FULL STROKE KEYBOARD: The Adam keyboard has been designed as a professional quality keyboard that combines ease of use with an impressive array of features. It is stepped and sculptured for maximum efficiency and has 75 full stroke keys which include 6 colour coded Smart Keys which are redefined for each new application; 10 command keys which are dedicated to the word processing function, and 5 cursor control keys for easy positioning of the cursor at any point on the screen. You can attach a Colecovision controller to the keyboard to function as a numeric keypad for easy data entry. It can also be held like a calculator, a feature which makes working with numbers particularly easy. The joystick part of the hand controller can be used in the same way as the cursor control keys, to move the cursor around the screen.

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BUILT-IN WORD PROCESSOR: Adam comes with Smart Writer word processing built-in. This program is so easy to use that you only have to turn the power on and the word processor is on line and ready to go. Detailed instruction books are not necessary as the Computer guides you step by step, working from a series of Menu commands. It enables you to type in text, then completely edit or revise it with the touch of a few keys. Changes are readily made and a series of queries from the computer confirm your intentions, so that you can continuously double check your work as you type.

COMPATIBILITY WITH COLECOVISION: By using high speed interactive microprocessors in each of the modules, the Coleco Adam is designed to take additional advantage of both the 32K ROM and 16K RAM memory capability in the Colecovision. If you do not already own a Colecovision Console (£99 inc VAT), then you will need to purchase this when you initially purchase your Adam Computer package (£499 inc VAT), making a total purchase price of (£598 inc VAT).

WHAT IS COLECOVISION: Colecovision is one of the worlds most powerful video game systems, capable of displaying arcade quality colour graphics of incredible quality on a standard Colour TV set. The console (see picture bottom left) accepts 24K ROM cartridges such as Turbo and Zaxxon and is supplied with the popular Donkey Kong cartridge and a pair of joystick controllers. Colecovision has a range of licenced arcade hits available such as: Gorf, Carnival, Cosmic Avenger, Mouse Trap, Ladybug, Venture, Smurf, Pepper II, Space Panic, Looping, Space Fury, Mr Do, Time Pilot, Wizard of Wor and many others. So there you have it, Adam plus Colecovision the unbeatable combination. Send the coupon below for your FREE copy of our 12 page Colour brochure giving details on the complete Adam system.

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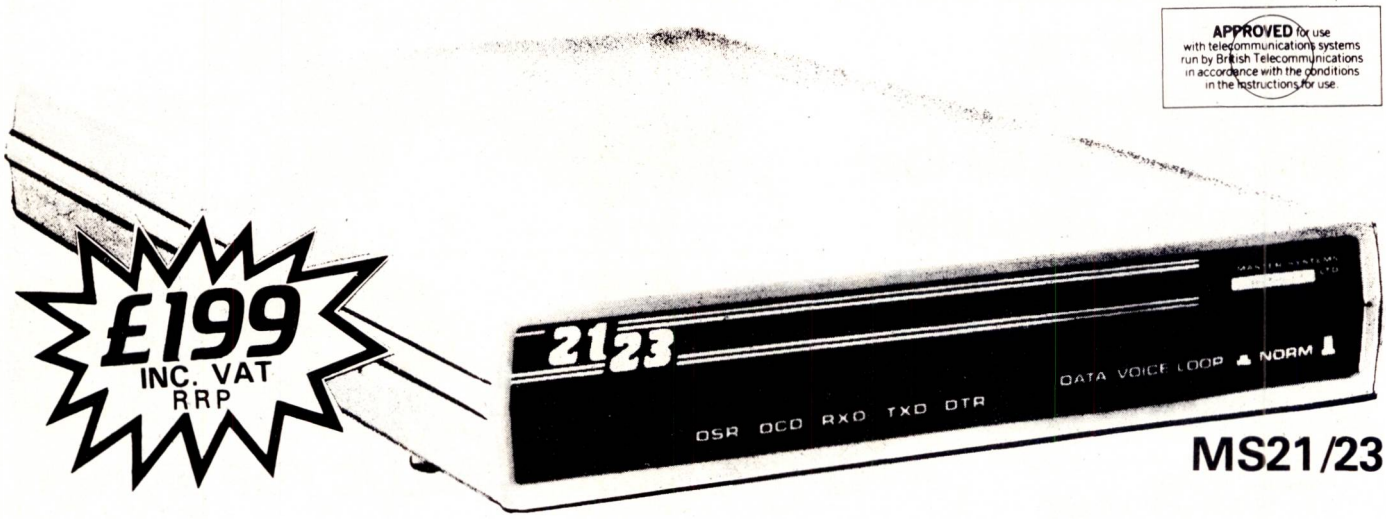

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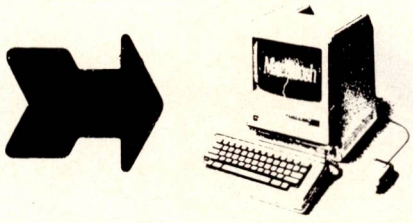

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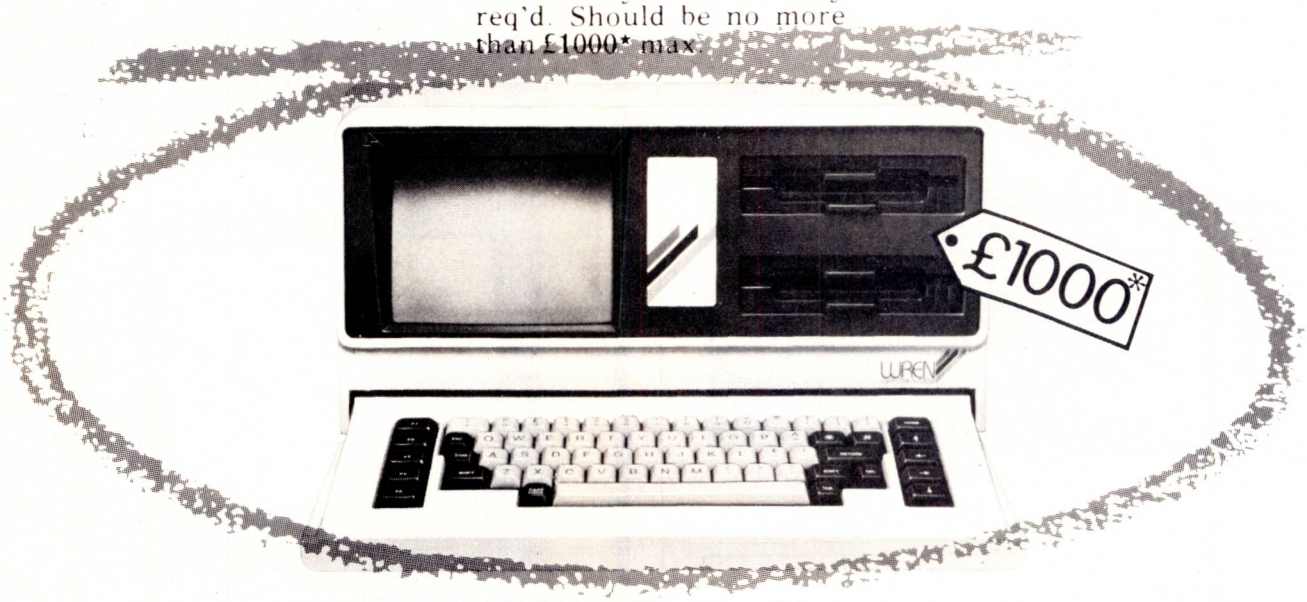

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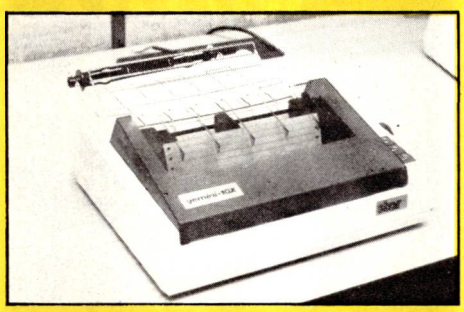

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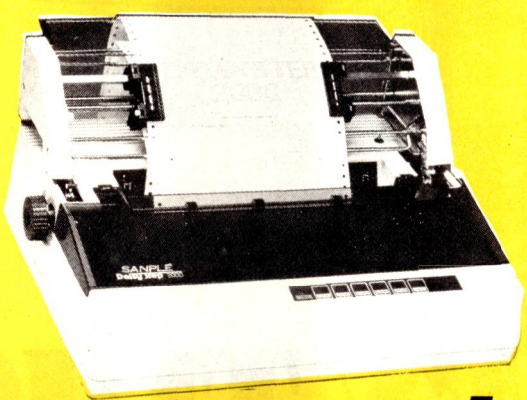

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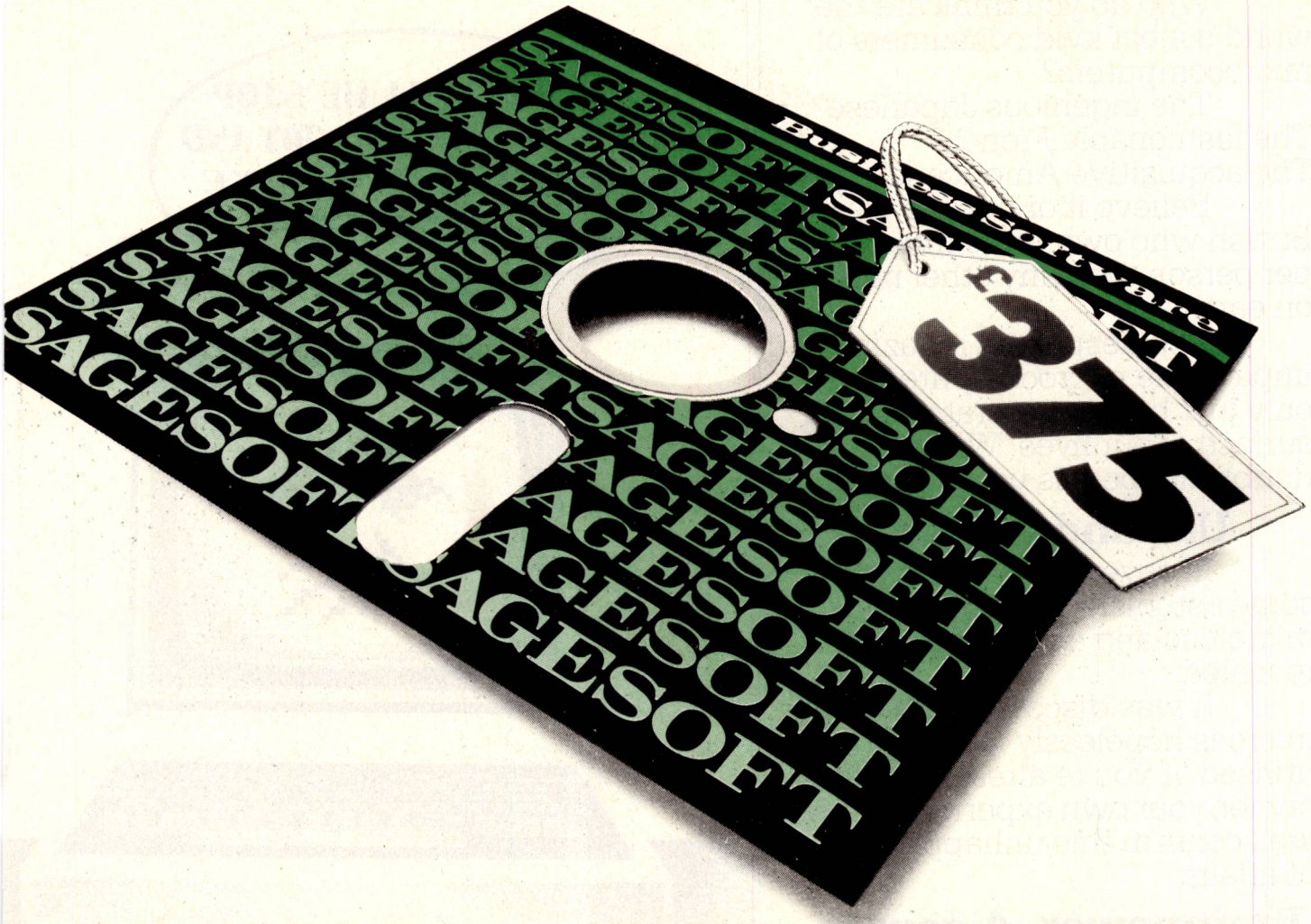

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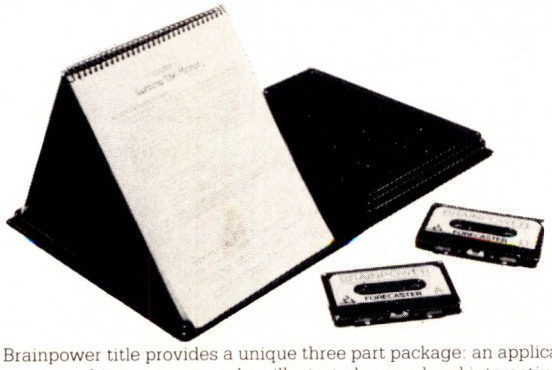

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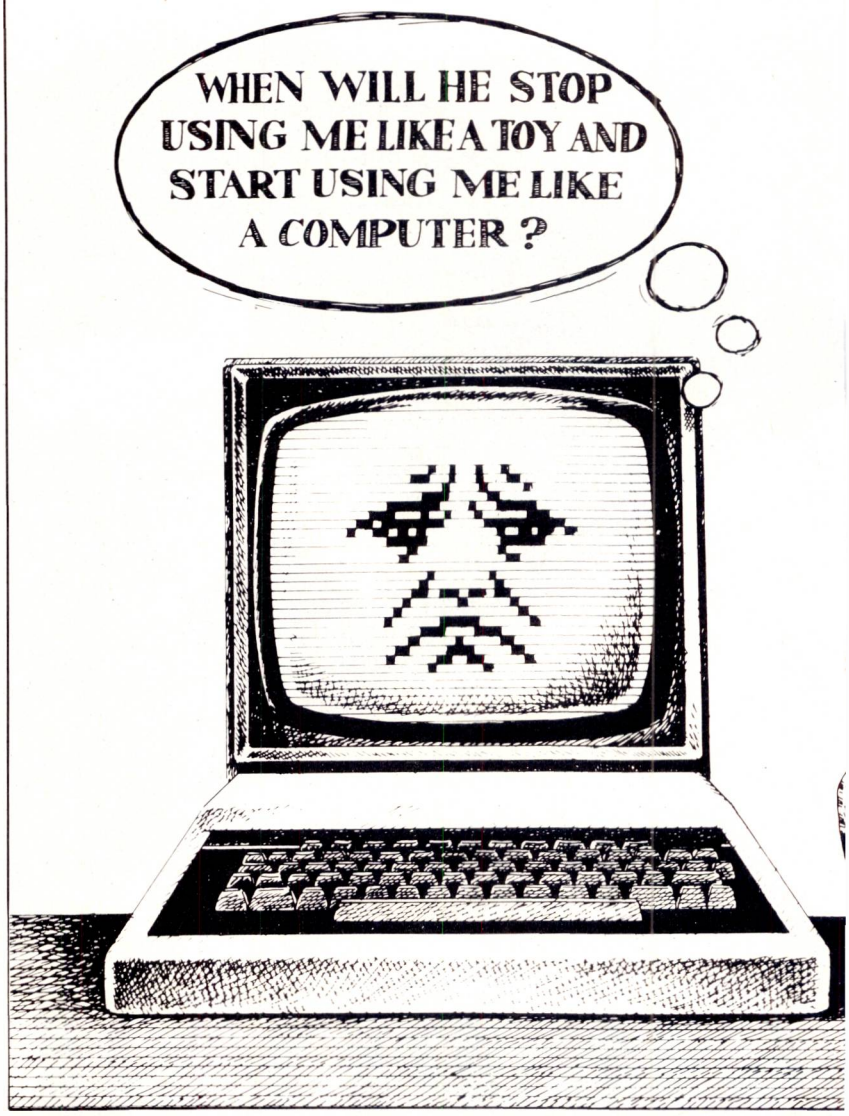

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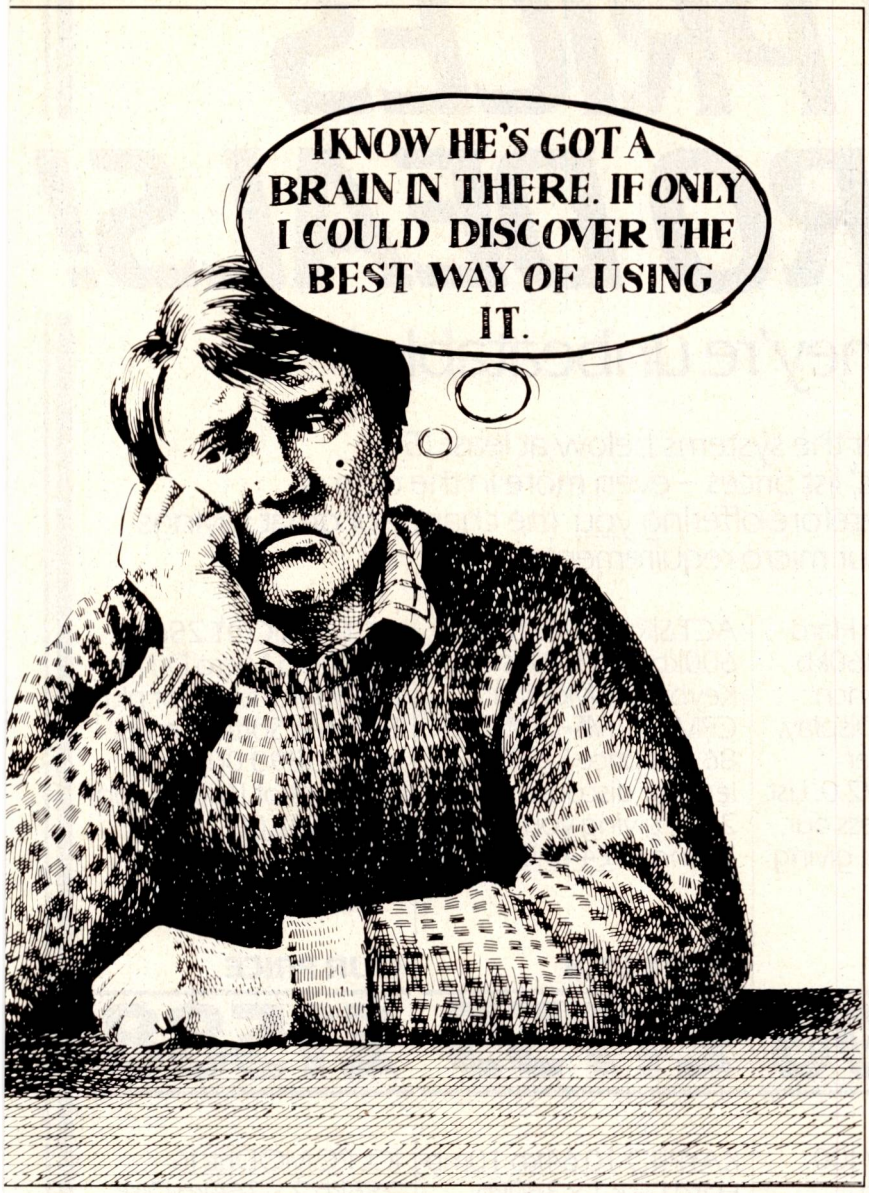

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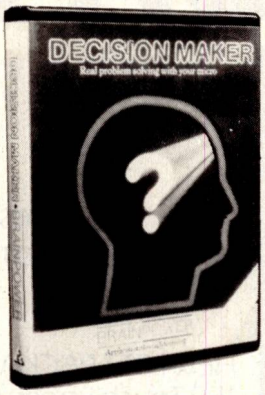

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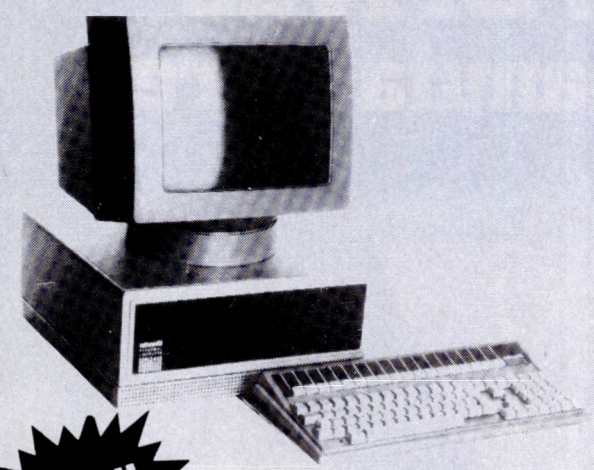

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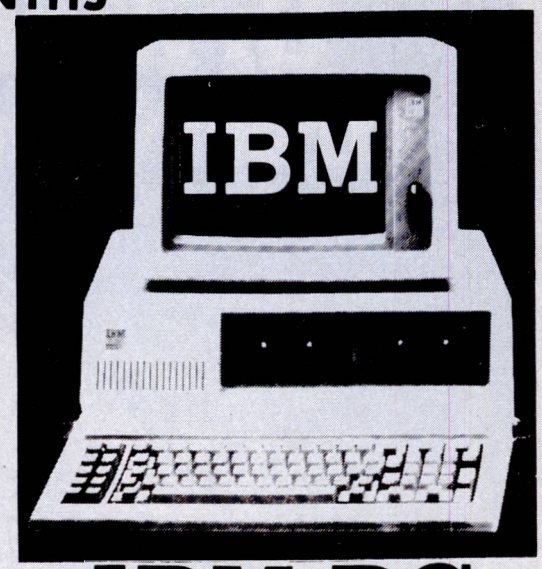

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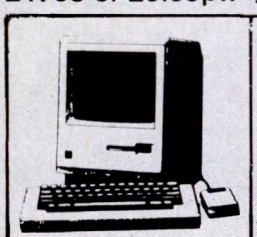

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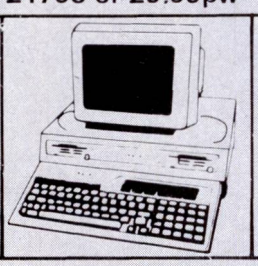

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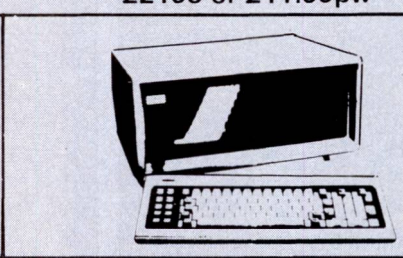

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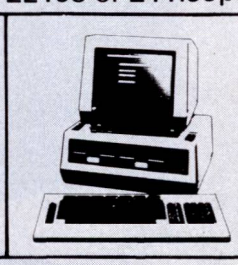

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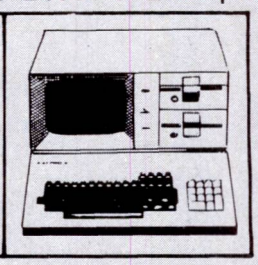

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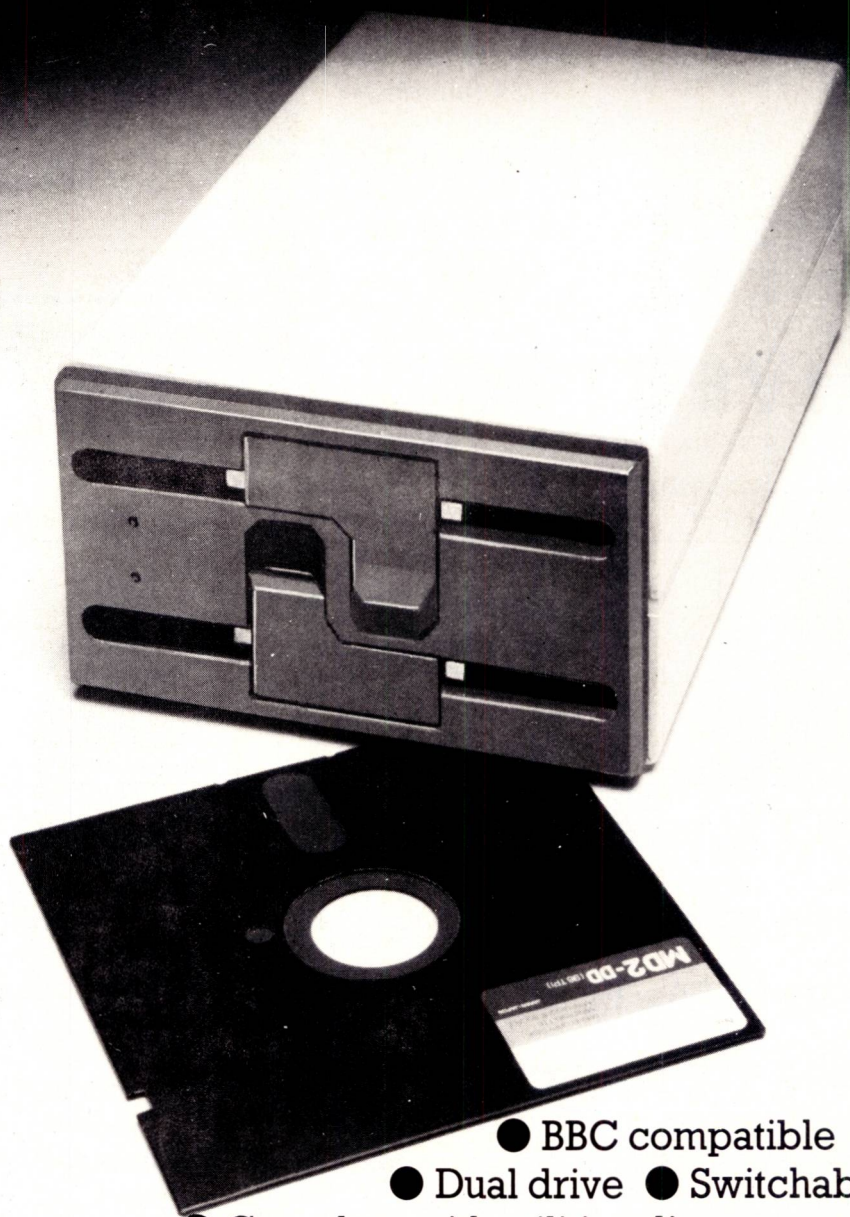

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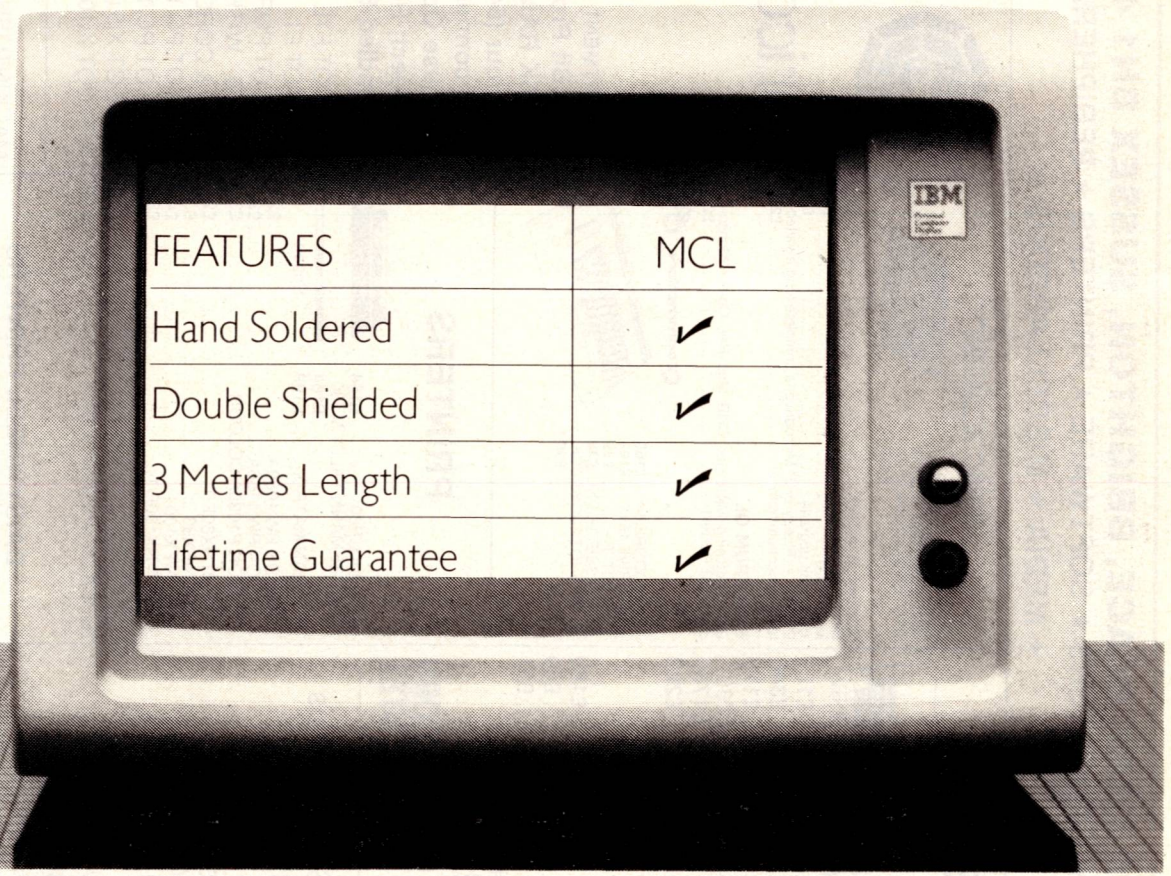

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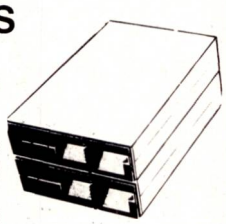

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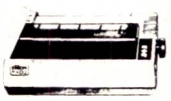

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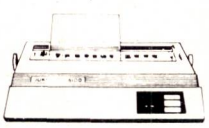

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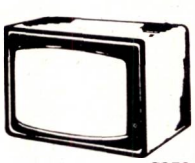

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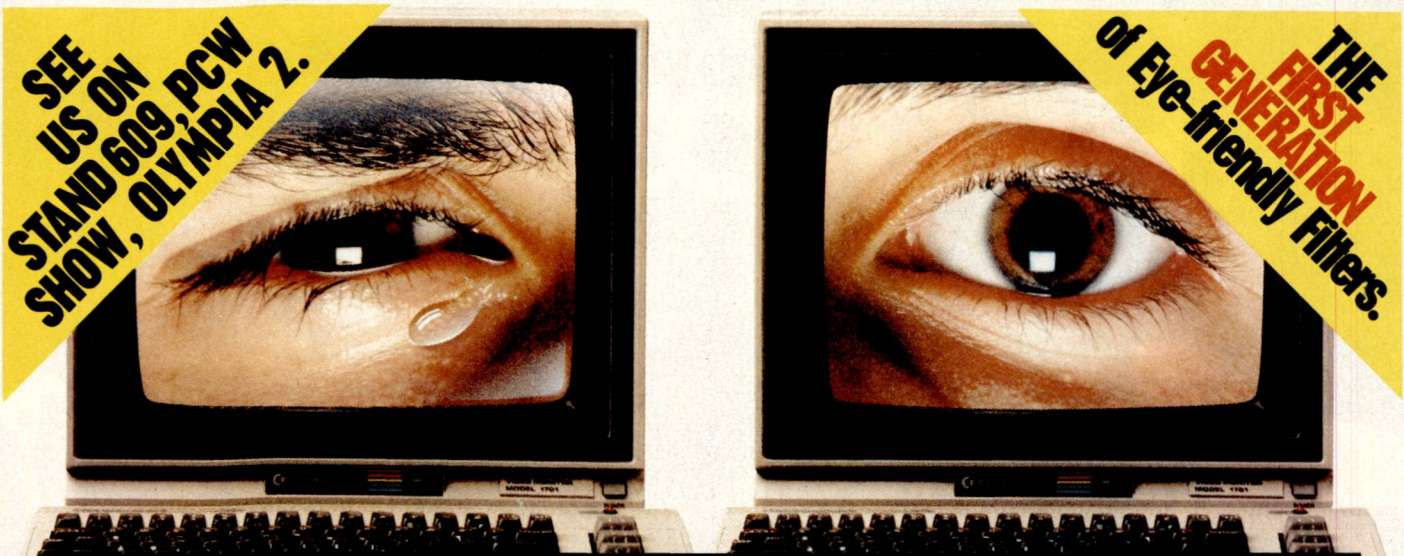

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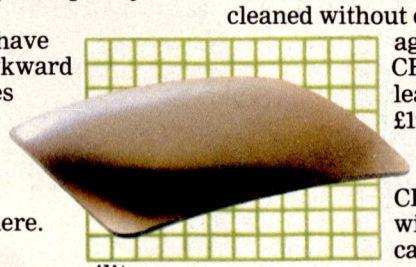
Up to now, most filters have been plastic — because it takes mindbending technology to bend optical-quality laminated glass.

Up to now, filters have been expensive — awkward production techniques have meant price tags from around £50 to well over £100.



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Mounted and removed in seconds by invisible velcro fastenings, the anti-static, anti-shatter CEAF is a major step forward in the operational safety of computer displays—unprotected screens can cause blurred vision, watery and itchy eyes, headaches and (according to such authorities as the Institute of Ophthalmology) even permanent changes in eyesight.

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Or fill in the Freepost coupon and your CEAF will be despatched within 48 hours. Orders can also be placed around the clock by phoning the CEAF Department on (091) 414 5524, quoting your Access Card number. For other screen sizes, please ring or write — the CEAF prices for 'specials' would be considered very competitive.... if there was any competition!

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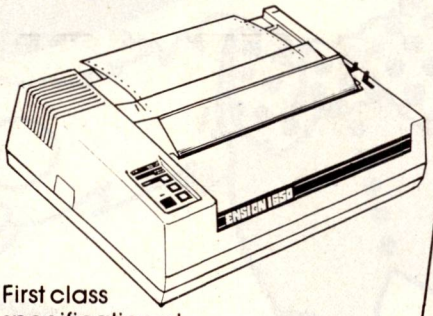

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Friction and tractor feed as standard. 80cps. Bi-directional logic seeking 13 × 9 dot matrix giving true descenders, sub and superscripts. Italic printing and auto under-lining. Condensed, emphasised, expanded and double strike (can be mixed in a line). Parallel interface fitted as standard.

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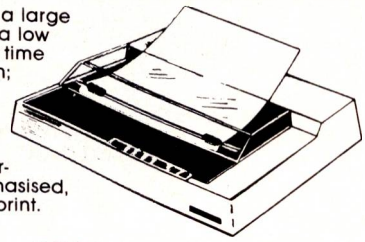

The Admate DP-80 has a large range of features and a low price. Ideal for the first time user. 80 cps; 80 column; Bi-directional logic seeking; block and dot addressable graphics; sub/superscript, auto under-line, condensed, emphasised, expanded and italic print.

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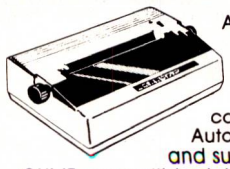

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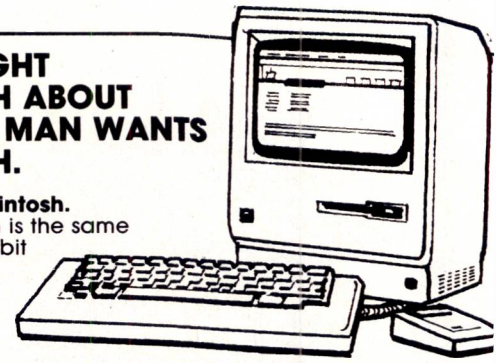

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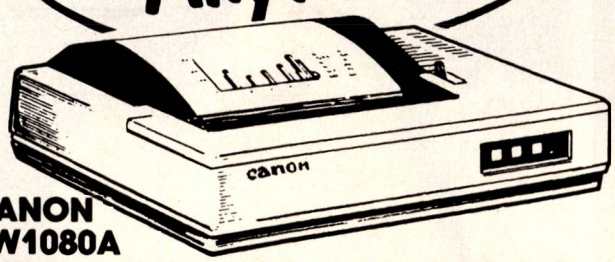

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80 cols; High speed printing, 160 cps; bi-directional logic seeking; fantastic 27 cps near letter quality; 23 x 18 matrix; very quiet — less than 60 Db; 4, 5, 6, 8, 10, 12, 17 cpi; down loading for user-optional characters; high resolution graphics; handles various forms, roll paper, fan fold, single sheet and multipart copy paper. Also available — wide bodied Canon PW1156A or KAGA TAXAN KP910 — New low prices!

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There's more software on the way from developers like Microsoft, Lotus and Software Publishing to mention a few. And with Macintosh BASIC, Macintosh PASCAL and our own Macintosh Toolbox for writing your own mouse driven programs, you could turn a few bob in your spare time.

All the right connections

On the back of the machine, you'll find built-in RS232 and RS422 Applebus serial communication ports for connecting printers, modems, and other peripherals without adding expensive cards. If you wish to double Macintosh's storage with an external disc drive, you don't have to pay for a disc controller card — that's built in too.

Talking of extras

Macintosh has a built-in polyphonic sound generator capable of producing high-quality speech and music.



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The Grappler offers a complete answer to printer interfacing, with many capabilities unique in the Commodore market place. Complete signal transmission allows many popular name brand printers to operate perfectly with the Commodore 64. Even Commodore's graphic character set can be reproduced on Epson, Star, Oki, Brother.

Prowriter and other popular printers.

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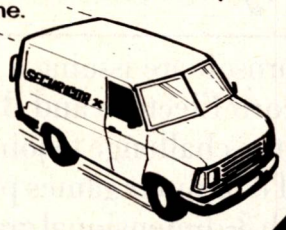

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As your prowess improves, you move into higher ranks.

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Then, and only then, will you qualify to call yourself a member of The Elite.

From harmless, you must become lethal.

In Elite, all players start as equals.

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Only the fittest will survive.

As you establish yourself as a survivor, you will win the right to a higher rank.

In all, there are nine, from "Harmless" to "Elite." And your computer will continually tell you where you stand.

Trade with 2,000 planets in eight galaxies.

Besides survival, your success also depends on the rewards you reap from the cargo that you carry.



e among the Elite?

That cargo can be anything from foodstuffs to contraband. If you decide to trade in contraband, the rewards will certainly be higher. But so will the risks you take.

To ply your trade, you can dock at any of 2,000 planets in eight galaxies.

However, before you dock, you must use your wits to assess the planet's political climate and the perils which may be waiting for you.

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We're waiting to recognize your skills.

Achieving higher status in Elite will tax your skills to the limit. Which is why you must download your game onto cassette or disc each time you take a break from play.

When you reach the rank of "Competent" or higher, you should send us the secret code number revealed to you by your computer.

We will send you in return a special document which certifies your achievement. And you stand to win a valuable prize.



Are you ready to accept the challenge?

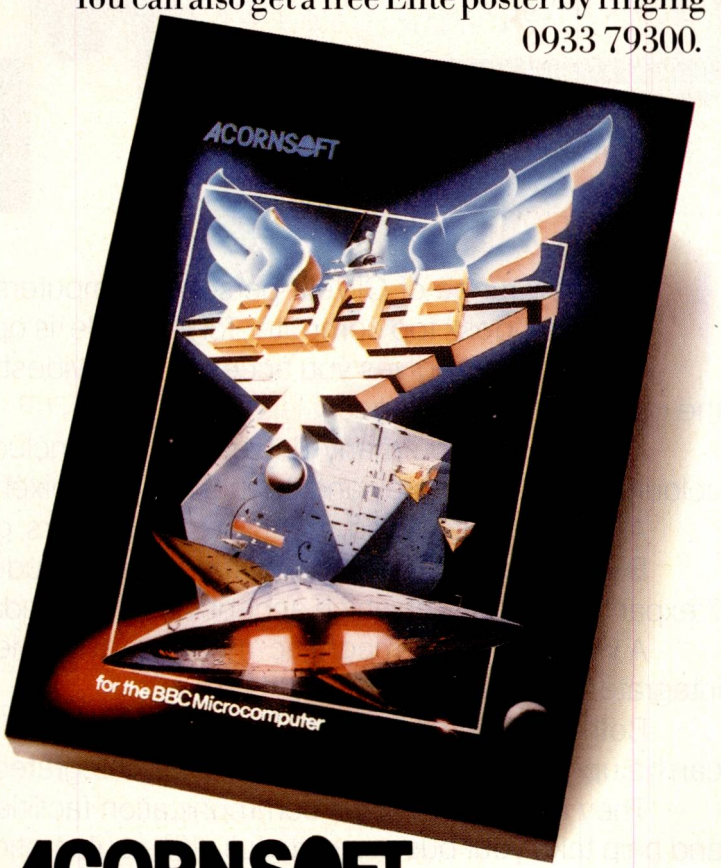
Elite is available on both disc and cassette for the BBC Micro and on cassette for the Acorn Electron.

With either, you will get "Elite: The Dark Wheel," a compelling novel which sets the whole mood of your adventure. You'll also get a flight training manual which will get you fit to roar into the unknown in your Cobra spacecraft.

Your Acornsoft dealer now has the entire package at £14.95 on cassette, or £17.65 on disc (for the BBC Micro) and £12.95 for the Electron. (For the address of your local stockist, call 01-200 0200.) Credit card holders can simply telephone 0933 79300 during office hours.

Alternatively, you can order by post from: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

You can also get a free Elite poster by ringing 0933 79300.



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Both the M24 and the M20 are powerful 16 bit personal computers for faster processing and both can be upgraded, step by step, into a fully integrated network system.

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'THE USUAL PROBLEMS OF MAN MEETS WOMAN'

* solved by Dateline!

Michael Wheeler is an articulate, good-looking businessman in his mid-thirties. Born and bred in London, his work has taken him all over the world. Despite his busy life-style he found time to marry, but unfortunately his marriage failed and he found himself back in London, trying to rebuild his social life.

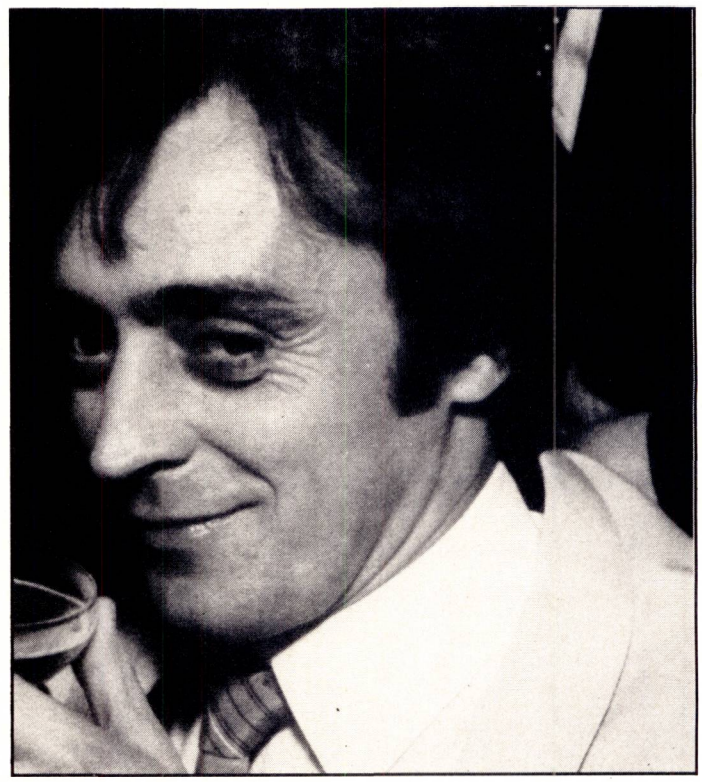
'My cousin, who lives in London, suggested that I should join Dateline. I must admit, I found the idea appealing because I was aware of Dateline. In fact, I had been a member way back in the sixties. I found no great romantic successes at that time but many, shall we say, nice encounters, so when my cousin suggested the idea again I thought 'Why not, I'm only going to live once, why not make the best of it?'

Michael didn't join Dateline to find 'the woman of my dreams'. 'I joined because after a long absence from a city like London you tend to find that your friends and acquaintances have married or moved away. Although I obviously missed female company, I also found that I had no circle of friends left at all.'

'When my first list of names from Dateline arrived and I began to receive calls from women with whom I had been matched on the computer, my social life improved out of all recognition almost overnight! My only problem was time, because all of the women I spoke to were so pleasant that I felt I had to meet them. In the event, I met four from my first list of names. Two I felt I could quite happily be friends with; the other two meant rather more.'

Michael doesn't mind people knowing he is a member of Dateline. 'There's not the adverse reaction from family and friends that I think some people may expect,' he said. 'I did perhaps feel, as many people probably do, that there's some sort of stigma about admitting to feeling lonely. But that's rubbish as loneliness affects every person at some stage of their life, no matter what their circumstances. It's something that has to be overcome by any means available to us. Dateline may sound cold-blooded to some people, but I have found it certainly isn't. It may perhaps be more socially acceptable to meet people of the opposite sex in pubs or clubs, but really Dateline wins above those places. I don't like competing with smoke and noise, and it's far nicer to know that the woman you're telephoning has the interests and desires you're looking for. It provides a basic understanding before you even say hello. Obviously, all the usual problems of man meets woman are still there, but you have conquered quite a few of the barriers that so often make a relationship fail before its really started.'

He stopped to consider for a moment. 'I don't know what you need from life. All I really want is happiness, and a large part of the happiness I seek is the happiness that can be gained from the relationship between a man and a woman. At least two of the women I have met directly through Dateline have become friends and it's good to know that if I am at a loose end there's someone I can 'phone for a chat or to arrange an evening out.'



Michael has recently suspended his membership of Dateline. He has met a young woman who is a friend of one of his Dateline introductions. Their relationship has blossomed into love and they are now engaged to be married.

If you would like to be one of the many thousands of people nationwide who have been enjoying a new social life, and finding love and happiness through Dateline, complete the simple questionnaire below. We will send you confidentially and completely free, full details about Dateline and how it works, and details of just one of the Dateline members who are compatible with you. Send to:
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1 Do you consider yourself:

☐ Shy ☐ Extrovert ☐ Adventurous ☐ Family type ☐ Clothes-conscious
☐ Generous ☐ Outdoor type ☐ Creative ☐ Practical ☐ Intellectual

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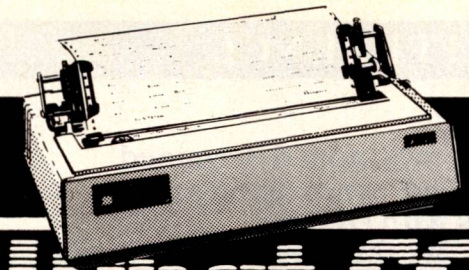

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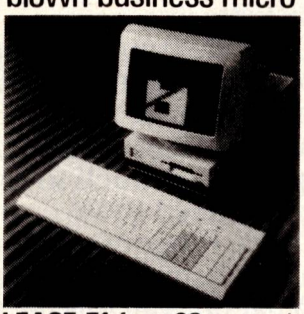

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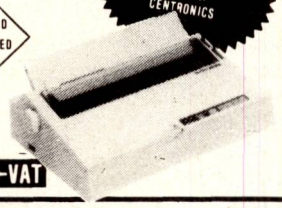

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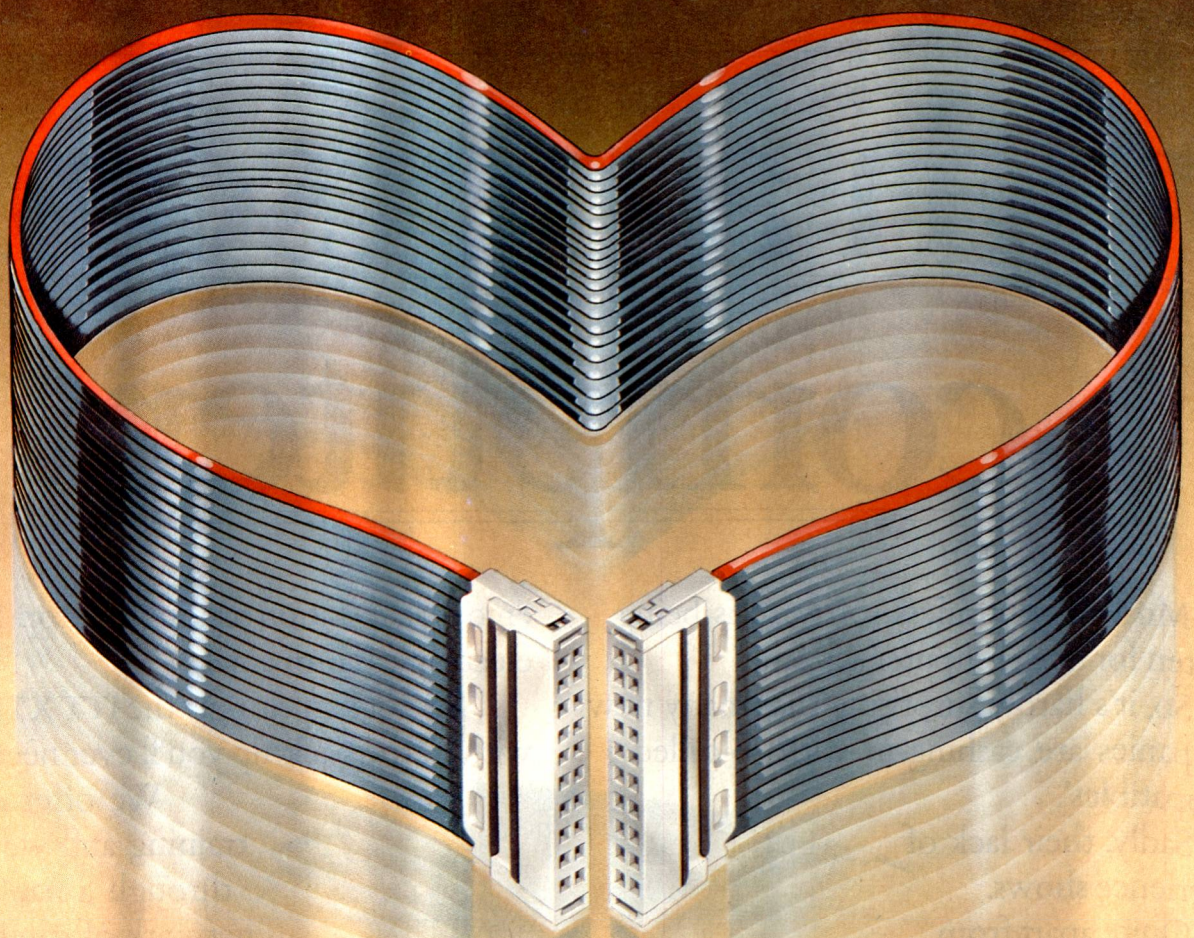

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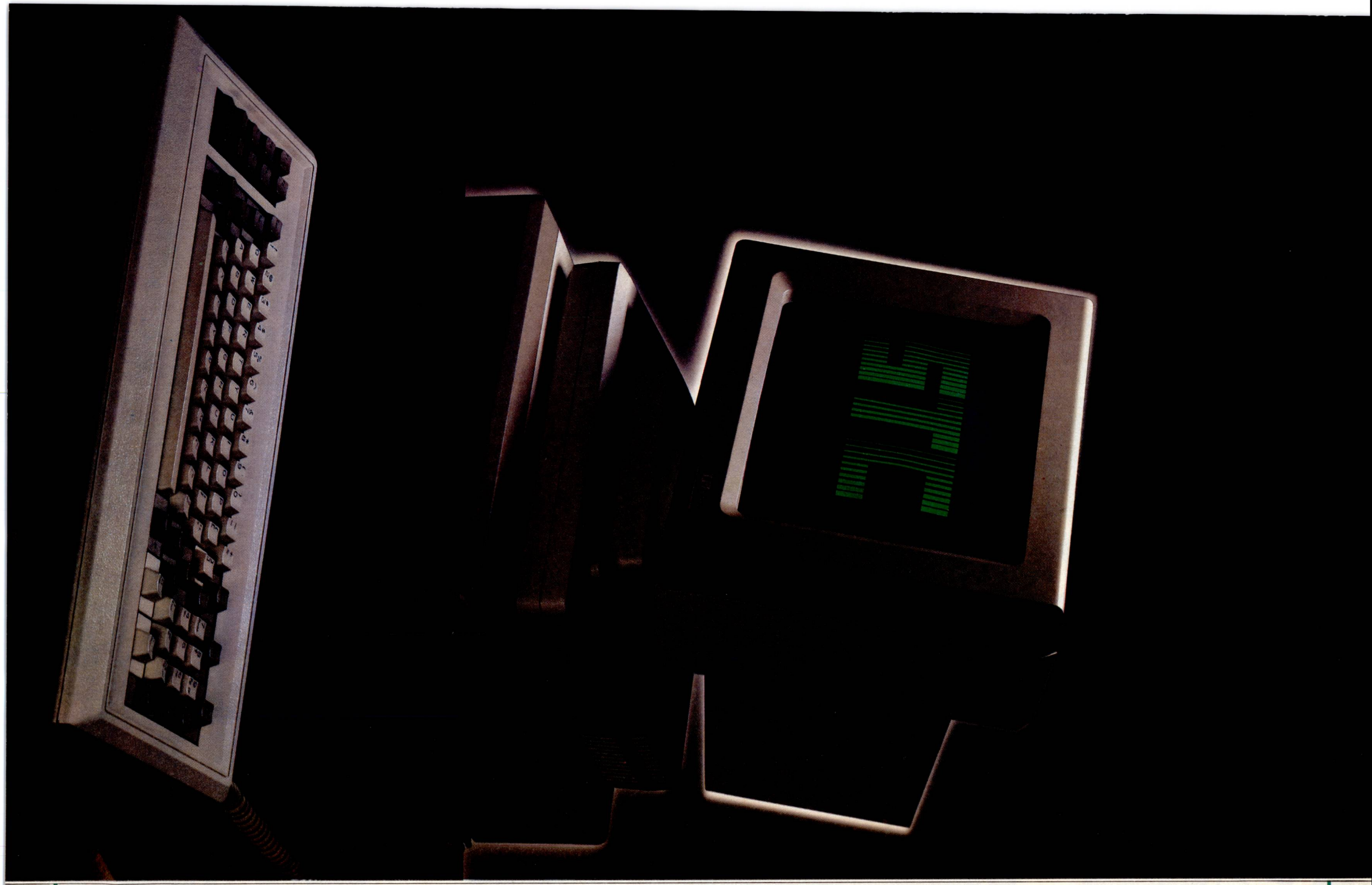

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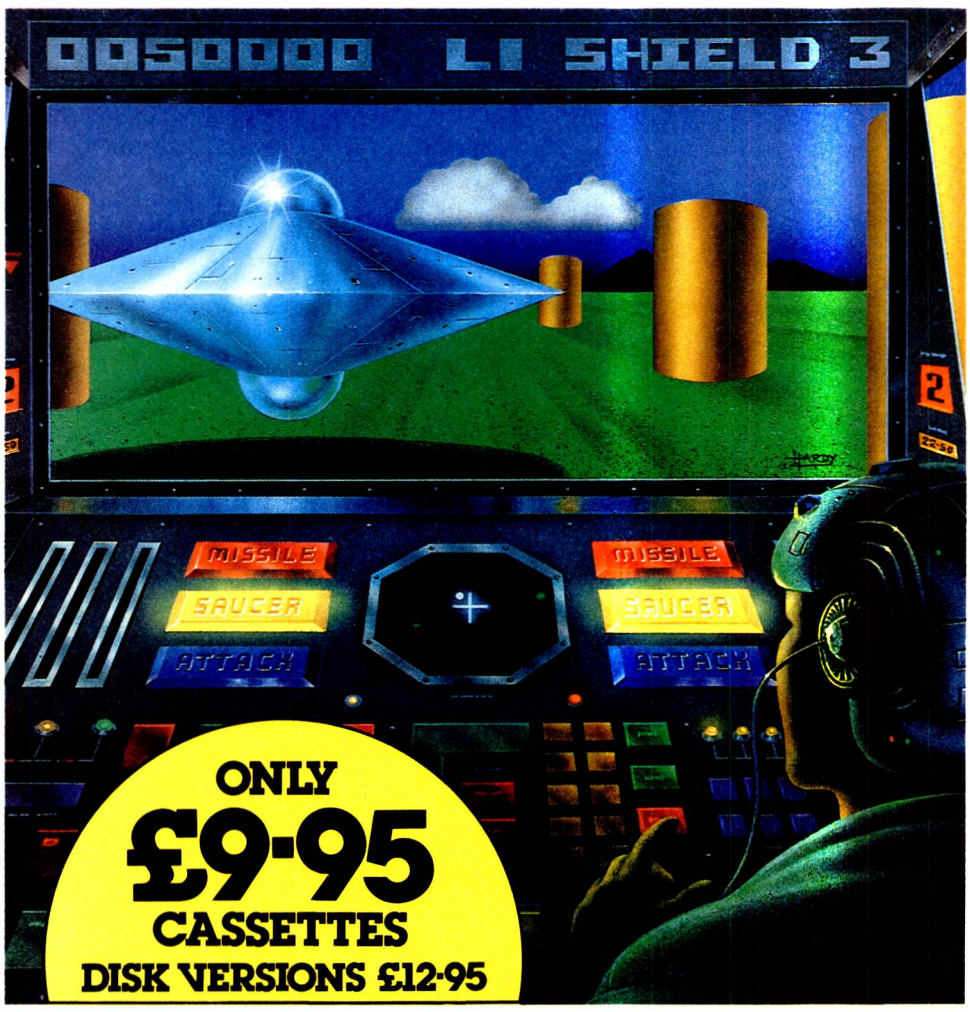

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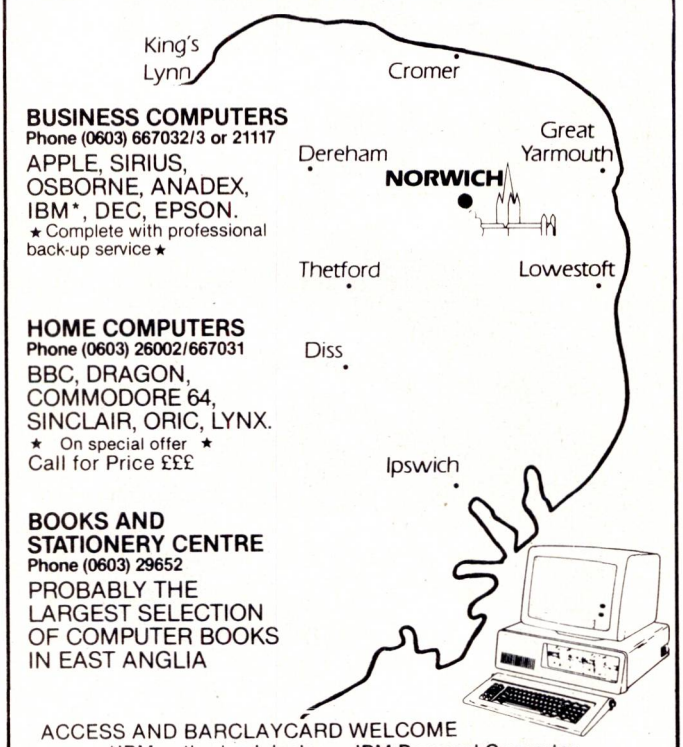

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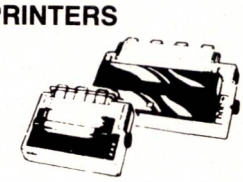

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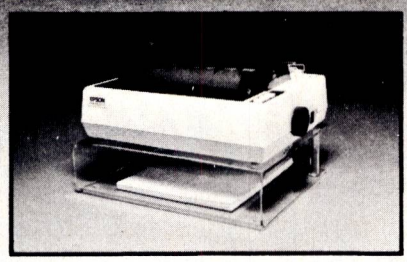

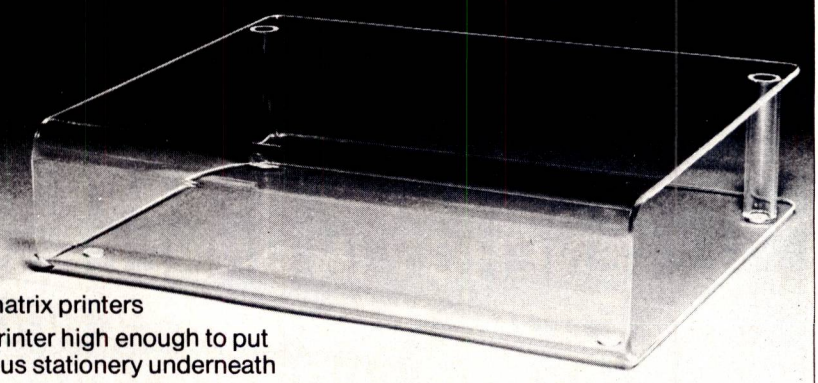

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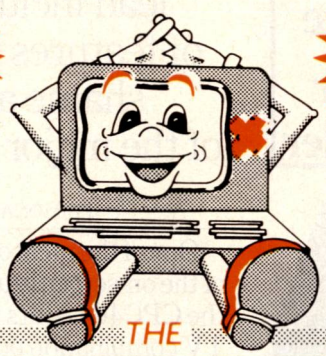

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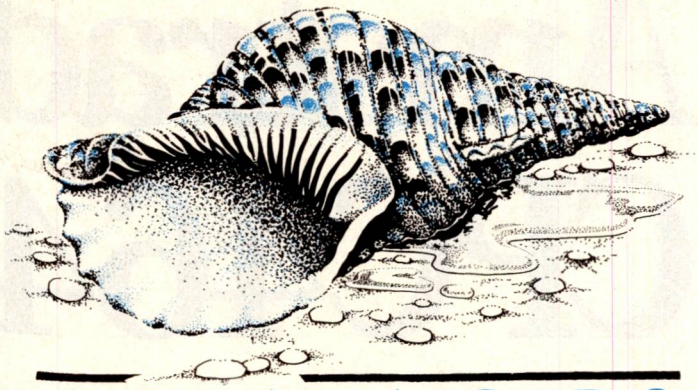

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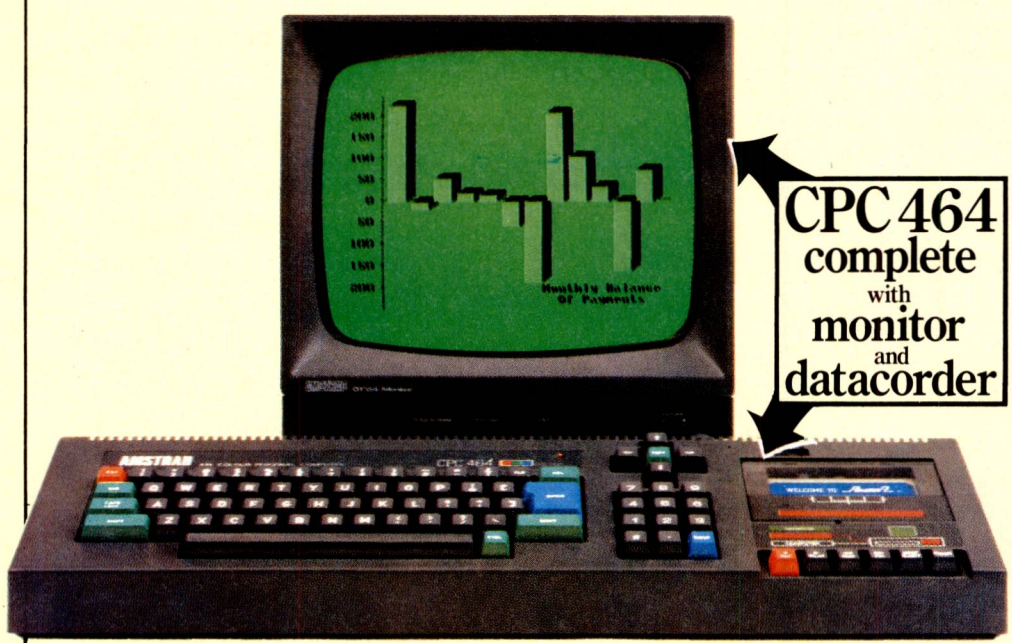
Amstrad's new CPC464 comes with plenty of free plugs.



CPC464 green screen VDU (GT64)

You may have noticed that the press has got very excited about our new computer system.

And rightly so.

Because the new CPC464 comes complete with its own green screen VDU or colour monitor, built-in cassette data recorder, 64K of RAM, 32K of ROM, typewriter style keyboard and a very fast extended BASIC.

When you consider that the complete computer system including green screen VDU and cassette data recorder will only set you back £239, that's plenty to get excited about.

You can use the green screen version of the CPC464 with a colour TV by connecting the optional power supply and modulator (MP-1).

"I think the Amstrad will give a lot of sleepless nights to Sinclair, Acorn and Commodore..."

POPULAR COMPUTING WEEKLY

Other micros can't get anywhere near the CPC464's memory for the price. Over 42K is available to users, thanks to the implementation of ROM overlay techniques.

Sophisticated and complex programs are easily accommodated.

And the CPC464 offers you high resolution graphics, 80 column text display, up to 8 text windows, a graphics window and a palette of 27 colours.

"The CPC464... in two boxes and one lead includes a list of features that would shame a hybrid of the major machines."

PERSONAL COMPUTER WORLD

One of the most obvious is the quality of the on-screen graphics. Quite simply, the CPC464 beats the micro/domestic TV combination out of sight.

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There's plenty of interest for music lovers when the 3-voice, 7-octave stereo output is fed through a hi-fi amplifier and speakers.

"The Amstrad is a powerful, fast machine, with plenty of memory, easy to program..."

PERSONAL COMPUTER WORLD

A fast growing range of Amsoft programs is already available.

The high quality software takes full



£239
Computer complete with green screen VDU (GT64)

£349
Computer complete with colour monitor (CTM640)

CPC 464 complete with monitor and datacorder

advantage of the CPC464's high specification and speedloading capability. Which means even complex programs can be loaded quickly.

Arcade games, educational programs and business applications are all designed to utilise the CPC464's impressive graphics, sound and processing abilities.



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"The Amstrad machine provides a lot of other features for a very low price."

GUARDIAN

At Amstrad, we're constantly looking to the future. That's why the CPC464 has a built-in parallel printer interface. A low cost optional disk drive system including CP/M* (with the option to access 3000 programs) and LOGO. A joystick port. And the virtually unlimited potential of the Z80 data bus with sideways ROM support.

With so many free plugs from the press, it's little wonder the CPC464 only needs one.



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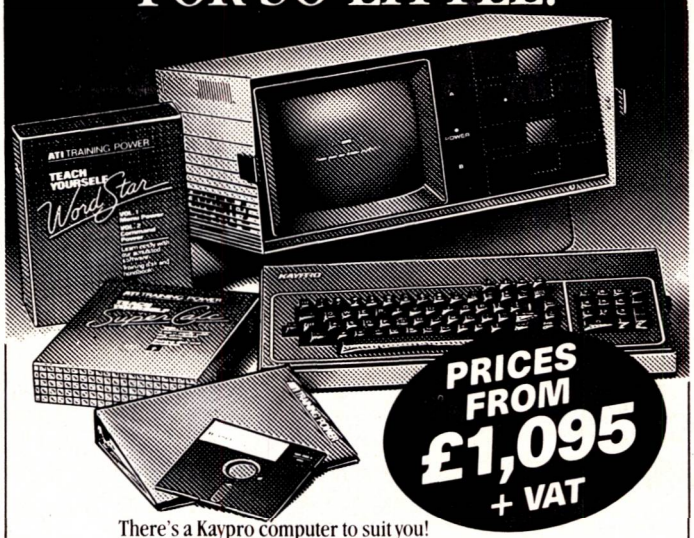

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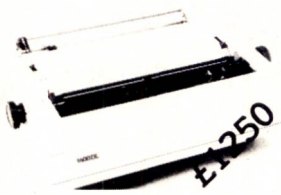

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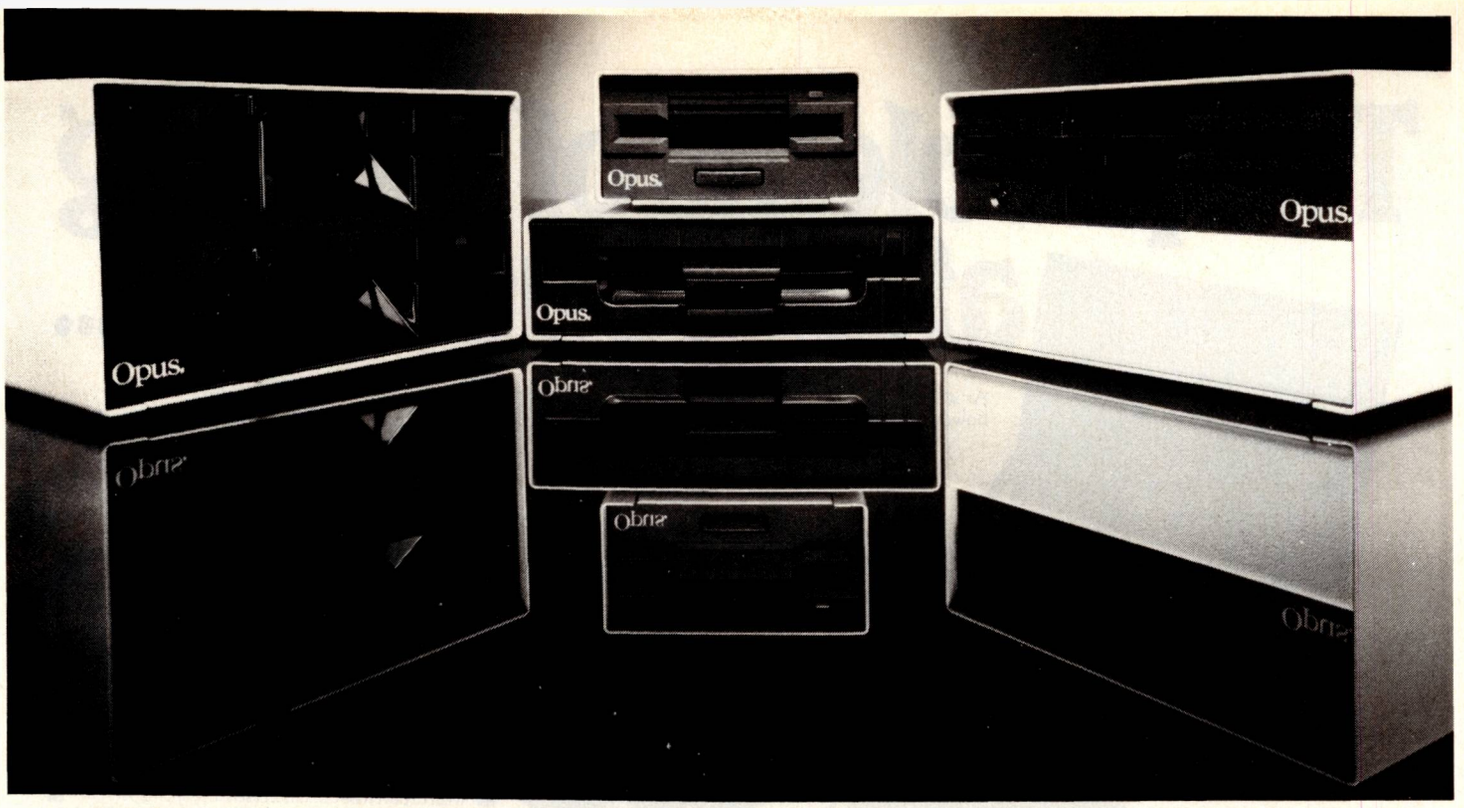

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PCW 59

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- MS™-DOS operating system customised to IBM compatibility
- Model G400 – Single, double sided, high density disc drive (320K formatted)
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• THE GRADUATE •

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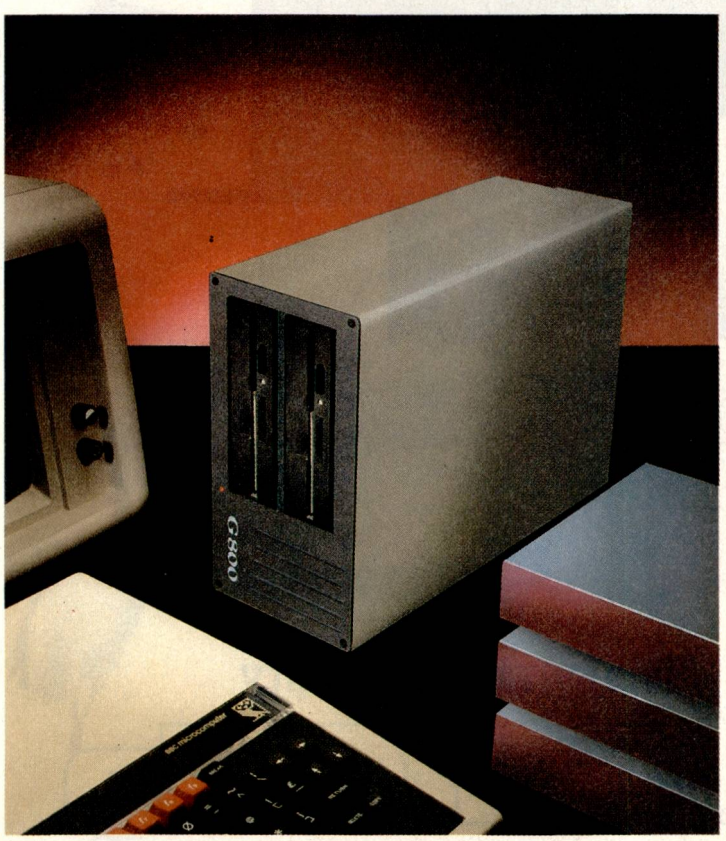

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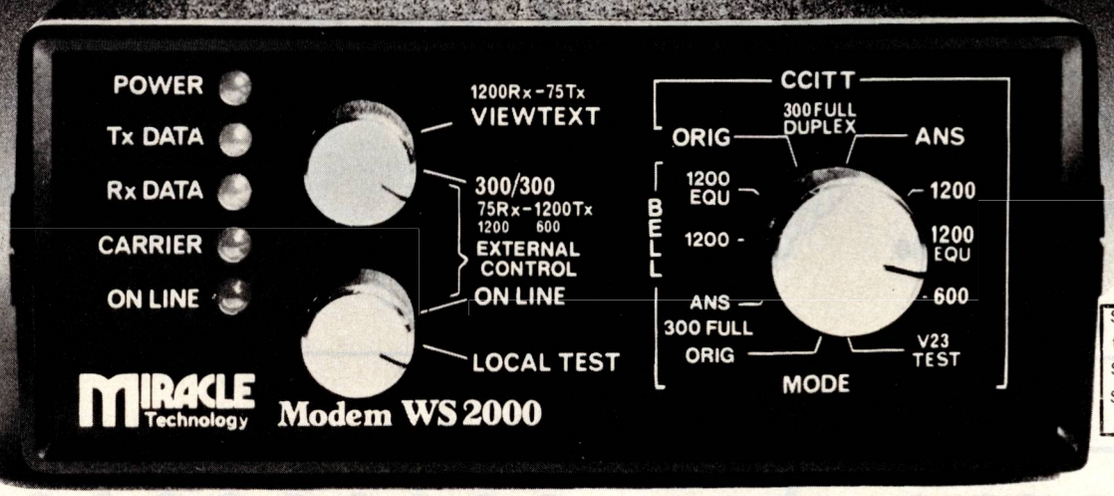

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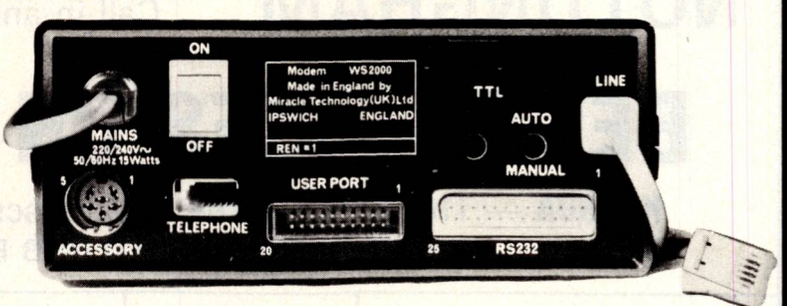

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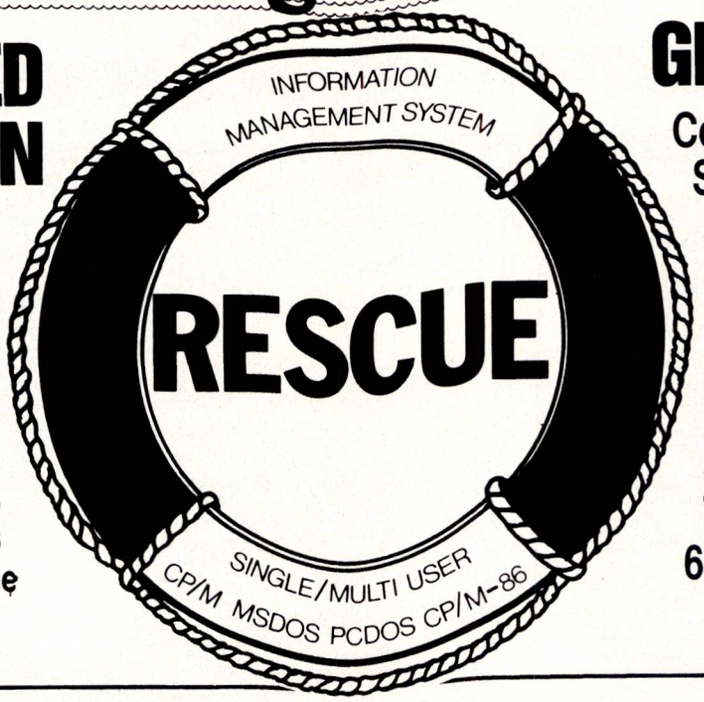

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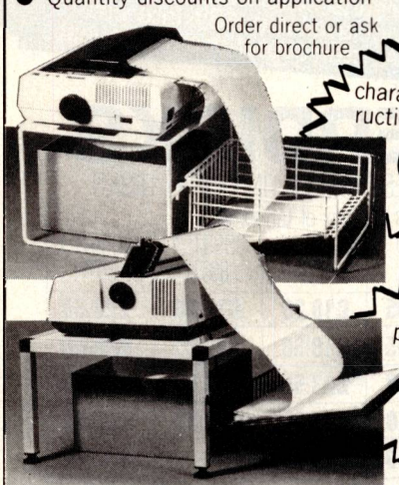

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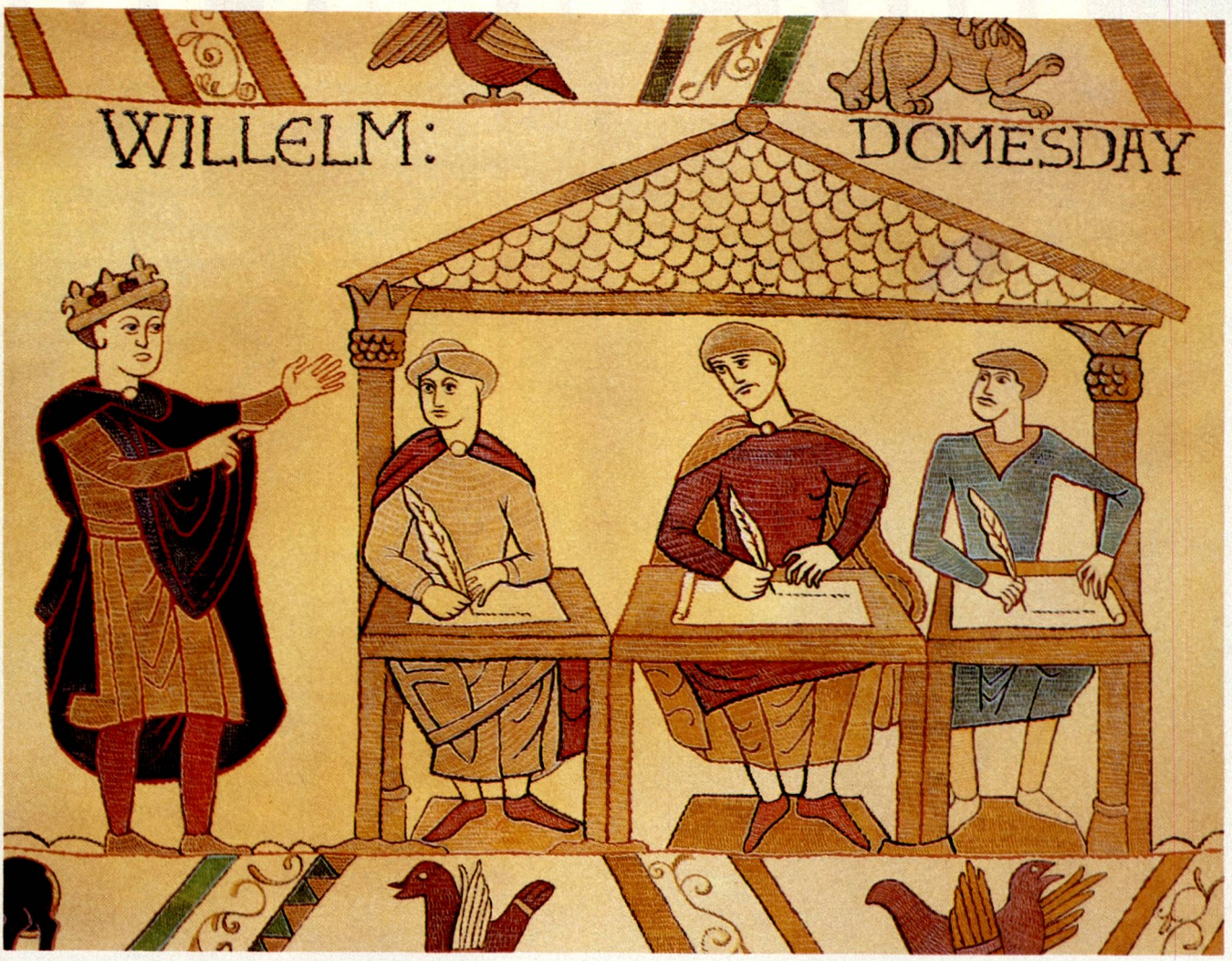

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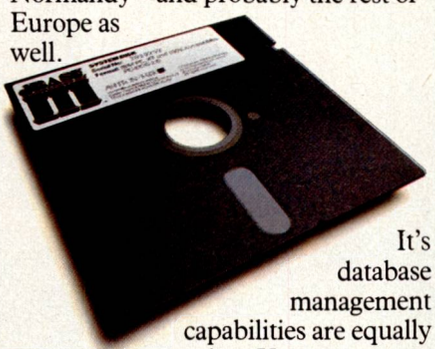

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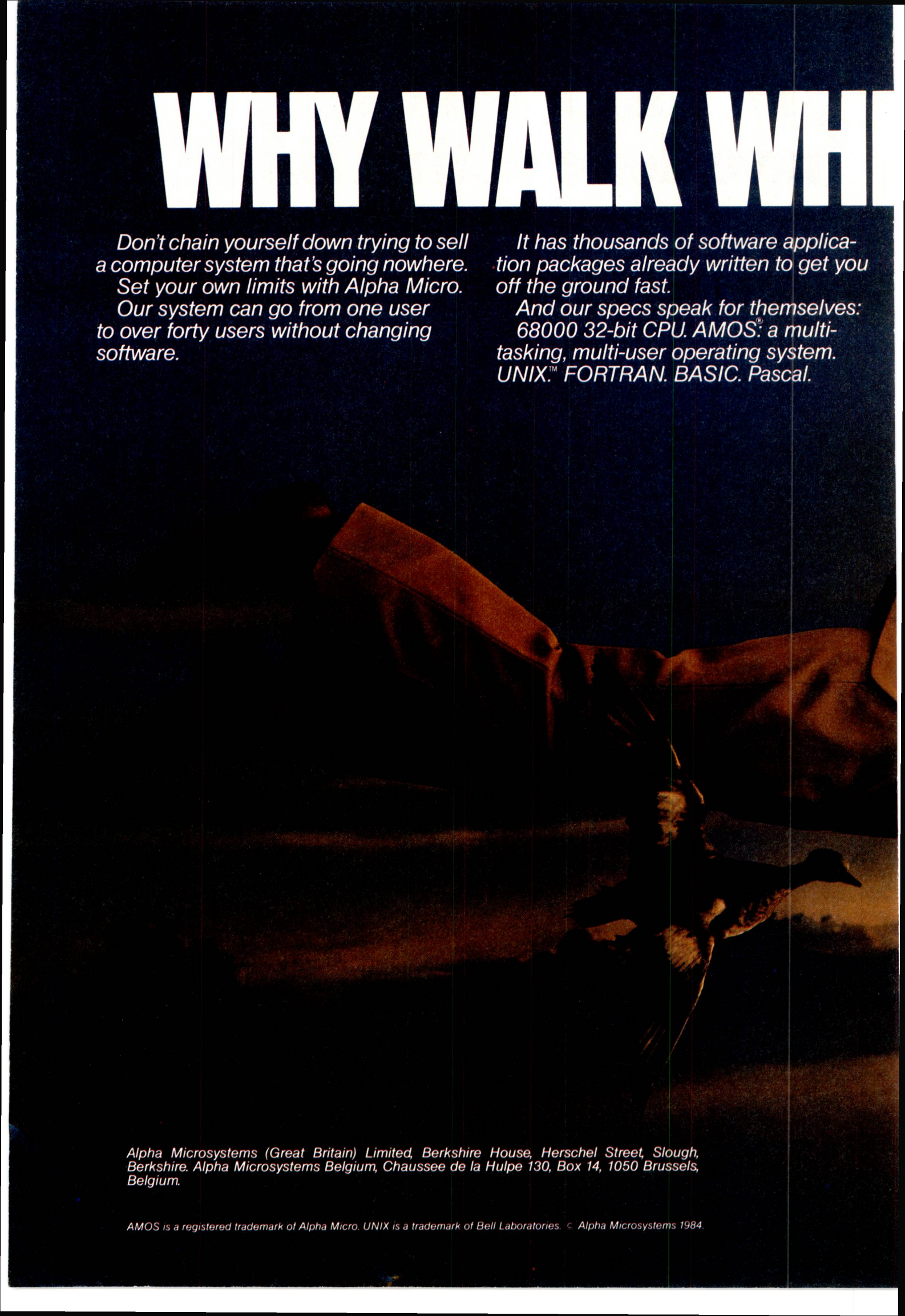

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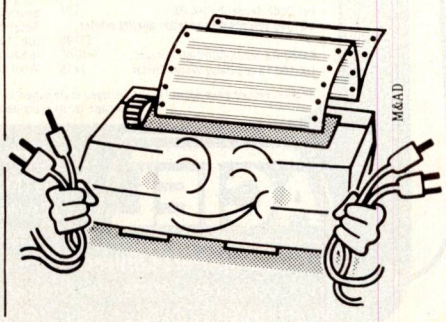

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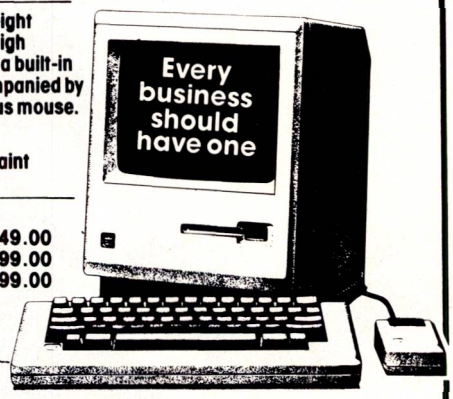

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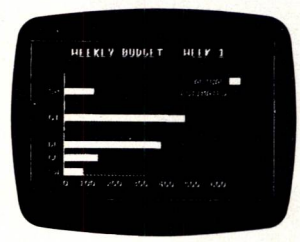



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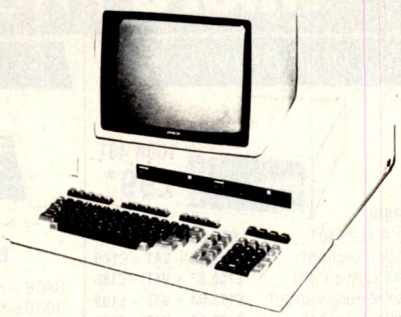

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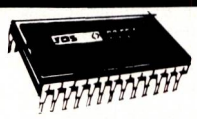

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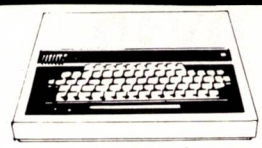

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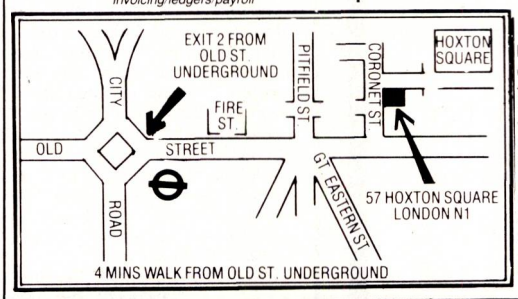

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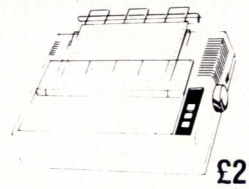

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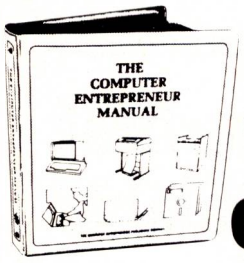

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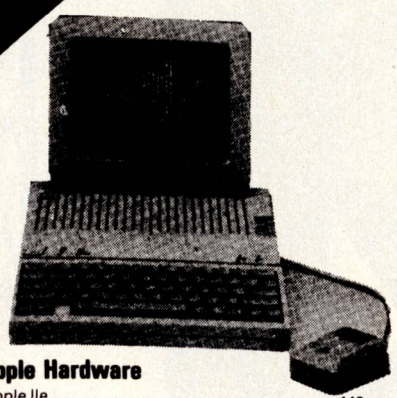

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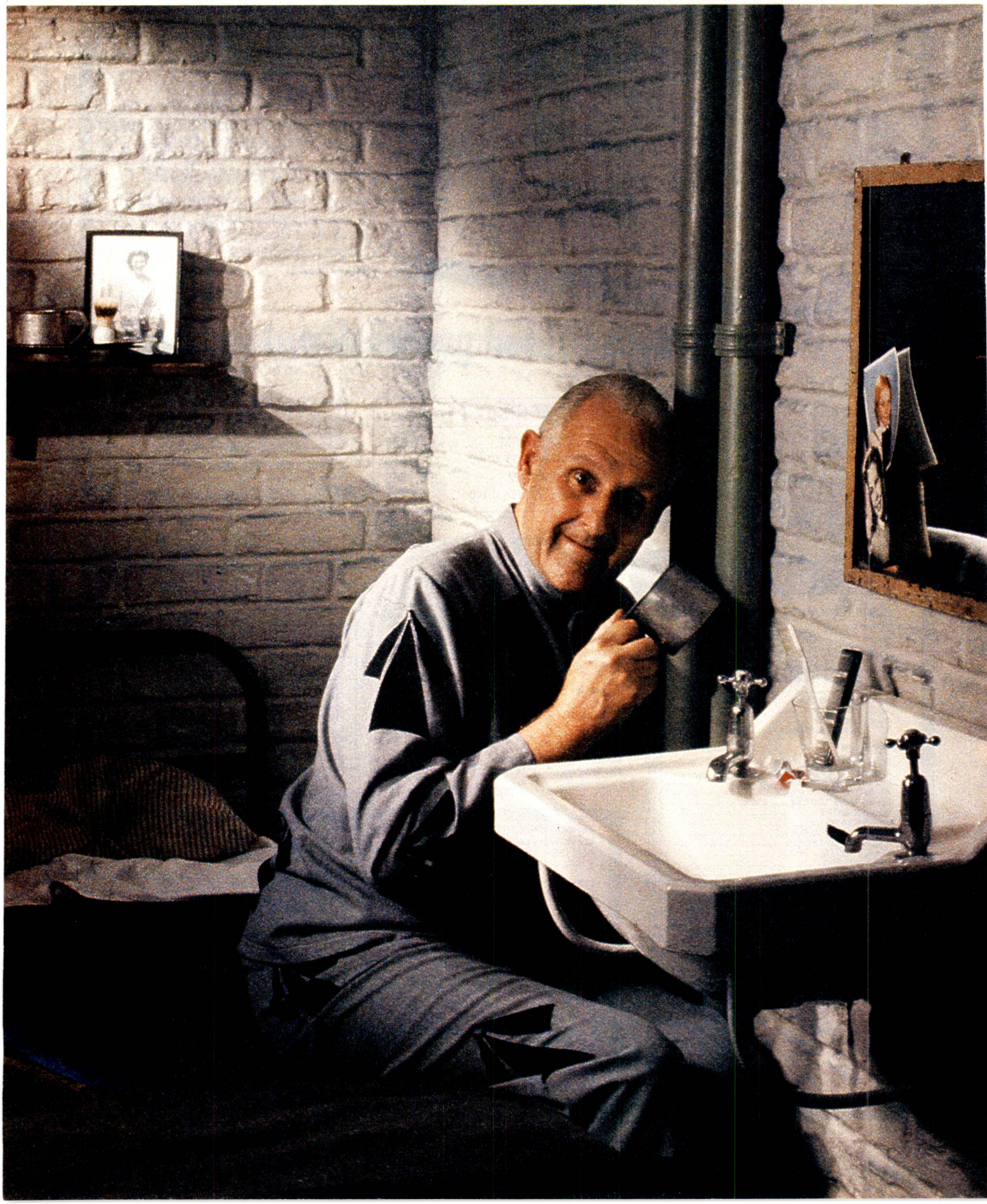

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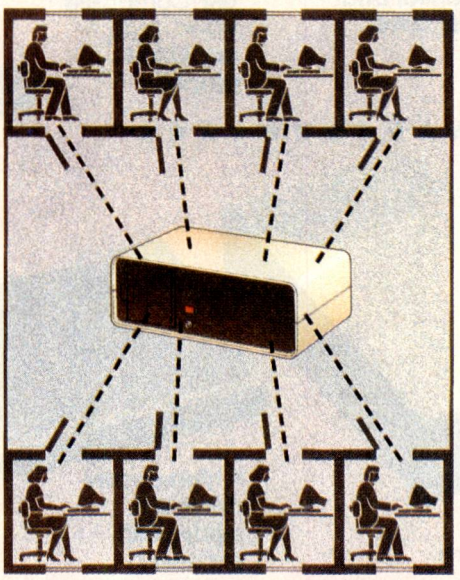

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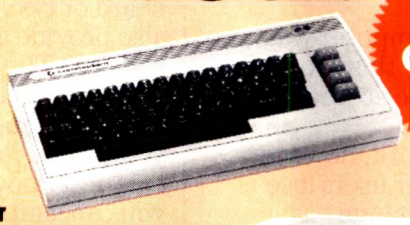

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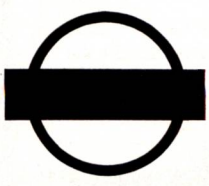

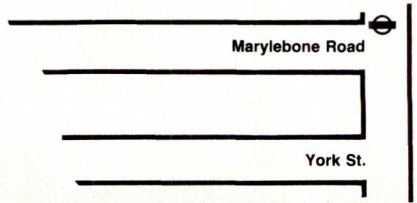

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NEWSPRINT



The IBM PC celebrated its third birthday recently with a big party—Kewney hopes no-one watched that nasty video, The Evil Dead. *Atari got up to its usual fun and games playing musical chairs while the gamblers took to playing the Ace. Just some of the spectacular events Kewney has witnessed during the last month.*

On with the show

The *PCW* Show is traditionally the place where new machines aimed at the Christmas market are revealed—Enterprise is upholding tradition this year, as—to a lesser extent—is Acorn.

Acorn is previewing its new range of business machines at the Show. The company stresses that this is just a preview, and that the machines will not be launched until later in the year. When they are you'll have to go to dealers to buy them because Acorn has decided that they're too complex for mass market chains to handle.

The BBC B is already being used in business, 'almost accidently' to use Acorn's phrase. Now Acorn aims to approach this market 'open-armed'—armed in this case with a range of seven machines with various processor options.

Despite reports published elsewhere, the micros will not be going out as the Professional Workstation Range—ABC (for Acorn Business Computers) is the likely brand name.

The title of Enterprise's new machine is—surprise, surprise—the Enterprise, with previous possibilities Elan and Flan having fallen by the wayside in the long wait for the micro.

Announced at the end of 1983, next news on the machine came earlier this year—to the effect that production was being rescheduled to September 1984.

The company argues that at least the machine will work properly from day one of its launch, and that the delay has given it a chance to develop a supporting range of peripherals and software.

Priced at about £250 for the 64k version, the Enterprise's features include built-in word processing, joystick and networking facilities. October is the time to look for it in the shops.

Storm in a teacup

Sadly, there was more fuss made about the financial mess that Future Technology Systems (FTS) got into last month, than ever anybody made about the company and its computers.

The mess was indignantly refuted by the outgoing managing director, Peter McHugh, who pointed to a rights issue worth £427,000 which was paid by all but two of the company's 16 institutional investors.

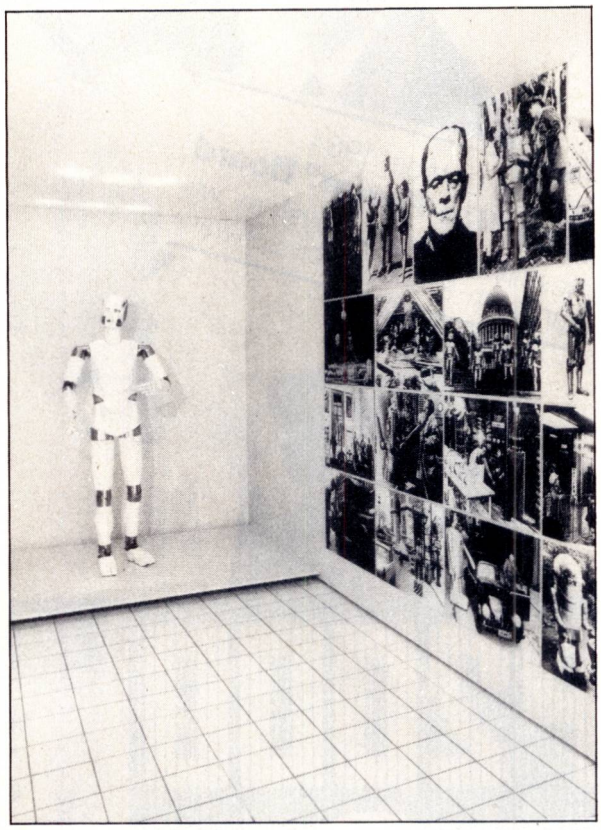
Then the new managing director, the famous champion of engineers, Sir Monty Finniston, warned journalists that they would be sued if they suggested that McHugh's departure was in any way related to a report from accountants Coopers and Lybrand, which mentioned 'appalling financial mis-management'.

McHugh himself told me that, so far from having left under a cloud, he had actually stayed on longer than he had planned, in order to see the company through its difficult patch.

Sir Monty was then quoted in *Computer Talk* as saying that McHugh was 'an excellent fellow, but I don't think he is an executive managing director.'

And McHugh suggested that the Coopers' report was really 'only one part of a much larger report, and there was no suggestion of malpractice, just the sort of problem any company growing at 800% could be expected to have.'

Everybody at the company observed in hurt tones that orders were flooding in, from Honeywell and from Computer Market in particular. They forebore mentioning Honeywell's dismal track record in micros, and somehow failed to remind journalists that Computer Market is the company which McHugh is running . . .



There is still time to see a Silver Reed robot disguised as Frankenstein's monster.

The new industrial robot is working on show behind the Victoria and Albert Museum, London, next to a robot built by IBM. Appropriately enough, as Silver Reed makes typewriters, its task is to use a typewriter.

The exhibition in the Boiler House seeks to show how the idea of man-like machines is frightening to most people, and to illustrate how these fears have been expressed in the past.

'For example, we draw the attention of visitors to the fact that Mary Shelley created her Frankenstein's monster at the time when the Luddites were destroying their new industrial machinery,' one of the organisers told me.

More directly interesting to computer enthusiasts, however, is the fact that these robots aren't just moving their arms around.

Instead, there are computer terminals, showing the 'thoughts' of the monsters, in terms of the instructions they obey, as they move.

The Silver Reed machine has a minimal memory, by computer standards—it can have 800 Basic-like instructions, and no more. These include operations like MOVE and WAIT and ROTATE.

The IBM machine is indulging in a more inward-looking vice. It is shown playing solitaire.

The Boiler House is behind the V & A, and the show runs until the end of October, so it is still worth planning an excursion, if you're interested. But don't plan on buying the robots, which start at £18,000.

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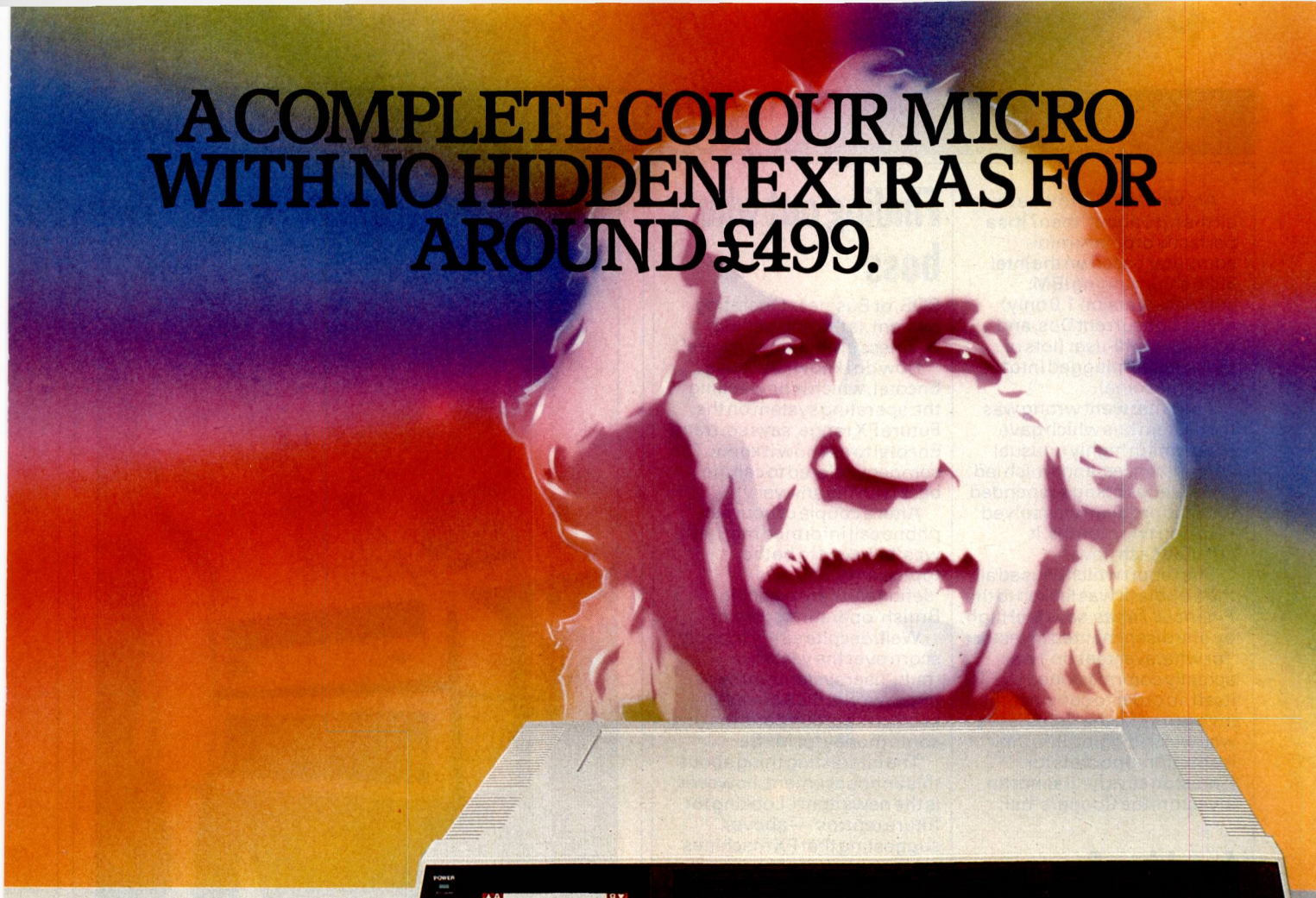

The title of 'genius' is not bestowed lightly on man or machine: those extraordinary qualities and powers of intellect are rare.

Einstein had them in full measure. And so now does the new micro computer from Tatung, designed and built in Britain and appropriately named – Einstein.

Einstein was created by Tatung, one of the world's leading electronic companies, and given the capacity and the remarkable capabilities to compete with computers costing far more.

Its simplicity of operation will appeal to the first time buyer and to businessmen who don't want to lose staff to expensive and time-consuming training courses. At the same time its operating system is both powerful and sophisticated to satisfy the most advanced requirements.

For those who have outgrown their existing primitive machine, the speed and capacity of the 500K built-in disc drive will make all the difference. And for the small businessman, the ability to store and retrieve all information in seconds will be as important as Einstein's built-in flexibility, which allows the system to grow as the business develops.

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Einstein has them all. Feature for feature, it meets the needs of the novice and the experienced operator, both at home and in the office.

Einstein, designed and built in Britain, is a complete colour micro computer with no hidden extras.

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TATUNG
Einstein

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†CP/M is a trade mark of Digital Research Inc.

Ah, what fun! And what was all the fuss about, then? It is a perfectly ordinary mini-computer based on the Intel 8086 chip, running IBM software (version 1.0 only) under Concurrent Dos, and offering multi-user (lots of terminals all plugged into the same machine).

And what went wrong was the system bus which gave problems in highly unusual circumstances, and which led to deliveries being suspended until the problem was solved — taking two months. It affected cash flow.

The report which caused all the trouble (it was leaked to the *Financial Times*, says McHugh, by one disenchanted investor 'for whatever reason') was actually commissioned by FTS itself, in order to convince the investors that the rights issue was worth digging into their institutional pockets for. Finniston says he'll send the investors the Coopers' bill.

Looking for future returns

I do hope that when I tell you that Future Computers has raised a million pounds from its backers, you don't say instinctively 'But you've already told us about that, and wasn't it £427,000?'

Future Computers is a quite separate company from Future Technology Systems (FTS), and was at some pains to point this out when it made the announcement. It described FTS as 'troubled', which I suppose is fair.

Future Computers is a company which shares people and investors with Encotel, which distributes its machines.

It has raised another £1m from backers who include Memorex and APA Venture Capital.

Future is banking on enormous sales of its networking equipment now supplied as part of its FX range.

Bob Jones of Encotel, a co-founder of the company, has announced that Future expects £10 million worth of sales in 1984, but that networking installations will account for 90 per cent of sales during 1985.

If that turns out to be more than optimism, it will be the first time networks have made such an impact on the market. Alternatively, Bob could be trying to say that ordinary hardware sales aren't going to be very good, I suppose.

Finding out who's boss

BOS, or Business Operating System, is the 'top-selling business operating software'.

How do I know? Because Encotel, which is now selling the operating system on the Future FX range, says so. I rang Encotel to ask how it knew. The company offered to call me back with the answer.

After a couple of hours a phone call informed me that it was 'believed to be the top-selling,' and was 'definitely the top-selling British' operating system.

Well, despite all my friendly scorn over the years for multi-user systems in the micro world, BOS does still seem to be around and making some money for MPSL.

The interesting thing about this announcement, however, is the news item ('Looking for future returns' — above), suggesting that FX machines are going to be sold primarily as network machines. A multi-user operating system on a networked micro could be quite useful in some offices.

BOS has made its own announcement about this, with a product called BOS/LAN, which links micros running BOS/5 and MBOS/5.

But BOS/LAN is not FX's local area network. It is aimed at linking any combination of Dec, IBM and Logica micros, with Ethernet as the network method.

'All the sophisticated multi-user features for file handling — shared access and exclusive access — are available across the network in exactly the same way as on a computer running MBOS/5,' is the claim made by MPSL development director John Johnston.

Details from Encotel on (01) 686 9687, or MPSL on (01) 831 8811.

Colex taking the fast bus?

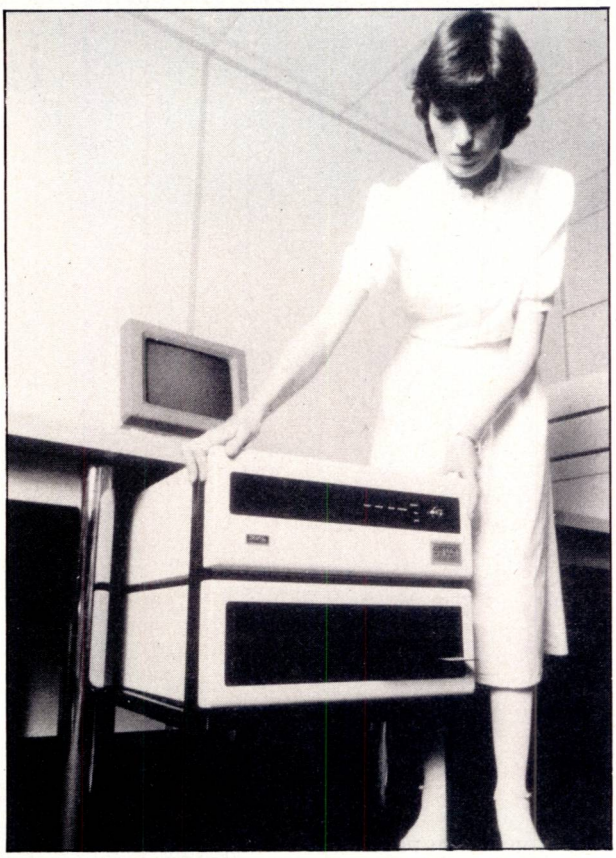
Just for comparison with the big Unix beast from Sirton, there is a £1000 system with the same chip, launched by Colex.

It's equally odd, in the sense of using a system bus which was designed for an 8-bit system — it has the STD bus which is meant for the Zilog Z80.

First version of this machine, the STD68000, was sold as having three times the power of the Z80 processor: this version, the STD6800-8 'is expected to well exceed this,' says Colex.

The £1000 buys you not only the processor, but a twin serial and single parallel interface board, a memory board with 64k (you'll need more) and something called the STD PSID, which must be necessary, but about which no information was available at press time.

The company reckons this is 'an environment suitable for CP/M68K,' which makes the Quest offering (see 'Quest for QL disks) look like a bargain, if it comes. Details on (0990) 23377.



This is a Unix super-micro, introduced by Sirton Computer Systems. It's unusual among Unix beasts, because it is based on the original S100 bus, which was used on the first micro, the Altair. It is also unusual in using the very old Version 7 or the slightly less old system III releases of Unix, which you don't see anywhere except in Xenix, these days. But there it is, priced 'only' at a half to a third as much as a VAX class scientific work station, according to the company. and (it says) equally powerful. It has a Motorola 68000 chip in it.

Details on (01) 640 6931.

Quest for QL disks

Disks are coming for the QL as two firms are out to offer an operating system on Sinclair's new super-micro. They are working on the theory that QDOS just isn't up to it.

One of them will be available with diskettes, as well as for microdrive users.

The other is actually the operating system which we all saw demonstrated in January, when the QL was launched.

Disks are to be launched by a company, Quest, which has taken out a licence for the 68000 version of CP/M — CP/M 68k.

'The idea is to complement QDOS, not replace it,' said an official Quest source, tactfully enough — but the effect was rather spoiled by the next comment: 'We don't regard QDOS as proven.'

Director Ralph Warren explained that the company, as a supplier of diskette drives, was primarily interested in getting people to buy disks. 'But we would worry about selling disks to people using QDOS, because there might be



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complaints about the disks which were actually caused by operating system failures.'

The Quest disks will not just be ordinary 5¼in drives. There will be hard disks, 3¼in Sony drives, and even 8in disks, for those who want to read IBM 8in mainframe disks.

The company wasn't sure about price, but will start off with 200k drives, which are pretty cheap these days. And since the operating system on microdrive cartridge, or on plug-in ROM, will be around £50, a disk subsystem for £300 is feasible.

The rival system is the one produced by GST to order by Sinclair. It was turned down because it wouldn't fit inside the QL together with SuperBasic.

Since Sinclair's own 'AH' version of QDOS had the same problem (as everyone knows, now), the people at GST somewhat understandably feel that the real reason was 'NIH syndrome' — Not Invented Here.

GST also points out that its operating software does proper concurrency for Basic users — you really can run several Basic programs simultaneously, in different parts of the screen. That was the feature which really impressed me about the QL when it was launched — and even the new 'JM' version of QDOS written by John Matheson doesn't do that.

This program is called 68KOS, and its only real drawback is that you don't get it free with the QL — instead you have to plug in a new ROM.

Expect to see reviews of this in a month or two, when evaluation samples start reaching the Press. Or, in other words, don't expect to buy it for a few months.

PC Junior growing up quickly

What people originally wanted from the IBM PC Junior was something like the IBM PC, but cheaper.

That, of course, was what IBM was originally determined not to provide — but it has now changed its mind, by announcing (in the US only) a version of the Junior with a proper keyboard, a lot of internal memory, and a fast RAM disk. There is also a speech synthesis chip.

At the same time, Lotus has announced a full-scale version of its runaway best-seller business program, 1-2-3, for the Junior — in ROM form.

Suddenly, the machine is worth taking seriously.

Official sources 'refused to speculate on future announcements' about when, or if, the machine might be released in Europe.

When the announcements were made in New York, IBM also released details of a very ambitious 'Writing To Read' piece of software, designed to teach literacy to kindergarten children.

The educational package may cause quite a stir in the US because they do at least have Juniors there, on which they can run the thing.

It sounds impressive enough — it is backed by official research showing that 'kingergarten and first-grade children can type whatever they can say.'

In effect, IBM is claiming to be able to teach literacy to most five-year-olds.

An official source in Boca Raton, headquarters of the PC group, told me that normally, educationalists would expect a typical kindergarten child with a vocabulary of 2000 words, to be able to read and write about only 100 words out of that 2000.

'We're saying that independent tests show that they can type a word, and once they can type it, they can read it, too.'

For the industry, however, the potential of the Junior in education is likely to be less interesting than the possibility of selling Juniors to business users.

The new keyboard will make a big difference — it is exactly the same 66-key layout of the old Junior keyboard, but uses entirely normal keys.

And, best of all to disgruntled users (but not to the makers of add-on keyboards, of course), IBM will provide this new keyboard as a free upgrade.

That means that anybody with an IBM PC Junior can go into any IBM retail outlet and get their new keyboard for nothing.

The really exciting move, however, is the RAM disk. It is provided by software, together with any 128k memory block — up to four blocks can be plugged into the parallel expansion port.

Not until you've used a RAM disk, will you realise how much time you spend in front of a computer, twiddling your



Everybody expected IBM to have something new to say this August at a party held to celebrate the PC's third (American) birthday — but nobody expected the company to have quite so much up its sleeve.

Starting from the top, there was a new multi-user micro, the PC/AT, backed up by the Xenix operating system; a windowing program called Topview running on most of the now extended PC family; and some networking suggestions to hold the whole thing together.

The new machine comes in two models — one at $3995 with 256k of RAM and a 1.2Mbyte built-in floppy disk drive, and the other at $5795 with the same size floppy drive but double the RAM and a 20Mbyte hard disk.

The ATs were launched not long after the upgrades to the PC Junior were announced, putting question-marks over the future of other machines in the PC family. IBM itself did little to remove such doubts, pointing out that the new 80286-based machine 'delivers almost five times the user memory and more than twice the information storage capacity previously available on IBM PCs' — adding, for good measure, 'and, in most cases, system performance is two to three times faster.'

IBM only promises that the ATs are 'compatible with most existing IBM Personal Computer hardware and software.'

Unsurprisingly it's more confident about PCDOS Version 3.0, another of the new launches: 'This version has added functions to support the new Personal Computer AT hardware and is compatible with all IBM PCs.'

But it's the IBM PC Xenix operating system that gives the ATs their multi-user capacity as it allows two terminals to share one AT's processing power. The operating system also allows more than one task to be handled at a time by any or all of the three users.

It's the multi-user ability which distinguishes Xenix from IBM's other, earlier offering in the Unix field, PC/IX, a multi-tasking but single user system.

Both of these systems are, however, based on the System III version of Unix — at a time when AT&T, one of the few companies equipped to fight it out with IBM, is heavily promoting System V.

The new windowing program, TopView, runs on the AT, as well as on the original PC and the hard disk and portable versions. Priced at $149, this package allows users to run more than one program at a time, switch from task to task, or display data from various applications on the aforementioned windows. Junior has been left out in the cold for the networking as well. IBM is selling various components such as network adapters and cabling kits enabling users to install their own networks linking up to 72 PCs, XTs, Portables and ATs.

If you want more, the company is also releasing specifications enabling third-party specialists to link up to 1000 members of the family. IBM aims to connect these systems to its projected token ring local area network.

The ATs are available now in the US, TopView is scheduled for early next year and the PC Network for this October. There was no word on UK prices nor availability at the time of going to press.

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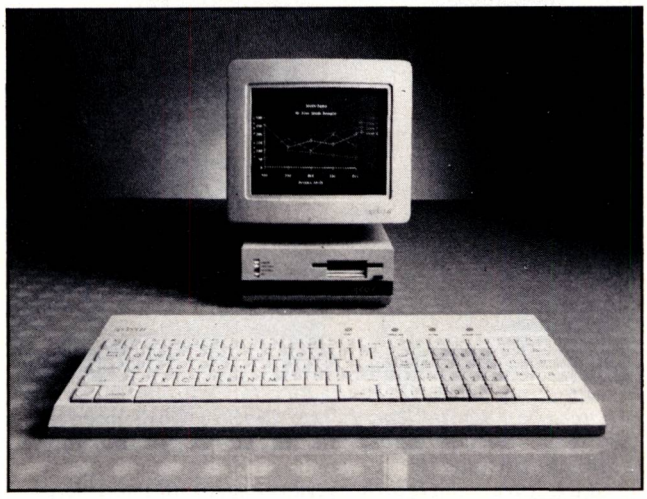



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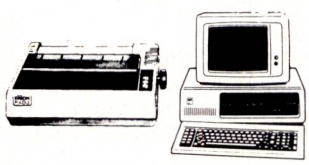

IBM PC PACKAGES

IBM PACK 1. Our IBM Starter Kit. IBM PC, two 360K disk drives, DOS 2.0, monochrome display, printer adaptor, 128K RAM, £2141 and we include the NEC 8023 graphics printer and cable, normally £329, at no charge.

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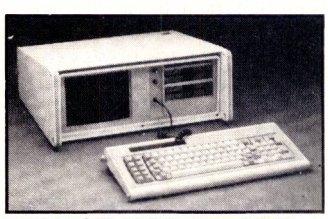

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fingers.

It isn't just when you load a program—though goodness knows that makes a difference enough—but when it overlays—when portions of a long program, too big to fit into the normal memory space, are pulled in from disk and then are started up.

Most programs use this method of making sure that anybody, no matter how little memory, can run them, and most of them waste around three to 10 seconds on each overlay. With the whole program in RAM disk, it takes microseconds.

With Lotus 1-2-3 on a plug-in cartridge, however, the possibility arises that people will actually prefer to use the Junior instead of the PC itself. Loading time will be instant, and with the RAM disk for spreadsheet storage, the program should run like a train.

The new 'proper' typewriter keyboard is likely to go a long way to putting smiles on the faces of US retailers. Many prospective buyers have given the horrible, Sinclair-Spectrum rubber keys as their reason for choosing something else.

Naturally there will be those in Commodore and Apple who may observe that the offer is only possible because there are so few users of the Junior already.

The bad news is the price: it isn't prohibitive, but an extra 128k of memory fetches $325. That isn't cheap, when you consider that the 16 memory chips involved cost $5 or less, each. And to go beyond the first add-on memory block, to the full 512 memory expansion, the buyer has to spend extra ($150 extra) on a power supply expander.

And the price of Lotus 1-2-3 isn't reduced, either—on ROM, it costs a full $495. But then, according to Mitch Kapor, boss of Lotus, it is a full feature 1-2-3, with no compromise on the code.

On the road to success

The reason for dragging into the news an agreement by which Kalamazoo will sell Aston-built Pertec micros, is the operating system involved.

Kalamazoo makes its living selling in 'vertical' markets, mainly motor distributors, with purpose-built software running on very ordinary equipment.

The deal is centred firmly around the Pick operating system (major rival to Unix in multi-user systems), and though it isn't yet clear exactly how Kalamazoo will use this system, it is clear that the company has no intention of using any other.

Pertec designed the original 68000-based processor, and sells it, directly and through Kode, into the UK. It also granted a licence to Aston Technology which markets it, together with some Rodime hard disk drives and Aston-made terminals, as the Crystal range.

I really don't want to over-sell this story, because although Aston talks enthusiastically about the 'tremendous success' of the range, with orders over £700,000, you do have to remember that this amounts to only 70 machines.

And when Kalamazoo and Aston boast that the deal 'could be worth over £2 million in the first year,' you must remind yourself that this involves selling only 200 more.

Also, it isn't altogether clear that Aston and Kalamazoo have quite the same things in mind. Aston's managing director, Graham Gough, told me that he believes that Kalamazoo will sell this machine into such businesses as hotels, and the motor distribution business.

Kalamazoo's traditional market for business systems is in the motor trade. However, a spokesman for the company said that this would not be an automatic outlet for the Crystal machine.

'Our motor trade division is autonomous,' said the executive, 'and this will be put forward as a multi-user option for them to install if they see fit.' The idea of doing hotel systems was also dismissed.

However, when Kalamazoo does start selling this powerful micro/mini, the software will be written in the Pick-based System Builder (a program generator developed in Switzerland by Atech-System Builder—reviewed in the June issue).

That program generator works only under Pick, and despite all the qualifications and reservations listed above, it is very interesting to see a deal so firmly tied to that operating system.

Mutual support

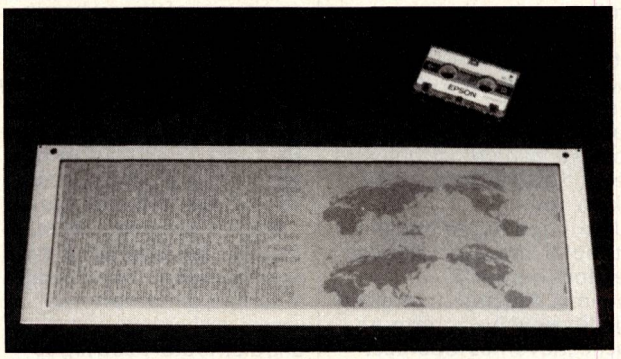
It's always nice to get support for a product from an independent expert—but don't be deceived by Fox & Geller's enthusiasm for dBaseIII into thinking F & G might be unbiased.

Fox & Geller sells a product called Quickcode, which can be used by people trying to manage dBasell, the parent database. It helps prepare command files, which is a way of saying that dBasell is really a programming language, and Quickcode is a sort of compiler.

Not surprisingly, Quickcode has now emerged as a dBaseIII compiler, too. So has the utility pair of programs dUtil and dGraph.

And, guess what? 'dBaseIII will be the fastest and most powerful program of its kind,' says Tony Riley, managing director of Fox & Geller in the UK.

Riley is on (01) 5805816.



Epson is prepared to sell anybody at all a flat, LCD computer display—providing you have about £300.

It has launched a 25-line model, and hopes to have high volume units available to system builders (that is, people buying in lots of 100 or so) by the winter.

And by the New Year, even private buyers who want just one, will be able to purchase it, says Epson.

The unit is said to consume only 20mA off a battery supply, which means that it can be used in battery-portable computers.

But the new display cannot be bought as a simple CRT replacement by the amateur user. An interface to the normal video output of a microcomputer would be a highly complex bit of engineering—not something for a couple of spare evenings with a soldering iron.

Things are different 'down under'

At the time when Epson is offering a 25-line LCD screen for £300, you might ask why the Australian micro, the Dulmont Magnum, comes with only an 8-line display, and the maker reckons that a mere 16-line display should cost an extra $500 on the $2500 US selling price.

The answer appears to be that Dulmont regards its machine as a bit special, and not for bargain hunters.

It is one of the new briefcase-held knee-tops, following in the footsteps of Tandy 100 and competing with things like Osborne's Encore and Hewlett Packard's Portable 115.

But this one has a *big* chip inside it, not just the ordinary IBM or Sirius 8088, nor even the full-size 8086, but the bigger brother, the 80186.

It has the nice (I'd say necessary) feature of using battery-powered memory—so that when the power is turned off, the memory goes into trickle mode, and keeps its contents.

And it offers MS-DOS 2.0, which is stored in permanent memory. It even has an ordinary video display output, according to preliminary information.

What it doesn't have, unfortunately, is a diskette. True, it has memory which can be used as a disk, to make programs run faster, but that doesn't solve the problem of loading the things.

The only word of a diskette interface refers to 'disk drives for the office are available in an expansion unit which can pack an extra 256k of RAM.'

Compared with the Encore, this one at £2000 and with only an 8-line display, seems like a pretty pricey package.

Included in the package is a set of the expected word processing spreadsheet and communications software. These were written by Dulmont, because the software houses they asked to

handle the job pulled out.

The company's claim that 'naturally, any MS-DOS program can be executed onto the machine, — for example, dBase II, Knowledgeman, and so on, is the one which begs the question of whether you have disks or not.

Until the company finds a distributor, however, all these questions are purely academic. Anybody interested in getting involved on a more practical level has to contact the Australian Trade Commission on (01) 4388561 and ask for Peter Mott.

Choice Apple

Pete and Pam is offering a disk drive for the Apple II. It is more compact than the outdated Apple drive (price £130 + VAT).

On the treasure trail

Both hardware and software sides of our industry often take refuge from facts which seem uncomfortable, by indulging in what they might call exaggeration.

This has started to hurt the software business.

The software distribution business is not entirely devoted to weeping and wailing about piracy — there are several of them who are taking a firm grip on the job of counting the money.

Specifically, there is to be an attempt to create an accurate 'top fifty' chart of games software, as opposed to the apparently random guesses which have dominated so far.

Market researcher Simon Treasure is probably right to say that the figures published in various parts are not as wrong as they look. But when one distributor has a top 50 which includes only 10 games from another distributor's hit parade, we aren't making sense.

The explanation, apparently, is that a good selling BBC program may still not make it into the top ten, simply because there aren't that many BBC machines. By contrast, a feeble Spectrum game may be quite a hit.

What the industry wants to know is: exactly how many machines of each sort are there? How many of the new machines are being sold each week? If a game sells 100 on the Amstrad a week after launch, is that to be expected? Or is it a flop? Or are there only 100 machines? Do the people who have ZX81s still use them? (Sir Clive uses them as door-stops).

Treasure is the man who draws up the Prism/MicroScope chart, and his plan is to get the industry to set him up as the coordinator of a joint industry Focus Committee, along the lines of successful music record industry groups.

Accurate figures can only be obtained from the industry itself. But the trouble about the industry is its tendency, as hinted above, to tell lies.

They tell lies because it's important. A month after a machine is first launched, the flow of nearly-ready software can dry up in a week, if the software people are not convinced that it is selling. A fat lot of good it does launching Super-Zapp for the Swizzocomp if the only ones sold are trade samples. So, of course, Swizzo Micro Ltd will announce that it is delivering 1000 a week, even if it isn't true.

However, the hardware people themselves need to know what's going on, and Treasure hopes to use this need for knowledge in order to screw information out of them.

His theory is that if they all provide accurate sales figures, week by week, to an independent auditor, who publishes only the global figure, nobody will have to give away any secrets in public.

The idea is excellent. There is only one small hiccup, of course, in the fact that Treasure appears to have been a little more successful in selling this idea than perhaps he planned to be.

He has been asked, by leading software distribution representatives, to go away and make concrete proposals for market research and statistic coordination, to be organised by himself.

But the software distributors have added the 'of course' rider that he, obviously, can't bid for the market research contract, if he's drawing up the terms.

Which will suit him very nicely, one day — but not just yet! At the moment, his sole source of income is the market research work he does on games software . . .



At last, Wrens are being built. After the delay, it seems only right that all the stops should be pulled out, and indeed the company reports that they are.

The Prestel-based portable CP/M system is built at Thorn EMI Dynatel's Treorchy plant, and the factory decided to stay open during the normal summer shutdown period, working to maximum capacity 'because general demand is so strong,' according to Prism.

How nice. And what a shame that the publicity had all been so effective, that I really was expecting to hear of enormous numbers built. In fact the holiday shutdown would only have lost production of 400 machines. I suppose that's impressive, but really, all the ballyhoo had led me to think in terms of rather more.

Fast action on anti-counterfeiting legislation

There really is no hope that individual computer users will stop asking each other for a copy of whatever software they notice their friends using — despite the recent success of Trevor Brownen's criminal suit against Yorkshire Software.

And, as the industry is at last realising, action must be taken to change the law.

There was excellent news for software writers in the judgment on Howard Austin, who was found guilty on several charges, all related to his selling of Crystal Software packages which he hadn't obtained from Crystal.

Crystal now hopes to sue the 19-year-old manager of Yorkshire Software for the £40,000 worth of lost sales the company estimates he cost them.

But the judgment, in a court in Devon, isn't quite what it seemed when it was greeted by one enthusiastic headline writer with the loud pronouncement: 'Software piracy a criminal offence!'

What the judgment actually proved was wrong *wasn't* software piracy — Austin wasn't charged with that. He was charged with selling something under the name Xtal Basic, selling manuals appearing to be Xtal Basic manuals, and passing the software and manuals off as genuine Xtal Basic, when he knew it was merely a copy.

Trevor Brownen, boss of Crystal, specifically did not attempt to claim copyright on the code itself.

The result is that nobody has yet established what would have happened if Yorkshire had just re-issued the software as 'Yorkshire Basic' — and those in the know seem fairly convinced that new laws would be needed to stop them.

Anti-counterfeiting legislation specifically for software *has* taken a real step towards the distant goal of a statute, with the reading of a Bill in the House of Commons.

That Bill was drafted by FAST — the Federation Against Software Theft — and stands almost no chance of being passed at this stage.

'The important thing is that introducing a Bill under the 10 minute rule gives us a mechanism for getting it printed and distributed among MPs,' commented one of the backers, Ranald Robertson (*sic*), who is chairman of the CSA's legal affairs group.

The object of FAST's action is to get a Private Member's Bill put forward — and they are due to put their names into the lottery hat in October.

Whichever MPs get picked to put forward a Bill, there will be some without a burning urge to pass a law on their own

continued on page 99

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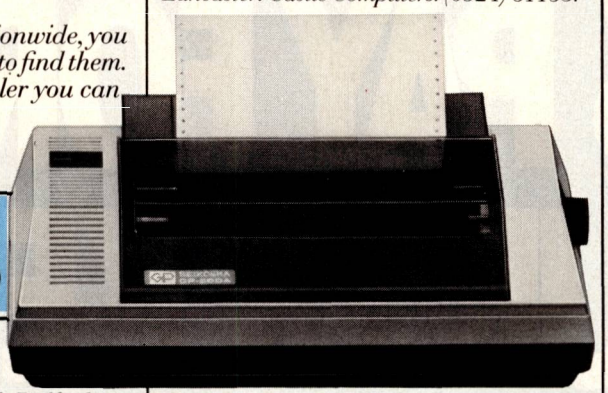

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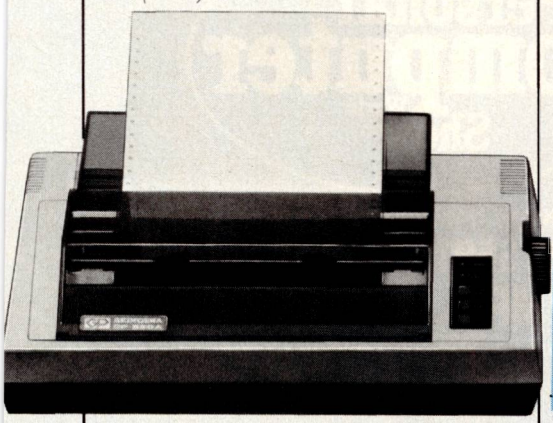

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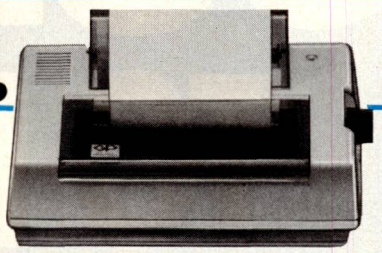

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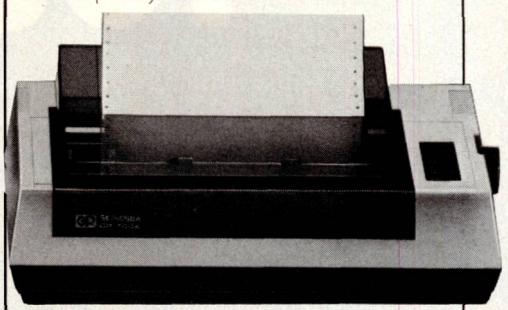

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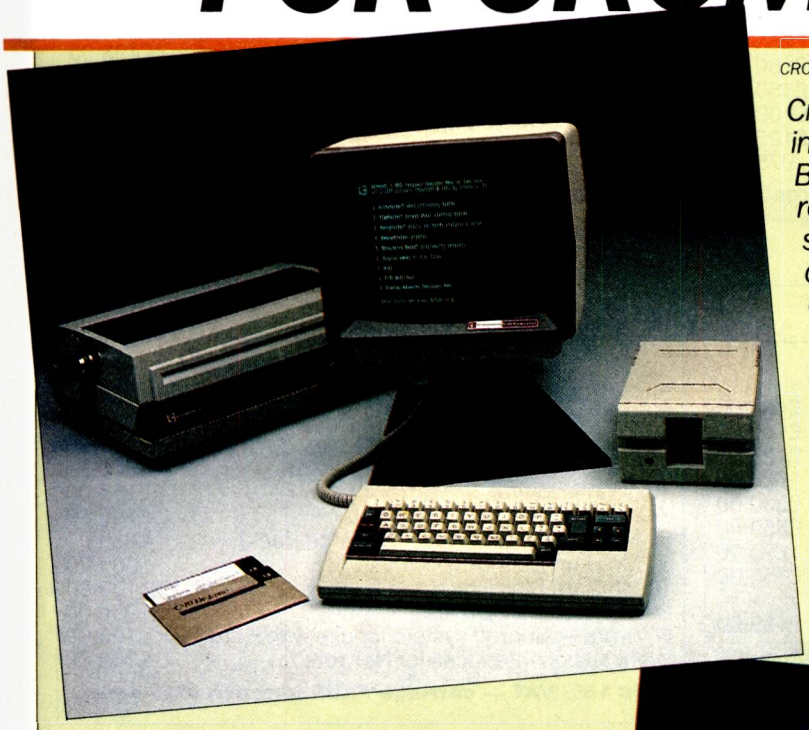


CROMEMCO C-10MP

Cromemco's C-10 personal computer includes a Z-80A microprocessor with 64K Bytes RAM, 24K Bytes ROM, high resolution 12" green phosphor 25 x 80 screen, detached keyboard, 5" floppy disk drive with 390K Bytes capacity, communications and printer ports, terminal emulation, graphical characters, CDOS operating system and 32K Structured Basic.

In the C-10MP we add a software "Super Pak": a full screen editor, WordStar, MailMerge, Writemaster, CalcStar and PlanMaster spreadsheet programs, Chess game, MoneyMaster financial analysis and InfoStar data base management system.

The System One Hard Disk computer, with an integral 21 Megabyte Winchester hard disk, includes Cromemco's dual 68000/Z-80A DPU processor (featured below), with 256K Bytes of RAM and 390K Bytes of floppy disk storage.

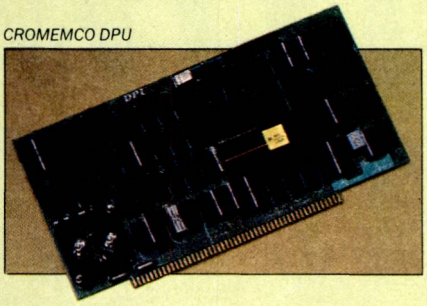
The S-100 bus has eight card slots, sufficient for expansion utilising Cromemco's range of interface cards for high resolution colour graphics, process control, analogue-digital data conversion and telecommunications.

A choice of operating systems includes CDOS, CP/M and CROMIX.



CROMEMCO CS-1HD2

CROMEMCO DPU



Cromemco's Dual Processor Unit is the ultimate professional micro-computer. It combines the flexibility of Z-80A 8-bit systems with the speed and versatility of 68000 16-bit technology and an address space of up to 16 Megabytes of RAM.

The DPU can be installed in several Cromenco computers, including the CS-1 featured above. For larger applications we recommend the CS-2, with up to 4 floppy disk drives, each of 390K Bytes capacity, an optional 21 Megabyte Winchester hard disk, screen and printer interfaces plus a 21 slot S-100 bus – sufficient capacity to cope with the most demanding industrial or laboratory requirements.

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NEWSPRINT

continued from page 94

hobby-horse subject, and who are just looking for something worth doing, preferably with a chance of receiving support from either side of the House, and likely to get their name into the history books as having put forward the new law.

Ranald Robertson of the CSA was pleased enough with the conviction in Devon, but pointed out, soberingly, that the defendant was fined a total of £40. That, with costs of £50, was the only criminal penalty exacted.

Robertson commented: 'If we had been talking about music or video tape copying, it would have been appropriate to expect fines of several hundred pounds.'

FAST is still hoping to get new legislation in 12 months.

Logica's version of events

Nice little touch of irony in an announcement from Logica, which sells Xenix (Microsoft's venerable version of Unix, now hopelessly outdated by developments from Bell) in this country.

Logica has been given the job of moving Berkeley release 4.2 (a much later version) of Unix onto the Norsk Data ND500 minis.

Considering how disparaging Logica was, only a month or two before, on the subject of Berkeley Unix compared with its own 'much more powerful' Xenix, it was lovely to watch the careful way the announcement praised 4.2, without in any way allowing comparisons to be made in the reader's mind, with Xenix itself.

Instead, Logica compared it with Ultrix, the version you get on a DEC VAX. Ho hum.

Paying the difference

A Sony 3½in disk drive is about to appear on the Electron, courtesy of Acorn itself. And from Sir Computers, there will now be a Mode 7 adapter. It can make the machine almost as good as the BBC Micro for roughly the same price.

The Acorn device is still unpriced, and nobody quite knows when it will appear. What makes it interesting, however, are the hints emerging from Cambridge that it will be available on the BBC Micro, too — with a totally new diskette operating system.

Word was that the Electron device, including interface, would appear this month.

Sir Computers, an independent supplier, claims that its adapter saves at least five kbytes of memory, when running BBC Micro programs that use the Teletext mode 7.

Normally, this very economic mode (in memory terms) is fudged by the Electron, and the result is that quite a bit of software won't work.

That remains true, unfortunately, with Sir's device, which the company claims 'is compatible with over 90 per cent of BBC Micro mode 7 software'.

Once you have plugged this £99 device in, plus the Acorn joystick interface, you have come so close to paying the full BBC Micro price that I really don't understand why anybody would want to make the 'saving'.

For those already stuck with an Electron (and Acorn believes there are some 150,000 sold) Sir Computers is on (0222) 621813.



Screendump printing at the touch of a button is one of the attractions of the Janome CP1018 printer from Thame Systems. This seven-colour printer costs nearly £900 and operates at 90 characters a second in near letter quality or 180 in draft quality. Screendumping is done through an optical RGB video interface which costs an estimated £45.

Thame can be contacted on (084) 421 5471.



Half the time you think you went into WH Smith, chances are you were in a Menzies shop — so it comes as no surprise to find that a company, like Smith's, is selling software and doing it down the phone lines.

Like the Romox system being tested by Prism, the Program Express machine from Palo Alto company ITS (Inventory Transfer Systems!) loads programs into ROM cartridges. But this one can also do disks and tapes for non-cartridge machines like Apple and BBC.

For the moment, this is experimental — Menzies won't decide for a couple of months whether to make this method of software distribution the standard one.

Inventory transfer indeed!

Last laugh on ACT

After having been a little rude recently about ACT's ability to be last with a software package, it seems only fair to add that the company has announced both Framework and dBase III for the Apricot range. Not that I've actually seen a sample yet, but at least ACT has made the announcement.

Much sweeter Apricot

Pascal on the Apricot now includes the original, portable UCSD P-system, following a release of the operating software by TDI of Bristol.

'Apricot users can now swap from MS-DOS to P-system, and share the hard disk,' the company claims, and quotes software brand names like Peachtree, Systematics, Jarman, Omnis 3, Ormbeta, Busifile, Jack, Aladin and Ferox Modeller, to prove that the system is much used.

Details from retailers, or on (0272) 742796.

The Evil 'Dread'

Launch of *The Evil Dead* as a video game nasty was rather spoiled recently when the Commodore 64 version crashed.

The blame was with Palace Software, which developed the program on a Commodore 64. As a result, when the system crashed the night before the launch, the company didn't know.

The Commodore 64 disk system is without any doubt the worst in the world. With the new chocolate drives, it has at last got round the trivial problem of saving programs on top of others — but with a white drive, you still run the risk of saying 'save FRED' and finding that the new version of Fred, being longer than the old, has run beyond the old one, and over the first part of the next program on the disk.

Such a trap did Palace fall into.

The company asked why on earth it didn't just dig out the backup diskette — surely it had made one as soon as it had got



What some people do when they buy a computer.

Buying a computer that's right for your business is often a matter of luck.

However careful you are, you don't know whether you've made the right choice until the computer is actually in use at your office. By which time it's too late to change your mind.

Wouldn't it cut the risk factor if you could try the computer before committing yourself? Not by attending a five minute showroom demonstration but by making a proper evaluation in your own business. That way you'd find out if it really did meet your needs.

Now you can do exactly that. Keep your options open. Rent a system for as long as you like with no commitment to purchase. When you're convinced it's right for you, buy it at a reduced price or arrange a long term rental. If it doesn't work out you can always try something else. We stock all the top names so you're sure to find what you're looking for and we also provide a full training programme. If a major breakdown occurs during rental we guarantee to exchange or repair your computer within a working day.

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the thing right?

'No, because it takes 45 minutes to copy a diskette on the Commodore drive,' said a rueful Richard Leinfellner, the programmer.

If you don't have a 64, I bet you think he was joking.

Technical indigestion

Should you be drawn into an argument with a technology freak who tells you that 'silicon chips are finished, and it's all going to be galium arsenide,' drop this little fact into the argument.

'A three-inch GaAs wafer still sells for fully 20 times the cost of a four-inch Si wafer.'

The information comes from a comprehensive, very informative report, explaining exactly what galium arsenide can do, and what silicon can do, and why.

The report is published by IPI, and was prepared by a research group called Eurogestion KK, in Denmark.

And it suggests that nobody at all will be using this technology for super-fast (or super low power) semiconductor chips in computers, until well into the 1990s.

It also suggests that the power-saving features will be irrelevant for some time, since most circuits built with this technology will have to share cabinet space with hot silicon chips doing other (irreplaceable) functions.

And memory chips built in GaAs will be small, and not very fast, for some years.

The only drawback to the report is its $995 price — but for anybody planning things looking ahead 10 years, I suppose the cost can be justified.

Details on the Denmark phone number 45 2 63 20 44.

Getting the sums right

An accounts program isn't always cause for comment in these columns: the reason for mentioning one, from Logical Step, lies in the trial offer the company has proposed.

For one month, prospective users can try out the 'fully integrated' C/FACC program for £50.

This trust of prospects is probably going to cause amusement at rival offices, where they will assume that people will simply make a copy, and send the £600 diskette back 'unwanted'.

Of course, many accounts programs suffer this fate anyway — on this occasion, however, the company will at least get £50 for its pains.

And it may make a few sales, too.

The main technical feature of the program is that it is not, as normal accounts packages are, a set of separate programs which can cooperate. It is one complete program for invoicing, ledgers, stock control, and so on.

Details on (0789) 842082.

Soft sell technique

A price cut on WordStar isn't to be expected in the everyday course of things. What MicroPro has done with its product, instead of that, is to package it for IBM family users together with all the subsidiary packages that some WordStar users buy.

So when you buy WordStar Professional you get all four — Mailmerge, StarIndex, and CorrectStar (a new one) — all for the £400 price.

The only snag, perhaps, is the thought that you mightn't have been going to buy anything other than WordStar . . .

Details of the offer will be displayed in the shops.

Micro with a silver lining

Silver Reed has built a computer for word processing, which uses an ordinary typewriter (well, ordinary electronic typewriter) as the keyboard and as the printer.

The company describes this system as 'automated typing the way a typist would like it, rather than as a completely different activity.'

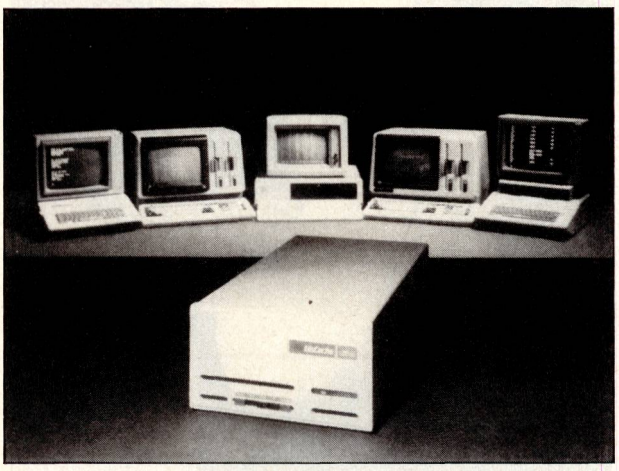
The system not only works with Silver Reed typewriters but will function happily with Olympia and Olivetti machines, too.

And the software chosen to drive it is Lexicom, from Dutch-owned software house MicroTrend.

Double the fun!

After the farce reported last month with DoubleMode, the company which took ex-rental sets and turned them into computer monitors, I was looking forward to telling readers how the happy end came.

The company had sent me an enormous coffin with enough CRT glass for a shop window, and it broke down on the second day of use. It had boasted about the repair deal it had struck: I was waiting for the 'factory holiday' to end so that we could investigate just



A genuine local net can link different makes of micro — and on that basis the British designed Cachenet from Eicon Research is a real local net.

It was launched first in the US, because (in the words of managing director John Hartley) it was important to judge the network's ultimate potential before launching it. That meant its potential in the US.

Eicon Research is based in Cambridge, and the breakthrough which its research people believe they have made is the use of a 'cache' of memory, holding the information most likely to be needed next on the network.

And it can be used by multiple users, with Apple IIe, NEC APC and IBM PC micros, altogether.

To quote the company's own theorising: 'Most business applications are disk-bound.' This is to say, most of the time you sit waiting for things to happen on a micro, it's probably not because the processor is struggling to calculate something or locate some data. It is probably waiting for the diskette head to find the right track, then the next one, and then the next one . . . and so on.

Hard disks, says Eicon, 'are fast compared with floppies, but still, RAM is 1000 times faster.'

It takes a mere 256k of extra memory to give Cachenet something like 10 times the speed (it claims) of rival nets — that is, the 'in use' speed, not the raw data transfer rates.

This 256k is used to store the most frequently requested sectors of data from the network disks, and 31 sectors next to any requested sector are also stored.

Software to run on this network is still not appearing at one program a day (IBM's current claim for the PC) but a start has been made.

'Several multi-user software packages,' says the company, 'including the databases Omnis from Blyth and Dataflex from Equinox, are already available, and both single and multi-user software can easily be adapted to run on the network.'

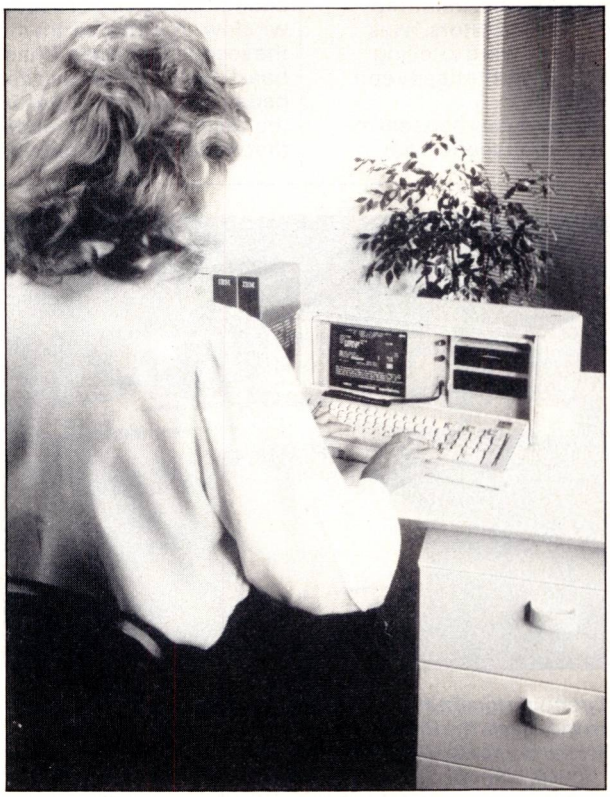
The reason so little has been heard about the system isn't the fact that it was launched in America, however. It's the fact that the company launched it on the NEC machine alone.

Only more recently has the Apple been added (under both Prodos and Dos 3.3, by the way) and the IBM.

Price starts at £2000 for a 10Mbyte disk, plus £245 for each interface. Software is £400. So for five micros and 10 megabytes, the total would be £3850, says Eicon.

The company is chaired by a man who is a celebrity in his way — Dennis Taylor, who was managing director of Hewlett-Packard until last year. And, it adds seriously, it has an equity investment of a million pounds from the Norwich Union.

Details on (0954) 81825.



IBM may have picked exactly the right time to launch its portable version of the PC into the UK, if information from inside Commodore is true.

Reports from unofficial sources suggest that the Hyperion-based Commodore PC will now be cancelled, and that the emphasis will switch the machine with a Zilog Z8000 and a Unix-type operating system, which isn't expected to be ready for at least six months.

IBM's portable isn't immediately impressive on its own, since it is one of the least 'compatible' of the compatibles.

It has its own operating system, Version 2.1, which will not run the standard versions of many popular programs.

When it was released in the US earlier this year, its arrival was anticipated by pundits, who forecast an end to the Compaq bonanza. Compaq got to be the fourth-biggest US micro company by selling a portable version of the PC, and, it was argued, why would anybody buy a 'fake' when the real thing became available?

It didn't turn out like that. The Compaq isn't cheap, maybe, and it isn't exactly the same as the PC — but it is cheaper, and lighter, than the IBM Portable. And it is more like the original, since IBM has fudged the new version in order to put both colour and monochrome screens onto the same display.

In the US, (Compaq says) sales have heavily favoured Compaq at the IBM's expense — and (naturally) the company expects the same thing to happen here.

'The Compaq offers a dual-mode, high resolution text and graphics display screen, more expansion card options, and a 10 megabyte hard disk version,' was the way UK Compaq boss, Joe McNally put it. 'None of these is available from IBM.'

A small price to pay

As regular readers of PCW will already have noticed, this magazine has been unable to resist the pressures of inflation. Our cover price last went up in January 1983, but it's now gone up from 85p to 95p. We won't bore you with details of why, but we hope that the contents of the magazine and its size — more than 100 pages of editorial — still make it good value. Readers who think otherwise should contact our Communications page as soon as possible. Subscription rates remain unchanged.

how fast this repair service worked.

Apparently there is no happy end. DoubleMode has ceased trading, according to the Irvine Development Corporation, and there is no chance of recovery.

Apparently there was no 'technical' reason for failure — which my experience doesn't altogether bear out, since the one I bought not only died, but killed my home power supply system and four fuses, too.

But the people who were so eager to publicise their new start-up company proved strangely reluctant to explain why it had died. 'You should write to the company,' they suggested. 'It wouldn't be appropriate for us to comment.'

Life after Valhalla

Legend, the company which won the BMA 1984 Game of the Year award for Valhalla is releasing a contender for the 1985 award.

The Great Space Race is a real-time arcade strategy game where you compete in a race across space in which anything goes.

Although games will be brief compared to Valhalla standards, Legend claims that it is continuing the movie style development which started with Valhalla. For instance, The Great Space Race is to include full facial animation of characters you meet.

According to Legend it took seven to 10 man years and a £¼m to develop The Great Space Race which is being launched simultaneously for the 48k Spectrum and the Commodore 64. Ironically, it was developed using expanded BBC Micros, but there will never be a BBC Micro version as the basic machine hasn't the memory to handle such a game.

Throw away the Ace!

Even at £26, it seems, they still can't get rid of the Forth-based Jupiter Ace.

An announcement, virtually a repeat of one issued two months ago, has reached me saying that 'the Ace is not dead!' — with the additional information that there is a range of new accessories available.

Boldfield Limited Computing is offering various package deals on software and hardware — a pack of six games, for example, for £4.40, or a 16k memory add-on for £8.

Examples of new hardware include a motherboard, which lets Jupiter users plug in Sinclair or Memotech memory packs, keyboards, or printers — at £12 plus VAT. There is a joystick interface for £17 plus VAT, a sound box for £34 plus VAT, and a new keyboard for the same price.

Be warned, however, that not all these products are gold-plated, Conran-look, space-age home accessories. 'We are confident that you would prefer our DIY approach, with some products uncased and others requiring soldering, to the alternative of paying much higher prices for identical accessories dressed up cosmetically to match the host computer,' the company says — and it has probably judged the nature of the typical Ace buyer accurately.

Details on (0487) 840740.

Musical chairs at Atari

Contrary to much-published rumour, John Baxter has not joined rival Atari. The idea that he might have followed Commodore founder Jack Tramiel to Atari probably arose because one of the new Atari bosses is indeed a Commodore man.

David Harris is now the man responsible for Atari's sales and marketing outside the US — and Harris had been a sales and marketing executive at Commodore.

People leaving Atari, now that Tramiel is in charge, include Graham Clark, the former boss, and marketing director Andrew Swanston. Tony Adams, sales director, has also left.

In the gap between Clark and Harris, the shop was minded by financial director Simon Westbrook — and he is staying on as general manager for the UK.

The new managers have new prices to play with in their efforts to sell Atari machines. The 600XL has had £60 lopped off its price and is now down to £99.99. The 800XL moves down to £199.99 from £249.99.

The two printers have come down by £100 each while £20 is the reduction on the Trak Ball and Touch Tablet. Most interestingly, Atarisoft titles now come in under £10. END

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With more and more hardware innovations becoming available, the P3100 has the capacity to make use of them without having to use expensive adaptors and expansion boards.

And as the monitor, printer, communications and expanded memory are built-in, the P3100 still has 4 expansion slots available for additional functions.

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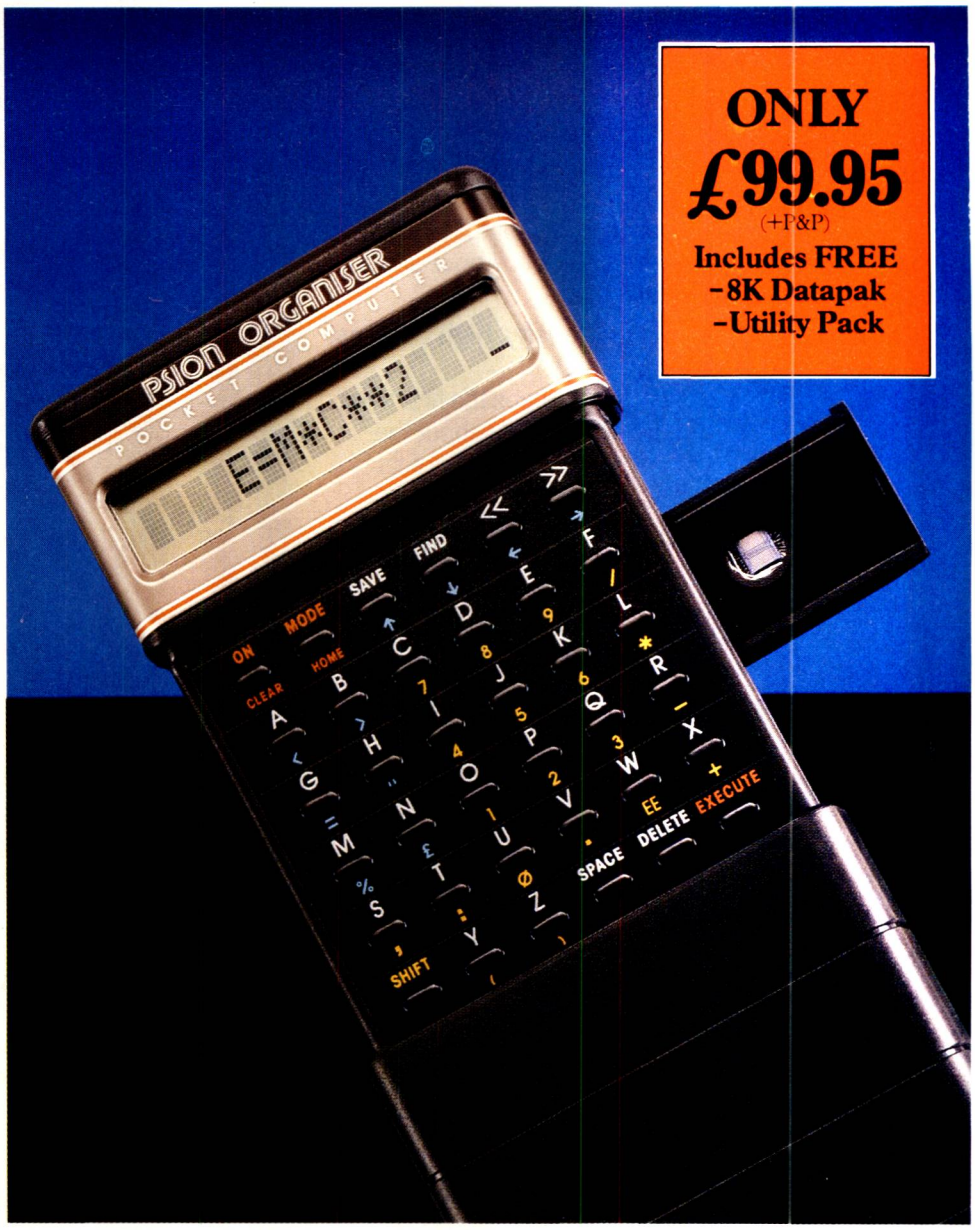

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Cash Flow – net present value
internal rate of return
Investment – bond redemption
yield, equity price to earnings ratio estimates
Compound Interest – payments
present value
capital appreciation
savings
Depreciation – straight line
reducing balance
lifetime estimate
depreciation charge schedule
book value schedule

SCIENCE

Physical Constants – Planck, electron mass, electron charge, Rydberg, Gravitation, Avogadro, speed of light, sound. Gas constant, permeability, permittivity, earth radius, Bohr radius, Astronomic unit, etc.
Conversion Factors – UK to MKS etc.
Formulae – LC circuit, Lenses, Bohr energy levels, Larmor, plasma, etc.
Integration Under a Curve
Least Square Fit
Solution of Polynomial Equations

UTILITY

LOG, ALOG, LN, SQRT, EXP, SIN, COS, TAN, ATN, ABS, INT, DEG, RAD, MOD, MIN, MAX, FAC, SGN, ROUND, MEAN, STDEV, PI, RND, RAND, ENG, FIX, POWER FUNCTION AND COPY.

MATHEMATICS

Bessel – functions
Polynomials – solutions of equations
Matrices – solution of matrix equations
Eigenvalues
Integration – under a curve
Curve-fitting – least squares
Statistics – mean
standard deviation
Chi-squared

LINK-UP COMMUNICATIONS

- Industry standard RS232 with ribbon cable plugs into a solid-state drive.
- Configuration module sets the Organiser to transmit and receive programs and data. Options are selected using the cursor keys including:

BAUD RATE : 150-9600
PARITY : ODD, EVEN, MARK, SPACE, NONE
PROTOCOL : NONE, RTS/CTS, XON/XOFF

AS A PERSONAL COMPUTER TO RUN YOUR OWN PROGRAMS

THE PSION ORGANISER has its own programming language – POPL – contained in the Finance, Maths and Science packs.

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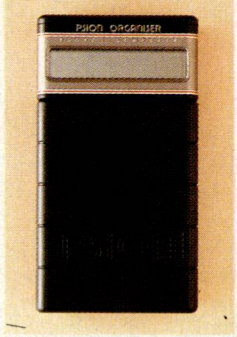

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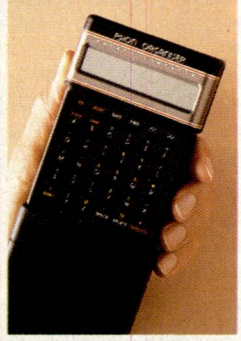

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The MTX512 comes with 64K RAM, expandable to 512K. Add to this another 16K VideoRAM dedicated solely to handling the screen memory, and you've got 80K. But how much user RAM is left when you're running high resolution graphics programs? Unlike other machines, the answer is still 64K, because the MTX512 uses the 16K VideoRAM plus a second processor – the Texas TMS9929A – to take care of screen graphics. The main processor used in the MTX512 is the Zilog Z80A, which gives the MTX Series CP/M compatibility – CP/M was written around the Zilog Series. And the Z80A inside the 512 operates at 4MHz.

Expansion is no problem with the MTX Series, because it is designed as an interlocking system – from the MTX512 up to the powerful Memotech Silicon Disc Systems.

MEMOTECH MTX512 MAJOR FEATURES

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- ROM cartridge port
- Uncommitted parallel input/output port
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- Hi-Fi output port
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- PAL composite video colour Monitor port

THE RS232 COMMUNICATIONS BOARD
(required for disc expansions)
- Two independent RS232 ports
- 60-way Disc Drive Bus supporting up to four 5.25 and/or 8 inch floppy disc drives, Memotech Silicon Discs, and Hard Discs

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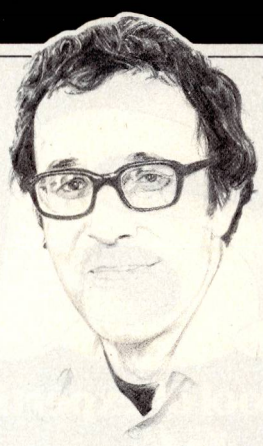

David Ahl reports from the States on the speedy next generation Macintosh, the unisex Amiga PC, the failure of Unix to catch on, and computer policy.

Next generation Macintosh

Although the Apple Macintosh has all kinds of advanced features and boasts a 32-bit 68008 CPU, users have complained right from the start that the Mac is slow and doesn't have enough memory. Thus, while the machine has been shipping in quantity for less than a year, insiders are already talking about the next generation Macintosh.

Much of the speed problem can be attributed to swapping programs and data to and from disk, so the new Mac will have a second 128k ROM which will contain much of the software now on disk.

Furthermore, the 64k RAM chips will be replaced by 256k parts from Japan, thus quadrupling the basic machine's RAM capacity to 512k. It's likely, too, that the new Mac will have a true 32-bit bus rather than the hybrid 32/16 bus found in the present model; this too should increase processing speed.

Two companies have already announced winchester hard disk drives for the Macintosh. Tecmar has four versions of its MacDrive: a 5Mbyte unit with a removable cartridge; dual 5Mbyte units; a 10Mbyte fixed hard disk; and a combination 5/10Mbyte unit. Davong offers six versions of its Mac Disk system with capacities of 5, 10, 15, 21, 32, and 40Mbytes; all are fixed disk systems. Access time of both the Tecmar and Davong units is about 75ms.

Foreign policy

In an effort to keep computers with possible military applications out of Soviet hands, the US Government is now monitoring all computer sales to foreign countries, even allies. The Commerce Department requires all exporters to have a licence, and any case that seems less than routine is passed on to the Department of Defence. The Customs Service is considering a scheme that would require manufacturers to install electronic bugs in computers, so they could be traced if they were smuggled out of the country.

Defence Department officials are convinced that even the current controls are inadequate, and are holding classified briefing sessions with industry leaders to try to convince them of the severity of the problem.

However, many manufacturers feel that the restrictions will mainly hurt exports while doing little to keep computers out of the hands of the Soviets. The prevailing feeling is that the Soviets will get around the regulations either by smuggling in US-made computers, or by buying similar systems from Japanese manufacturers.

Executives point out that European, Japanese and Taiwanese desktop computers are readily available in the Eastern bloc. People simply buy the systems they want in Vienna and truck them over the border to Budapest, now the personal computer capital of the Eastern bloc. 'It's absurd to think the Government can stop that kind of traffic,' said one manager.

Amiga PC: the continuing story...

I mentioned the Amiga PC several months ago (*PCW*, May), but the final prototype looks even more interesting with its built-in unisex speech. It's based on the 68000 CPU, has 128k, a disk drive with 320k capacity, composite video and RGB output, a detachable keyboard, stereo sound (with four channels), parallel and serial ports, a bus connector and joystick ports.

Graphics and animation are superb. Low resolution is 320×200 pixels with an astounding 4096 colours, and a high resolution mode of 640×400 provides 24 colours. A frame buffer and sprites produce high speed animation in low-res mode. In addition, the system allows simultaneous vertical scrolling, horizontal scrolling, and animation of images.

The Amiga proprietary operating system is window-based, although the unit can also support CP/M, MS-DOS, and the P-System. A 'speech lab', incorporating both male and female voices with an unlimited vocabulary, is built in.

Amiga also promises 20 applications software packages upon release of the system in the autumn. Price is projected to be $1500.

Miss for Unix

Not only will Unix fail to become an industry standard, but it will also achieve only a very modest market penetration, according to a recent study by International Data Corp (IDC). These conclusions, from an initial study conducted in February, have been reinforced by subsequent interviews with end users, OEMs, and vendors.

The main reason for its lack of success is that its cryptic command structure is difficult to use. While Unix could be made more friendly, such a transformation would lead to a loss in efficiency, one of the major advantages of the system.

Furthermore, Unix is inefficient for small systems, according to the study. Some software developers have reported that Unix programs on small systems actually run slower than with standard operating systems.

A third limitation of Unix is its lack of standardisation. Although AT&T designed the system to be standard, several implementations including Version III, Version V, the Berkeley Version, and Xenix have cropped up.

Another problem with Unix is that it tends not to be easily transportable across different microprocessor architectures; different implementations are required for 8088/86, 68000, and 32032 CPUs.

A final problem identified by IDC is a lack of applications software that runs under Unix. It lacks the ability to support integrated database management systems, integrates communications and resource servers, and cannot accommodate advanced graphics packages, therefore few software developers have produced packages for it and they seem to be disinclined to do so in the near future.

Interestingly, the major commitment to Unix is by hardware manufacturers, a fact which may lure software developers to produce software for the system. Nevertheless, the report concludes: 'There is no more reason to believe Unix will become a standard any more than any of the alternatives will become standards.'

Random bits

Warner Communications sold Atari to Jack Tramiel for no cash down and $240 million in promissory notes. Tramiel, former president of Commodore, dismissed the entire marketing department but has not revealed any of his future plans yet . . . Gavilan is finally shipping two versions of its notebook computer some six months late. An ominous note is the company's return to the venture capital market for another $15 million . . . Franklin Computer, maker of the most successful of the Apple work-alikes, has filed for relief in the Bankruptcy Court under Chaper 11 . . . Software vendors, particularly those with extensive commitments to Atari, VIC-20, TI99/4 and Sinclair, in the face of heavy inventory returns, obsolescence and saturation, are cutting prices and payrolls in an effort to keep afloat . . . The first American manufacturer of computers (in the 1940s), Sperry Univac, is selling a personal computer made by Mitsubishi in Japan . . . Another rah-rah yankee manufacturer, Monroe, procures its PC from Ricoh, another Japanese maker . . . The National Computer Conference (NCC), by far the largest show in the 1970s, fell far short of its attendance goals this year. 110°F temperatures in Las Vegas in July discouraged some attendees, but the rise of Comdex and various regional PC shows was probably more of a factor. END

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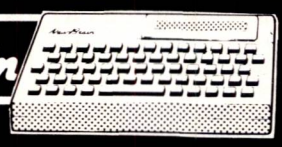

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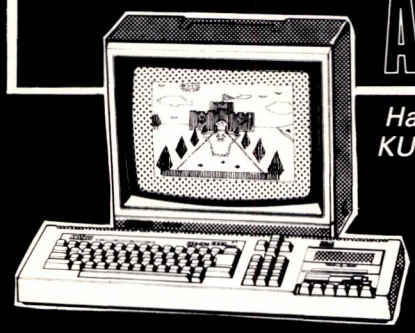

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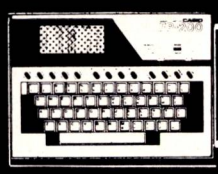

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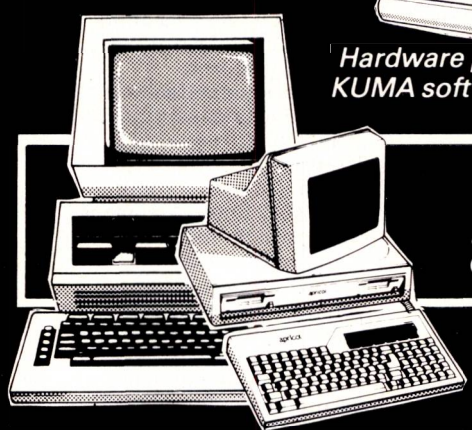

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ORIENT EXPRESS



Shinichiro Kakizawa reports from Japan on an MSX machine with stereo sound, examinations in computer proficiency, a calculator cum *credit card and software for Buddhists. Well, praise be!*

Music while you work

A new MSX machine, Palcom, has been launched by Pioneer, a company known for its stereo equipment and more recently for optical laser disk players. The reason why Pioneer has joined the microcomputer business is clear—it wants to give added value to its laser disk business by providing a specially developed micro with convenient facilities and an interface specifically designed for laser disk players.

Palcom can control optical video disk players through a direct interface connection. As part of the deal, a number of computer games with video disks can present much more realistic pictures than any existing microcomputer graphics. The direct access capability of the video disk can provide pictures instantly, which is essential for computer games.

As Pioneer is a stereo machine supplier, it hasn't forgotten a sound system for its computer: game sounds are all generated in stereo. Mixing the sound from the video disk, stereo players, and computer-synthesised music is another standard feature of Palcom.

Hole in your pocket?

An optical modem the size of a cigarette pack has been announced by Kanto Electronics in Tokyo. It's just 100mm × 50mm × 22mm, and can be directly attached to the interface slot without using cable or, alternatively, built into the machine.

The modem detects line defects and optical data errors; and communication distance is a maximum 100 metres using plastic fibre cable. It's a useful piece of equipment when you're settting up your micro network in a hazardous, electrically noisy environment, but at £170 is slightly more expensive than standard modems.

Universal standard in print?

Epson is attempting to establish a standard for interfacing printers. It's proposing that ESC/P, which stands somewhat clumsily for Epson Standard Code for Printers, be adopted worldwide. The aim is to provide a common control code architecture across all microcomputers and printers, so that any printer can become connected to any microcomputer without change. At present the printer is always the major headache when buying new software, which may not be entirely compatible with your model of printer.

I understand the Epson people are busy persuading as many manufacturers as possible to agree with the new standard; and it seems that more than 20 companies have already agreed to join the bandwagon.

More time for prayer

If you thought no more specialised software markets could be discovered, you have obviously underestimated Japanese initiative.

Denkei Computer Systems has come up with a software package to help priests and monks run their Buddhist temples more efficiently. Running a Buddhist temple is, I'm told, far from simple. It involves a lot of paper work, direct mailing, keeping records of ancestors' posthumous sacred names, accounting, and other administrative tasks. The newly announced software addresses all these areas and creates more free time for the monks' traditional involvements: chanting, zen meditation and preaching.

So far the introduction of microprocessor systems into Buddhist temples and Shinto shrines has been slow, except in large temples which can afford a sizeable computer department. Denkei thinks this is mainly due to the lack of suitably packaged software systems for the smaller temples, and hopes to change things with its new Temple Management System. According to Denkei, there are over 50,000 Buddhist temples and many more Shinto shrines in Japan awaiting suitable software systems. It believes many of them will buy its software, which costs from £950 to £1200 depending on the options the user chooses.

Calculating credit

A credit card which can be used as a calculator has been announced by a finance company in Kyoto. Jointly developed by Casio and Dainippon Printing, the plastic credit card is laminated to the back of the Casio ultra-thin SL-800 calculator in place of the usual plastic back cover. It costs £6.50.

In Japan over 100 million credit cards are now in use and competition between the rival card companies is very tough, so in order to keep one step ahead the credit card companies are using all kinds of gimmicks to pull in the customers. The calculator *cum* credit card, from Shinkyoto Shinpan, is one such attempt to increase the usage of the cards.

Shooting for the market

Another camera has succumbed to the lure of the Japanese micro market. Asahi Optical Industry, famous for its Pentax cameras, has announced its first 32-bit Pentax computer.

The Pentax runs a Unix-like UNOS operating system from Charles River Data Systems. This system is a high-end scientific and business micro, targetted mainly for CAD/CAM applications using Asahi's proprietary program SCICARDS. It features a VERSA bus and can construct the Ethernet local area network.

Time to be certified

One-day examinations to test the knowledge and experience of micro users were held recently in some 25 major cities in Japan. This was the second year of these nationwide examinations, and more than 10,000 micro users took part.

Japan is a highly competitive society where you can do practically nothing without a certificate; these are issued by the appropriate authority showing that you are properly qualified. Apart from the usual things like driving and flying licences, you have to pass rigorous government examinations to become a hairdresser, a cook, or even a masseuse.

And computers are no exception. The Ministry of Industry and Trade (MIT) has been conducting an information processing engineers' examination for over 15 years. Unlike cooking a fish, it's not compulsory to acquire a licence to run a computer; however, if you happen to be one of 150,000 people who have a licence your chances in the job market are greatly enhanced, your salary prospects are better, and you can charge higher fees for your freelance services.

So far this arrangement has only been applicable to the mini/mainframe users, and micro users were happily left alone to be content with their little machine. But now, as microcomputers spread into every home and business, the situation is changing—and you can study for a certificate to demonstrate proof of competence as a micro user.

The examination is organised by the Japan Microcomputers Club Association. It seems the papers are getting more difficult every year—last year every other participant who sat the examination failed.

Anyway, I'm not going to tell you whether or not I sat this year's examination. END

NETWORKS

Peter Tootill has thought up a novel application for data buffers and has the latest details on computerised shopping.

Data buffers

As you may recall Prestel uses part of the CCITT V.23 standard and talks to you at 1200 bits/sec, but you talk back at only 75 bits/sec. If the RS232 interface on your system can't be configured to handle the different transmit and receive baud rates and you want to use it to access Prestel or PSS at the 1200/75 speed, then you have a problem. One answer is to buy an expensive modem such as the DaCom DS 2123 GT (at around £500) which buffers the data and always talks to your computer at the same speed no matter the speed at which data is coming down the line.

But an idea occurred to me while I was reading the blurb on the 'Aculab' data buffers regularly advertised in *PCW*. These are basically designed to work as 'printer spoolers'.

The idea is that you connect one between your printer and your computer. When you print something the buffer can receive the data as fast as your computer can send it and stores it, sending it to the printer at a speed that the latter can handle. Buffers can be as large as 256k, so you can 'print' quite a big file and then carry on with other work on the computer while the printing is still going on. Buffers are available for parallel to parallel, serial to serial and hybrid (parallel to serial and vice versa) applications.

You could use a data buffer between the RS232 interface of your computer and the modem so that if the computer couldn't handle the split baud rates, then the buffer could take the data in from your system at 1200 baud and send it to the modem at 75. It would need to do nothing to the data coming down the line except receive it at 1200 and pass it on at the same speed.

A quick call to Aculab confirmed that this would be possible, although not with a standard unit. It did say, however, that it would be prepared to make them to order at the same price as its standard data buffers (around £200). A dual standard modem (also around £200) and a data buffer would save around £100 compared with a GT-type of modem. However, the modem would normally give you a lot more features such as auto-answer and auto-dial.

If you already have a 1200/75 modem, however, which you can't use with your computer, then a data buffer would be a cheap way of making this possible, especially if it could still be used as a printer buffer; this should be possible if you get a combined parallel/serial model.

Aculab is on (0525) 371393. DaCom is on (0908) 311885.

Computerised shopping

More news on Commodore's Compunet which has lined up a US-style service.

Compu-Card is an American system for mail order shopping, or rather 'telephone order shopping'. The idea is that you decide what you want (by visiting your local shops) and telephone Compu-Card which will give you its price for the item in question—which it claims will normally be cheaper than your local one.

The main interest of Compu-Card to telephone networkers is that it's available online in the US to 'CompuServe' subscribers, and now Compu-Card in the UK has linked up with Commodore to make the system available to Commodore users via the Compunet system. It'll be interesting to see if Commodore can tap a new market among Commodore owners over and above those (not just Commodore users) already subscribing to Micronet—there are certainly enough 64s and VIC 20s about.

Bulletin Board news

Two more bulletin boards have closed down. The first is CBBS-Cumbria. The sad story behind this is that the sheer aggravation of people calling outside system hours and not using the ring-back system forced the system operator to give up. *Please, please* make sure you check the system hours of a BBS before you call it. If you aren't sure and can't find out, your best bet is to call in the evening—and be prepared for a *real* person to answer. If this happens you can (politely) ask if you have the right number and check the system hours and mode of operation. Don't call a BBS at 3am unless you are sure it runs at that time—very few people like to be woken up in the middle of the night!

The other system that has closed down is Rewtel. This was an online 'electronic catalogue' for the Ambit International electronics components company.

The good news is that there are a couple of new systems to report. The first is TBBS Nottingham. This is a multi-mode system and it will cope with V.21 and V.23 (Prestel) calls in originate or answer mode. The number is (0602) 289 783 and it runs 24 hours a day.

The second new BBS is another TBBS-based system. (TBBS looks set to take over in the UK!) It is a specialist board and its title should tell you what it's about—it's called 'Clinical Notes Online'. Run by a publishing company called ICRS-Elsevier, Clinical Notes Online is a data acquisition system for the company's database on 'Datastar' (a bibliographic database based in Switzerland, but available on the UK PSS network). Clinical Notes Online is (initially at least) available to the general as well as the specialist user.

By the time you read this, an old friend may have returned. Bettisfield Remote CP/M system is expected to be back on a new 24 hour number in the autumn. The latest news will, of course, be on Liverpool Mailbox and other BBSs. One enhancement that the system operator hopes to have is the ability to receive V.21 and Bell 103 standards at 75, 110, 134.5, 150 and 300 bits/sec in originate or answer mode! This will be useful for anyone with an old Teletype terminal as these normally run at 110, or even 75 bits/sec.

US networks

A new type of BBS is appearing in the US; this is the 'networked' BBS. Once you have dialled one, you can transfer your call to another by a normal menu selection. One example is called the 'Mindstorm Network' and can be found on (0101) 812 235 0908. As far as I know it's a 24 hour system.

Another new Stateside system aimed at jobhunters is called 'CLEO' which stands for 'Computer Listing of Employment Opportunities'. This operates in half a dozen areas in California but covers jobs all over the US & overseas. The details are as follows:

(0101) 213-618 8800 Los Angeles
(0101) 408-294 2000 San Jose
(0101) 415-482 1550 San Francisco
(0101) 714-476 8800 San Diego

Or call (0101) 213-618 1525 for 'access assistance'.

BULLETIN BOARDS

UK free networks

CBBS South West . . . Tel: (0626) 890014. Hours: 24 hours daily.

Mailbox-80, W Midlands Tel: (0384) 635336*. Hours: 6pm-8am daily (ring-back system).

Modem Operating Frequencies

Modem Type	Speed (Bit/s)	Duplex	Transmit Frequency 0 Hz	Transmit Frequency 1 Hz	Receive Frequency 0 Hz	Receive Frequency 1 Hz	Answer Tone Freq Hz
CCITT V.21 Orig	≤300	Full	1180	980	1850	1650	—
CCITT V.21 Ans	≤300	Full	1850	1650	1180	980	2100
CCITT V.23 Mode 1	600	Half	1700	1300	1700	1300	2100
CCITT V.23 Mode 2	1200	Half	2100	1300	2100	1300	2100
CCITT V.23 Back	75	—	450	390	450	390	—
Bell 103 Orig	≤300	Full	1070	1270	2025	2225	—
Bell 103 Ans	≤300	Full	2025	2225	1070	1270	2225
Bell 202*	1200	Half	2200	1200	2200	1200	2025

Bell 202 has no back channel as such, only a 5 bit/sec on/off signal (387Hz = on, no signal = off) used for handshaking. (CCITT V22 & Bell 212A do not use single frequencies like these and cannot be simply included in such a table.)

American/Canadian networks

TYPE	SYSTEM NAME	NUMBER	NOTES
Forum 80	HQ System	0101.816-861 7040	
CBBS	HQ System	0101.312-545 8086	
FBBS	HQ System	0101.312-677 8514	
ABBS	Ottowa, Ontario	0101.613-725 2243	
ABBS	HQ system	0101.703-255 2192	
MABBS	Fort Walton Beach	0101.904-862 1072	
Bull-80	Alabama	0101.205-492 0373	
Conn-80	Colour Computer	0101.212-441 3755	colour graphics for TRS-80 Colour

European networks

ELFA	ABC-MONITOR Sweden	010.468 730 0706	Half duplex
ABC-Banken	Halmstadt, Sweden	010.463 5110771	
ABC-MONITOR	ABC Club of Sweden	010.468 801523	Passwords required
CBBS	Gothenburg, Sweden*	010.463 1292160	75/1200 baud
		010.463 1690754	300 baud
	Helsinki	010.358 0722272	

*After receiving the tone and connecting your modem, either type <C/R> or type: <COM C/R>. The system then asks for a password which is: 'cbbs' *in small letters*! If you only get '>' when you dial up, the system needs resetting and you type <I> C/R.

Forum-80 Hull . . . (Forum-80 HQ) Tel: (0482) 859169. International electronic mail, library for up/down loading. Hours: 5-11.30pm, Mon-Fri; noon-11.30pm, Sat & Sun (CCITT); midnight-8am, daily (Bell 103).

Hamnet. . . Tel: (0482) 497150. Hours: 6pm-8am, daily.

Forum-80 Users Group, PET Users section shopping list system. Hours: Tues/Thurs 7-10pm; Sat/Sun 1-10pm; nights, midnight-8am, US (Bell 103) standards.

Forum-80 London . . . Tel: (01) 902 2546. Electronic mail, library for down-loading. Hours: 7-10pm weekdays; midday-10pm weekends. Ring and ask for Forum-80.

MG-Net CBBS London . . . Tel: (01) 399 2136. Facilities: electronic mail, program downloading. Hours: Sun 5-10pm.

Liverpool Mailbox . . . Tel: (051) 428 8924. Electronic mail, down-loading, TRS-80 information. Hours: 24 hours daily.

TBBS, London . . . Tel: (01) 348 9400. Hours: daily 9am-7am.

BASUG . . . Tel: (0742) 667983. Hours: 24 hours daily.

Computer Answers . . . Tel: (01) 631 3076. Hours: 24 hours daily.

CBBS Surrey . . . Tel: (04862) 25174. Hours: 24 hours daily.

Blandford Board . . . Tel: (0258) 54494. Hours: 24 hours daily.

Southern BBS. Tel: (0243) 511077. Messages, down-loading. Hours: 8pm-2am daily (ring-back system).

NBBBS-North Birmingham . . . Tel: (0827) 288810

TBBS Southampton . . . Tel: (0703) 437 200 (ring-back)

Stoke ITeC (Information Technology Centre) (Remote CP/M) . . . Tel: (0782) 265 078. Hours: 24 hours daily.

UK commercial systems which are free in part

DISTEL. Tel: (01) 679 1888. Run by Display Electronics (new and surplus electronic and computer equipment, components, etc). The system provides information about stock lines, credit card sales, and some message facilities. 300 baud only at present. Cost: free. 24 hours.

MAPTEL. Tel: (0702) 552941. Run by Maplin (electronic components and micro-computers). Provides information on stock levels, credit card sales to existing customers only. 300 baud only. Cost: free. 24 hours.

ESTELLE. Tel: (0279) 443511 V21 (Datel 200); (0279) 441188 (Datel 600); (0279) 441222 (Datel 1200). For customers of STC Electronic Services. Office hours only.

Subscriber commercial systems in the UK

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 per quarter and no time charges outside peak periods, 80 per cent of pages are free. 6pm and Saturday mornings, no time charges outside these hours (time charges also apply to domestic users). Information: Dial 100 and ask for Freefone Prestel sales.

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.

Subscriber business systems in the UK

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. *RING-BACK SYSTEM—dial the number, let phone ring once and then ring back.

Most software companies assume you look like this.

There are plenty of software packages around to help control businesses. Most of them do some of the things you require very well indeed.

The trouble is, they can be rather a handful. You need one disc for word processing, another for spreadsheet.

One for database, another for graphics and so on. Each with its own set of commands.

Lotus Symphony™ does everything any office is likely to need on one disc.

It puts you in touch with others. No man is an island and Symphony's communications let you receive and send data back and forth between your mainframe and other computers.

It does your word processing. After all, once you have all your data together, you don't want to start again with another disc to put it into a letter.

It gives you an enormous database with instant access to 8000 records.

And its spreadsheet is the largest and most advanced there is with 8192 rows by 256 columns.

Colour graphics are a buzz word these days, so Symphony gives you seven. All of which are available at a single keystroke.

Symphony also caters for people who like to see everything at once.

So you can have spreadsheet, database, graphics and word processing all on screen at the same time. Each in its own window.

Then you can zoom in and out and shuffle them around like papers on a desk. Also with add-in applications, Symphony can grow with you, so there are no limits to what it can do.

Yet although it does the work of many, Symphony is easier to operate than some dedicated programmes.

But if your needs are simpler there's still Lotus 1-2-3.™

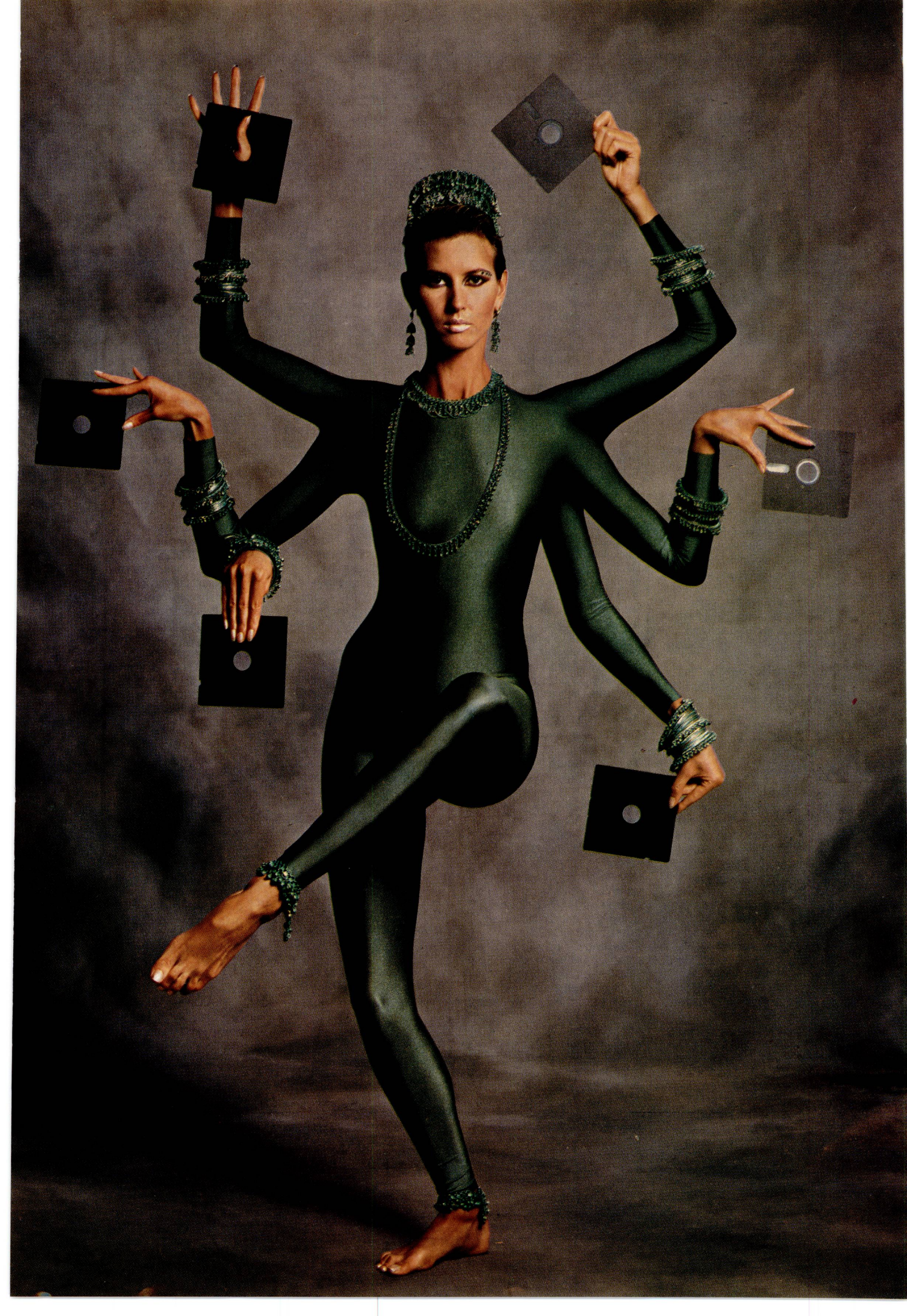
It covers the needs of most offices (spreadsheet, graphics and database) on, of course, one disc.

Because one thing Lotus always assumes is that you only have one pair of hands.

For further information on Symphony and Lotus 1-2-3 (still the biggest selling software package in the world) call Teledata on 01-200 0200.

Lotus™ 1-2-3™ and Symphony.™

SYMPHONY NOW AVAILABLE FOR THE IBM® PC AND XT,™ COMPAQ™ AND 100% IBM COMPATIBLES. 1-2-3 NOW AVAILABLE FOR THE IBM PC AND XT, COMPAQ, ACT APRICOT,® OLIVETTI™ M24, 100% IBM COMPATIBLES, DEC RAINBOW,™ WANG PROFESSIONAL,™ AND TI PROFESSIONAL COMPUTER.™



COMMUNICATIONS



This is the chance to air your views — send your letters to Communications, Personal Computer World, 62 Oxford Street, London W1A 1HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Better late than never

We ordered a printer cable (part no ANG 04) costing £16 from Acorn Computers c/o Vector Marketing on 1 April 1982. Several letters were sent regarding the non-appearance of this item and after six months of complaining we gave it up for lost.

A couple of months later we received a letter stating that our cassette lead would be with us in the near future. *Cassette lead*! What cassette lead?

This morning, 1 August 1984, two and a half years after ordering, the cable arrived with a despatch date of 25 July 1984.

Stuart Ward & Tommy Coombs, Dunmow Computer Centre Ltd, Essex

'Informed opinion?'

I enjoyed Mike Liardet's article on writing software ('Creating a Program', *PCW*, June) but must object to his casual dismissal of p-code systems, whose advantages he claims 'accrues to the implementor and not to the user.' Intermediate languages offer the worst of both worlds' (between interpreters and native code compilers).

Survey statistics published elsewhere showed the p-System to be number four in the operating systems hit parade (after CP/M-80, MS-DOS, PC-DOS and Apple DOS — but well in front of CP/M-86), with 12% of users. This is surprisingly popular for an operating system with no advantages to offer! It must show that a great many people feel, as I do, that the p-System has a great deal of benefits to offer implementor, user/programmer and end-user alike.

The p-System is certainly easy to implement on a target machine, although why Mike Liardet considers this a negative point I don't know. It simply means that since it's so easy, it has more than likely been done (if not, then you can buy the 'adaptable system' version which requires only a working CP/M BIOS, and install it yourself). It also means that a range of software written for the p-System has become immediately available.

The programmer benefits greatly from the built-in portability of p-code programs. He knows that all programs previously written for the p-System (by himself or others, regardless of which machine) will run on his new system. In addition, he can take advantage of the ability to develop his software on faster machines (such as the SAGE or VAX computers) then download it to a target machine — *any* target machine. On the other hand, he can take pleasure from the fact that the p-System provides a wider market for his software than any other operating system since it includes the entire CP/M market, IBM and compatibles, Apple, DEC 68000 and Z8000. On all these systems, his software will not even need to be re-compiled.

The end-user is relieved of the burden of machine dependencies. He is able to take advantage of new developments in computer hardware without being forced to scrap his current software investment, the value of which is no longer threatened by the doubtful futures of some computer manufacturers. This advantage is provided by no other operating system. Even CP/M (which claims portability of code) restricts the user to the Z80 processor (although I am beginning to hear rumours of Z80 emulators for faster machines — that is, a p-code CP/M).

You may consider that you are simply swapping dependency on the future of your hardware for dependency on the future of the p-System. This is true to a certain extent, although I have no reason to doubt the future of the present distributors. I leave it to you to consider which situation you prefer.

A lot of rubbish is generally touted about p-code systems, usually rotating around the word 'interpreter' (the distributors call it an 'emulator'). This brings to mind the example of a Basic interpreter (with its notorious slowness), when in fact the two are worlds apart. A Basic interpreter has to perform a multitude of tasks, but the bulk of the work involves syntax analysis of the source text whereas a p-code interpreter does relatively little work: it simply takes the p-code and executes it, and since no syntax analysis is necessary the process can be extremely fast. Obviously some degradation will occur, but this is very small compared to normal 'interpreters'. In fact, the code produced often runs faster than supposedly better 'native code' compilers. It's certainly more compact, meaning that you can write larger programs on smaller machines.

Finally, for those who feel that they *must* have native code, one of the tools provided by the p-System is a native code generator. This takes a p-code file as input, and outputs a machine code version. A nice feature of this is that you still retain the benefits of a p-code version of the software for portability, but are now allowed to convert to native code for speed once the program is transferred to the target machine.

I hope I have shown that p-code systems do have advantages to offer other than those enjoyed only by the implementor as I think that Mike Liardet's comments on this reflects simple prejudice rather than informed opinion.

Don Milne, Rosemount, Aberdeen

Advance to go?

Anthony Bretherton (Communications, September *PCW*) says that he believes my review of the Advance was inaccurate, yet fails to point out any examples of such inaccuracies.

I consider the keyboard to be appalling and would never consider using it for word processing (a prime use of a business system); a reviewer in another magazine felt it to be 'well-made'. Both are honest, subjective opinions.

I agree that Advance could not and does not describe the system as portable. My remark about portability was originally a joke, but was rephrased in such a way that it could be misinterpreted as a serious criticism. I do, however, stand by my description of the machine as a 'great hulking brute'. It may be little bigger than the PC at its base, but is undeniably much taller — especially if you buy the recommended monitor. Wind resistance may not be important but, to many people, a pleasing appearance is.

The bug in DOS 2.11 is one which Advance freely admits, and is the reason that the machine is currently being sold with DOS 2.13.

Finally, I accept your criticism of my comparison with the bottom-of-the-range PC: the two do not provide equal specifications. I would, however, observe that many people do not require either 256k RAM or a colour display, and I had already discussed the faster speed of the Advance.

Surya, Sun Technical Services. London

Singing the Memotech's praises

Considering the trouble Guy Kewney obviously takes to report a comprehensive and penetrating view of innovation in the microcomputer industry, it is surprising that the developments of one particular company consistently escape a mention in Newsprint.

The Memotech machine is one of only a handful of home computers which offer true upgradability to a business system, and is competitively priced at both ends of the market.

What sets it aside from the competition, however, is the successful application of state-of-the-art thinking to every aspect of the product range. While Acorn (with its Z80 add-on processor), Advance and Camputers triumph in the ability to 'stuff' existing hardware and design

into distinctive looking plastic boxes, Memotech has developed fast-access silicon disks, ROM-based CP/M software, and the expansion option of a high resolution graphics processor, which is capable of reproducing more information on a screen than can be generated from a colour TV camera.

As a matter of passing interest, this is all encased in an aluminium shell which probably represents the only innovation in the physical housing of microcomputers since they first appeared: it simultaneously protects circuitry from radio interference, overheating, and physical damage.

On a personal note, the flexibility of the MTX series will actually enable me to afford a WordStar-derived word processing system for project work and job applications in my final undergraduate year, because the ROM-based version of WordStar does not require disk drives.

John Proudlove, Leicester

(Your wish is our command—see the Memotech Benchtest on page 168—Ed.)

Are we speaking the same language?

In reply to Anthony Hegedus' & Daniel Sutton's Basic-bashing letter in the July issue of *PCW*, what could replace Basic? Forth and Pascal are suggested, but Forth is, in my opinion, little more than a medium-level assembler. It, not Basic, is the 'most complicated and unreadable' language around—remember that it was designed for engineers and astronomers to control radio-telescopes and other mechanical equipment, not for home micro users.

Pascal is a much better choice, but is usually disk-based and compiles the source code. I don't think it is really suitable for beginners who wish to experiment, writing very small programs, quickly and making many changes and corrections. Pascal was, after all, written for university students and professional programmers who wished to write large programs (often 10,000 lines of code or more). The great advantage of Basic is that you can edit your program from Basic, and then immediately run your program, re-editing it whenever you find any errors (or rather, when the computer finds them!).

My own suggestion for an easy replacement of Basic is a little-known Danish educational language called Comal. It was developed very recently—in 1980, as opposed to the sixties (Pascal) or the early seventies (Forth). Comal is really an interactive cross between Basic and Pascal.

At first glance, Comal is little more than a set of structured extensions to Basic. However, the difference in clarity between a nicely written Comal program and *any* Basic program is amazing. Comal adds spaces between keywords—even if you had omitted them, and indents all loops (correctly unlike BBC Basic with LISTO 7 selected). It is structured, having such useful commands as: repeat-until, while-endwhile, if-then-else-endif and case-when . . .-endcase; and allows procedures and functions. It is a thousand times easier to use than Microsoft, GW *or* BBC Basic! It, unlike Forth or (to a lesser extent) Pascal, is designed specifically for educational use in schools and in the home—not for controlling radio-telescopes!

My final point is that we may, of course, leapfrog all such 'procedural' (do this, then do that) languages, and replace Basic with a 'functional' language, such as Prolog or Hope, in which we tell the computer all the rules that can be used, but not the order in which to apply them.

The job of the language is to work out the solution by applying the rules in whichever order it 'thinks' best. These languages are undoubtedly the next major step forward in computing, but it may be some time before home micro users get any of the benefits.

Already, however, some micros, notably the Spectrum, have versions of Micro-Prolog appearing on them. And what about Logo, Lisp, and others, several of which are appearing, strictly as second languages, on various micros.

Duncan White, Amersham, Bucks

Writing a blank cheque

Many micro magazines have remarked on the high price of Sinclair microdrive cartridges. One of the proposals, however, to offset the loss of revenue throughout the software industry caused by illicit copying, is to impose a surcharge on blank cassettes. Effectively this is what Sinclair has done—though it would seem that the company should provide software houses with cartridges at reduced price so that software on cartridge is marginally more expensive than a blank. This would reduce the benefits of copying (even though microdrives are multi-file media) and pass the profits to Sinclair and its associates.

Perhaps this explains why there is no cassette interface?

D Mitchell, London N16

It's not what you put in . . .

I think Brett McBain, in the August issue, is wrong in assessing the value of something from the work put into it. A better way might be to estimate the entertainment time derived from the object. A good book then may give 10 hours of entertainment, whereas a good program may give an order of magnitude more.

In an attempt to raise the silly argument, which is so much a part of the micro scene, to the level of an art form, may I further suggest that while a human being may be conceived in a very short time indeed and with little effort, few people would choose these criteria to estimate the individual's eventual value to the rest of us!

Jonathan Moore, Cheltenham, Glos

The use of HOLD isn't bold

Guy Kewney's Benchtest of the Tatung Einstein in the August issue was admirable—thorough, and well balanced—but his comment that using HOLD 'can also be a nightmare' is no more relevant to its worth, than it would be to say that a Rolls-Royce can be a nightmare if you carelessly drive it through a built-up area at over 100mph!

The HOLD command is also available in Xtal 3 Basic, and is one of the most useful tools available to a programmer. Here is an example of its use: let's suppose we have a program covering lines 0-9000, together with a second program occuping the same lines. Suppose that we want to take a subroutine occupying lines 8000-8500 from the second program, and compact it so that we can slip it into a space between lines 300-400 in the first program. It could be done like this:

(1) Load the first program
(2) ENTER <HOLD 1,9000>
(3) Load the second program
(4) ENTER <DEL 0,7999>
(5) ENTER <DEL 8501,9000>
(6) ENTER <RENUM 300,2>
(7) ENTER <LIST>. This allows you to check that the renumbered Lines lie between 300 and 400, but if not to renumber them again.
(8) ENTER <MGE>

The deed is complete; and I do not think any other interpreter would make it quite so simple.

Note too that if a part of a program is renumbered, then all the GOTOS are correctly renumbered including the lines which have temporarily 'disappeared', because they are being HELD.

Let's hope that all future interpreters have this facility.

Andrew R B Ferguson, Henley-on-Thames, Oxon

Ode to a QL

In your August issue, Leslie Phoenix gave a somewhat one-sided explanation of the meaning of the term 'quantum



XCHANGE

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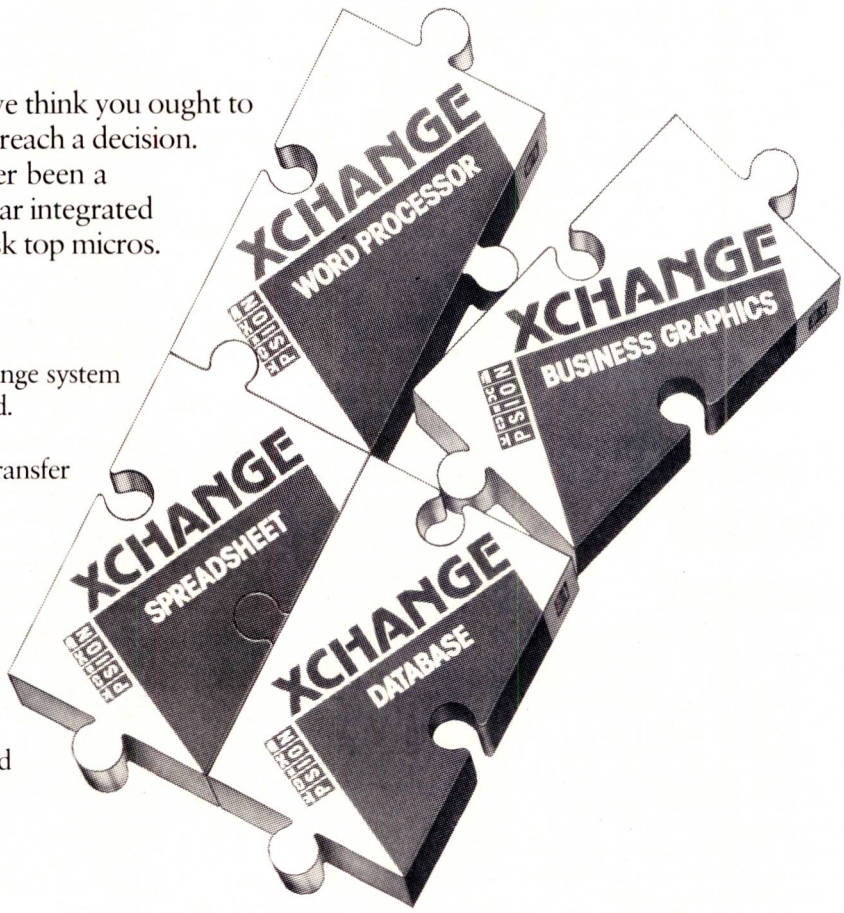

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leap'. I have never seen a concrete scientific definition of it in any reference book and when it first came to my attention (about 15 years ago) it was always being used during lectures to mean something insignificant (that is, the smallest leap possible).

Later, to my astonishment, it started appearing in the popular press in the sense of a leap of staggering proportions. In fact, I complained to a *Sunday Times* journalist about this.

In the absence of concrete proof to the contrary I choose to believe that this is yet another media 'hype' and intend to poll the readership of some suitable scientific journal in order to settle the question for good. I certainly do not agree with your correspondent's interpretation, which is more poetic than scientific. After all, whether measured in nanometres or electron volts they are still very small leaps. Their discontinuity is hardly surprising—that is what quantisation is all about!

Incidentally, on the subject of poetic quanta, your readers may like to know that the immortal 'Rabbie' knew something about waiting for Uncle Clive's products,

'I waive the quantum o' the sin,
The hazard of concealing;
But oh! it hardens a' within,
And petrifies the feeling!'
(R Burns. *Epistle to a Young Friend*)

He was obviously a keen hacker, as shown by his:

'What's done we partly may compute,
But know not what's resisted.'
(R Burns. *Address to the Unco Guid*)

And did he not say something about 'mice ganging aft a-gley?'

Dr David J Fisher, Cardiff

Room in the next carriage

With reference to Paul Overaa's series, 'Teach Yourself Assembler', part 7 (August), forgive me if I'm wrong—not being *au fait* with Z80 machine code—but it strikes me that his 'final version' of the Z80 buffering routine, (Fig 6), will not work as the buffer gets full.

The test for buffer full is that the counter is incremented from 255 to 0, whereupon the, now zero, counter is stored, so the buffered 255 characters are lost.

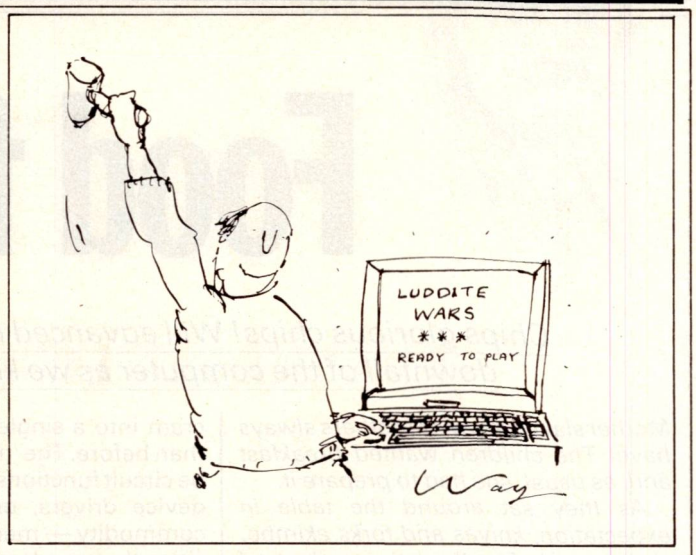
Not only this, but the last character read is thrown away.

If this is what is meant by ". . . any over-sized entry will be safely ignored," I am not impressed.

R P Flood, Liverpool

(The point you have missed is that the routine is designed to handle input items of up to and including 255 characters only (plus a terminating carriage return!). At the 'buffer full' point, where 255 characters have been entered, the typing of a carriage return will result in the correct storing of the count (255) at the head of the buffer. If you reach the buffer full condition and the next character entered is not a carriage return then you are trying to deal with a string of at least 256 characters. At the top of page 164 we do point out that oversized entries such as this will be 'safely ignored'. If you attempt to enter a 256th character that is not a carriage return the routine will treat that entry as invalid and, as you rightly state, the 255 characters collected before the routine recognised that the entry was invalid, are ignored.

To appreciate why we used this approach you need to understand the operation of the 6502 version. This uses indexed absolute addressing to place the character in the buffer. If we did not screen out 'partial entries'—that is, simply took the first 255 characters or anything typed, then the 6502 version would 'wrap round' the buffer area and on the 256th, 512th character . . . would, firstly, place the latest character into buffer byte 0 (creating a false count in the count area) and, secondly, overwrite existing data in the buffer. This would result in meaningless partial entries being created in the 6502 version—Ed.)



Case of the missing 'brain

I bought my NewBrain AD (612-160) from Grundy Business Systems (GBS) in November 1982. In July 1983, the machine was returned for repair because of a problem with the video output signals. However, in September 1983 I was notified that GBS had gone into liquidation, and that my unrepaired NewBrain had been put into safe-keeping.

I subsequently wrote to the liquidator enquiring about the condition of my machine. The reply was that the matter had been forwarded to Tradecom International BV.

After waiting for some time, I became impatient and wrote a letter to Tradecom in December 1983; but I did not get a single word of reply.

Recently, I ordered another NewBrain AD from Kuma Computers Limited. Nevertheless, I won't give up on my original NewBrain, though I am now more interested in getting the money back rather than the machine as I have another one.

What should I do?

Leonard Chan, Kennedy Town, Hong Kong

(Tim Harris at the liquidators, Deloitte Haskins & Sells (DHS), assures us that machines such as yours are in store in the UK, and will be returned at the owner's expense, on application to DHS at 128 Queen Victoria Street, London, EC4.—Ed.)

Micros and music

The Capital Region Information Centre (CRIC), part of the Micro-electronics Education Program (MEP), is producing a booklet for music teachers and students entitled *Microcomputers & Music Education*. Following an introduction to the subject, the booklet will contain a list of useful software/hardware currently available.

Could any readers with relevant information contact me as soon as possible:

Nick Pickett, Music Dept, Middlesex Polytechnic, Trent Park, Cockfosters, Hertfordshire

Bad practice

While I am not a NewBrain owner I suspect that the DEF FN() problem described by AV Thomas (TJ's Workshop, *PCW*, June) could be due to the function definition being set up on entry rather than at run time; and plainly the search of the definitions table ends at the first occurrence of the name being searched for.

Whatever the reason, I would regard multiple definitions of the same function as bad practice. Most languages prohibit it.

PR Chantler, Barnhurst, Kent

BLUDNERS

Things got a little confusing in Guy Kewney's September news story on Torch (page 91), announcing that the C68000 micros had been officially approved for connection to BT lines.

The picture which ran with the story was of an early version of the Graduate, Torch's IBM PC compatible upgrade for the BBC B.

In fact the on sale version looks a little different. All this is, of course, entirely separate from Torch's Unicorn upgrades to the BBC B which, at the top of the range, offer the 68000 processor and Unix System III.

***PCW* Show**. With much embarrassment we admit to getting the dates of our own show wrong in the Show Preview (September 84). The dates are 20-23 September, with Trade/Press day on the 19th.

Program File: 'Butterfingers' (August *PCW*) for the UK101 was attributed to only one of its two authors.

Our apologies to Martin Beeby for missing his name off the credits.



Food for thought

Chips glorious chips! Will advanced molecular engineering bring about the downfall of the computer as we know it? Martin Banks chews it over.

Mother slaved away as mothers always have. The children wanted breakfast and, as usual, she had to prepare it.

As they sat around the table in expectation, knives and forks akimbo, she placed before them the products of her endeavours. 'Now remember to eat your chips, dear,' she told the youngest. 'You'll never be brainy if you don't eat your chips.'

'Aw, but Mum,' whinged the small person, 'they taste awful. They don't taste a bit like the ones Grandma makes.'

'Yes dear,' Mother replied, 'but hers are made in the old-fashioned way — from potatoes. These new ones are much better for you. They're full of fibre and trace elements — and they're good for the brain.'

'Good for the brain?' the small person enquired.

'Yes, eat enough of them and they might grow into one inside you.'

Yes, well. Ever since the national newspapers first discovered the microprocessor *et al* and found that they were generically referred to as chips, stories of the chip kind have been found everywhere. In time, all that clever stuff passed on, never, one hoped, to be seen again. But current research and development efforts are leading us inexorably towards the bio-chip and more 'chip'-based stories.

More properly called molecular electronics, bio-chips are expected to be around in workable form within the next 20 years. This may seem like a long time, and it is when one considers just how far the microcomputer business has come in under 10 years from the appearance of the early Altairs and Imsais. But it's no time at all in the great scheme of things, and when one considers what might be possible with bio-chips, the progress made so far in electronics starts to look like the early struggles of the Wright Brothers.

It is first necessary to consider what molecular electronics is all about before thinking about its implications. In essence, what is happening is the development of a technology that can create circuit elements which are some 50 nanometers long: (the size of an individual molecule). In the world of microelectronics, it means the ability to cram into a single device much more than before. The 'more' in question can be circuit functions like I/O systems and device drivers, or that all-important commodity — memory. Storage capacities thousands of times greater than anything currently envisaged could be possible, while the complexity of functions available in a single chip is nothing short of mind-boggling.

All this is well beyond the capabilities of any semiconductor technology currently used to process silicon-based integrated circuits. Indeed there are still two schools of thought on which is the best way to achieve such results — the biological route or the biochemical route. You will note that the same prefix appears in both cases — bio. Organic materials such as proteins are to be the building blocks from which these devices will be manufactured. It's quite possible that genetic engineering will be used to create microbes which will actually synthesise circuit elements, or even complete circuits.

Not surprisingly, there are many technical problems to be solved before molecular electronics appears as a working entity. Not least among these problems, according to one forecast report from Technical Insights in the USA, is just how connections between the molecules will be achieved. They will have to be brought together in some form of matrix if there's to be a working circuit, but achieving it with such small elements is going to require something completely different from good ol' copper wire.

Despite such apparently fundamental problems, the Technical Insights forecast is predicting that the first demonstration chip components, items such as simple switches and memory elements, could well be in existence within five years.

This is not very long to wait and see if the new technology does emerge. And if it does then be ready, for it's likely to bring with it not only major opportunities for new applications of electronics and computer technologies; it could also wreak havoc with existing applications and design approaches. The computer, as we currently conceive of the beast, may be doomed.

As an example of what might be possible, take that most typical of applications — the small business management system. Take also the area of portable computing, the convenience of which interests all of us. Many people and companies have, from Adam Osborne onwards, tried to combine these two into a single entity with varying degrees of success.

The Osborne had the essential applications but was somewhat hernia-inducing when it came to portability. The smaller the machine, however, the less it meets the applications criteria, until one ends up with pocket 'computers' that are essentially calculators with ideas above their station.

Molecular electronics holds out the promise of Gigabyte-sized memories driven by 64-bit processors, all in a pocket calculator package. And a keyboard? Well, with processing power like that available, throw in speech recognition and synthesis for nothing: the pocket-sized business computer becomes quite feasible. The amount of processing power that could be squeezed into a small space would make it feasible to spread computing power around. There would be more than sufficient power to handle all the communications problems, and overcome the majority of protocol and operating system mismatches that are the great hindrance to intercommunications today. Instead of working on producing new standards that everyone should adhere to, we could work on producing systems which didn't really care too much what 'standard' was used. It could run everything from Kansas City audio tape, through CP/M and MS-DOS, then go on past Unix towards whatever comes in the future.

And with that level of power coupled with complex communications (all in a tiny little package, remember), why not have systems implanted in us? The sci-fi ideas of implanted computers to allow the blind to 'see', or to control artificial limbs, could all be possible applications.

And the opening scenario? Even that could happen. We could start eating our way to a better memory and see IBM buy Kellogs as its new distribution company. END

Illustration by Tony Randell

PCW 119

Commodore Plus/4

Commodore has kept the world waiting for its first new machine since the best-selling '64, and has now produced the Plus/4—an inexpensive home/small business micro with four built-in software packages. How does it compare with its projected nearest rival, the QL? Tony Hetherington finds out.



Commodore shares the number one-selling micro slot with Sinclair through its Commodore 64, so the computer world has waited with bated breath for the new Commodore micro, the Plus/4.

For under £250 it offers the potential buyer a home micro with four built-in business packages, a word processor, spreadsheet, file manager and graphics package.

It has, however, abandoned the sprites and sound of previous Commodore machines in favour of a new Basic and a built-in machine code monitor called Tedmon.

Hardware

The Plus/4 is extremely small. It's not down to the size of the Spectrums of this world, but it must be the smallest machine yet to house a full qwerty typewriter-style keyboard, and function and cursor keys.

This 'micro' computer is housed in a charcoal grey plastic case and is accompanied by a power supply, TV lead and manuals: The power supply is standard Commodore which looks ridiculous alongside the Plus/4, and should be hidden at all times.

The qwerty keys are moulded from off-white plastic, and are nicely shaped but have rather a light touch; nevertheless, I didn't have any overtyping problems. The letter and number keys also have two graphics, or functions, attached to them, and are accessed by pressing the required key along with either the SHIFT or COMMODORE keys. Arranged along the top of the qwerty keys are four grey function keys, which with the shift key give seven programmable functions and a HELP key.

There is an MSX-style cursor key cluster on the bottom right of the keyboard, with the cursor keys shaped into arrows.

The keyboard unit is physically similar in shape to the Oric Atmos, as it has a flat plate containing the keys mounted on an angled plinth. This plinth slopes the keyboard at a pleasant angle, and also contains a range of ports and interfaces.

The right-hand side of the machine houses the ON/OFF and RESET keys, and the left side a TV output. From left to right along the back are the power input, serial port, cassette port, I/O port, a cartridge slot labelled 'memory expansion', two joystick ports and a video output.

The two joystick ports are Commodore's own design, and replace the standard ports found on the VIC-20 and '64 to allow you 'to use Commodore's advanced joysticks'. I tried these 'advanced joysticks', but couldn't find anything about them that was so spectacular to warrant a move away from standard ports.

Another Plus/4 move away from standards is the cassette port which allows you to use the new Commodore 1531 Datasette, but I've yet to discover any significant differences between this and its VIC and '64 predecessor, the 1530.

Fans of the infamous 1541 disk drive will be delighted to hear that you can still use this with the Plus/4 via the serial port (note that this is soon to be replaced by the 1542 drive, which is really a bug free 1541 in a different-coloured box). You'll also be able to buy a super new fast disk drive, the SFD-481, which is reportedly 12 times as fast as the 1541 and will plug into the cartridge slot.

The curious I/O port will apparently take an RS232 adaptor plug, and a modem that allows Commodore owners access to a wider range of peripherals and accessories.

The review machine was described as a 'final preproduction model', and its insides revealed exactly what that meant. The hardware was the final configuration, but was achieved by the use of numerous EPROMs and a spaghetti of patching wires. The hardware will stay the same but the circuit board will be tidied up on production versions.

The Plus/4 is driven by a 7501 processor (another 6502 derivative) which runs at between 0.89 and 1.76MHz. This is dependent on the amount of text and graphics on the screen, which is reminiscent of ZX81 days with its fast and slow modes.

Alongside the CPU is 64k of RAM and a bank of four ROM chips, which include 32k ROM incorporating the Basic and 20k of 3-Plus-1 software.

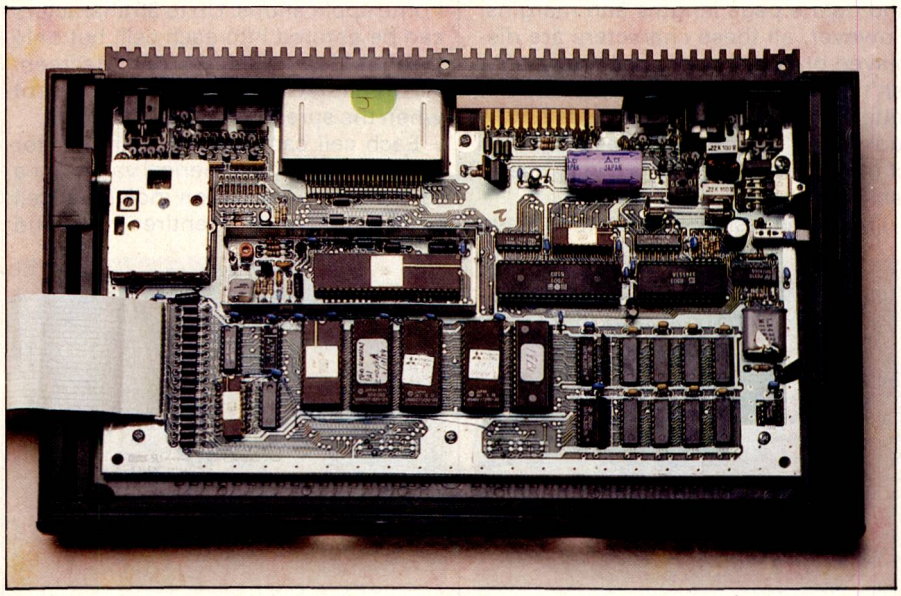
System software

When the Plus/4 is switched on the opening screen is displayed, informing you that the Plus/4 runs under Basic 3.5 and has 60671 bytes free. Below this is an invitation to press F1 and enter the delights of the built-in 3-Plus-1 software. 3-Plus-1 is to be a major selling point of the Plus/4, and in Commodore's eyes sets up the machine as a QL competitor.

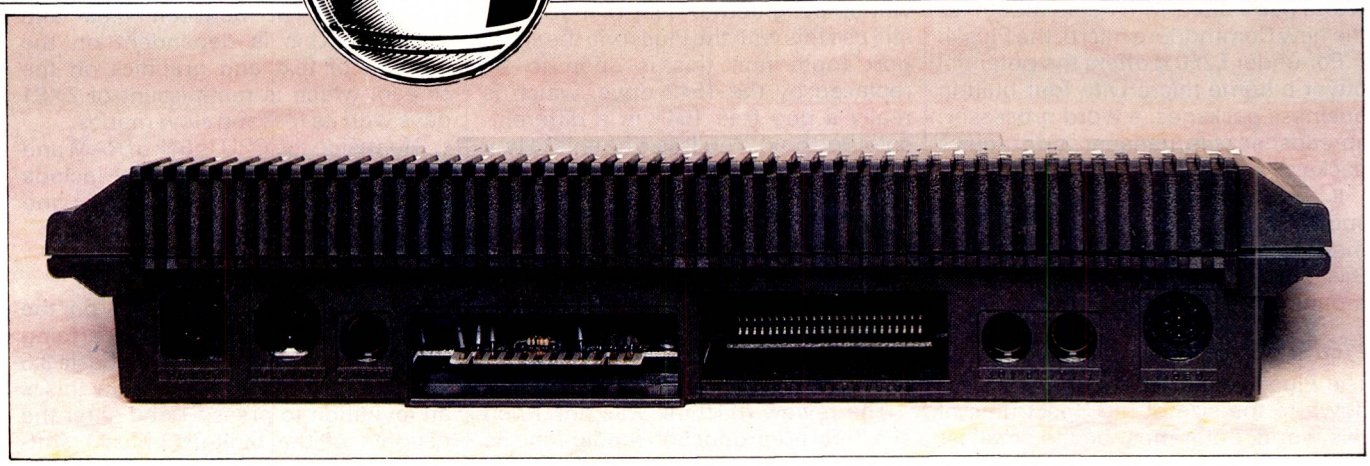
Consequently the success of the Plus/4 will depend largely on the relative strengths of 3-Plus-1 over its QL



The keyboard features a full qwerty layout and an MSX-style cursor cluster



The 3-plus-1 software is housed in two ROM chips alongside the Basic ROM chips



From left to right: power, serial output, cassette port, I/O port, cartridge slot, and two non-standard joystick ports

counterparts.

Pressing F1 from the power-up screen takes you directly into the first of the three main packages, the word processor. The other two, a spreadsheet and a file manager, are accessed from the word processor via a few key presses. Unfortunately Commodore has failed to give these packages a name, so I'll have to christen them for the sake of individuality.

In essence the word processor is a subset of the Easy Script program available for the '64, so I'll call it Subscript. The others are not so easily defined, and are best referred to as 4calc (spreadsheet) and 4base (file manager).

The final package which forms the 'Plus-1' is described as a business graphics package, but is little more than a graphing utility used solely by 4calc so I'll treat it as such.

Subscript is a competent product which allows you to type and edit 80-column documents on a 40-column screen. You can also insert special control characters into the document's text which are used to centre or justify text, create page headers and footers, and define page lengths and margins. However, all these characters are displayed on the screen at all times, so it isn't until you actually print out the letter or document that you see how it looks. This is unfortunate as a preview of the finished product is a very useful facility.

On the plus side you can load, save and merge documents from a disk drive, and integrate Subscript with the other packages to produce, for example, a letter individually addressed to everyone on your mailing list held on 4base. Although it's possible to use Subscript without a disk drive to type, edit and print letters, it's best used with one. The same is true of 4calc, but one is essential if you are to use 4base.

Subscript has one final but essential task to perform, and that is to be a front end for the other packages. For example, you enter the other packages from Subscript and before anything can be printed it must be passed to Subscript. This may have its disadvantages, but it also means that any graph spreadsheet or database record can be easily incorporated into a Subscript document.

4calc is a powerful spreadsheet program and is entered by keying 'tc' (to calculator) while in Subscript. It has a standard spreadsheet format with the screen as a window that's moved over a larger spreadsheet. The window size is just three rows of 12 cells, but the whole sheet is 50 rows by 17 columns making a total of 850 cells — sufficient for most home applications. Up to 36 characters can be entered into each cell, but only the first 11 are displayed on the screen. All the characters are of course present when the spreadsheet is printed out.

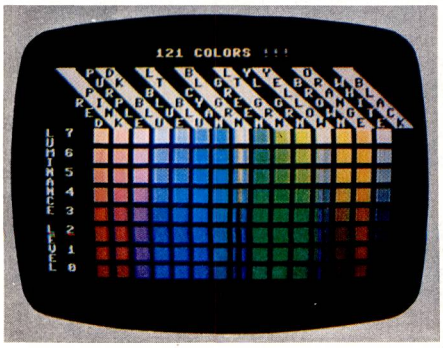
Each cell can be filled with text for either a heading, numerical values, or a formula that can act on individual cell contents and sum entire rows and columns.

4calc includes a powerful spreadsheet editor which not only allows you to change the contents of any cell, but also lets you insert or delete cells in the middle of rows and columns. You can even copy whole rows or columns and edit them, thus greatly speeding up input of a lot of similar data.

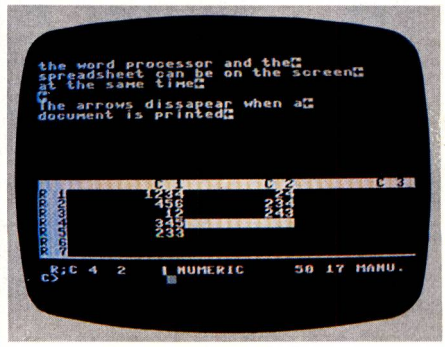
Press 'gr' when in command mode and your spreadsheet will be automatically graphed by the so-called business graphics package. Although this is quite useful there's only one type of graph available, and that's a very rough bar chart. It's rough in the sense that it's unfinished, for it has neither a scale or axis labels. The bars themselves are constructed solely from hash signs.

However, all is not lost. Since 4calc is fully integrated with Subscript, it's easy to pass the graph or indeed all or part of the spreadsheet to Subscript. It then becomes part of a Subscript document and can be edited. Particularly useful in this respect is Subscript's search and replace utility, which can be used to replace the hash signs with a more appropriate character to give the bar chart a more pleasing appearance. Transferring data from 4calc to Subscript is made even easier by the ability to split the screen and have it displayed in either half: you can pass a completed spreadsheet to Subscript knowing exactly where it will appear in your document.

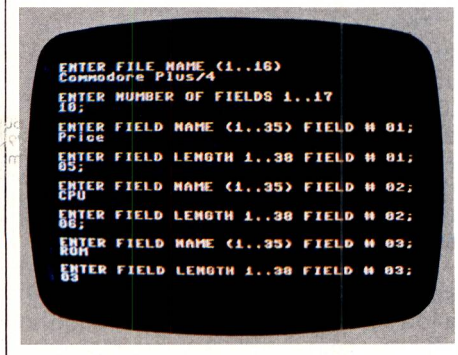
As with Subscript, 4calc supports a disk drive so that you can load and



The Plus/4 features 121 colours



Subscript and 4calc displayed together



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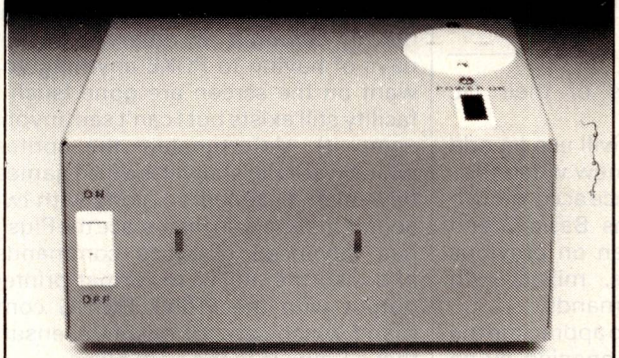

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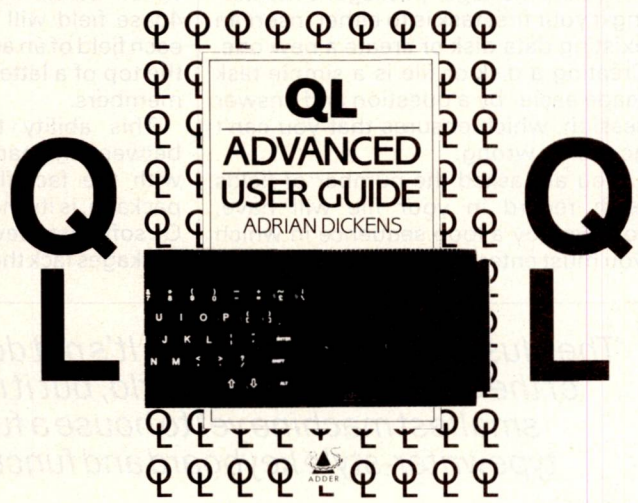

The **QL Advanced User Guide** is the authoritative reference guide to the Sinclair QL system. Written by Adrian Dickens (author of the best selling BBC Micro Advanced User Guide), in collaboration with Tony Tebby (QDOS system designer), over 350 pages packed with new information are provided. Information includes: 68008 programming, 'Jobs' and multitasking, resident procedures, transient programs, heaps and stacks, system 'Traps' and utilities. Many examples are provided, including: QDOS experimentor program, real time on screen clock, new SuperBasic functions like BPUT@ and SINH, toggling between screen 0 and screen 1 (to allow fast graphics), complete microdrive backup utility, parallel printer interface (software & hardware design both fully described) plus many more.

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save completed spreadsheets. A disk drive is, of course, essential to 4base as it's a disk file manager package. On entering it your first task is to either insert an existing data disk or create a new one. Creating a disk or file is a simple task made easier by a question and answer session, which ensures that you can't go too far wrong.

You are asked the number of fields each record in your file will have, followed by a loop sequence in which you must enter each field name and the number of characters allowed for the contents. When this sequence is complete, 4base displays all the field names and field lengths along with a calculated maximum number of records allowed. This is limited by the capacity of a disk and has a maximum of 999 records, obviously affected by the length of and number of fields as well as the field names. The minimum number of records is 200, which consists of 17 fields of 38 characters, each with a 35-character field name. Consequently you may have to be prepared to reorganise your file to get the required number of records.

When you have defined your file, 4base formats a disk for you. This is dependent on the number of records and can take between 130 and 160 seconds, and is longer than the standard disk formatting because it writes record details onto the disk. Once this is completed, 4base will report the space left on a disk.

It may seem a little curious to have on average 140 free blocks, particularly if you have had to reduce field lengths to accommodate your records, but this space is used by 4base to store sort files created by its powerful sort routines. You shouldn't use a 4base disk for spreadsheets or documents as they will take up this space.

When the file is defined you can easily enter record details. You can also search for specific records or have 4base run through them in sequence — in fact, all you would expect from a database including sort routines. You can sort the whole file by any field or fields and even sort a set number of records (for example, the first 50), or define a range in which only sorted records will fall.

As with 4calc, data from your files can be printed by Subscript. The data is passed to Subscript but is drawn from the 4base disk; all the necessary commands are part of Subscript. These are additional control characters which define where in a document a 4base field will appear: for example, each field of an address file is defined at the top of a letter to be sent to a club's members.

This ability to rapidly pass data between the parts of 3-Plus-1, coupled with the fact that it's a ROM-based package, is its main advantage over the QL software. Nevertheless, the 3-Plus-1 packages lack the innovation and some of the better features of their QL counterparts.

'The Plus/4 is extremely small. It's not down to the size of the Spectrums of this world, but it must be the smallest machine yet to house a full qwerty typewriter-style keyboard and function keys.'

Plus/4 programmers will use an odd mixture of the old and new when they program in Basic 3.5, since according to Commodore it contains Basic 2 and Basic 4 commands seen on previous Commodore machines, mixed with powerful graphics commands.

Programmers will also appreciate the full screen editor accompanied by an overworked ESCAPE key. Pressing this key together with others produces powerful editing features, such as delete to start or end of a line. In addition, you can also scroll lines, insert characters and even define a screen window.

Another overworked key is the HELP key which aids in program debugging. Imagine that you have written a program with several multi-statement lines and one of them contains an error. At first sight, the Plus/4 is particularly unhelpful as all it displays is 'Syntax error' followed by the line number; pressing HELP will display the whole program line and flash part of it, starting with the statement containing the error. This is quite an unusual interpretation of a HELP key, and there are further surprises contained in the Basic — commands that are found on other machines but have an unusual format or syntax. For example, Auto 10 will, as on other machines, generate program line numbers but instead of Auto on its own having the same effect (as 10 is usually the default value), it turns off the line numbers.

Plus/4 programmers have access to a total of 121 colours (eight luminances of 15 colours plus black), which can all be present together on the high resolution screen.

The high resolution screen has a resolution of 320 × 200 pixels, each of which can be set. The colour of the pixels is restricted to one foreground and one background colour in each 8 × 8 pixels square. More colours can be included in multicolour mode, which falls half way between high-res and the 24-line 40-character text mode. This has a lower resolution of 160 × 200, but each character can have more than one colour.

There are two more graphic modes: the high-res and multicolour modes, with the bottom five lines reserved as a text window.

Seasoned Commodore programmers will be surprised with the ease in which high resolution graphics can be created on the screen. Lines can be drawn with the DRAW command as well as BOXes and CIRCLEs; boxes can be filled in and even rotated through any angle. A powerful PAINT command ensures that irregular shapes can be quickly coloured: in other words, the days of having to POKE anything you want on the screen are gone (such a facility still exists but I can't see anyone using it). Unfortunately the sprites, which were the stalwarts of '64 games, have also disappeared along with two sound channels. In their place the Plus/4 has advanced graphics commands, and also the ability to format printed output with the PRINT USING command which can, for example, ensure that a £ sign is in the right place.

As a bonus to machine code programmers there's a built-in machine code monitor called Tedmon. Through a series of ten commands this allows the machine code buff to examine and manipulate blocks of memory, and even assemble or disassemble single lines of 6502 machine code.

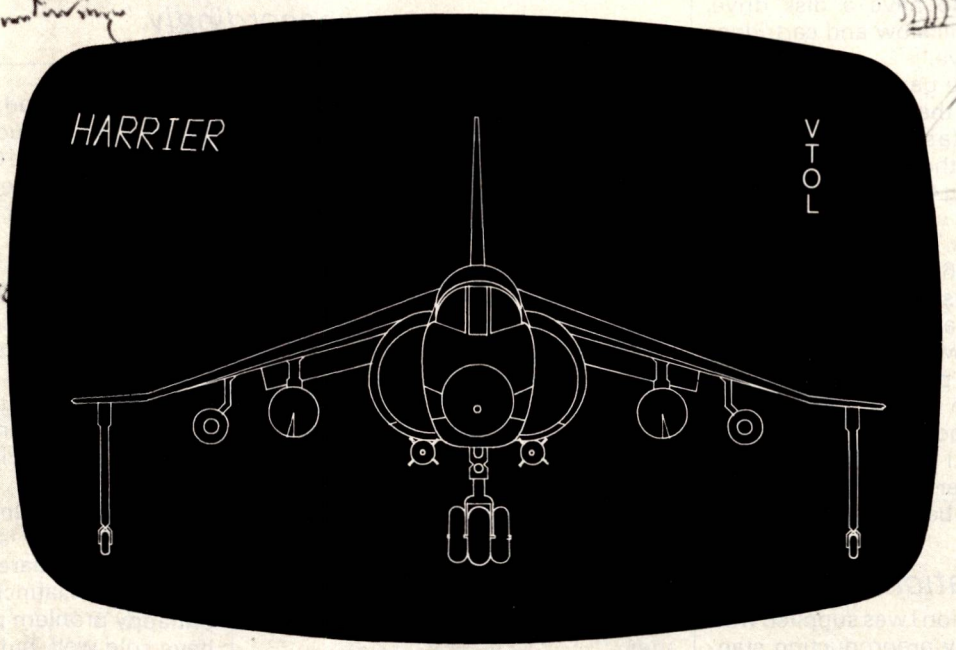
It's not really surprising that Basic 3.5 contains a full list of disk commands, since its built-in software is so heavily dependent on a drive being present. HEADER is such a command, and is used to format a disk before it's used by the Plus/4. There are two forms to this command: one which formats the entire disk before writing a directory, another which overwrites an existing directory. The full header takes about one-and-a-half minutes to format a disk, whereas the quick HEADER can overwrite a directory in just three seconds. Obviously the full header

Benchmarks

BM1	2.0
BM2	9.8
BM3	18.2
BM4	18.7
BM5	18.8
BM6	34.8
BM7	55.3
BM8	101.1

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

Drawing and words...



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must be used on a new disk, but if you're recycling a disk then the quick header will suffice, since with the old directory overwritten the disk is effectively wiped.

Applications software

With the inclusion of built-in applications software the need for other packages is not so great. Indeed it will be difficult for companies to sell Plus/4 owners business programs as they will already own three good packages.

Software might be supplied on three different mediums — cartridge, cassette and disk, but I imagine that disk will be the most-used medium as Plus/4 owners will also have a disk drive. Cassettes are still slow and cartridges are still expensive.

Some cassette games will probably filter up from the Plus/4's younger brother, the C16 (a scaled-down version of the Plus/4 without the built-in software and missing 48k of RAM). This lack of memory may well be a problem for software houses, especially as in high-res mode, the C16 is left with a feeble 2k.

Most of the existing software houses, which produce games for the Commodore machines, were initially sceptical about the Plus/4, particularly those who rely heavily on sprites. This initial resistance will soon pass if the machine sells well, but I doubt whether the typical Plus/4 user will rush out and buy the latest camel-bashing game.

Documentation

The documentation I was supplied with was undoubtedly preproduction standard. It consisted of piles of photocopied sheets which split broadly into three parts: a Basic tutorial; a 'Plus/4 encyclopaedia'; and a separate guide to the 3-Plus-1 software.

All three were easy to read, and contained many examples and exercises all designed to help you learn more easily. The Basic tutorial clearly explained the simpler concepts of programming through commands and sample programs, leading the user on to the encyclopaedia which presents an alphabetic list of the Basic commands, and contains syntax, an explanation of its purpose and some examples.

Together these forms provide a relatively good guide to Basic but don't expect to learn too many advanced techniques, as all such topics are replaced with a signpost to the forthcoming *Plus/4 Programmers' Reference Guide* (this will cost you extra, probably around £7). Some of the information omitted from the manual concerns the creation of random access and relative disk files: these are better and faster than the sequential files dealt with all too briefly in the manual.

I can understand the need for a separate book to deal with using ROM calls and addressing the user port, but syntax for the Basic commands should be in the Basic programming guide. After all, using random access files is far easier than using a machine code monitor.

The final part of the manual is thankfully more comprehensive, and tells you all you need to know about the 3-Plus-1 software.

Each package is dealt with in turn, and full operating instructions are given along with examples and exercises. Each section closes with a command summary and relevant details on integrating the software with other packages.

The 3-Plus-1 manual also makes several references to a demonstration disk, which seems like an excellent idea and would round off an attractive package.

Prices

The Plus/4 is competitively priced at just under £250. However, you should regard the purchase of a disk drive as compulsory at an additional £220. The whole package carries a price tag of about £470, more than the cost of a QL.

No prices were available at press time for the cassette player or the new SFD 481 disk drive.

The Plus/4 is about £30 more expensive than the Commodore 64, and there are no plans to reduce the 64's price. Commodore feels that the Plus/4's built-in software and lack of sprites and sound channels will keep the two machines apart; the idea being that games players will buy the '64 and the more serious users will choose the Plus/4.

More direct competition exists between the C16 and the VIC-20, with the C16 being introduced in a starter pack for £129.95. In true Commodore style, it intends to continue selling the VIC-20 'if the demand exists.'

'Price is obviously an important factor to consider and the Plus/4 plus disk drive is about £70 more than a QL, therefore the onus is on Commodore to either prove that the extra is worth it, or reduce the price accordingly.'

Conclusion

So what is the Plus/4's potential place in the market? It has a vastly improved Basic, but also some annoying features. The worst of these are the non-standard joystick and cassette interface, which aren't even compatible with the previous Commodore machines.

Its biggest selling point will be the built-in 3-Plus-1 software packages, which aim it squarely at the QL market. If it had been launched during the QL's unhappy problem phase then it would have sold well, but the QL's problems are now said to be all but over and the machine will be in the High Streets as the Plus/4 is launched.

The potential buyer is faced with a difficult choice. The QL is by far the more innovative product, and the Psion packages certainly outperform the Plus/4's 3-Plus-1 packages. However, Commodore could argue that the Plus/4 uses proven technology and therefore should be bug free. 3-Plus-1 is built into the ROM and therefore instantly available as well as being fully integrated — hence the dilemma.

Price is obviously an important factor to consider and the Plus/4 plus disk drive is about £70 more than a QL, therefore the onus is on Commodore to either prove that the extra is worth it or reduce the price accordingly. After all, the Commodore 64 started life at over £300.

Commodore 64 owners will argue that similar packages to those incorporated in 3-Plus-1 are already available for their machine, but the total cost is almost twice the price of the Plus/4.

The Plus/4 will have an interesting impact on the market-place. **END**

Technical specifications

CPU:	7501 running at between 0.89 and 1.76MHz
ROM:	32k incorporating Basic 3.5, 20k 3-Plus-1 software
RAM:	64k, 60k available to users. 10k used in high resolution mode.
Display:	Text (40 × 24), high-res (320 × 200) and multicolour (160 × 200)
Keyboard:	67 typewriter-style keys including four function keys and four cursor control keys
Colours:	121 colours (15 colours; eight luminances + black)
Sound:	One channel, two tones
Dimensions:	66.7mm × 422.3mm × 238.1mm (H × W × D)

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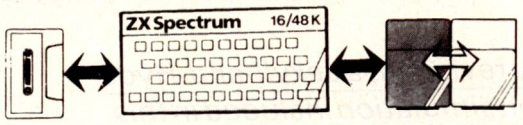

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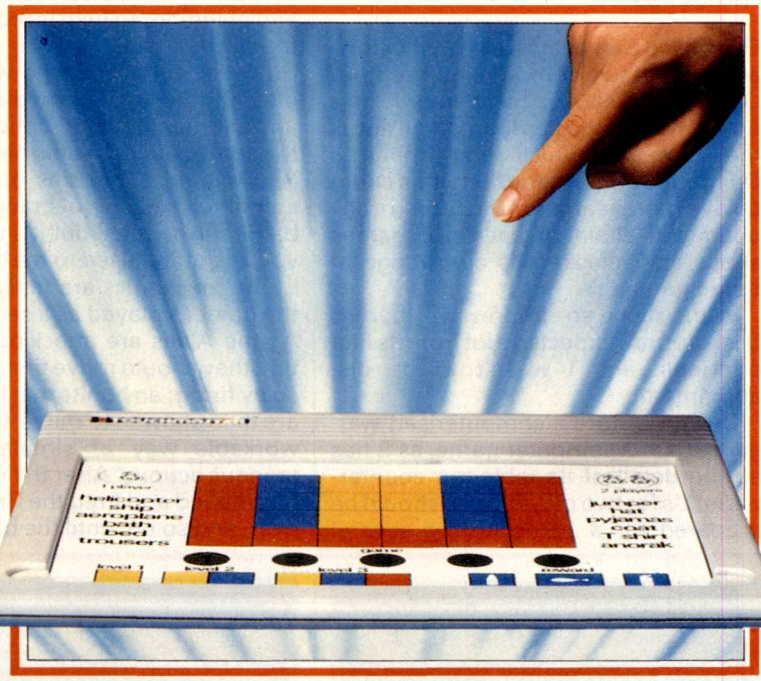

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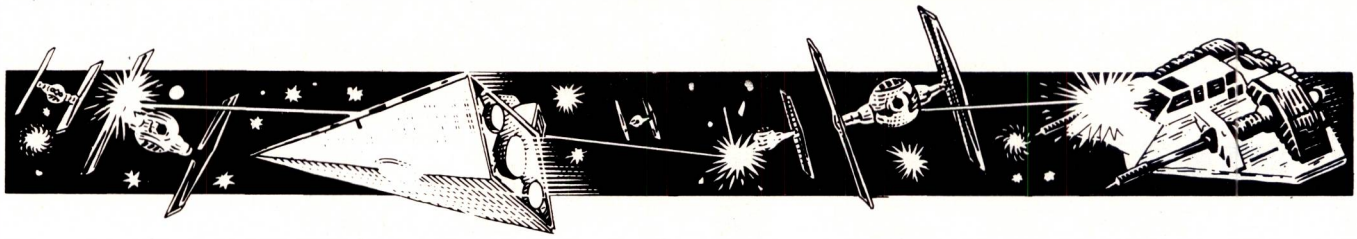


The spirit of World War II lives on with D-Day revisited, a Jekyll-and-Hyde starbase mission and an Olympic decathlon simulation included in this month's selection of games for the Commodore 64, Spectrum and BBC. Tony Hetherington is the man on the starting block.





More fighting on the beaches

Title: D-Day
Computer: 48k Spectrum
Supplier: Games Workshop
Format: Cassette
Price: £7.95

D-Day and Battlecars (reviewed below) are the first two computer games from Games Workshop, a company which is no stranger to the games market. It was the company which first imported Dungeons and Dragons into this country over nine years ago. Since then it has opened a chain of specialist games shops and released its own range of board games.

With such an impressive games background I expected a lot from its first offerings, and I wasn't to be disappointed.

D-Day is more a computerised wargame than a computer game, as it has all the detail of its table-top counterparts. It's for two players who should be prepared for a battle lasting several hours.

The game simulates several stages of the D-Day landings including the landings themselves, the push-out and the battle for Arnhem. The stages are represented as scenarios (four in total) which must be individually loaded into a central game system. The first stage is to set up the 100 pieces (40 Allied units, 60 German). This can take some time and planning, so help is provided in the form of maps of the battlefields. However, for those who want to start playing the game immediately there's an auto-deployment option in which the computer places the pieces for you. You should avoid this option as the computer has some strange ideas for battle formations, but it's useful when you're getting used to the game.

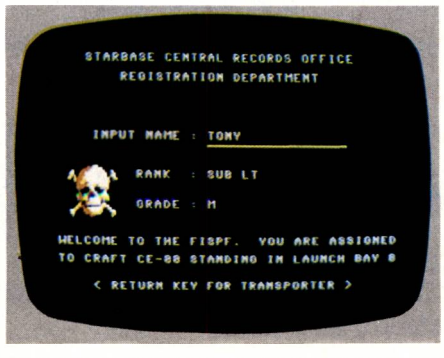
The mechanics are fairly smooth as the game is played as a series of turns. As the Allies are attacking it's logical that they should move first, and they do so by firing; any units that haven't fired are then allowed to move. It's a silly but workable way of simulating simultaneous actions. After the Allied player has moved and fired the Germans take over, and so on, until the battle is won.

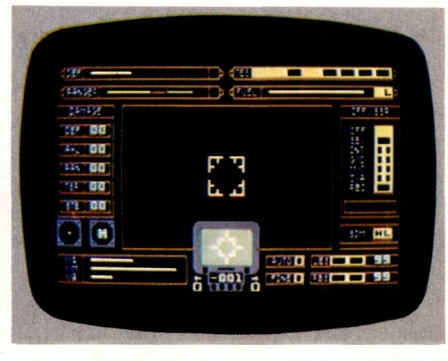
One of D-Day's best features is the variety of units available — tanks, infantry, trucks, ships and bridge layers. The tanks and infantry are normal offensive units but all have their own attack, defence, movement and range strengths which determine the relative abilities of the units and their effectiveness in battle. The trucks and ships are used to transport these units around the board to strengthen a weakened flank or start a new offensive. The bridge layers are invaluable and are used to build bridges across otherwise impassable territory, so should be protected at all costs.

Terrain naturally has an important effect on the battle, as it can slow the enemy advance or provide much-needed cover. Roads are crucial, so you should guard them ready for that decisive push.

The playing area, or battlefield, is divided into a 63 × 63 grid, although only 15 × 15 squares are displayed on the screen at any one time in the left-hand of two square windows, with the right-hand being used for messages. For example, 'Place the cursor over the unit to fire and press O': whenever a unit is selected, either for moving or firing, its attack and defence details are displayed at the bottom of the screen.

Comparisons are bound to be made between this game and Atari's Eastern Front, but D-Day is streets ahead. It's by far the more complicated of the two but this adds to the enjoyment, and any problems caused by the Spectrum's screen display are overcome by the inclusion of maps in a package that's excellent value for money.





Mission impossible

Title: Interdictor Pilot
Computer: Commodore 64
Supplier: Supersoft
Format: Cassette
Price: £17.95

The opening screen of this space flight simulator features a superb picture of a

skull, which is appropriate when you consider the new pilot's fate.

You sign in for a mission which will take you across the galaxy and hopefully end safely on board a federation starbase, but many hazards lie ahead before your journey's end.

Your mission is to destroy as many ships of the evil Jahdra-Gallan Alliance as possible without suffering too much damage to your own Interdictor MK III fighter.

The screen display consists of an impressive array of instruments to aid you in your mission, particularly those which help in the difficult process of identifying approaching craft.

There are a number of direction and range indicators and, most useful of all, the transponder. This is a device that transmits and receives identifying signals from other craft, and should help you to decide whether to run, disengage or fight. A neat tactic uses the ability of your MK III to mimic the signal transmitted by other craft: for example, you approach a Gallanic Cruiser transmitting as if you were a similar craft. Once you are in laser range, open fire.

This tactic has one small drawback—you are never sure that the ship you are about to blow up isn't another MK III employing the same strategy. The penalty for destroying your own ships is severe and should be avoided.

Skilled pilots will be able to distinguish approaching craft by their acceleration rates and relative deflector shield strengths, which could dramatically increase life expectancy as early identification will allow you to warm up your lasers in time. This is crucial as warm-up can take 18 seconds—a long time to wait while someone's taking pot shots at you.

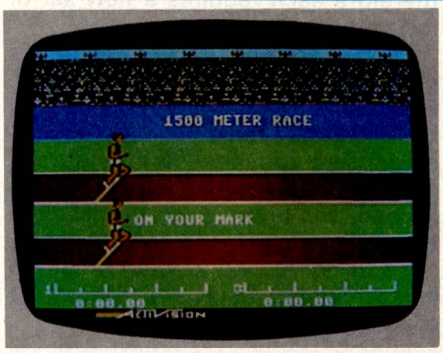
A successful recovery by a starbase is rewarded by promotion and the chance to fly again.

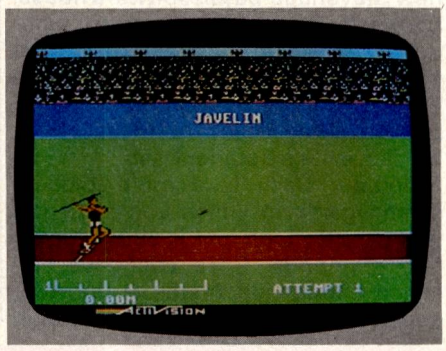
If you'd rather not risk life and limb you can always train on the simulator before flying for real, when your performance is recorded in your career record and can be saved to either tape or disk.

This superb game is completed by an impressive 50-page instruction book, which includes memos from your command warning you that ramming is not an approved method of attack, although it's effective.

Interdictor Pilot is written by a now compulsory RAF pilot, which accounts for the game's realistic feel.

It's not the cheapest game around but, in my opinion, it's certainly one of the best.





Olympic waggling

Title: Decathlon
Computer: Commodore 64
Supplier: Activision
Format: Cassette
Price: £7.95

Can you beat Daley Thompson's Olympic score? That's the challenge of this gruelling game in which you attempt all the decathlon's events in a single session. You can practise against a computer opponent, but the real challenge is when you play against up to three other people.

The graphics are superb and they move smoothly, and believe me you really feel the strain as you pound around the track. You get your man running his socks off by frantically waggling the joystick from side to side.

It's a simple method but effective, and for once the amount of effort you put into the game directly affects your performance.

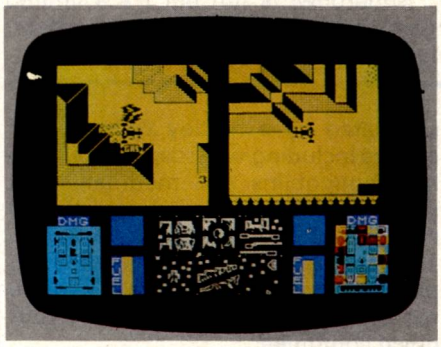
In the throwing and jumping events you achieve your best results by pressing the fire button at just the right moment. The pole vault is the most technically demanding event as it requires a combination of waggling and pressing to get you over the bar safely.

As in the real decathlon you are awarded points based on your performance in each event. A good score of over a 1000 points is met by a fanfare and a cheer from an otherwise silent crowd.

It's unlikely that any two people will be good at the same events, which results in a fascinating contest. In my case I have to score well in the high jump and pole vault in order to build up a sufficient lead to stay in front after the hurdles and 400 metres.

The final event is the 1500 metres and, in my opinion, this is the most demanding, as you have to maintain a fast pace for about three minutes before a gruelling sprint for the line. I'm just glad there isn't a marathon.

It's difficult to find fault with this excellent program, but, after all that hard work, I think it's a shame that there isn't something more interesting than the scores displayed on the screen to congratulate the winner.



Highway code

Title: Battlecars
Computer: 48k Spectrum
Supplier: Games Workshop
Format: Cassette
Price: £7.95

The year is 2081 and motor cars have changed. They are driven by a new breed of gladiators, and are covered in armour and bristle with weapons. They are driven around race circuits and the tight streets of a town in a duel to the death, so strap yourself in and away you go.

You can grapple with either a human or computer opponent, but the human challenge is far more interesting because both players locked in mortal combat are using the same Spectrum keyboard. The control keys used by each player are well laid out, so you shouldn't get in your opponent's way, but before you start you should establish whether tactics such as elbowing are allowed. Joysticks would solve this problem but there are just too many controls required, so the smell of burning rubber (the Spectrum's keyboard) will literally fill the air as the action hots up.

You have remarkable control over your car as you can steer wherever you want, accelerate and brake, drop oil and nails on the road behind you or to the sides, and fire a laser at most angles.

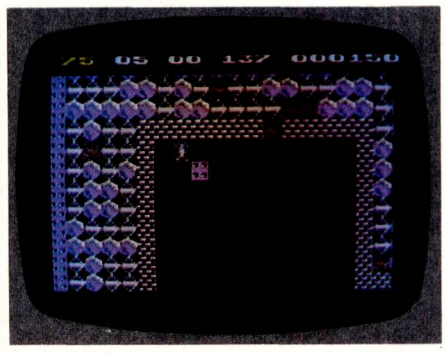
With all this weaponry around it's incredible that the race actually starts, never mind finishes, as you begin the race with a difficult decision. Do you make a run for it and ambush your opponent later, or do you let him have it straightaway?

The screen display helps rather than hinders the action and is split into three windows. Along the bottom is a display that shows a map of the whole circuit, fuel and speed gauges for both cars, and a much-needed damage display. There is, of course, considerable wear and tear on these cars, so there are pits

scattered around the track where you can either refuel or have your car repaired.

The race around the circuit is nominally a contest over five laps, but the town version drops all pretence as you start at opposite ends of the town and it's quite clear there's going to be only one survivor.





Diamonds are a meanie's best friend

Title: Boulder Dash
Computer: Commodore 64
Supplier: Statesoft
Format: Cassette/disk
Price: £8.95/£10.95

Boulder Dash is the third release by a new Stevenage-based software house, Statesoft. Its aim is to import high-quality American software with the first releases from First Star. The others are Flip Flop, a Qbert variant and a super zap-em game called Astrochase, but my favourite's Boulder Dash.

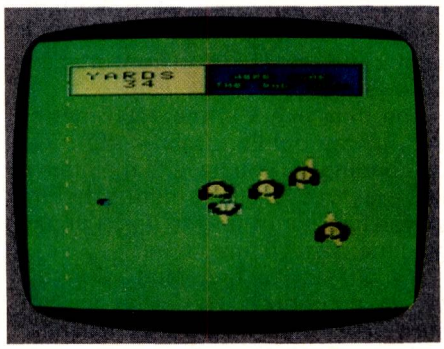
Boulder Dash is a multi-scrolling screen game in which you must dig your way through rock in an attempt to find diamonds. Once you have collected enough diamonds, a doorway appears and you can progress through to the next screen.

However, also in this rock are a number of boulders which will fall on your head if you dig under them, but if you're quick enough you can get out of the way.

This is more than a little reminiscent of an arcade game called The Pit, but Boulder Dash takes that simple idea to its limits. For example, the boulders don't just plummet straight down: they collide and bounce off each other. Knocking one boulder can start an avalanche. Every screen is different and therefore each requires a new set of tactics.

Some screens have diamonds guarded by meanies in enclosed areas, others have free-roaming meanies, and one doesn't appear to have any diamonds. All you can see is a huge green amoeba that's getting bigger by the second, and lower down the screen a trapped group of meanies.

It's up to you what you try, but I'm sure whatever you pick you'll enjoy the challenge.



It's an up-and-downer!

Title: Superbowl
Computer: Dragon 32
Supplier: Cable Software
Format: Cassette
Price: £6.95

Poor Floyd has it all to do. You're a running back for the Dallas Cowboys and have to catch the ball and run 100 yards to score a touchdown. And you've got four downs to do it in.

Unfortunately, realism has taken a time out during this game as you're completely on your own. Not only that, the opposition, the Washington Redskins, seem to have more than 11 players on the pitch. In a memorable 34-yard run, I passed no more than 23 Redskin defenders.

The game is simply four attempts to run a total of a hundred yards dodging lunging defenders as you go. Get clobbered for the fourth time and the game ends with a report on your progress.

That's all there is to it. It's not exactly a simulation of American football but the game-starved Dragon owners will probably like it. It will have to be drastically modified if it's to stand conversion to any other machines where the games market is more competitive. Indeed, if the Dragon is to make anything of its reincarnation the standard of its games must improve.

Superbowl is fun but it's a limited game which won't have the cheerleaders waving their pompoms.



Of critters and crystals . . .

Title: Swords and Sorcery
Computer: BBC B
Supplier: Kansas City
Format: Cassette
Price: £10.35

Kansas goes to great lengths to explain that its new game, Swords and Sorcery, is a quest rather than an adventure game; the difference being that you're no longer alone, and control a party of unlikely characters in an attempt to retrieve four crystals that were once a princess.

It's more a cross between an adventure game and a maze game, as the crystals are dispersed throughout a randomly generated maze. This maze is populated by a motley collection of critters including wizards, priests, goblins, hobgoblins and madmen, who you'll meet at frequent intervals and may either join your party or attack you. This can lead to death and a chance to play again, or you can go on to explore more of the multi-level maze as your quest continues.

The game is well programmed and contains some nice features, such as the function keys used for single key entry of commands like fight, take and drop.

Add to that a strange wailing noise coming from the Beeb to accompany your efforts and you've got a fun game.

END

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ASPECT

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PCW 131

One step at a time

As programming in Basic on a micro is interactive, it's often easier to debug a Basic program by correcting errors as they are flagged at run time; to do the same at machine code level you need a program known as a monitor. Nick Ryman Tubb's Spectrum monitor allows you to single step through machine code programs in order to debug them.

A single step program is probably the most useful debugging tool a machine code programmer can have. It allows him to check his code by stepping through each instruction one at a time, while onscreen the registers and memory are displayed continuously.

At the press of a key the current instruction pointed to by the program counter is executed. Any effect this instruction has will be displayed on the screen. The programmer can then, if need be, change register values, look through or change memory, or simply execute the next instruction.

Single stepping teaches you how each instruction works by giving you a window into your computer. You can try out any instruction, sets of routines given in text books or any of the *PCW* SubSet Z80 routines.

As you step through the code you'll see exactly what is happening, and this will increase your understanding of how the routine operates. See *PCW*'s Teach Yourself Assembler series (February-August 1984) which gives a lot of information on the Z80, and will help you understand how the Z80 operates.

There follows a description of how the single step program and monitor operate. If you feel that you aren't up to this, miss it out and go straight onto the operation section. Once you have mastered machine code using the monitor, go back and read it!

Usually a single step program operates by inserting a breakpoint after each instruction; this is usually the Z80 restart (RST) instruction. However, this type of mode zero interrupt is not available for use on the ZX Spectrum (or other zero-paged ROM systems).

This program uses a separate area of main store memory to which instructions are transferred — one at a time. The instructions can be modified, if necessary, and then executed. This method allows the ROM to be stepped through — like the hardware single step on the Nascom 1 computer.

A Basic hex loader program (Fig 1) has been included to enable you to type in the hex from the listing directly. You must type in the hex code, two digits at a time, from the hex dump/flowchart. Once you have typed in the Basic program, and saved it, type RUN <enter>. The program will then ask you for the decimal starting address (that is, 60000). After typing this in you can then proceed to type in the hex, one byte at a time. Push RETURN after each byte.

The main program (Fig 2) comes in two parts: the single step routine and the monitor. When the first part has been typed in you must push SHIFT+SPACE. Now type RUN and enter the starting address as 61008. You can now type in the second half of the machine code.

When the program has been typed in, break out of the hex loader (SHIFT+SPACE) and save it by:

SAVE "monitor" CODE 60000, 1268 <enter>

Once the machine code has been saved type:

RANDOMIZE USR 60000 <enter>

The screen will clear and a question mark will be displayed at the top left-hand side of the screen. The program is waiting for an execution address (PC). Enter this in hex (for example, 18C1) and push enter.

You'll notice that not only are the values of the registers displayed, but also the next five memory locations to which the register is pointing (these are held inside brackets).

If you start with the address 18C1 (hex) and push 'z' several times, you'll see registers changing; then all the characters on the screen will start to flash. This is because you have just stepped through a ROM routine which makes them flash!

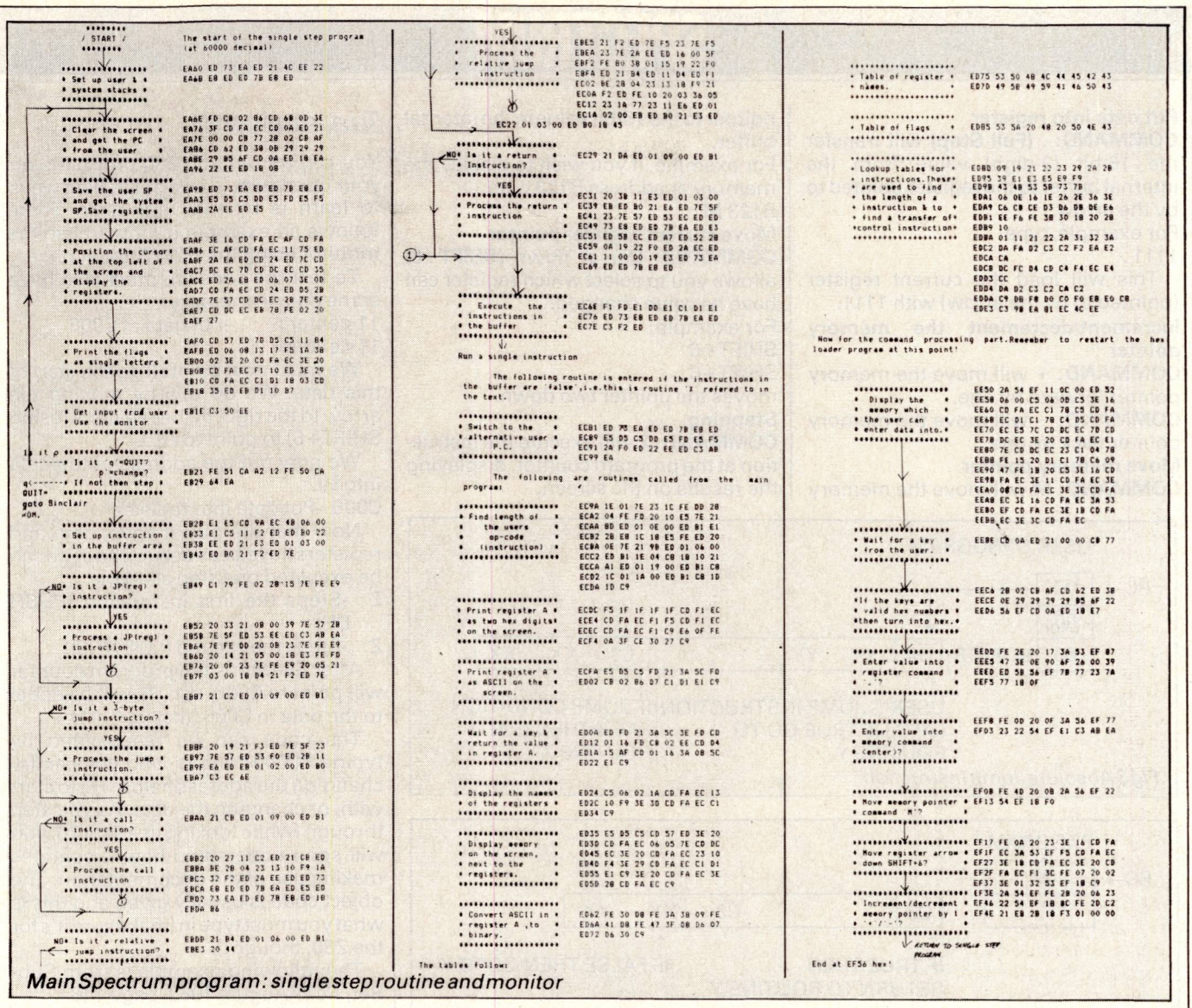
Principle of operation

When the program is run and the user's program counter ('PC') set up, the first instruction is transferred to the buffer area. Here it's tested to find out if it's a change of control op-code (that is, does the program counter need to be changed?).

If the instruction is not a transfer of control (that is, a non-branch instruction), a three-byte jump is inserted after

```
10  REM**********************
20  REM**Hex loader program**
30  REM*(C)TubbResearch,1984*
40  REM**********************
50  CLS
71  PRINTINVERSE1;"ADDRESS";
    INVERSE0;"";INVERSE1;
    "CONTENTS";
    INVERSE0;"";INVERSE
    1;"INPUT"
75  FORy=1TO20
76  LETx=0
80  LET1=4:LETb=add:GOSUB
    1000
90  LET1=2:LETb=PEEKadd:LET
    x=10:GOSUB1000
100 LETx=20
105 LETa$="■■"
110 PRINTATy,x;a$;FLASH1;
    INVERSE1;"?"
111 PAUSE4e4
120 LETi$=INKEY$:IFi$=""THEN
    GOTO120
130 IFCODEi$<>13THENLET
    a$=a$+i$:GOTO110
135 IFLENa$<>2THENGOTO215
140 LETt=0
150 FORp=1TO2
160 LETa=(CODEa$(p))-48
170 IFa>9THENLETa=a-39
180 IFp=1THENLETa=a*16
190 LETt=t+a
200 NEXTp
210 POKEadd,t
215 LETadd=add+1
220 PRINTATy,x;a$;""
230 NEXTy
240 GOTO70
1000 LETa$="":LETa=0
1010 LETc=(b/16-INT(b/16))*16
1040 IFc<=9THENLET
     a$=a$+CHR$(48+c)
1050 IFc>9THENLET
     a$=a$+CHR$(55+c)
1060 LETb=INT(b/16)
1070 IFb<>0THENGOTO1010
1080 FORi=LENa$+1TO1
1090 LETa$+a$+"0"
1100 NEXTi
1110 FORi=LENa$TO1STEP-1:
          PRINTATy,x;a$(iTOi);:
          LETx=x+1:NEXTi
1120 RETURN
```

Fig 1 Hex entry program listing



Main Spectrum program: single step routine and monitor

the user's op-code in the buffer area and the buffer is then executed. The Z80 will execute the user's instruction and the jump; this jump directs control to the single step program which then displays registers, flags and memory contents.

In the case of absolute jumps the jump op-code is transferred to the buffer and the operand (that is, address) is saved. A new operand is copied into the second and third bytes of the instruction so that the jump, if the condition is true, will pass control to routine 'y'. A second jump is copied after the first which points to routine 'x'. If the jump operation fails, control will be passed to routine 'x'.

After the buffer is executed control will be passed to either routine 'x' or routine 'y'. The program counter can then be updated as need be, and the next instruction fetched (Fig 3).

Relative jumps are converted to their absolute jump equivalent and processed as absolute jumps. Call instructions are also converted to their jump equivalent. A return address is pushed onto the stack, and the call is treated as though it were a jump.

A return instruction is transferred to the buffer followed by the three-byte jump to routine 'x'. The return address is unstacked and saved, and the address of routine 'y' is put onto the stack. The buffer is then executed (Fig 4). For all the instructions mentioned so far, the conversions set out in Fig 5 are used.

The 'DJNZ' instruction is converted to the two instructions,

DEC B

JP NZ,<abs>

where the absolute address is calculated from the relative address using the same routine as the relevant jumps (since DJNZ is relative). Jump to register instructions are never directly executed. The target register value is collected and placed in the program counter, and the next instruction is executed:

JP (HL)	JP (IX)	JP (IY)
!	!	!
!	!	!
PC=HL	PC=IX	PC=IY

Restart instructions are executed in the same way as non-branch instructions (Fig 6).

Monitor commands

Eight commands are available from within the monitor. These enable the user to change the data in memory, in the program counter or in a register selected by the user. Documentation of these commands is as follows:

Change Program Counter

COMMAND: P allows the program counter to be changed anywhere in the 64k of addressable memory. After the command is typed, the screen will be cleared and a question mark displayed at the top left-hand of the screen. You can now type address and push 'ENTER'.

Quit

COMMAND: Q resets all the I/O vectors and returns to the Sinclair Basic mode.

Hex Entry (1-9, A-F): these make up the 8- or 16-bit binary numbers which can be entered. Pushing any of these keys stores their value in an internal buffer until another command is executed.

Put data into memory

COMMAND: <ENTER> will enter the data in the buffer to memory and increment the memory pointer.

For example, type:

11 <ENTER>

22 <ENTER>

33 <ENTER>

This will enter the values 11,22,33 (hex) into three consecutive memory locations.

Put data into register
COMMAND: . (Full Stop) will transfer the 16-bit (2-digit) value from the internal buffer to the register pointed to by the arrow.
For example, type:
1111 .

This will load the current register (pointed to by the arrow) with 1111.

Increment/decrement the memory pointer
COMMAND: + will move the memory pointer forward by one.
COMMAND: − will move the memory pointer back by one.

Move memory pointer
COMMAND: M will move the memory pointer to the 16-bit value in the internal buffer.
For example, if you wish to display the memory at address B123 type:
B123 M

Move current register pointer
COMMAND: Cursor down (SHIFT+6) allows you to select which register can have its value changed.
For example:
SHIFT+6
SHIFT+6
moves the pointer two down.

Stepping
COMMAND: Z will execute the instruction at the program counter, displaying the results on the screen.

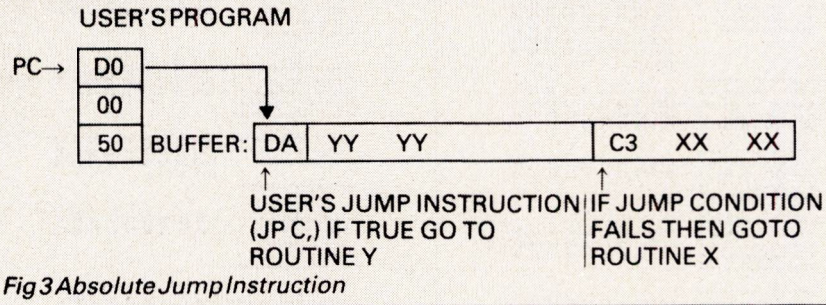


Fig 3 Absolute Jump Instruction

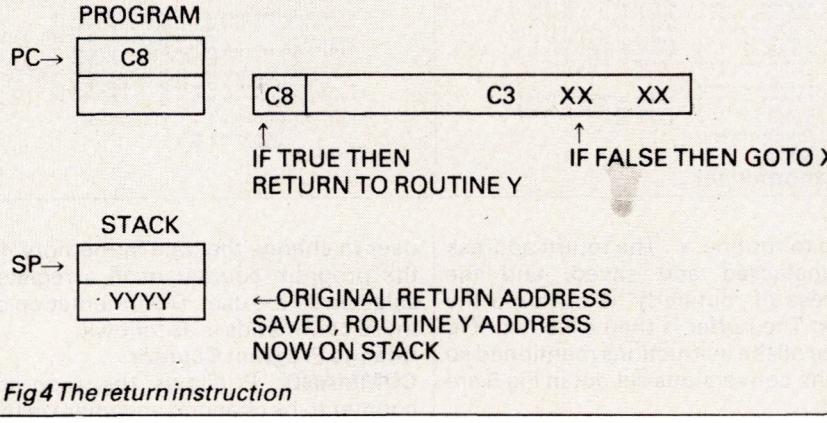


Fig 4 The return instruction

= CONDITION	= CALL	= JUMP	= RELATIVE	= RETURN	=
= C	= DC	= DA	= 38	= D8	=
= M	= FC	= FA	=	= F8	=
= NC	= D4	= D2	= 30	= D0	=
= NONE	= CD	= C3	= 18	= C9	=
= NZ	= C4	= C2	= 20	= C0	=
= P	= F4	= F2	=	= F0	=
= PE	= EC	= EA	=	= E8	=
= PO	= E4	= E2	=	= E0	=
= Z	= CC	= CA	= 28	= C8	=

Fig 5 Instruction conversion chart

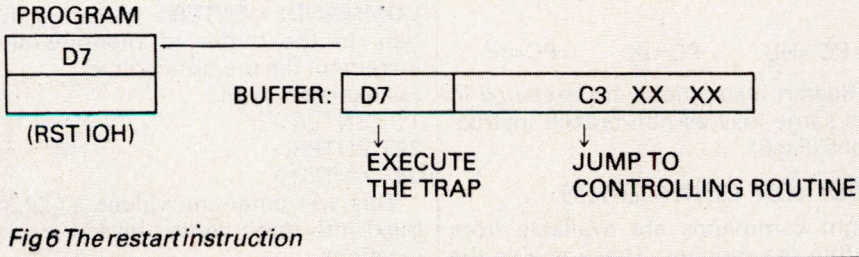


Fig 6 The restart instruction

Trial and error

You can try out any Z80 programs on your Spectrum — one of the best ways to learn is by trial and error. There follows an example of how to use the monitor using the *PCW* SubSet pages.

To test the code we must also have some data in memory:
11<enter> -Put data at C006
11<enter>

We must now point HL to the start of this data. We do this by moving the arrow to the right of the registers (using SHIFT+6) to point to HL.

We now put the address of the data into HL:
C006. -Put data into register

Now that the object code, data and registers have been set up, the code can be executed one step at a time:
Z -Steps the first instruction (PUSH DE)
Z -Steps the second (LD E, (HL))

After five steps the program counter will point to C006, and HL will be equal to the data in C006 (that is, 1111).

The code can be re-executed by typing PC000<enter> and you can try changing the address held in HL to start with, or changing the data. As you step through (while looking at a listing), you will soon understand how it operates making use of the documentation. The object code is usually given and this is what you must type in (make sure it's for the Z80, though!).

The following example is from SubSet, *PCW* August 1982, page 146.

The instruction 'LD HL, (HL)' is not supported by the Z80 CPU (a reader submitted some code to simulate this instruction). The code will load the register pair HL with the contents of memory pointed to by HL.

The code to do this is given below:

PUSH DE	D5
LD E,(HL)	5E
INC HL	23
LD D,(HL)	56
EX DE,HL	EB
POP DE	D1

Load the monitor by :LOAD "monitor"CODE. Execute the monitor by: RANDOMIZE USR 60000, and type in the start address of the code:
C000 <enter>

We now want to enter the six hex bytes given on the right above:

C000M	-This moves memory to C000 hex
D5<enter>	This puts D5 at C000 and moves memory by one.
5E<enter>	This puts 5E at C001
D1<enter>	This put D1 at C005

Note that the single step routine will *not* work if you execute any of the three following instructions:
RETI (op-code ED40)
RETN (op-code ED45)
DI (op-code F3)

END

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Mind over matter

Research is currently under way into the building of a computer with the power to mimic the awesome processing structure of the human brain. Michael Stevens reveals some remarkable similarities between recent innovations in computer technology and the way in which the brain works.

Nothing short of immortality (and a king's ransom) awaits the designer of a computer system capable of intelligent behaviour of the same scope and power as the human mind. Despite this attractive prize, Artificial Intelligence (AI) researchers are not single-mindedly trying to create machines in their own image.

Computer technology, more than any other development in the history of mankind, has emphasised human fallibility and shown us that our way of doing things is not necessarily the best. Computers already surpass the brain as number crunchers and organisers of massed information because they do it in a more efficient way.

Unreliable access

If you've ever fumbled in vain to recall that piece of information on the tip of your tongue, you'll be aware of one of the major failings of the brain — the unreliability of access to its database. Even though the power of the brain's memory system is greater than any computer system yet conceived, the way it achieves this power creates the occasional bug which temporarily fouls the system. In addition, the major part of the brain's 'work' is carried out in the short-term memory which, like the Von Neumann arrangement of a Central Processing Unit (CPU) mediating between input, memory, and output, has a limited processing capacity. It can only hold about seven or eight pieces of information at one time, but it does excel in being able to swiftly change its contents according to the many demands made upon our attention.

This facility is provided by the most important structure in the short-term memory system, known, unfortunately, as the *hippocampus*. We actually have two of these, one in each half, or hemisphere, of the brain, specialised for logical sequences and patterns of information. The hippocampus compares sets of information to discover their similarities and differences; it evaluates the importance of information by comparing it with past experience recorded in the memory, and decides how it should be processed. It's a sophisticated filing mechanism which selectively routes information to various processing systems, including its proper location in memory, by drawing upon the whole of the database (or past experience) for its operating instructions.

Novelty and habituation

By comparison with previous experience the hippocampus can determine when a specific state exists, or when certain conditions are fulfilled. It's essential to the 'interrupt' and 'stop' functions which decide when specific programs should end, and when the content and direction of information processing should be changed. The hippocampus also helps determine the importance of particular tasks or events by comparing them with experience stored in the database, so we can devote the necessary processing resources to them. Wired into this system is a particular sensitivity to *novelty*, which has obvious survival advantages. It's also partly responsible for *habituation* to repeated stimuli, enabling the brain to jump familiar intermediate steps in processing, and preventing wastage of limited processing resources on 'uninteresting' events.

Both these facilities have been recreated at a conceptual level on computer systems. For example, Douglas Lenat's system designed to formulate mathematical concepts has several primitive equivalents initially built into it at a high level. One of these is an interest in sets of information which fulfil a number of criteria, including the equivalent of novelty (a new set of information) and habituation (a common set of information). Lenat's system is therefore able to sort new information to discover how it compares with that already stored in the database, and determine what processing action is necessary — a facility much the same as that provided by the hippocampus in the human brain.

Using such high-level concepts, computers can mimic functions of the brain without becoming involved in the mechanical complexities of how the brain works.

Motivation

Another area in which 'mimicry' has been achieved is the computer equivalent of human motivation. An important influence on motivated behaviour is the emotions, which are essential in giving direction and personal meaning to our thinking and behaviour.

To produce an AI system of significant complexity, we would have to give it something analogous to the emotions. At present this is done by weighting — instructing the system that a particular event or set of circumstances has more value (or gives greater pleasure?) than others in terms of whether they begin to achieve the intended goals of the system. Weighting may be ideally suited to chess programs and the like, but brief consideration of the variety of human motives highlights the complexity and even the undesirability of following this line of research.

Even so, emotions result from assessing the personal meaning and value of experience at any particular moment; this is achieved by comparing our current situation with past experience. For a computer to do this it would need to learn from experience as we do — a researcher's dream. Such a system would be able to change its processing strategies according to its past mistakes and successes — the fundamental basis of all intelligent behaviour.

At birth our brain has a genetically determined pattern of 'wiring'. As we develop our experience is analysed and split into its different components, which are routed throughout the brain in fixed patterns representing specific experiences. Like the picture on a jigsaw, they only reveal their full meaning when all the pieces are in the correct place. Each time the brain processes information, the content of that information fractionally alters its circuitry. In this way, rules for manipulating information (or fitting together jigsaw pieces) gradually evolve, and the programs which coordinate information processing through the various systems of the brain are formed. The world model, which is gradually deposited in the brain's circuitry in this way, guides our thinking and behaviour.

There are two basic ways of producing AI systems which could function with an 'adult' understanding. Either

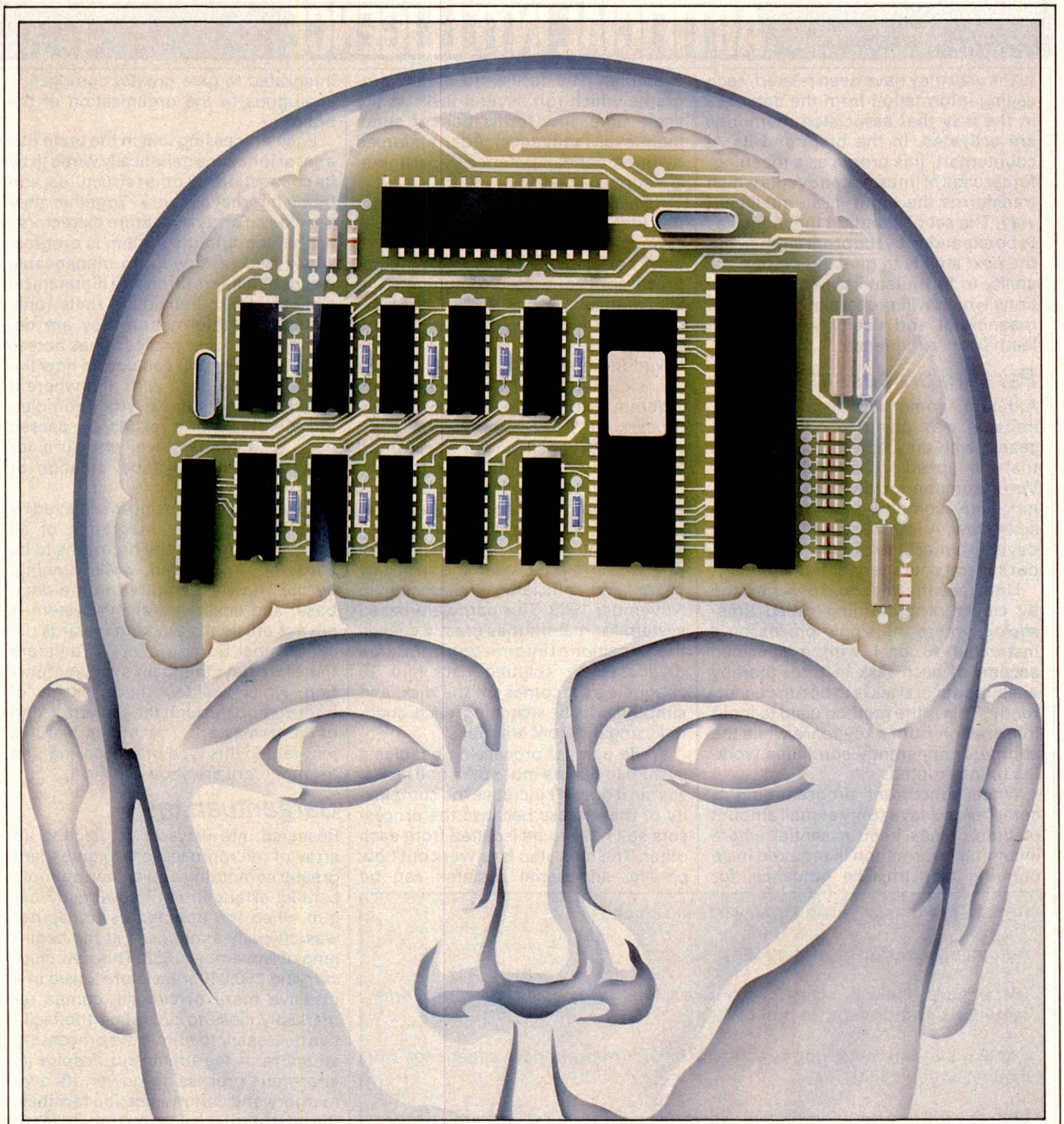

Illustration by Melvin Smith (The London Agency)

they're supplied with the knowledge we acquire as we grow up in a similarly organised way, or we create systems which learn as they 'experience' various situations. Both these approaches present enormous problems for the AI researcher. For example, how exactly are rules, concepts and values (its programs) represented in the brain and how do we learn them? Currently we seem to be making more progress in the area of supplying AI systems with their world knowledge ready-structured in high-level languages. The primitive computer equivalent of information stored in the brain is the keywords and patterns which form the database of some AI programs.

By association input to the brain triggers specific patterns of recalled information, depending on the content of the input and the memory structure which has evolved from previous input. This information is therefore part of a much larger and immensely complex web of interrelated data, and when one piece of information is recalled (like taking one piece of a jigsaw) it has a fixed relationship to the whole of the memory structure (or jigsaw picture) — the whole of our past experience. In this way, contextual rules, relationships and associations are automatically assigned to input and determine the way it's to be processed (or where the piece of jigsaw fits).

The fifth generation languages, Logo and Prolog, both usually written in Lisp, are moving towards the provision of a conceptual framework that will mimic the huge range of relationships among data and the rules governing them, which are created in the ramifying structure of the brain. These languages enable us to simulate complex data structures, but avoid the problem of copying the brain's processes. High-level languages are therefore one way of producing a database of the kind which evolves in the brain through learning.

The so-called 'declarative' languages like Prolog enable us to describe relationships between data rather than instructing a processor to manipulate it in a particular way. Instead of defining the procedure for solving a problem, they have the facilities for definition of the rules governing its solution.

When a program written in this type of language is run, the standard functions call upon one another according

to the way they have been related, each calling information from the database in the way that associated memories are activated. In the brain and its AI counterpart, this produces a meaningful cascade of interrelated events which transforms the input in an intelligent way. The set of standard functions has to be expanded by the programmer, but the next step is to give the system the ability to formulate its own new functions which will process input in more meaningful and useful ways. It will learn from 'experience'.

Parallel processing

Although some will dispute it, new impetus was given to computer research with the depressing realisation that the 'speed limits' of the existing Von Neumann architecture make running very complex programs impossibly slow. A logical step was to try to develop a machine capable of carrying out several operations simultaneously.

Until recently this could only be done by clever programming called time-slicing, where the single processor is instructed to deal with a specified section of each task in turn, thereby enabling several tasks to be run concurrently. This is the method used to input information from a keyboard while the computer apparently continues working uninterrupted.

While concurrent programming is complex and saves only a small amount of time, it has been essential where incoming information is required in an ongoing task (missile guidance, for example). The facility to create programs which run several tasks at the same time now forms part of some high-level languages. Ada, endorsed by the American Defence Department, is a sophisticated example.

Realising that time-slicing was not the ideal solution, the question was soon asked: 'Instead of using one CPU, why not use a collection of microprocessors connected together?' True 'simultaneity', as it's known, has now been achieved on systems using more than one microprocessor, which are linked in parallel so theoretically they can simultaneously handle as many different operations as there are microprocessors. This will eventually do away with the need for time-slicing, and the Occam programming language is designed to take advantage of systems with multiple microprocessors. One application of the parallel channel idea is ICL's Content Addressable File Store (CAFS), developed over the past few years and officially announced in November 1983. This hardware-based system for mainframes greatly speeds the extraction of information from large databases by splitting data into 16 channels as it comes off the disk, and simultaneously searching each channel using different criteria.

While parallel processing enables a system to handle more than one task at a time, it doesn't increase the complexity of these tasks because the processors still have to be isolated from each other. The next step is to work out how parallel and serial systems can be integrated to give greater complexity, analogous to the organisation of the brain.

Each processing unit in the brain has a set of functions genetically wired in by its connections to other structures, and by its internal circuitry. Together they provide an array of 'feature extractors', so that input to the system is progressively broken down into manageable pieces as it filters through a hierarchical analytic tree. Individual units only receive the information they are designed to process and each has access to a database, so it can decide how the input is to be dealt with and where it should be routed next. After completing their tasks, the results are passed back to a higher level structure for integration into a global solution or routine.

Purposeful processing is achieved by serial and parallel integration of all units. This enables the programs to be constantly monitored, while running, by the knowledge stored in the database, and ensures that the system is always efficiently working towards the correct goal. Some processing units are therefore devoted to an overseer function which guides the passage of information through the system, a kind of 'routemaster'. The major features inherent in this type of processing unit arrangement are shown in Fig 1.

Gargantuan task

Research into ways of connecting an array of microprocessors to give them greater computing power than a simple parallel arrangement had already begun when the new Inmos transputer was officially announced at the beginning of November 1983. This new chip, carrying 250,000 transistors linked in a massive maze of circuits, comes remarkably close to providing the facilities necessary to mimic the processing structure of the brain. But despite its enormous processing power, its own memory and communication facilities, the next step — using the transputer to create a truly intelligent machine — is a gargantuan one. How do we connect them in the appropriate configuration, and what selective modifications need to be made to their internal architecture to suit specific functions?

At London's Imperial College, a team is already exploring the use of multiple arrays of interacting transputers. Designated the Alice (Applicative Language Idealised Computing Engine) Project it will combine 64 transputers in a sophisticated knowledge-based system. The team hopes to have a prototype running by 1985, and its progress could tell us how well suited this new chip is to AI applications.

With the wider use of this and similar innovations, we can expect a period of accelerated advancement in computer technology. END

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Automatic selection of appropriate programs.

Hierarchical analysis, with feature extractors, which cuts down the time required and adds depth to processing.

Continuous pattern-seeking by comparison of current and past 'experience' for content and relations.

Concept and rule formation which evolve through the analysis of 'experience'.

A dynamic system which allocates limited processing resources according to perceived needs.

An emotion equivalent to providing 'motives' for action and to guide information processing.

Capable of learning — keeping track of all processing and continuously rewriting programs to accommodate new 'experience'.

Automatisation of habitual strategies to conserve limited processing resources.

Relational databases whose mapping is determined by the probability of relations among data, and between data and rules, and which are updated by 'experience'.

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Fig 1 Major features of a human-like AI system

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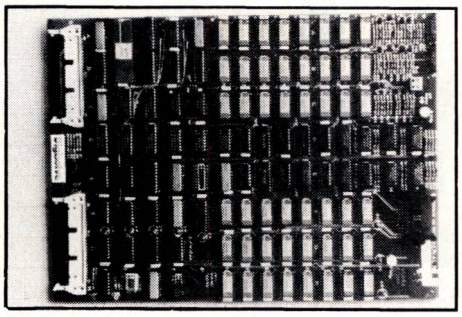

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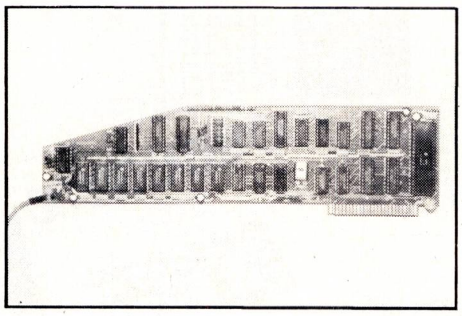

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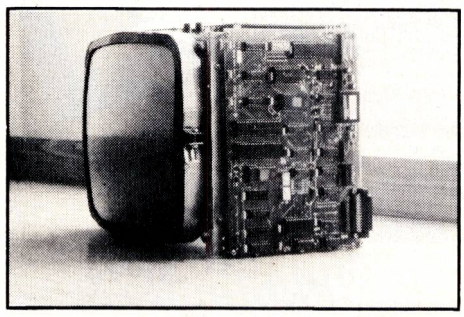

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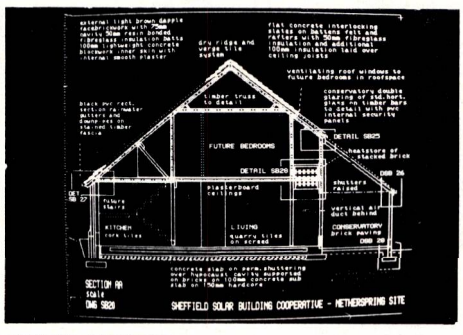

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A friendly approach

It's the little things in life that count, or so says Peter Gerrard as he suggests ways of solving minor programming problems on the Commodore 64 before tackling the larger, more infamous ones.

One of the great problems facing any Commodore 64 user is the lack of commands to enable him to use graphics and sound. This is a well-known failing of the machine, and has been much lamented and criticised in the past.

However, there are other less spectacular but rectifiable failures, so I'll take a look at some of them and offer one or two solutions.

Input

The first major failing is on the INPUT statement. As Commodore users will know, it takes the following form:

```
10 INPUTA$
```

or

```
10 INPUT "NAME PLEASE";A$
```

In a badly written program, this can cause many problems for the unwary. If the user, by mistake or design, presses the RETURN key, then A$ will contain a null string and cause all kinds of problems at a later stage.

But there are simple ways around this. You could add to the one line above in the following way:

```
20 IFA$ = ""THEN" TYPE SOMETHING
   IN!": GOTO10
```

However, this is not a very professional way of solving things, and is hardly likely to inspire confidence in anyone using the program. One could, for example, type SHIFT and RUN/STOP and, with perseverance, break out of the program. Another common way of preventing the problem is as follows:

```
10 INPUT "NAME PLEASE *[3CL]";A$
```

Here, a flashing star will appear in place of the cursor ([3L] meaning 'press the cursor left key three times), and a line like:

```
20 IFA$ ="*"THEN? "[2CU]": GOTO10
```

will trap the pressing of the RETURN key on its own, as that action will put an asterisk into A$. Even this is fraught with danger though, since the user can easily use the cursor keys to move the cursor around the screen and thoroughly ruin everything. One possible solution is to use a routine as shown in Fig 1. We'll go through this line by line in a moment, but first of all here's a brief outline of its capabilities.

Input subroutine: the routine only allows the user to enter characters whose ASCII (or rather COMSCII) value is less than 96. That is, the cursor keys cannot be used to disturb the input prompt, the shift key cannot be used in conjunction with any character, and by some later checking a RETURN over a null string will not be allowed to drop through.

Explanation: line 6 CHR$(8) inhibits the action of the shift and Commodore logo keys combined; CHR$(9) gets it back again. The latter part of the line clears the screen and turns the print mode to yellow.

The '*N*ow what' prompt is printed up by line 10. Note the italicised 'N' in the word 'Now': this is the Epson FX80 printer's way of saying that it doesn't like Commodore 64 upper case characters. When you enter the program, enter everything in normal mode and use the shift key to get that '*N*'. The latter part of the line sends control to the master subroutine.

Line 12 is an option. Line 15 prints out what was typed in just to prove it, and goes back for another input.

Our comment string CM$ is declared to be equal to zero in line 60014. Line 60015 prints CTRL and 9, a space, CTRL and 0, and a cursor left respectively. Ignore the commas — they are only present to make the listing more legible, but don't forget that all-important semicolon at the end.

Line 60016 is a straightforward GET loop, which will wait until a key is pressed. The ASCII value of the key pressed is checked in line 60017, and if it's greater than 95 then we don't want to know, so back to line 60016 again. If you only wanted a numeric input, for example, you could check for ASCII values in the range 48 to 57, not forgetting 13 for a RETURN key press and 20 for the DELETE key.

Line 60018 checks the length of the input string, and if it's greater than 20 characters go to line 60022. Again, this limit can easily be changed to suit your own requirements.

If the ASCII value is greater than 31, line 60020 adds that character to our input string CM$, and echoes the character onto the screen before going back to line 60016 for more. If the ASCII value was 13 (the RETURN key has been

```
6 PRINT CHR$(8):PRINT"[CLR,YEL]"
7 REM INHIBIT CBM LOGO AND SHIFT KEY ACTION
8 POKE53280,0:POKE53281,0:POKE53272,23
9 REM BLACK BORDER, BLACK BACKGROUND, AND UPPER/LOWER CASE
10 PRINT "NOW WHAT ";:GOSUB60000
12 IFCM$="QUIT"THENPRINT"[CLR]END":END
15 PRINTCM$:GOTO10
60000 REM **********************
60002 REM *  INPUT SUBROUTINE  *
60004 REM *                    *
60006 REM *      PCW 1984      *
60008 REM **********************
60014 CM$=""
60015 PRINT"[RVS,SP,OFF,CL]";
60016 GETZ$:IFZ$=""THEN60016
60017 Z=ASC(Z$):IFZ>95THEN60016
60018 ZL=LEN(CM$):IFZL>20THEN60022
60020 IFZ>31THENCM$=CM$+Z$:PRINTZ$;:GOTO60015
60022 IFZ=13ANDZL THENPRINT" ":RETURN
60024 IFZ=20ANDZL THENCM$=LEFT$(CM$,ZL-1):PRINTZ$;
60026 GOTO60015

READY.
```

Fig 1 Input subroutine

pressed) line 60022 checks that the length of the string, ZL, is greater than ZL (here we're simply checking to see whether it has any length or not, which are of course the same thing since you can't have a negative string: don't all write in at once). If it's greater, the line prints a space and returns from the subroutine.

If the ASCII value was 13 (the delete key) and the input string has a length greater than zero, line 60024 reduces the input string using the LEFT$ command and echoes that delete key press onto the screen.

Finally, line 60026 trots back to line 60015 to start anew with the next character.

This is a general purpose routine that can easily be changed to suit specific purposes. You can also remove the function of the STOP key, which is the only way of breaking into that routine; this is achieved by a POKE808,239 and life returns to normal with a POKE808, 237.

As a general rule, don't do this until you're sure the program is working correctly, since there are few things more annoying than making numerous alterations to the program, running it, and then discovering that you can't break into your now totally crash-proof program to save the new version.

User-friendliness

The program outlined above is easy to use and simple in operation and illustrates the principle of user-friendliness. However, it's a shame to spoil a program for a ha'porth of bytes, and all too often most of us have come across commercial programs that seem to do everything right, but have one or two niggling little errors which convince us that really, the program isn't very good at all.

Common problems

Inputs, like certain people, never seem to go away, and one of the most common mistakes made in programs is this:

```
10 PRINT "ANOTHER GAME (Y OR N)?"
20 GETA$: IFA$= ""THEN20
30 IFA$="Y"THEN1000: REM
   ANOTHER RUN
40 SYS64738: REM RE-SET THE
   MACHINE
```

The programmer has assumed that the user, by the act of not pressing the 'Y' key, does not want to play another game. It's all too easy to press the wrong key, here with dire consequences. A check along the lines of:

```
40 IFA$= "N"THENPRINT"BYE.": END
50 GOTO20
```

Another frequent problem is not inhibiting the action of the Commodore logo and shift keys in games that use high resolution graphics, with the result that displays can look quite ridiculous at times. A straightforward PRINT CHR$(8) solves this problem and PRINT CHR$(9) gets us back to normal.

It's often possible to enter a number into a program when the program really wants a string, or *vice versa*. Fig 2 is a menu selector, and only allows the user to press the right keys.

Menu selection: this, like our earlier input routine, is a general purpose program that can easily be adapted for individual needs. Basically, it prints a set of options and waits for a key to be pressed. If the right key is not pressed, nothing happens; but if it is, control passes to the required part of the program before returning to the menu.

'Sorting out the minor program problems before encountering the major ones will give them a degree of authority and professionalism.'

Explanation: Lines 20-100 print up a list of menu options (not very exciting I know, but it suits our purposes). Line 120 prints up a simple message, while line 130 transfers program execution to the subroutine starting at line 2000, which checks for the key press.

The keyboard buffer is cleared by line 2000 to prevent keystrokes being stored up. Line 2001 is a simple GET statement. In line 2002, if the 'Q' key is pressed the 'QUIT' option has been selected, so the program ends. Line 2004 checks on the ASCII value of the key being pressed. If this is less than 49 or greater than 57, the key pressed was not a numeric in the range one to nine, so ignore it and wait until a suitable proper key is pressed.

Using the ON . . . GOTO command, line 2006 scales down the ASCII value until it falls into the range one to eight, and goes to the required part of the program. Lines 3000-10000 are brief routines to inform the user which option has been selected. Of course, in your own programs this instruction would be more extensive.

Conclusion

Sorting out the minor program problems before encountering the major ones will not only make the writing of programs easier, but it will give them a degree of authority and professionalism.

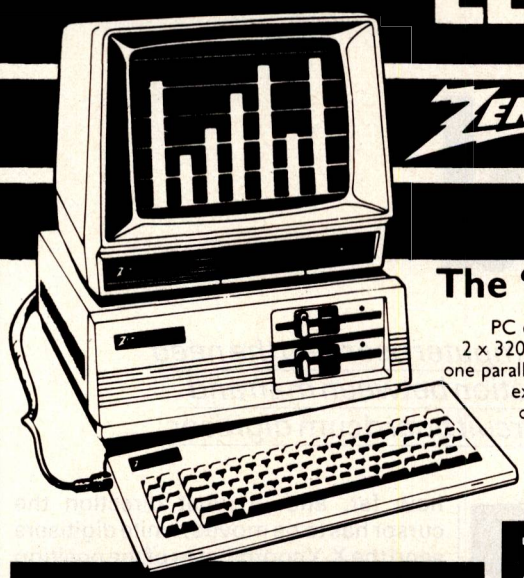
The programs presented here are specifically for the Commodore 64, but can be transferred to other machines as required. END

```
4 PRINTCHR$(8)
5 REM INHIBIT CBM LOGO AND SHIFT KEY ACTION
6 POKE53280,0:POKE53281,0:PRINT"[CLR,YEL]":POKE53272,23
7 REM BLACK BORDER, BLACK BACKGROUND AND UPPER/LOWER CASE
10 REM START OF MENU
20 PRINT"OPTION ONE   : PRESS '1'"
30 PRINT"OPTION TWO   : PRESS '2'"
40 PRINT"OPTION THREE : PRESS '3'"
50 PRINT"OPTION FOUR  : PRESS '4'"
60 PRINT"OPTION FIVE  : PRESS '5'"
70 PRINT"OPTION SIX   : PRESS '6'"
80 PRINT"OPTION SEVEN : PRESS '7'"
90 PRINT"OPTION EIGHT : PRESS '8'"
100 PRINT"TO QUIT     : PRESS 'Q'"
120 PRINT:PRINT:PRINT"PRESS ANY KEY FOR MENU OPTION."
130 GOSUB2000
135 FORI=1TO1000:NEXT
140 GOTO6
1995 REM ******************
1996 REM * MENU SELECTION *
1997 REM *               *
1998 REM *    PCW 1984   *
1999 REM ******************
2000 FORI=1TO10:GETA$:NEXT
2001 GETA$:IFA$=""THEN2001
2002 IFA$="Q"THENPRINT"[CLR]BYE.":END
2004 Z=ASC(A$):IFZ<49ORZ>57THEN2000
2006 ONZ-48GOTO3000,4000,5000,6000,7000,8000,9000,10000
3000 PRINT"OPTION ONE SELECTED":RETURN
4000 PRINT"OPTION TWO SELECTED":RETURN
5000 PRINT"OPTION THREE SELECTED":RETURN
6000 PRINT"OPTION FOUR SELECTED":RETURN
7000 PRINT"OPTION FIVE SELECTED":RETURN
8000 PRINT"OPTION SIX SELECTED":RETURN
9000 PRINT"OPTION SEVEN SELECTED":RETURN
10000 PRINT"OPTION EIGHT SELECTED":RETURN

READY.
```

Fig 2 Menu selection

IN MICROSYSTEMS ONE NAME LEADS THE REST...VSI



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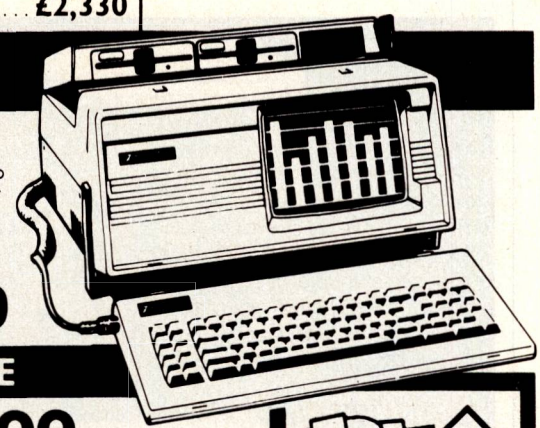

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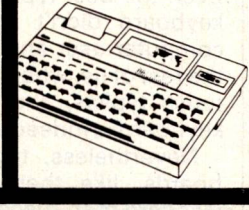



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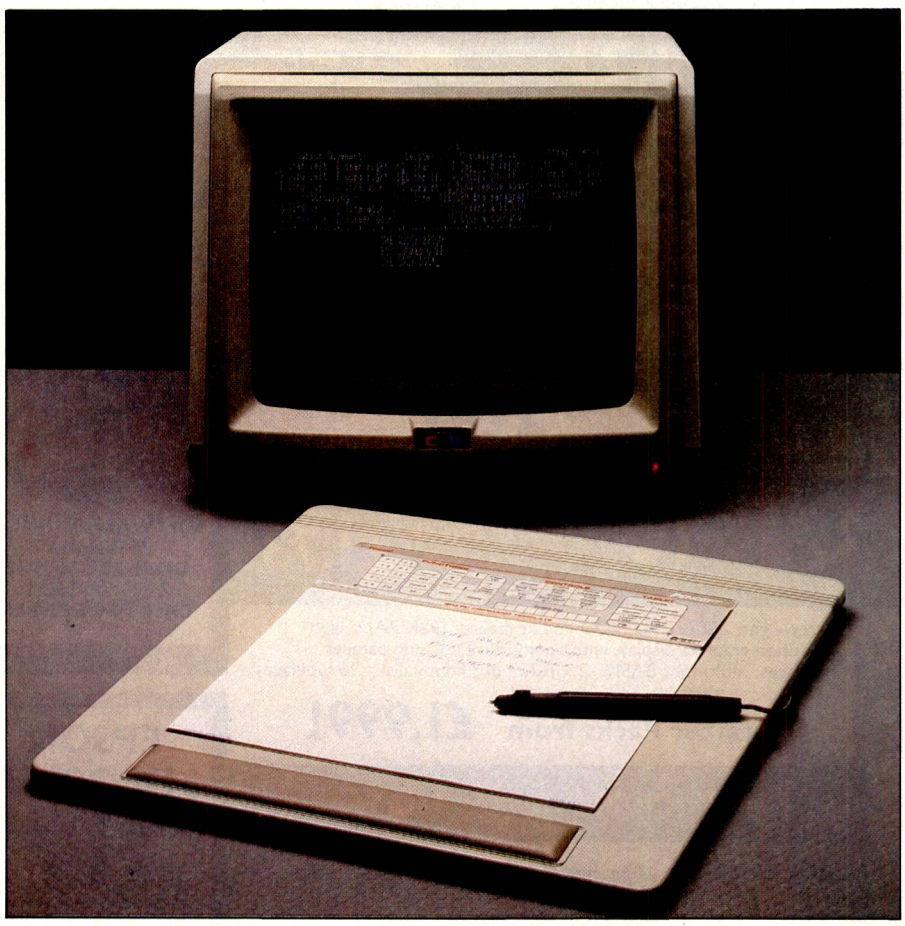
Penpad

Keyboard mastery has apparently evaded many computer users, so the need has arisen for alternative methods of communication between man and machine. Gareth Jefferson considers Penpad, a circuit board cum digitiser tablet for the IBM PC.



Even the best typist must wish that a keyboard didn't stand between the computer user and the computer. For the rest of us, who are less than perfect touch-typists, the standard qwerty keyboard is indeed a real barrier.

Nevertheless, typewriter-style keyboards, like them or not, are the standard man-machine interface as far as data input goes, but their deficiencies have not gone unnoticed and numerous attempts at improvement have been made. The Dvorak keyboard, said to be more 'ergonomic', emerged many years ago; court stenographers have been transcribing proceedings at dictation speed on stenographs; Denis Norden has been using his Microwriter; and a plague of mice has broken out all over the civilised world, but the qwerty keyboard reigns supreme.

However, it has to be admitted that there are some things ordinary keyboards do not do well. They are not particularly convenient for moving cursors about the screen, and are quite hopeless for the direct input of graphics.

Alternative devices

Two classes of device have grown up to overcome these problems — mice and digitisers.

Mice work by telling the computer how far, and in what direction the cursor has to be moved, while digitisers send the X-Y coordinates of the position on a tablet of a stylus or transparent plastic cursor. Mice are ideal for rapidly moving the cursor around the screen, and, to a slightly more limited extent, for inputting graphics. Digitisers are ideal as graphics input devices: they give absolute positional data and generally offer high or very high resolution — at a price.

Pencept Inc of Waltham, Massachusetts offers IBM PC users 'a new and better way to learn and use your PC' thanks to the Penpad, a digitiser that, according to the manual, 'does the work of various specialised computer devices: a typewriter keyboard, a mouse, a touch screen and a digitiser'.

The manual goes on: 'Penpad is very easy to use, because Penpad allows you to work with a pen and paper — just the way you are used to working.'

The claims made for Penpad are impressive: 'With Penpad you don't need a keyboard'; 'With Penpad you don't need special function keys'; 'With Penpad you don't need a mouse or a touch screen'; 'With Penpad you don't need an expensive digitiser.' You do, however, need £830 + VAT for the hardware, and several hundred pounds' worth of 'optional' software to use it. What kind of device do you get for your money, and do the claims really stand up?

The Penpad, distributed by Kode in the UK, comes in two parts: a large circuit board that plugs into a vacant IBM slot, and a digitiser tablet with attached pen. The circuit board is an impressive device in its own right, and has more computing power than many desk-top computers. The heart of the system is a Motorola 68000 supported by 128k of ROM (in 27128 EPROMs) and 64k of RAM. Communication between the board and the tablet, and between the board and the PC, is via two Z80 DARTs (the Z80 DART is a chopped-down SIO that only supports asynchro-

nous communications). The need for this considerable processing power will become apparent when we look at what the Penpad is capable of doing.

The tablet itself is a slim plastic-encased board with an 11in × 11in writing surface, and an area at the top which takes templates. The tablet connects to the PC's circuit board via a cable and a miniature 15-pin D connector. The stylus, which is about the size of a fountain pen, has a built-in ball pen and is connected by a thin cable to a socket at the rear of the tablet. Like most digitisers, it works by transmitting high frequency magnetic pulses which are detected by a coil in the tip of the stylus.

As the blurb suggests, one way of using Penpad is to replace the keyboard and allow handwritten characters to be entered via the tablet, rather than by means of the keyboard in the usual way. Once the PC has been booted up and the standard software loaded, Penpad will function in character recognition mode in parallel with the keyboard. Characters written in the writing area of the tablet, provided they are tolerably well formed, are recognised and transmitted as ordinary ASCII codes. All characters must be written in upper case style, but lower case characters will be transmitted if the letters are written half height.

Portions of the tablet can also be defined as a 'command template', meaning that areas of the tablet will transmit specified character strings when touched by the stylus. In default mode, the top of the tablet is configured to emulate the IBM's non-character keys (function keys, ALT, CTL, backspace, cursor keys, ENTER, and so on). Utilities are available to allow customised templates to be created, and several predefined templates are available for popular applications software such as Lotus 1-2-3 and the IBM Personal Editor.

Penpad can be used in digitiser mode. Unlike the mouse mode, which transmits cursor codes, the digitiser mode bypasses all forms of character recognition and processing. It transmits the X-Y coordinates of the pen position at rates of up to 100 points per second, and with a resolution of up to 200 points per inch. These coordinates can then be processed by the computer entirely under software control. At this digitising speed, and with this degree of resolution, Penpad in digitiser mode should be ideal for medium resolution graphics input in applications such as low-level CAD. It could also be used for the input of Chinese and Japanese characters, notoriously difficult to handle using an ordinary keyboard. Unfortunately, software does not yet exist capable of recognising such complex symbols — not surprising when you consider the processing power needed for just a handful of alphanumerics.

To get full benefit from the Penpad you need more than the basic utilities provided when you purchase the tablet.

Pendraw, available for an extra £165 + VAT, allows simple graphics to be entered and saved on disk with ease. Shapes can be entered onscreen either freehand, or as lines, ellipses or rectangles (by specifying end points or height and width). Other commands, all, incidentally, issued by touching command panels on the command template, include FILL, ERASE, MOVE and COPY. Screens can be saved onto or loaded from disk, and two screens can be held in memory at a time, swappable at a touch of pen to panel. One background and three foreground colours may be used at a time. Text may be added anywhere to the picture by switching to text mode. A useful UNDO function allows second thoughts, and SAVE will save the picture to a named file.

Another software option, Penform, also costs £165. This allows customised forms to be created to your own specifications, although getting these to work with existing applications software is no trivial task for the inexperienced programmer, unless the form is only going to send ASCII codes and strings already recognised by the program. Penform is a powerful piece of software that is comparatively straightforward to use, first by creating a blank form and then by defining the fields within it. At a form's creation stage, some quite sophisticated data entry error checking can be built in by specifying allowable data types — rather in the way some databases allow only specified types of data to be entered in specific fields.

Allowable data types are: upper case alphabetic, upper case alphanumeric, numeric, check boxes, 'other' (user specifiable), and date and time. Field types can also be specified: data (for normal entries), fill (to hold pre-defined data), and required (for fields with mandatory input).

Usability

There is no doubt that the Penpad is an impressive combination of hardware and software. In mouse mode it works at least as well as a conventional mouse, albeit at a price that would buy a whole nest of mice. As a digitiser it offers medium resolution and high speed — both more than adequate for the IBM's capabilities at a price comparable with other digitisers of similar performance. It would be ideal for CAD applications capable of being run on an IBM.

As a graphics input device it works with incredible ease, and beats cursor keys or joysticks hands down. Try as I might, though, I really couldn't think of any use for the graphics that Pendraw allows you to create — creating logos to go with your programs, perhaps?

As a means of creating and using custom-designed forms and templates, Penpad might be able to justify its cost in a few hypothetical situations. It's certainly easier to jab a pen at a box labelled RETRIEVE than to type the same word in at a keyboard, or to tick a box labelled NEW MEMBER rather than get the same effect on a keyboard. One suggestion is that Penpad would be useful used like this in a warehouse for inventory control, where ham-fisted workers might find a conventional keyboard beyond their powers of concentration or the keys too small for their sausage-like fingers. I find this rather implausible. Better, surely, to train people to use keyboards and have done with it. Keyboard mastery is said to be a marketable skill these days, too!

As for the claim that Penpad does away with the keyboard for text entry, it is frankly laughable. Penpad's character recognition mode puts me in mind of wicked Dr Johnson's comment on women preaching: '. . . like a dog walking on his hinder legs. It is not done well; but you are surprised to find it done at all.' The surprising thing is that Penpad can indeed recognise handwritten letters, provided, that is, you remember to put tops and tails on letter l's and to cross zeros. You also have to keep your eye on the screen at all times. Penpad frequently fails to recognise even carefully formed characters, and seems to find special difficulty with the slash (/), double quotes ("), round brackets and square brackets. If you are a one-finger typist and think that handwritten text entry would be a godsend worth upwards of a thousand pounds, ask the dealer to let you write in DIR B:/W. Watch the screen and if you don't get D1R B1C? or similar after five seconds, Penpad may be for you.

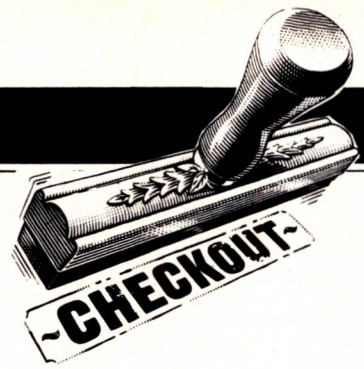
'As a digitiser it offers medium resolution and high speed — both more than adequate for the IBM's capabilities at a price comparable with other digitisers of similar performance. It would be ideal for CAD applications capable of being run on an IBM PC.'

Conclusion

If all you need is a mouse to quickly move the cursor around the screen, then a mouse would be a far better buy.

To justify the cost of the Penpad you either have to have a pressing need for a well engineered digitiser, or be using applications software where the keyboard really gets in the way.

If the applications involve more than a minimum of text entry (and what application doesn't?), even the most inept typist will quickly find the keyboard faster, more accurate and much cheaper. END



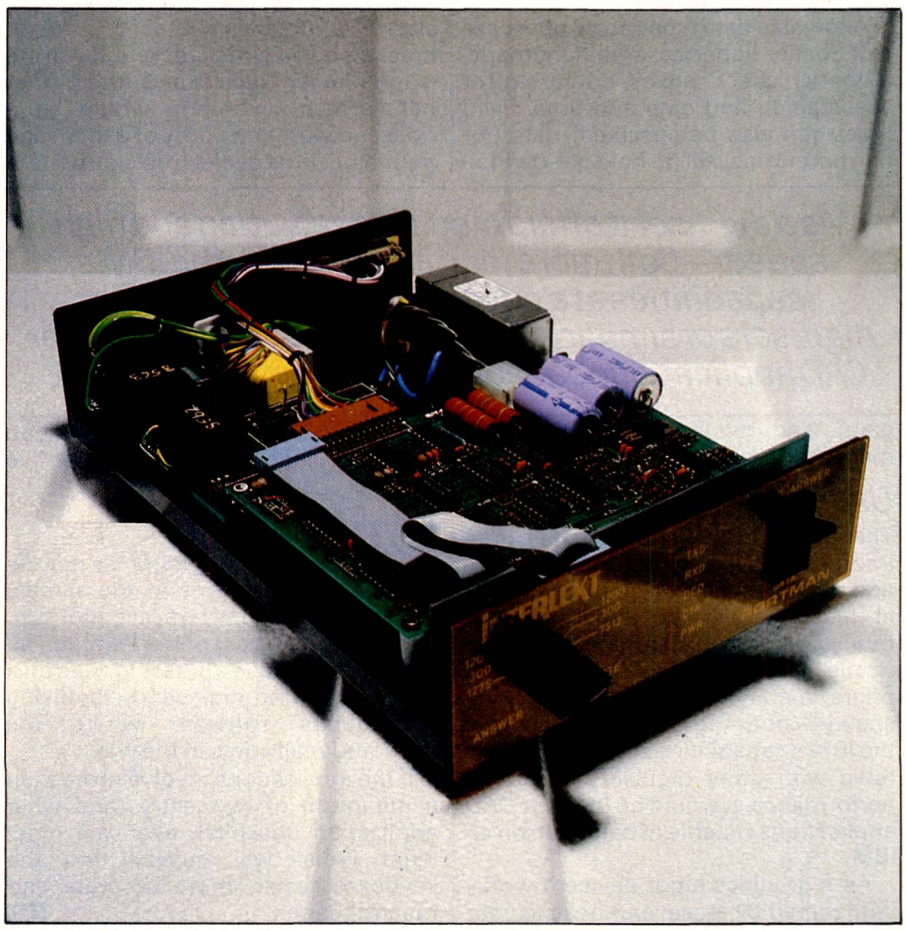
Portman modem

Interlekt, long-standing supplier of professional data communications equipment, has advanced its range with the Portman, a multi-standard modem with BABT approval. Peter Tootill tests the line and reports.

There are now a number of multi-standard modems appearing on the British market. The main advantage these have over the old single-standard types is that one modem gives you access to several different facilities: for example, CCITT V.21 for bulletin boards and many online systems, and V.23 for Prestel.

The Interlekt Portman is a V.21/V.23 modem with built-in, auto-answer capability. It's also one of the first multi-standard modems to be approved by the BABT (British Approvals Board Telecommunications) — use of un-approved modems is illegal. Interlekt is an established modem manufacturer and has been supplying data communications equipment to the professional DP market for about six years. As well as modems, its range of products includes data analysers, local area networks, sophisticated diagnostic equipment for communications applications, and data scramblers.

The Portman costs £195 + VAT and carriage, making a total of around £230. This price excludes an RS232 cable, but includes a cable to connect it to a telephone point, a mains cable and 13 amp plug (you'll need a two-way adaptor if you're using one of the new-style telephone sockets). There are still problems involved in supplying a modem with a telephone socket on the back, so the obvious method of plugging the modem into the telephone socket and the telephone into the back of the modem is not possible. The reason for this is that the new British Telecom telephone sockets are considered *unsafe*, and any equipment incorporating one causes problems with the BABT approvals procedure. Apparently the rules are being changed to make the sockets safe (I would have thought that the *sockets* would have to be changed to make them safe — obviously I've missed a point somewhere!).



First impressions

The Portman arrived well packed in several layers of 'bubble plastic' packing material in a cardboard box inside more layers of bubble packing. It is, however, solidly built in a metal case and should stand a bit of rough handling. The case is painted orange and the front panel is brown. At 6.5in × 10.5in × 2.5in it's large enough to stand a telephone on, which means that it needn't take up any extra space on your desk. The modem weighs 3.6lbs.

The front panel carries two switches and a column of indicator LEDs. The left-hand switch is a six-position rotary type and selects the relevant operating standard: the Portman provides 1200 half duplex, 300 full duplex and 1200/75 asymmetric duplex speed. On the right is the manual/auto-answer toggle switch which has two normal positions and a third 'momentary' contact position; it also carries a green LED to show that the modem is connected to the phone line. This LED is labelled 'data' which is rather misleading as it doesn't indicate the presence of data on the line. This is done by two of the other (red) indicator LEDs. This bank of lights is for 'power', 'data terminal ready' (DTR), 'carrier detect' (DED), and received and transmitted data.

The rear panel carries a standard 25-way (DB-25) RS232 connector, a mains fuse, the mains and telephone connecting cables and an earth tag. The instructions say: 'You are required to

connect the tag marked "Hard wire to protective earth" to a suitable earth.' They don't tell you what a 'suitable earth' is. The reason for the earth is to 'prevent hazardous voltages from passing across the telephone line interface when the Portman is not plugged into the mains.' I suspect that these notes are included to satisfy BABT requirements.

The RS232 socket provides a generous selection of control lines (Fig 1) which should be sufficient for all normal purposes. The use of a standard DB-25 socket is welcome: many systems (micros and modems) have been recently appearing with non-standard sockets which can lead to problems when connecting to them.

Pin	Signal	Name	CCITT No
1	PGND	Protective ground (chassis)	101
2	TD	Transmitted data	103
3	RD	Received data	104
4	RTS	Ready to send	105
5	CTS	Clear to send	106
6	DSR	Data set ready	107
7	SGND	Signal ground	102
8	CD	Carrier detect	109
9	+8v	} test	–
10	−8v	} voltages	–
20	DTR	Data terminal ready	108/2
22	RI	Ring indicator	125

Fig 1 Portman RS232 connections

Inside

Internally the modem is neatly laid out and uses good quality PCBs. There are three of these: the main PCB, the auto-answer PCB and the PCB that carries the front panel controls. Intriguingly there are a number of empty spaces on the main board that are marked for relays and capacitors. These apparently are used in the IDC30, which is a bare board version of the modem designed for OEMs to incorporate in their own equipment. This can be supplied in several versions including auto-dial, with TTL rather than RS232 level outputs, and with software speed selection.

Interlekt is also working on a version of the Portman which will enable micros that cannot handle split baud rates to use Prestel. This will work by buffering the 75 bits/sec line, and allowing the micro to work at 1200 bits/sec full duplex. It is also working on a synchronous adaptor which will allow the modem to be used with high-level protocols such as IBM 2780.

The Portman uses the ubiquitous AM7910 'world standard' modem chip and, although this can provide Bell (US) frequencies as well as CCITT, modems using this feature cannot obtain BABT approval. Interlekt will be producing an export version that will provide both Bell and CCITT frequencies, but this will not be BABT-approved.

In use

The modem is generally straightforward to use. In originate mode you simply dial the number you require and, when you hear the modem tone at the other end, press the toggle switch down and release it. This connects the modem to the line; pressing once again will release the line. One thing not stated in the manual is that the DTR control line must be turned on (that is, taken to at least +3 volts) or pushing the switch down will not connect the modem to the line. If no connection is made to the DTR pin (pin 20 on the RS232 connector) it floats high, but if your micro or terminal does connect to this line it will have to turn it on before you use the modem. In most cases it will do so without any further action on your part, so you won't normally have any problems.

In manual answer mode the modem presents no difficulties. You use one switch to set the operating standard and the other to switch the modem on or off line. Auto-answer also gave no problems despite the manual's vagueness. I originally wasn't sure whether the RI method of auto-answering was supported and, as my BBS software is set up to use this method, I wondered if I would have to reconfigure it to use the Portman on my system. In fact, all I did was plug the modem into the telephone socket line at one end (using a two-way adaptor), and plug the RS232 cable from the computer into the socket on the modem (no problems with non-standard sockets here). I then set the rotary switch to '300 answer', pushed the toggle switch to auto-answer, and sat back and waited. Within a few moments the next caller had rung in and the modem behaved beautifully. I left it working for a few days continuously and there was no sign of over-heating, or any unusual problems with data corruption or lost carriers. The Portman also dropped the line cleanly if no carrier was detected, and at the end of a call.

The modem worked perfectly at the other speeds too, and I liked the generous provision of LEDs on the front panel. 'Power', 'online' and 'carrier' are common, but the 'DTR', 'transmit' and 'receive data' are less common. They make it much easier to work out what is going on should you have any problems.

One absent feature is a test mode in which the modem, when offline, echoes back data to the terminal as you type at the keyboard. This, also, is a very useful feature when setting up or trying to work out what has gone wrong if things are not going according to plan.

Documentation

This gives useful basic information about connecting up and using the modem. It's generally adequate, although the section on using the modem in 'auto-answer' mode (that is, to answer the telephone automatically without any human intervention) is a little superficial. It doesn't, for example, discuss the two main methods of auto-answer. These are:

a) where the modem answers the phone as soon as it rings and informs the computer when it gets a carrier; and

b) where the modem tells the computer that the phone is ringing (using the ring indicator (RI) line), and lets the computer decide whether or not to answer it.

The Portman supports both methods of auto-answer depending on whether DTR is already set high on receipt of a call. The manual doesn't make any reference to this, but in fairness most users will just plug it in and it should work without any problem. Method (b) is useful if you want to implement a 'ring back' system, or to have the modem answer calls during certain hours only. A little more explanation of how the auto-answer system works would be helpful to those wanting to do the slightly more unusual things.

The last page of the manual contains a sevice registration card (there's a two year 'return to factory' warranty on the modem), and a card to send to British Telecom to tell it that you're going to be using the modem and, optionally, to ask it to install a socket.

Interlekt has a national service organisation and can offer a post warranty service agreement.

The manual provides no information about accessing the other transmission modes that the chip is capable of, such as Bell 103 or CCITT V.23 600 bits/sec mode. It just says that these other modes can be 'supplied on request'. Indeed it stresses that 'there are no user-accessible controls inside the Portman', and 'interference with internal components will invalidate the warranty.'

Conclusion

The Portman is a well made and ergonomic modem. Its only drawbacks are the price, which is higher than some competitors, and the lack of an auto-dial function. The latter won't worry many people and there aren't many other BABT-approved modems around that offer auto-answer facilities. The manual would have been greatly improved by the addition of a 'technical' section, but should be perfectly adequate for the majority of users. END

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SOFTWARE

A different aspect

Kathy Lang views Aspect, a multi-file data management system with a macro generator, aimed at those requiring a powerful package which can be tailored for the naïve user.

Anyone looking for a data management system will find that an increasingly large proportion of those on the market contain many powerful features, which will be used mainly by experienced users who are setting up systems for novices. Presumably this is a reflection of the increased power of the larger micro systems now available, especially the increasing popularity of hard disk systems. It also reflects the growing number of large companies who are buying micro systems by the score for implementation in user departments by experienced data processing staff. Microft Technology's Aspect falls clearly into this category.

Aspect is a multi-file system: that is, it permits several data files of different structures to be related to each other and processed together. The package provides two kinds of relationship: a close-knit link in which records of several different formats may be stored together in a single logical file, and a looser linking of separate files. Individual sets of records, called levels, must have the same structure, but each field within a record occupies only the space needed for the currently stored value. This makes the package economical in file storage for applications containing a lot of varying information, including small amounts of running text.

Aspect is at heart a command-driven package, operated by issuing commands constructed by the user. However, a number of features are provided to help in the construction of commands.

An experienced user can set up menus of macros, which are, in essence, collections of commands for carrying out a particular task. These menus can then be used by the less experienced. Aspect provides a macro generator for creating the most frequently needed types of macro; the generator takes you through each step of macro construction using a combination of menus and question-and-answer techniques to ensure that nothing is forgotten.

Alternatively, most commands (those which do not require the specification of a full-screen display layout) can be used directly, and macros can be directly activated through the 'DO macroname' command. (Macros are very similar to Basic programs with line numbers, while directly enacted commands parallel Basic's Immediate mode.) A particularly attractive feature is that Aspect macros are compiled rather than interpreted (most data management systems with pseudo-programming features interpret their commands), which makes the system relatively fast.

When Aspect is run, the user is asked to enter a password and the date; the main menu is then displayed (Fig 1). If a special menu (which must be called MAINMENU) has been set up for your use, pressing RETURN activates it (1 is the default option on the system menu), and thereafter you are given whatever features the special menu provides.

Constraints

Fig 2 shows the main constraints and features of Aspect. The limit on record size is unusually large, but within it is a limit of 500 characters on each 'level' of the record. Where each record contains only a single level, the 500-character limit applies to the whole record. This will not be a problem in most applications, where the information is truly structured — indeed, the 'level' approach can be very helpful in a good many business applications.

For example, suppose you wish to store customer records which include a name and address (one per customer), invoices (many per customer), and items in invoices (several per invoice). In Aspect, you would define a three-level record, the first level containing the name and address, the second the invoices, and the third the individual items on each invoice. The stipulation which Aspect makes is that each record should be uniquely identifiable by its own key, together with that of the level above it. This means that each invoice for a single customer must have a different invoice identifier, and each item on a single invoice must have a different item identifier.

ASPECT Control Menu
1 Call in MAINMENU
2 Direct Commands
3 Notepad and Macro Display
4 Macro Design and Maintenance
5 File Maintenance
Type in selection number [1]
Press ESCape for Help

Fig 1 Main menu

Where this kind of structured approach is appropriate, it can help to ensure that logical errors do not occur in the data. (Those familiar with relational terminology will recognise the enforcement of second normal form.) The limit of 500 characters will be unimportant, as you can extend this by creating lower levels. However, there are circumstances — notably those where a substantial amount of running text is involved (for example, library catalogues and consultation records) — in which this limit will be highly inconvenient.

Aspect provides the usual data types — numeric, character and date, which may be displayed and entered in a variety of formats, plus a 'multiple value field' format which can be very useful in fields like addresses. This format allows you to have a single generic name for a field which covers several occurrences with the same specification, yet also allows you to refer to the individual occurrences by name. A four-line address can be described with a single name, but you can still refer to each line when setting up the printing of address labels. This feature, coupled with the fact that Aspect does not reserve space for data when fields are empty, means that it would be suitable for applications where much of the data was grouped, the size of each group being variable. An example might be personnel records in a recruitment agency: each person recorded may speak: no

Maximum file size	OSL
Max record size	3500 ch (500/level)
Max no fields	150+
Max field size	120 at present
Max digits	30
Max prime key length	120
Special disk format?	No
File size fixed?	No
Link to ASCII files?	Yes
Data types	C,N,D,Ref
Fixed rec structure?	Yes
Fixed record length stored?	No
Amend rec structure?	Add field-change MAP, otherwise by copying
Link data files?	Yes
No data files open	12+
No sort fields	49
No keys	1 per level
Max key length (chars, fields)	120, 6+
Subsidiary indexes kept up-to-date?	NA
Data validation	Good
Screen formatting	Row/col co-ordinate
Unique keys	Mandatory
Report formatting	Default, row/col coordinates
Store calculated data	Yes
Totals & statistics	Yes
Store selection criteria	Permitted
Combining criteria	And, Or, Not
>1 criterion/field?	Yes
Wild code selection?	String within
Browsing methods	Primary key
Interaction methods	Menus, commands, full tailoring
Reference manual (max 5*)	**
Tutorial guide+ (max 5*)	None
Reference Card+ (max 5*)	None
Online Help+ (max 5*)	**
Hot-line?	Free at present

Notes: + memory dependent—these figures apply to systems with 128k memory

Fig 2 Features and constraints

foreign languages, French, French/German, Swahili, Serbo-Croat; Aspect provides a convenient and economical way of storing such fields.

File creation

The first step in setting up an Aspect datafile is to create a MAP macro, which is simply a set of definitions of each field in the file. Each level in the file has a name, and a key consisting of one or more fields used to identify the record within its level. Aspect requires keys to be unique, so each top-level record, and each record in a single-level file, must have a unique key. No other direct access to records is provided; if you want to retrieve records by specifying values of other fields, you must read the file sequentially.

Once the file definition has been created, you must ask Aspect to create an empty file using that specification. Finally, you must create an INPUT macro, which contains the rules for taking information from the keyboard and storing it in the data file or files. This involves a definition statement for every field, plus various items such as the calculation to be carried out before a field is stored, and whether the field is mandatory. Considerable flexibility in prompting is provided, so that you can specify messages for the operator, their position on the screen, and actions to be taken depending on the value of the operator's responses. You can also specify Help text, to accompany as many fields as you wish, by entering a question mark at the start of the field position.

Aspect allows you to have several INPUT macros for a single data file, and you don't need to include all fields each time. For a personnel record file which contains details of salaries, it's possible to set up an INPUT macro, which does not include the salary field, to enable clerks to amend the records without access to confidential information. You must specify the position each required field is to occupy using row and column coordinates, rather than the more common 'paint-a-screen' method which is usually easier to use. Aspect does not give any indication how the display will look when these coordinates are used—you have to execute the macro to see how your format has worked in practice.

Data input and updating

All data entry from the keyboard is done via an INPUT macro. This must include the key fields necessary to identify the records to be updated; ASPECT allows you to retrieve records for updating only through specification of key fields' values. If you enter a key value which is not in the file, it is assumed that you wish to create a new record. Where there are several key fields, you must specify the value of each exactly; access to lower levels is possible only through the higher. However, by using a feature called 'position control', you can access records in key sequence without specifying the key each time, and you can move between levels.

Data validation is excellent: fields can be checked for accuracy and conformation to particular patterns; updating of fixed fields such as account numbers can be prohibited, and so on.

Records can also be updated in a batch. The features provided are identical with those for extracting subsets of information, and include sorting and calculation. The difference is that records are replaced, rather than copied to a different file. For numeric fields, you can choose whether the result of a calculation is to replace a field value or be added to it.

If you wish to provide facilities for file reading only, you can use the VIEW macro. This works in almost the same way as the INPUT macro, except that you are not permitted to make changes to the record. The other major difference is that you don't have to specify exact keys to start browsing: the 'position control' feature allows you to specify an incomplete key. You will get an error message, but the record pointer will nevertheless be positioned at the start of the first relevant record, and you can then browse through. For example, if you type 'SM' into a five-character key field, you'll be able to browse through all records for which that key begins with the letters SM.

In addition to the display of individual records (one per screen), you can use the REPORT command, either directly or in a macro, to compose lists of summaries of records for display only. These features are identical to those provided for printed reports, and the choice of screen, printer or both for showing reports is governed by a single system switch which can be reset at any time.

Aspect's standard reporting format, unless you specify something more sophisticated, is one row per record, with each field shown across the report in a column with width equal to the maximum size of the field. Using this format, you can limit the fields reported on, and also select particular records. This facility can be used either as a direct command or in a macro. A simple form of the command, used to carry out Benchmark four, follows:

```
REPORT FILE PCWTEST SELECT WHEN
TYPE EQ "DAL" GIVE LIST OF REFNUM
END
```

This command will cause Aspect to select all the records in which the field Type contains the characters DAL, and list the value of the field Refnum for those records; this list can be printed, or appear on the screen. When displaying reports, you can choose to pause every 20 records to have a look at the results. You can produce a summary, showing totals and sub-totals if appropriate, just by changing the parameter LIST or SUMMARY in the example above. It's also possible to set up sets of instructions to be actioned each time a record is read or as each line is printed; for example, to perform intermediate calculations.

More sophisticated layout can be provided by setting output options. These permit you to change the amount of space a field occupies and the spaces between fields, spread each record



SOFTWARE

over several lines, print headers and footers on each page, and so on. You can also request several levels of subtotalling, and specify a page change when any or all of the subtotal level criteria change. Calculations can be performed on subtotals and totals; for example, to permit the display of percentages. The reporting facilities can also be used on external files which use any of the formats Aspect can read.

When selecting records for editing on the screen, you are limited to using key field values. For retrieving records for reports, whether for display on the screen or printing, when writing sets of records to other files (of Aspect format or one of the external formats), or when updating as a batch process, the facilities are much more flexible. Three types of selection are provided: you can select only those records which match records in another file; select records which match a range of values from a single key field; or select records matching a set of criteria using the WHEN option. This option can test any field, and allows you to test with the usual range of comparison operators (=, <, >, and so on, all in conjunction with NOT to reverse their meaning), plus a substring operator which allows you to find characters in a particular position or anywhere in the field. Comparisons may involve field values, constants or expressions; tests may be connected with AND or OR in any combination within a selection, and brackets may be used to force a particular order of evaluation.

When retrieving records for interactive amendment, they appear in key field order. For reporting, whether to the screen, printer or a file, records may be sorted in order by any field or combination of fields in ascending order, using a parameter to the REPORT command. The same options apply when extracting subsets of information with the EXTRACT command.

Calculations may be performed on fields from files, or on memory variables. These must first be defined to give their name, size and type. Calculations may use the normal arithmetic operators, plus a range of functions such as ABS, INT, LOG, and the basic trigonometric functions. Strings may be concatenated together, and new strings created by using the EDIT operator.

Multiple files

Two file linkage methods are provided. A tight link is given through the Level provisions which allow you to specify several different levels in a single logical file, with each level having a different structure. In fact, each level is stored in a separate physical file to ease data retrieval, and to make it easier to be economical with storage, but this need not concern the user.

The number of levels you can have depends on the memory available — the minimum is six, while on a 256k Sirius, 12 are permitted. Since each level is accessed through the level above it via a unique key, the relationship between the different sets of records is predefined. Individual files with their own MAPs may be linked to one another in ways that are not predefined, but are specified through the LINK option in the INPUT and REPORT commands. The use of levels constrains you to a particular structure, but gives protection against storing invalid data. The LINK mechanism, on the other hand, gives greater flexibility, but puts more onus on the user to check the accuracy and integrity of the information and data relationships.

File housekeeping facilities allow you to delete, copy and rename files and macros, and display directories.

Tailoring

There is a sense in which all Aspect applications are tailored to individual requirements, since some essential functions can only be carried out through stored macros. For example, the INPUT command is only normally used in a macro. Macros have some of the features of programs, and some distinct differences. The main difference is that most macros are essentially procedural — they carry out one function, with that function being activated by a single command. However, the range of options available through a command allows you to behave almost as if you were writing programs.

For example, if you wish to produce a report, you would normally construct a REPORT macro containing a REPORT command. This single command implicitly incorporates the instructions needed to cycle through every record in the file, carry out certain actions in the process, and terminate at end of file. Yet by adding an OPTIONS parameter, you may include processing instructions which are to be acted upon each time a record is read or a line of the report is completed.

The EXTRA option defines temporary storage for the imported records, the OUTPUT option specifies the destination of these records, and the GIVE option specifies the fields to be imported. The SELECT PROCESS option counts each record and displays the result every 20 records (essential when you are monitoring a process that takes well over an hour). You can create memory variables to store temporary results, and the variable COUNTER is an example of this. Temporary variables may be stored in a special NOTEPAD file if required. (Every major command allows you to include provision for error handling.)

The Aspect approach takes a bit of getting used to if you already know something of conventional programming, but it actually relieves the user of the need to bother with a lot of unnecessary housekeeping. For still more flexibility, it's possible to use Aspect in conjunction with the programming language C to gain the advantages of Aspect file handling where it will be valuable, yet retain maximum control.

Once you have constructed a set of macros, you can directly execute them through the DO command, or you can set up a menu so that they are activated just by typing a single digit shown against a description of the option. The complexity of Aspect can be hidden from naive users, while giving them access to the full facilities of the package.

Access to the package is restricted to

Benchmarks

BM1	Time to add one new record (Inst)
BM2	Time to select record by primary key (8secs*)
BM3	Time to select record by secondary key (NA)
BM4	Time to access 20 records from 1000 sequentially on three-character field (6mins 29secs)
BM5	Time to access record using wild code (8secs*)
BM6	Time to index 1000 records on three-character field (NA)
BM7	Time to sort 1000 records on five-character field (28mins 10secs)
BM8	Time to calculate on one-field per record and store result in record (54mins 30secs)
BM9	Time to total three fields over 1000 records (6mins 55secs)
BM10	Time to add one new field to each of 1000 records (time to change MAP only)

Time to import a file of 1000 records: 1hr 16mins

Notes: NA = Not Applicable — no secondary indexes
* Time to display full record on screen — retrieval time instantaneous

those knowing the password.

Aspect allows you to import records from ASCII text files in several different formats, including comma-delimited and fixed length records. Importing is as flexible as extracting from data files, and features the ability to select records and fields for importing.

User image

Aspect is essentially a command-driven package with a reasonable level of prompting, and with a macro generator to help novices construct their own macros. The macro generator works on the basis of a combination of menus and question-and-answer dialogues. This works reasonably well, but in a package with such flexibility it's bound to be a somewhat daunting task for new users. I found it easier to learn a little about the commands for creating and amending macros, and use these directly, rather than going through the generator.

However, this is not to say that all is sweetness and light when using Aspect in direct mode. Certainly those commands which can be used in this mode to operate on data files are reasonably easy to construct, and give you the required results quickly; but the system development commands are less attractive, notably CREATE MACRO and AMEND MACRO. When you enter one of these commands, you are prompted to enter a macro line; this prompt is repeated after each line you type, and takes up a complete line. If you list a few lines of the macro to see what you've got, and add or amend, you lose sight of the listing twice as fast as you would if the prompt didn't take a whole line.

Each line of a macro must have a line number. When adding a line, type the line number and then the line text. You can't request an 'insert mode' and keep entering lines without the prompt line intervening, nor is there any facility to prompt for line numbers. You change a line, type EDIT line number, and are then in an Edit mode very similar to that used in Basic. During editing, the line being changed is shown at the bottom of the screen in reverse video. Furthermore, there is no facility for testing your macro other than running it which involves compilation first, and this lengthens the time needed to test a macro. Clearly the *ability* to compile a macro is invaluable since it makes execution much quicker, but you should be able to choose a test mode which just interprets; the package should also be able to do a simple syntax check on each statement as it's typed in.

All in all, I found the system development side of Aspect rather unhelpful, although the ability to copy a macro and use it as the basis of a new one is very useful. In both direct and generator modes, Aspect provides some on-screen help. This is available through the 'interrupt screen', which is accessed throughout by pressing the ESC key.

The interrupt facility allows you to display help text, cancel the current activity, print the previous screen, or change various system parameters (most often the switch between showing reports on the screen, the printer or both). This feature is extremely helpful (it contrasts with the inability of many packages to permit interruption of an activity), and its consistency of use is reflected in other uses of special function keys. For example, on the Sirius, F3 allows you to step back to the previous activity or entry, whatever that may be according to the context. When inputting, F3 takes you back to the previous field entry; when entering information to the macro generator, it returns you to the previous prompt, and so on.

Documentation

The Aspect manual is a thick A4-size document consisting primarily of reference material. There is a chapter on using the macro generator, which is aimed at helping novices to start using the package, but anyone without previous computing experience will find this pretty hard going.

There follows a description of the general material relating to all commands, a command summary (which doesn't show the syntax, just the function of each), and a description of each command. Since each command can have several sub-commands, and many of these are common to several commands, commands and sub-commands are listed separately in alphabetical order. If you want to build a complex command, you may need to check half a dozen different places in the manual. This problem would have been avoided to a large extent by the provision of a proper reference summary card showing the full syntax of each command, but including the syntax.

Conclusion

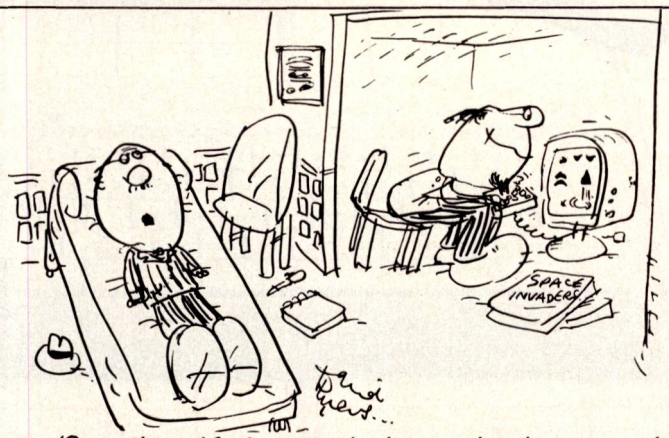
For those who are looking for a package which will give them the ability to tailor complex applications for naive users, Aspect is well worth looking at. It will be most useful to those whose data has a clear structure, of the sort which lends itself to description as a hierarchy of succeeding levels.

Nevertheless, Aspect is a powerful and flexible package, and should provide a useful tool for system developers. If a reference card were provided, and the development tools enhanced, it would be ideal.

END

Summary

Package Type	Database management system with multi-file features used with commands and tailored menus. Powerful system primarily for system developers and thence for novice users using such tailored facilities.
Ease of Use	Good for system designers, if rather tedious at times. Difficult for novices.
Documentation	Thorough but terse reference manual, with command description spread wide. No tutorial guide or reference summary.
Costs (ex VAT)	£400 (£40 for demo version max 50 records).
Supplier	Microft Technology Ltd, 45a Radnor Walk, London SW3. Tel (01) 352 7876



'Sometimes I feel people don't care a jot about me . . .'

Apricot F1

The Apricot F1 is a compact and inexpensive small system pitched firmly at the £1000 business machine market, and is designed for those who wish to perform certain tasks to a high standard. How will it serve as a replacement for jaded Apples, PETs and Sanyos? Peter Bright tests it out.



What shall we call the baby? These words must be one of the largest single causes of family arguments, but it's not just happy families who have trouble choosing names for their new offspring. Micro companies spend months agonising over registered trademarks, copyright, and all the other obstacles in the path of common sense.

Take the case of ACT. Most people thought that its new machines would be called 'Rascal'. People inside ACT also thought so, because that's the name printed on the PCBs inside the machines. Then someone discovered that the name had already been registered in Outer Mongolia or some such place, so it kept the Apricot name and called the new machines the Apricot Portable and the Apricot F1.

The Apricot F1 is cast in the same mould as the previous Apricot machine. It offers a true 16-bit 8086 processor, 256k of RAM and is equipped to drive a colour display as standard; all this for £995 plus the cost of the monitor.

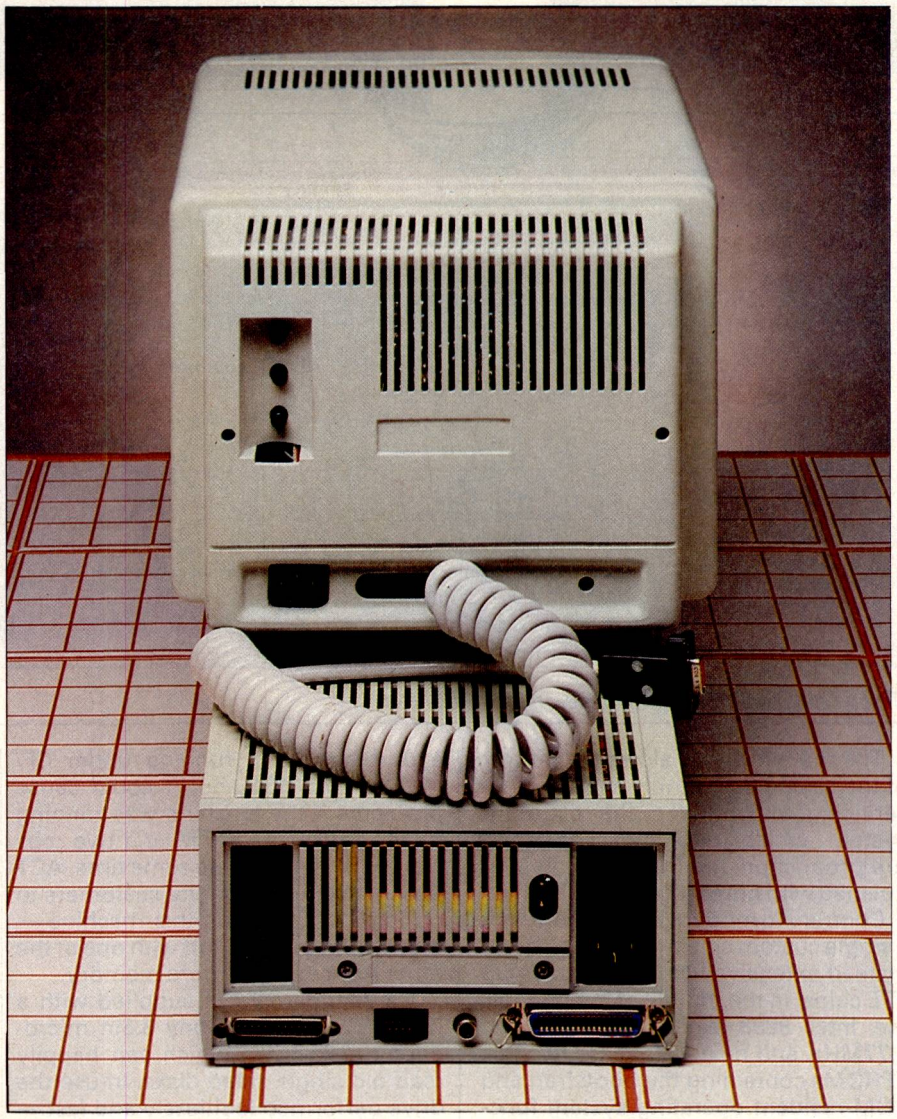
Hardware

The F1 conforms to the traditional three box design — main unit, keyboard and display. The main difference is that it manages to accommodate this in about a third of the space taken by most other systems. All the units are finished in dull cream. It's very much in the same 'transportable' vein as the 'old' Apricot, and can be supplied with a soft carrying bag to tote it around.

The main unit is very narrow but quite deep. Its top is a two stage affair and gets taller halfway back to accommodate the power supply. The front half is flat and is designed to support the monitor.

The front of the main unit houses the disk drives, LEDs for power, caps lock, scroll and disk, and a transparent cover for the infra red receiver. At the back, from left to right, we have RS232 serial port, colour monitor out, composite monitor out, centronics printer port, power in, power out and an on/off switch.

On the right-hand side towards the rear is a system expansion port. ACT is hoping to sell a basic five-slot expansion box to OEMs to plug their own hardware into. The expansion box is nothing more than an extra F1 case with different front and rear panels, which means that extra hardware can be added and the system will still look trim and neat.



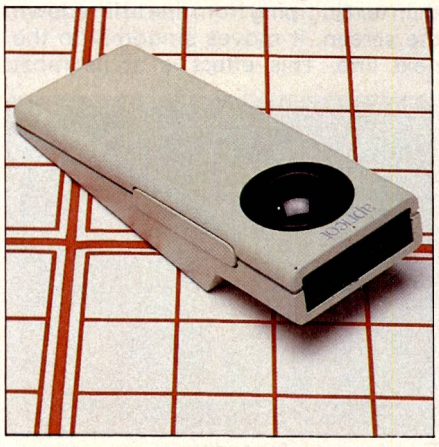
Rear view: note the system expansion port

Getting inside the F1 is simplicity itself — just take out two screws, remove the back panel and take the top off. It takes about thirty seconds.

Once you have removed the top, the first thing you notice is that there's shielding everywhere. The power supply is totally encased in its own box, there's a massive shield over the front of the unit and even the disk drive has heavier than usual shielding.

The main front shield performs two tasks. It reinforces the plastic lid so that the heavy colour monitor can be rested on top, and prevents any unwanted interference from the monitor messing up the electronics.

At the front of the box next to the disk drive are the speaker and decoding circuitry for the infra red receiver. All cooling for the system is achieved by convection — the F1 doesn't use a fan.



ACT's mouse/trackerball



The main unit is narrow but deep



'The keys look just like the pieces in a Scrabble set . . .'

The main PCB lies along the bottom of the casing and simply slides out for servicing. In contrast to the rest of the system which was most definitely pre-production, the PCB was very well finished with not a single patch in sight.

Contrary to modern trends there isn't a single custom chip or ULA anywhere; instead extensive use is made of 74LS TTL chips. In the middle of the board is the Intel 8086 which is clocked at 4.77MHz, and next to that are two 16k EPROMs containing the bootstrap and ROM-resident operating system functions. To the right of the EPROMs are two banks of 16 64k RAM chips giving a total of 256k with no parity. In the top left-hand side of the board is a socket for a single Apricot-compatible expansion card.

There are a couple of interesting omissions on the F1's PCB. The first is that there's no socket next to the 8086 for the 8087 maths co-processor. Apparently the demand for the chip isn't high enough to justify the cost of providing the socket.

The second is that there's no DMA chip — the CPU has to fend for itself. Obviously this is mainly a cost consideration: when you are building a thousand pound system something has to go. The lack of DMA shouldn't be a problem when running under CP/M-86 or MS/DOS, but it could cause problems if the machine was running under Concurrent CP/M and two jobs went for the disk at the same time. ACT doesn't expect too many customers to go for Concurrent on this machine — they would be better off with one of the other Apricots with more memory.

The standard F1 is supplied with a 720k double-sided Sony 3.5in micro-floppy disk drive, which can happily read old single-sided disks. In use the drive performed faultlessly and fast — the new machines no longer have the WordStar speech problem that plagued old machines.

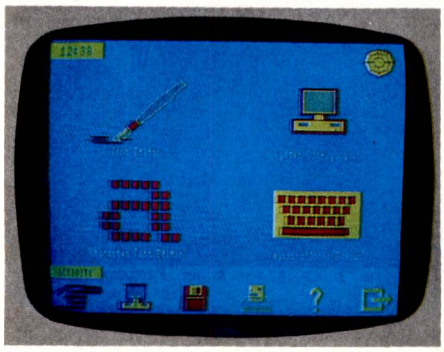
My only reservation about the disk drive is that it tends to overheat. If you left a disk in the drive for any length of time it would be hot to the touch, but while this was disconcerting I didn't have any reliability problems. My second reservation concerns the supply of disks. Plain old single-sided disks have been in short supply for some time, and it looks as if the double-sided disk situation will be worse.

The F1 is supplied with both composite and RGB video outputs as standard. The reasoning behind this seems to be that the skinflints will hang a cheapo composite monitor on the system, while everyone else will either go for ACT's compact hi-res monochrome Apricot monitor or its new compact colour unit. ACT can also supply a modulator unit which allows the F1 to be plugged into a domestic television.

ACT's new colour monitor is a very impressive piece of kit. It uses a Sony Trinitron tube and electronics to achieve very high clarity combined with compact dimensions. Unfortunately you also have a couple of grands' worth of pre-production hand-carved plastic casing, so I reviewed the system using a Microvitec colour monitor. This looked totally out of place — the rest of the system was neat and compact, and the massive Microvitec looked completely incongruous.

The graphics resolution on the F1 is not as high as the Sirius and Apricot, but it's still a very respectable 640 × 256. In this mode the F1 can display up to four colours out of a palette of 16 onscreen at any one time. Text display is 80 columns by 25 lines. As with all Apricots the fonts are 'soft', and new fonts can easily be called up.

When you switch on the F1, the text on the screen 'smooth scrolls': rather than text jumping from line to line down the screen, it moves smoothly to the next line. This effect is at its most



The main ACTivity screen



The keyboard table editor



The character font editor

impressive when deleting a line in WordStar — instead of the line just disappearing, it appears to slide under the line above.

The smooth scrolling is one application of the F1's system of screen pointers. Instead of directly controlling the screen, programmers can access a system of line pointers to play around with the display. ACT has a nice little demo program that uses the pointers to define windows in which data is scrolled up, down, sideways and rotated, all at high speed. It remains to be seen how many programmers use this feature, as the F1 is the only member of the Apricot family with this ability.

Normally the keyboard is not one of the most interesting aspects of a micro — this is certainly not the case with the F1. The most striking feature of the keyboard is that it doesn't use a cable to connect it to the main unit — ACT has chosen to use an infra red light beam in place of the more usual coiled cable. This is only the second time I've seen this idea implemented on a micro; the first machine to use it was the IBM PC Junior where the light beam was a disaster. The problem was that the signal often got garbled on its way to the main unit. At best this meant that the machine didn't understand your command, at worst it executed a different command.

ACT has overcome this problem by developing its own error detection/correction 'hamming' code. Each letter is transmitted as a 32-bit code. Of that, eight bits are used for type and no less than 12 bits are used for error detection/correction.

This supreme effort certainly paid off in use. While I was testing the machine I tried everything I could think of to fool the system — I bounced the signal off the walls, and used the keyboard way beyond its rated two metre range. Invariably, it either registered the correct key or didn't register at all. It never wrongly interpreted the key.

Having said that, you can't expect to be able to wander around the room typing your life's work and expect the system to pick up everything you type. The keyboard signal is fairly directional; when the machine first arrived, the keyboard would only work if it was directly in front of the main unit. When I looked at the keyboard I found that the infra red LED transmitters were badly aligned, so I bent them back into shape. This improved matters — the keyboard was usable when it was virtually at a right-angle to the front of the main unit.

The only major problem with the infra red system is that the path from the keyboard to the main unit has to be relatively free from obstructions. It doesn't mind the odd piece of paper or small box, but it does object if you use the keyboard on your lap and the lip of the desk gets in the way.

One interesting point is that keyboards are not keyed into individual systems. This means that you could line up three or four F1s, pick up a keyboard, hit a key, and all the systems would register the key; this could be a problem if a number of people were using F1s in the same room. ACT has thought of this, and supplies a length of fibre optic cable which can be used to join the keyboards and system units to stop interference.

The rest of the keyboard is rather disappointing. The keyboards on both the Sirius and the original Apricot were very good. The F1 broadly follows the same path except for the function keys, which have been moved yet again and now live on the far right-hand side. The microscreen which adorns the 'old' Apricot keyboard has been dumped in favour of a more traditional layout.

The keyboard unit as a whole is ultra-low profile and very compact. The underside houses two flip-down legs to adjust the typing angle, and two removable panels which open to reveal the battery compartment and the main PCB. This houses the decode logic, infra red LED transmitters and the clock/calendar.

'ACT's new colour monitor is a very impressive piece of kit. It uses a Sony Trinitron tube and electronics to achieve very high clarity combined with compact dimensions. Unfortunately you also have a couple of grands' worth of pre-production plastic casing, so I reviewed the system using a Microvitec colour monitor.'

The top houses 92 keys plus four buttons marked RESET, REPEAT RATE, SET TIME and KEYBOARD LOCK.

The main qwerty typing area takes up two thirds of the available space with the rest being occupied by editing/cursor, numeric and function keys respectively. These functions are crammed together with no gaps between any of the functional groups.

All the function keys have pre-printed legends. Some of these, such as the HELP key, are fairly obvious choices; others, such as KEYWORD VOICE and SET UP are not so obvious. KEYWORD VOICE is used for voice control on the Apricot Portable and doesn't do anything useful on the F1. SET UP is used to transmit the time and date from the keyboard clock to the main unit when the system is booted up.

In use I wasn't particularly impressed with the keyboard. For the first time ACT is using a 'membrane' keyboard instead of the more traditional switch type. From a production point of view membrane keyboards have significant advantages — they are cheaper to produce, more compact and allegedly more reliable than conventional keyboards. The trouble is that I have yet to find one that feels anywhere near as good as a traditional unit.

The keys feel, look and sound just like the pieces in a Scrabble set and don't register until they have been pressed down quite forcefully. The space bar was a major problem: it's very close to the mains casing and doesn't register until it's significantly below the casing's lip. When you are typing, your thumb catches on the edge of the casing and you have to make a conscious effort to pivot it down to make the key register. In fairness to ACT I was using a hand-made pre-production keyboard, but I can't see how the production units will be sufficiently different to make the problem non-existent.

Also supplied with the review machine was ACT's version of the mouse. A more apt name would probably be the rat, because it's about three times larger than most other mice on the market. It consists of a large ball and two buttons running down each side to enable you to select options.

Like the keyboard, the mouse communicates with the main unit via an infra red link. This caused me problems more than once, because I found myself pointing it at the cursor on the screen rather than at the main unit.

In addition to being able to mouse around the desk, the ACT mouse can be used as a trackerball. Anyone who has played 'Missile Command' in the amusement arcades will know how a trackerball works. For the uninitiated, it's a large ball mounted in a holder. The cursor can be moved by running your hand over the ball and rotating it in the direction you want to go. In practice I found it easier to use the mouse as a trackerball than mousing all over the table.

System software

All the Apricot range supports MS-DOS, CP/M-86 and Concurrent CP/M 3.1. However, anyone who has used an Apricot will know that ACT has done a great deal behind the scenes to make it easier to configure the system: the old Apricot used about 120k of user RAM for the operating system.

The F1 has cut down on the size of the RAM BIOS by placing some of the operating system routines in ROM, but nevertheless the system still eats just under 90k of user RAM. Having said this, 40k of that is taken up by the bit mapping for the display, so things aren't quite as bad as they first seem.

The review machine was supplied with MS-DOS version 2.11 which is virtually bog-standard Microsoft. The only unusual behaviour exhibited by the machine was that it appeared to be doing some disk cacheing. When I typed DIR the operating system looked at what was on the disk and then printed it. However, when I typed DIR again it printed the directory straight away without bothering to look on the disk.

On the old Apricot you can set aside a cache area, but the F1 shouldn't support this. It turns out that the cacheing was achieved by allocating more buffers to MS-DOS in the CONFIG.SYS file, rather than having a separate disk cache.

The machine was also supplied with GSX, a kind of graphics operating system. The problem facing people writing graphics software is that different micros have different ways of accessing the graphics screen. Graphics programs written for one machine probably won't run on another — GSX attempts to get around this problem.

GSX sits between the hardware and the applications program, and provides a consistent interface. As long as the program just accesses GSX's functions and doesn't go directly to the hardware, it should run on any micro that has a GSX driver.

'It's very hard not to be impressed by the F1. It could have had less memory, no colour and no fancy software, and still be competitive in this sector of the market. Its main competition will come from the Sanyo MCP555, but the F1 scores over the Sanyo in a number of important areas . . .'

ACT has made extensive use of GSX to ensure that programs will run on all its machines regardless of display type. The current Apricot range has no less than four different types of display for its applications programs to cope with: the old Apricot has an 800 × 400 black and white display; the Portable has a 640 × 200 LCD display and an eight-colour 640 × 256 display; in addition, the F1 has a four-colour 640 × 256 screen. To write individual customised programs for each model would have been a nightmare, so ACT wrote one suite of generic applications programs and four GSX drivers. Obviously ACT is hoping that independent software producers will also use GSX to make their products portable across the Apricot range.

Anyone who has used the old Apricot will remember the Manager program, which was supplied in an attempt to keep the end user away from the terrors of the operating system. Whether you used it or not, it did come with some useful utilities and was at least a step in the right direction.

For its latest batch of machines ACT has developed the successor to the Manager to be known as 'Activity' (ACTivity — geddit?). This sits on top of the operating system, and makes extensive use of ikons and the ACT mouse in an attempt to be as friendly as possible. The whole package has been written in-house using a combination of Pascal MT+ and assembler. In addition to being standard on the new ACT machines, it will eventually be retro-fitted to the existing Apricot machines.

Activity should autostart as soon as the system is booted. The review copy had to be called manually, which simply meant loading the appropriate GSX driver and then typing ACTIVITY.

Once loaded, the main screen is displayed in glorious technicolour. At the time of writing ACT programmers were arguing over what colours the different screens should be: consequently my version had a not-so-endearing habit of printing some sections as blue on blue!

Movement of the cursor around the Activity screen can be achieved either by using the ACT mouse, or by using the numeric keypad as a multi-way cursor control with '.' to select the option. One good feature is that when you're using the keyboard to control the cursor, the cursor will glide in the direction you send it to the next valid choice. This means that you only have to press the key once rather than having to keep it pressed down.

The main Activity screen can be divided into three main sections — top, middle and bottom. The top few lines display the time and the ACT logo.

The data displayed in the middle section varies depending on what's in a file called ACTIVITY.CON. If the file is not present Activity will display a list of all the executable files on the current disk (that is, all .COM, .EXE and .BAT files). These files can be executed by using the cursor to select the filename from the list and then selecting 'Run Program'.

If there are entries in ACTIVITY.CON, Activity will display user-defined ikons in the middle section of the screen. You could, for example, have a WordStar ikon showing a keyboard, SuperCalc with a calculator, and so on. The ikons can be created by the user with the ikon editor and then stored on disk. If applications programs have ikons associated with them, they are selected by moving the cursor over the ikon and clicking the mouse button, or hitting '.' on the numeric keypad. If the disk is changed while you're in Activity, it scans the new disk and updates the display of executable files.

The bottom section displays the main control ikons, and also has a DOS command line for people who want to directly type their DOS commands rather than playing around with ikons.

There are six main control ikons which are displayed all the time you're in Activity.

From left to right they are: a picture of a pointing hand labelled 'Activity'; DOS, a computer labelled 'Utilities'; a disk labelled 'Disk', a question mark labelled 'Help' and a square with an arrow labelled 'Exit'.

'Activity' will always get you back to the main Activity screen, DOS allows you to perform operating system functions, and 'Utilities' allows you to get into either the ikon editor, character font editor, keyboard table editor or the system configurator.

The ikon editor was one of the features which didn't work on the review system. In theory it allows you to create your own ikons and store them on disk. You can then use them by making the appropriate entry in ACTIVITY.CON.

The character font editor allows you to alter the make-up of existing characters, or to make up new character sets of your own. The screen is broken up into three main sections: on the left are ikons for editing characters — rotate, delete, invert, and so on; the central section is the grid where you edit the character; and the right-hand side shows the source and the target fonts. When you have created your wonderful new character set you can save it to disk for later use. You can even save a header record describing your new work of art.

The keyboard table editor allows you to configure different keys on the keyboard to produce different strings. This is very useful for customising keyboards for applications programs such as WordStar, or you can configure certain keys to print often-used words.

The editor screen displays a graphical representation of the keyboard at the top of the screen. You select the key you wish to work on; the bottom of the screen then displays what the key is currently configured for. You can use the character set on the bottom right of the screen to re-define your key. When

Benchmarks

BM1	2.0
BM2	6.0
BM3	12.2
BM4	12.5
BM5	14.1
BM6	25.8
BM7	39.8
BM8	38.6
Ave	18.9

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

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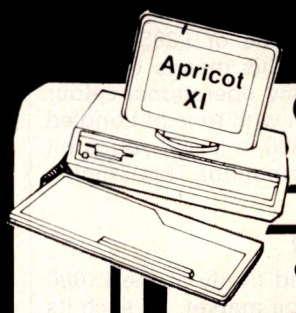

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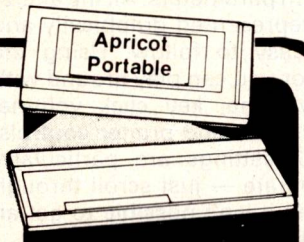

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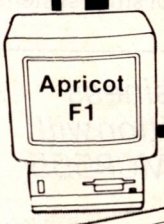

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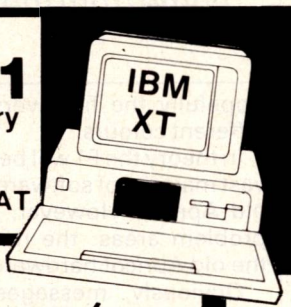

• *System 4* •

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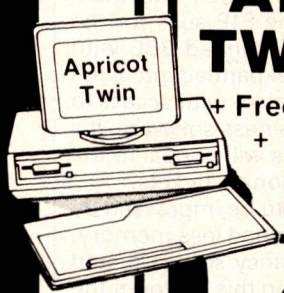

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you have finished, you can get a print-out of the new key settings and save the layout to disk.

The system configurator is used to reset system parameters. All the alterations are represented graphically and are very easy to follow. Using the configurator you can play around with the bell volume, key click volume, RS232 protocols and printer controls. The RS232 settings are particularly easy to operate — just scroll through the options; it isn't possible to get an illegal command.

You can also use the configurator to load your previously saved fonts, keyboards and logos into the system so that they become the default settings.

The next main control ikon is 'Disk', which allows you to perform most of the common housekeeping activities such as formatting, copying and verifying disks. When these options are chosen, the appropriate DOS function is called and Activity is reloaded. The idea behind this is that if you are doing a single disk copy, you need as much RAM as possible to cut down on the number of times you need to swap disks around in the drive.

'Help' was not implemented on the review machine, but by the time the system reaches the shops it will feature an on-line help facility.

Applications software

The F1 is supplied with an impressive range of bundled software. From ACT come three packages: a tutorial, ACT Sketch, and Diary; from Sorcim come Superplanner, SuperCalc and Superwriter. The Sorcim packages are well known so don't need further description, but the two ACT packages are new for this machine.

ACT insists that ACT Sketch is not its version of programs like MacPaint. Its main purpose is to generate pictures which can be incorporated into applications programs.

Sketch has all the usual arc and line drawing facilities as well as colour filling. At one level you can use it to create a basic picture which can then be printed out, but its main feature is its ability to create a GSX command file. This has two advantages: a list of GSX commands takes up far less space than a screen image, and you can incorporate the GSX commands into an applications program, thus making it very easy to write programs with a high graphical content.

The Diary program is a simple database application used to create an electronic desk diary (this is the package which is voice-driven on the Portable machine). This program also makes heavy use of graphics — the opening screen has a picture of a closed diary. The commands are very English-like: for example, to look at a particular page you say OPEN_AT followed by the date or YESTERDAY, TODAY or TOMORROW. Unfortunately this package was a victim of the blue on blue syndrome which made it hard to use. Hopefully the final version will have different colours.

In theory the F1 will be able to run the vast majority of software written for the old Apricot. However, there are two problem areas: the microscreen and the old Apricot hardware.

Obviously, messages which were sent to the Apricot's microscreen won't be displayed on the F1 because it doesn't have a microscreen. ACT says it will provide a utility which re-directs microscreen messages to the 25th status line.

Programs which directly accessed the Apricot's hardware without going through the BIOS probably won't work. ACT says that these programs are in the minority, but programs such as Open Access will have to be altered. As I mentioned earlier, ACT hopes that software houses will use GSX in future.

Documentation

As this was a pre-production machine, no documentation was supplied.

Prices

The Apricot F1 is very good value for money. The system unit will set you back £995, and the monitors cost £200 for black and white or £395 for the colour version. This means that you could have a fully operational colour business system with tons of bundled software for £1390 — less if you don't want ACT's flash monitor. This is highly competitive.

Conclusion

The F1 is pitched firmly at the £1000 business machine market. As such its main competition will come from the likes of the Apple IIc, Sanyo MCP555 and the Prism Wren. (This is an increasingly competitive and potentially lucrative area of the market: the thousand pound mark is a great psychological barrier for small systems purchasers.)

'The F1 is pitched firmly at the £1000 business machine market. As such its main competition will come from the likes of the Apple IIc, Sanyo MCP555 and the Prism Wren.'

ACT is well aware that there are a large number of old Apples and PETs in the field which are now fully written down in the books, and whose owners are looking around for a replacement that's cheap and can perform the same fairly basic functions.

ACT is also making a concerted bid for a slice of the educational market with the F1E variant of the F1. Its main argument is that the F1E sells for the same price as an expanded BBC with disks, but it can be expanded into a full function business micro with access to a wide range of business software. It's easy to see how this will appeal to the higher level educational markets.

It's very hard not to be impressed by the F1. It could have had less memory, no colour and no fancy software, and still be competitive in this sector of the market. Its main competition will come from the Sanyo MCP555, but the F1 scores over the Sanyo in a number of important areas, the most important being its decent capacity disk drive.

My main worries centre around the keyboard, but even here the criticisms must be tempered by the machine's value for money. Also, I'm not sure how useful the infra red link is. ACT seems to be fond of gimmicks it can use to distinguish its products from the rest. The old Apricot has the microscreen which has been dropped on the F1; the F1 has infra red which will probably be dropped on the next machine . . .

The F1 is not designed to provide a powerful general purpose microcomputing facility. It's for people who need a good value micro to perform one or two tasks well. Given its chosen market, I can't think of anything that comes close. Very good. END

Technical specifications

CPU:	Intel 8086 clocked at 4.77MHz.
RAM:	256k.
ROM:	32k.
Display:	Up to 640 × 256 displaying four colours out of 16.
Keyboard:	92 keys, membrane construction.
I/O:	RS232, centronics, composite video, RGB video, system expansion bus.
Operating systems:	MS-DOS, CP/M-86, Concurrent CP/M 3.1.
Bundled software:	ACT Sketch, ACT Diary, Tutorial, Superplanner, SuperCalc, Superwriter.

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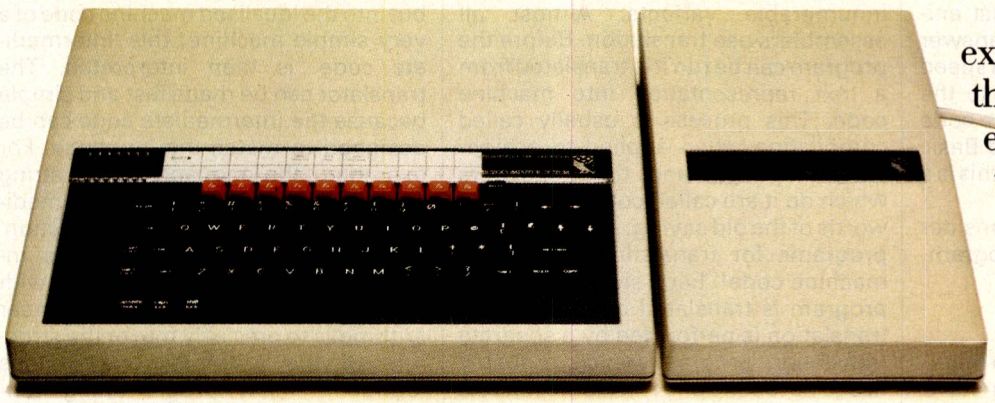

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Eureka!

Compilers play a large part in computer programming but what are they, how do they work and how do you choose a good one? Ric Wickham provides the answer.

Budding Basic programmers invariably run out of speed as soon as they try complex real-time games or fast animated graphics. The traditional answer is to code the bits that need more speed in machine code. This has led to the general impression that machine code programs are fast but hard, and Basic programs are easy but slow, but this is a gross oversimplification.

To see why, we need to consider language levels and types of programming system.

Language levels

Computer languages divide into 'high' and 'low' levels, terms which have evolved from 'problem oriented' and 'machine oriented' languages respectively.

A high-level language, typified by Pascal and Basic, uses English-like commands to specify a sequence of operations to the machine. To use such a language, you must know how to solve your problem: the language is used to describe that solution to the computer.

Low-level languages correspond to assembly codes. Each statement in the language corresponds to a single data object or a single machine code instruction. Some languages allow sequences to be grouped together so that a single statement can give rise to a whole sequence: this kind of group is called a 'macro'. To use a low-level language you really need to know how the machine works, because you must describe to the machine how you think it should solve the problem. You need to be able to remember the names of the machine instructions and understand what they do.

The hexadecimal and decimal machine codes used by many micro enthusiasts are at an even lower level, one totally ignored by most programmers in the computing industry. At this level you not only have to understand the instructions, but also remember (or keep referring to) the decimal or hexadecimal number which is represented by an assembler mnemonic.

Types of programming system

There are two main ways in which a computer can execute a program — translation and interpretation, plus innumerable variants. Almost all assemblers use translation. Before the program can be run it is translated from a text representation into machine code. This process is usually called compilation when applied to a high-level language, and the translators which do it are called compilers. In the words of the old saying: 'Compilers are programs for translating errors into machine code!' Each statement in the program is translated only once. The translation is performed by a separate translation program which probably has to be loaded and run (some micros, such as the BBC machine, have assemblers built in). The translation program takes the text of the user's program (the 'source text') as input and produces a file of machine code as output.

The major advantage of translation is that the resulting machine code programs are very fast, but there are two principal disadvantages, both relatively minor. One is the necessity of loading the translator program; the other is that all the name information from the original source program is usually thrown away by the compiler, so the diagnostic messages from a failed compiler program generally leave a lot to be desired.

The method used by almost all Basic systems on micros is 'interpretation'. The program is run by inspecting each source line of the program in execution order. As each statement is analysed, data areas representing the variables of the program are changed as if that fragment of program had been directly executed. It follows that a statement in a loop is analysed each time the loop is executed, and this re-analysis of the source text makes interpreters slow.

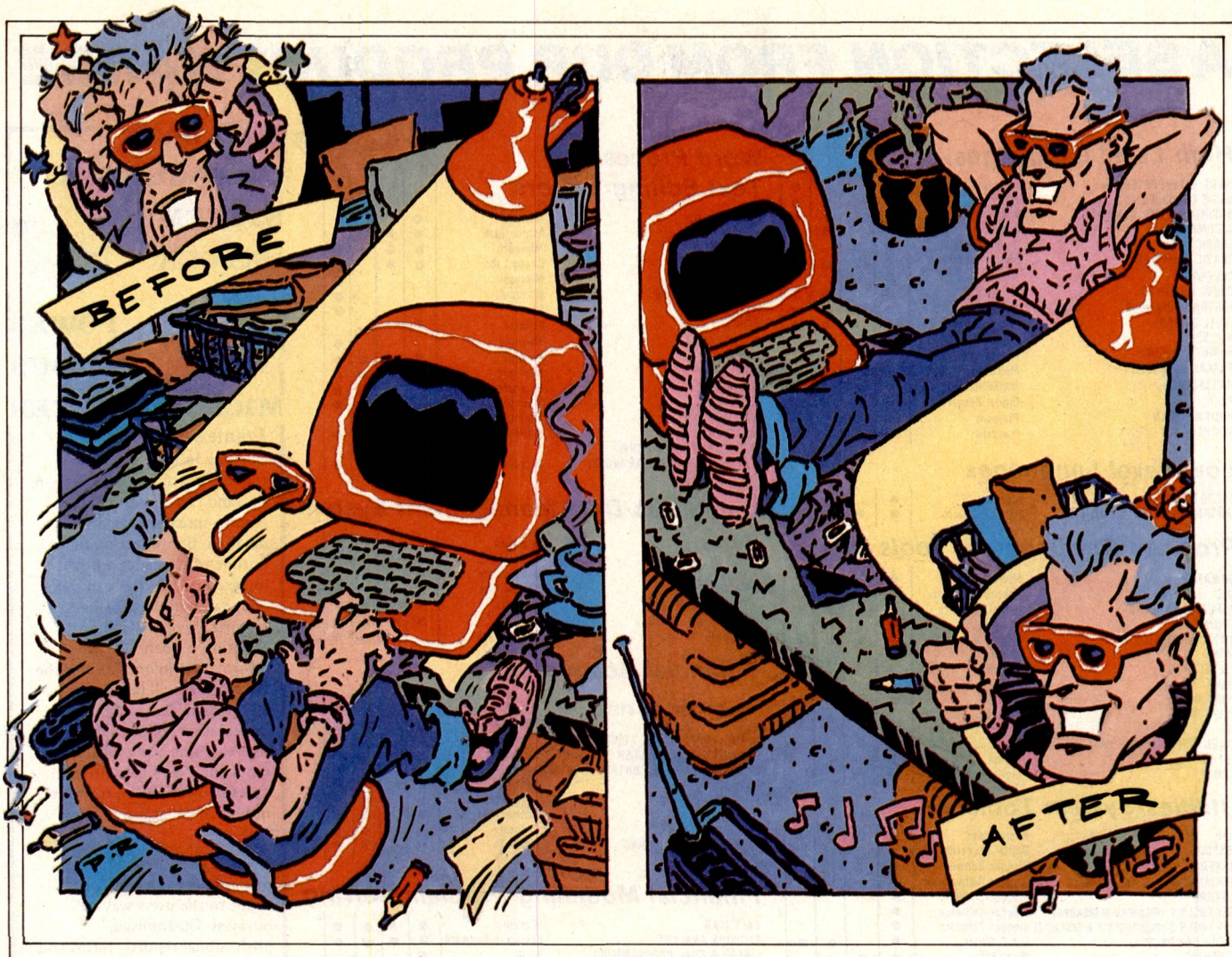
The main advantage of interpretation is the superior diagnosis ability of the programs it runs. Since the source is present during execution, and the interpreter is using it directly, error messages are given in source-language terms. Many interpreters allow a program to be interrupted; the programmer can then change variables and in some cases even edit the program, then resume execution.

Most programming systems translate programs not into machine code, but into the idealised machine code of a very simple machine; this 'intermediate code' is then interpreted. The translator can be made fast and simple because the intermediate code can be designed to match the language. For example, if the language needs a string comparison operation, the intermediate code can have a single 'instruction' to perform that operation. The intermediate code can be provided with stack operations and real number arithmetic to precisely mirror the structure of the arithmetic expressions found in most programming languages; this greatly simplifies code generation. Even the mechanisms provided to find variables can be tailored to the declaration rules of the source language.

This makes the translator smaller, faster and easier to write (and more likely to be correct). The interpreter which runs the code will go much faster running the intermediate code than an equivalent interpreter will directly running the original source, since it doesn't have to read the individual characters of the source program, analyse the statements or look up identifiers in a dictionary. The compiler has done this and encoded the results in the intermediate code.

The translation process

The first stage of the compilation process is normally called 'lexical analysis'. This stage reads the source file and combines the characters it contains into 'symbols'. Each symbol is a single object in the source language: a name, a reserved word (such as LET in Basic), a string ('complete with quotes'), a number of various kinds of operator. This stage also removes any characters which don't add anything to the meaning of the program: spaces, new lines, comments, and so on. Quite often, the lexical analyser will generate all the error reports the compiler can produce, because it 'knows about' the source text and can therefore identify errors with particular characters on particular lines of the source. The output from the lexical analyser can be thought of as a series of strings. More



usually, the lexical analyser is a procedure which puts the string for the 'next' symbol in a standard place each time it's called.

The next stage is 'dictionary look-up': this is called to turn the strings produced by the lexical analyser into numbers so that they can be manipulated more easily by the rest of the compiler. After a symbol has been looked up it is described by the class of symbol (name, operator, and so on), and the index of the entry in the compiler's dictionary which holds its text. Such a description is usually called a *token*. If a given symbol is used many times in a program, the dictionary entry used is the same each time; a given name is always represented by the same token, wherever it occurs in the source.

There is a common combination of lexical analyser and dictionary look-up, in which the lexical analyser recognises all symbols except names and directly converts them into tokens. Numbers are represented by a token which specifies that its type is 'number', and gives the value represented instead of the index of an entry in the dictionary. Strings are represented by writing them into a special string buffer. A token is passed giving type of string and a value which specifies which string in the buffer is being represented. Names are looked up in the dictionary, which can now be a subroutine of the lexical analyser rather than a process in its own right. Only names are held in the dictionary, which reduces the number of entries to be searched and the number of searches performed.

The tokens are passed next to 'syntax analysis'. This stage works out what the programmer's instructions are by analysing the structure of the program according to the structure rules (syntax) of the language. Particular statements can thus be identified as, for example, declarations or assignments, conditional or loop, as appropriate. There are a number of ways of doing this, and even a number of ways of automatically generating this part of the compiler.

The output from the syntax analyser is a data structure which represents the entire program. Since a real data structure is very large and complex to control, a micro compiler is more likely to represent it as a series of procedure calls, where the sequence of calls gives the shape of the structure and the parameters of the calls give the values in the structure. Even large compilers often use this procedural interface; mainframe compilers such as the BCPL compiler use the calls to build the structure, while micro compilers manipulate the information directly. (In fact, some mainframe compilers do too, notably the 'standard' Pascal compiler.) Again, it's possible to compromise: for example, by building a structure for a subset of the language (expressions are the favourite), using it as appropriate and then discarding it.

Whether the structure is built or not, it is conceptually passed to 'semantic analysis'. This analyses the structure of what the programmer wrote and works out what he meant. There are three main parts to semantic analysis: name analysis, expression analysis and macro generation.

Name analysis inspects every declaration to ensure that it's legal and finds out what it means, and also inspects every use of any name and relates it to the correct declaration. Most Pascal-like languages allow you to re-use names provided you don't use them ambiguously. The rules for doing this are called the 'scope rules' and vary enormously, from Dartmouth Basic (never re-use anything) to ADA (you can do anything you like provided the compiler can sort it out). Name analysis enforces the scope rules.

The second major function of semantic analysis is expression analysis; this is often so primitive that it's hardly recognisable as a separate function. It involves re-ordering expressions (keeping the operators in the same hierarchy so that the expression still means the same) to making the best use of the machine while evaluating them.

For example, if you write '5 + 3*A' the compiler might be fooled into generating code to load the 5 into a register before doing anything else: this wastes

Illustration by Peter Richardson

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a register. On a single-register machine the 5 would immediately have to be stored somewhere while the machine evaluated 3*A, which might also waste a temporary storage location. The generated code would look something like this:

```
Load        5
Store       Temp
Load        3
Multiply    A
Add         Temp
```

whereas if you had written '3*A + 5', which means the same, the code might have been:

```
Load        3
Multiply    A
Add         5
```

Expression analysis, if it exists, is simply a set of routines in the compiler which implement some simple laws of arithmetic — for example, that A+B is the same as B+A, and that 'NOT (A AND B)' is the same as '(NOT A OR NOT B)'. Clearly this is easier to do if the semantic analyser has a structure in store which describes the whole expression and which it can modify, which is why some compilers build structures to describe the complete program and many of the ones that don't at least build structures for expressions. However, it's possible to do re-ordering without building the structure.

The semantic analyser must call the code generators to produce the final program. Each code generation procedure usually corresponds to a macro in the sense described in connection with assemblers. The semantic analyser decides upon the general sequence of operations to be performed and calls the final stage of the compiler — the code generator — to produce it.

It is only here that translators and interpreters part company; at this stage, compilers produce code whereas interpreters perform the specified operations.

Some functions of a code generator are fairly simple: planting code in response to calls from the semantic analyser, allocating and organising space for variables, keeping a list of the addresses of labels, and so on. However, the code generator can do many other useful things too: it can look to see what you are loading and storing, so that if the semantic analyser tells it to load something it has just stored, it can remember that it already has the value in a register. This tends to happen in sequences such as:

```
A  := 0;
B  :=0;
```

which a simple compiler might translate into:

```
Load        0
Store       A
Load        0
Store       B
```

It also happens in sequences such as:

```
A [ i ] := A [ i ] + 1;
```

where the compiler may not notice that an index register already contains the variable 'i' when it comes to generate code for the second access to 'A[i]'.

Organisation of a compiler

A compiler will typically consist of:

(1) Lexical analysis and dictionary look-up;
(2) Syntax analysis;
(3) Semantic analysis including name and expression analysis; and
(4) Code generation.

These can organised in various ways. Again, there are two extremes and several compromises.

Each function can be applied to the entire program in turn. This produces a 'multi-pass' compiler which reads the program (or some representation of it) several times. The scheme above, with the functions grouped as shown, leads to a four-pass compiler in which pass one turns the program into a stream of tokens, pass two turns the string of tokens into a string of directives to build a syntax tree, pass three turns the tree into a string of macro calls, and pass four turns the macro calls into machine code. Each intermediate form of the program contains control information, and may contain hints from the previous pass.

'To use a low-level language you really need to know how the machine works, because you must describe to the machine how you think it should solve the problem.'

The advantage of a multi-pass compiler is that each pass can fill the main store of the machine; the total size of the compiler can therefore be larger than the main store size, which allows the compiler to be correspondingly 'more clever'. The disadvantage is the operational complexity of handling several subprograms which must be linked together, and the time and disk space required for several intermediate copies of the program. (It's possible to run a multi-pass compiler on a tape-based system but I wouldn't recommend it). There are also problems merging error messages from different parts of the compiler into a report which the user can understand.

The other extreme way to organise a compiler is to pass each symbol, token, structure or macro onto the next part of the compiler as soon as it has been generated. Essentially, such compilers pass a piece of the source program right through every function of the compiler, then go back for the next bit. In practice there is always some overlap: such a compiler is called *single pass*.

The advantage of a single pass compiler is that it's a single program which uses no temporary resources (disk files, and so on), so is operationally convenient even for a cassette tape-based system. The disadvantage is that it all has to go into mainstore at once, together with the dictionary and any data structures that it may use to describe the program. On machines with no start/stop facility on their cassette interface, the source code and the generated machine code have to fit in too. Even considering exceptions to this rule, most micros are far too small to hold a really good compiler in one pass.

Again, compromise is possible. To eliminate the cost of writing and re-reading the intermediate files, one Fortran compiler for a tape-based system (the IBM 1401) modified the source program in store, reading successive passes of the compiler into a tiny reserved area. This area was so tiny, the compiler had 64 passes.

Organisation of the machine code

There are three main ways to organise the machine code produced by a programming system: it can be left in store ready to be executed; it can be written to an external file (tape or disk) in whatever standard the machine requires ready to be reloaded by standard facilities; or it can be written in a *relocatable* or *linkable* form which allows it to be processed by a special

continued on page 166

'Many interpreters allow a program to be interrupted; the programmer can then change variables and in some cases even edit the program, then resume execution.'

There's one big difference between the IBM PC and the computer below, and it's only fair that you should know about it.



Advance 86b specification. Intel 8086 CPU. MS DOS operating system. Twin-disk drives. 128K RAM expandable to 640K. Interfaces for light pen, printer/plotter, joystick, monitor and RS232C. Capacity for 4 expansion boards, plus a further 2 true 16 bit slots. Graphics - 16 colours. 80/40 columns x 25 row text. 640 x 200 pixels. Package illustrated **Kaga KP810 Printer** (with NLQ) **£345.00** inc. VAT and **Novex 12" Monitor** (amber) **£89.95** inc. VAT.

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loader, and either put anywhere in main store or linked to other programs. Although the relocation and linking facilities are logically separate, they are normally provided together. There is usually no reason to relocate a completed program.

'If you choose a multi-pass compiler, make sure that the passes all load and call one another: it can be operationally inconvenient to control them yourself. Two-pass assemblers work rather differently and don't present this problem.'

Leaving the program in store is called *compile and go*. This saves the filestore and time to dump and reload the program, and is operationally convenient. However, unless the standard facilities on the machine allow you to take copies of main store, there is no way to save a copy of the compiled program; you must recompile it every time you wish to run it. Don't panic — you can save arbitrary areas of store on most machines and even on those where you can't (for example, the TRS-80 where you can get utilities to do it for you).

Leaving the program in store means you can't normally compile a program to occupy the same addresses as the compiler, but there are exceptions. Some compilers, and more assemblers, build the program in one place but fix up its jumps as though it were in another. The last thing such a system does is move the program to where it ought to be.

Writing code to a file

The most common organisation for machine code is to write it to a file ready to be reloaded (in a fixed place) and executed. The compiler (or assembler) writes the code in any odd corner of store that it can find, as though it were at the correct address. The code is then written to a file with control information which will ensure that it's reloaded into the correct address, not the address it was dumped from.

The disadvantage of writing absolute code to a file is the extra step required to reload the program before it can be run. If this step is mandatory it can be irritating, particularly for small programs where everything has to fit into the main store. Another disadvantage, which applies to assemblers rather than compilers, is that such translators won't usually allow you to specify more than one ORG statement to say where the generated code is to go.

The relocating organisation relies on the compiler or assembler putting enough extra information into the machine code file for the relocating loader to find all the program-dependent places and patch them to the right values for a particular run. Such loaders normally have some facility to combine areas together by *external reference*, either named (as in Pascal) or numbered (as in BCPL). This allows a library of procedures for common tasks to be written, compiled once and then incorporated into any program that requires them. This scheme also allows construction of programs which occupy nearly all main store (except for the bit taken up by the relocating loader itself, typically very small).

Again, you cannot specify the load address freely in your source program; in fact in most systems you can't specify it to the compiler at all, but tell the loader where you want things. The disadvantage of this scheme is its complexity. The main advantage, overwhelming if you write a lot of similar code, is that a change to one module of a multi-module program doesn't automatically mean recompiling the whole thing, even if the module you have recompiled has become larger and other modules of the program have to move to make room for it. The loader will just relocate them for you.

Choosing a compiler

Your choice of compiler obviously depends upon the inherent capabilities of your machine. The owner of a BBC Micro is less likely to want to buy a Basic compiler than the owner of a Spectrum because he already has a very fast Basic interpreter which will compile assembly language inserts. Spectrum Basic is slower because the interpreter is simpler. (This is why the Spectrum can have more storage than the BBC machine; in this game everything's a compromise!). Also, the Spectrum has no easy machine code facilities.

It's also worth looking at the language which the translator translates. How anyone can claim that a compiler which won't compile arrays is a 'Basic' compiler I don't know — but some people do. The buzzword is *subset:* many compilers only compile a restricted language called a subset. This is fine, but some subsets are extremely small. Be sure you know what you're buying.

If you choose a multi-pass compiler, make sure that the passes all load and call one another: it can be operationally inconvenient to control them yourself. Two-pass assemblers work rather differently and don't present this problem.

If you need the ultimate in performance you need a compiler which compiles to machine code. However, for a language like Pascal this will almost certainly mean accepting restrictions on the level of supported language: it will be a smaller subset. This is because the scope rules for Pascal are too complex for most micros to support in full in machine code.

Warning

Beware of highly optimising compilers written by firms you've never heard of. Optimisers sometimes get confused by unusual sequences of code. Such bugs are hard for manufacturers to find because they can't test every optimising path under every possible precondition of the compiler. If you hit such a bug, a perfectly correct program will simply 'go wrong' and you'll go mad trying to discover why.

Finally, the thing you should do first: look at the error messages the compiler produces when you give it an incorrect program. The American professor, D Knuth (who wrote a series of books called *The art of computer programming*) remarked that, of programs run in his university, 90 per cent are 'short, Fortran and wrong'. The language is all that has changed!

A compiler should tell you which part of your program is wrong and what it thinks is wrong with it. It should tell you this in plain English, not numbers, and if the error is misuse of a name it should tell you which name. It shouldn't produce an 'error number' and expect you to look it up (the machine is better at looking up things than you are). The only exception is a cassette-based single pass system, where the space required to store the texts for all the messages is likely to be too great. END

'A compiler should tell you which part of your program is wrong and what it thinks is wrong with it. It should tell you this in plain English, not numbers, and if the error is misuse of a name it should tell you which name. It shouldn't produce an "error number" and expect you to look it up . . .'

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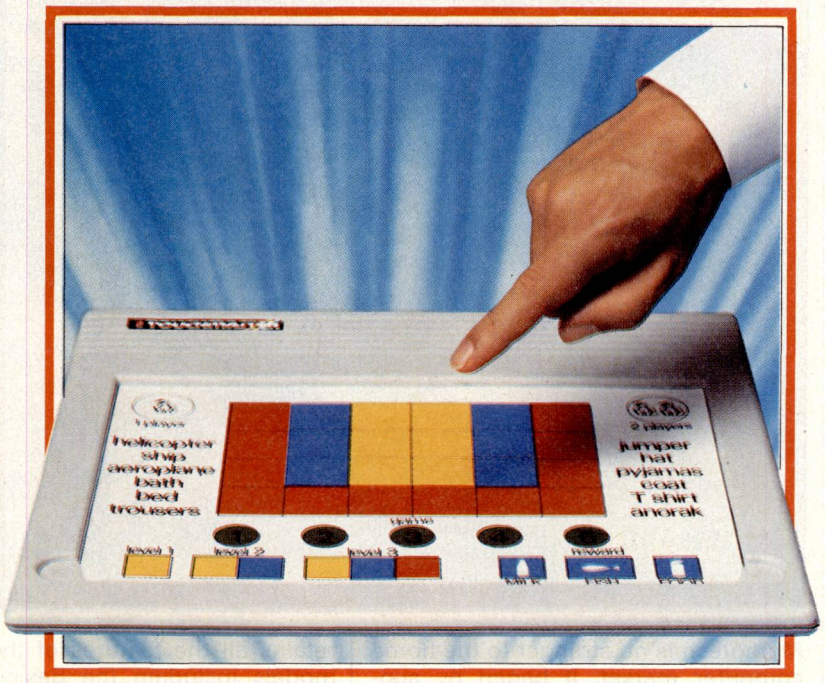

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Memotech RS128

Memotech's former excursions into the micro market have received critical acclaim, but it looks as though the RS128, a home computer with immense expansion potential, will be the machine that earns the company most praise. Tony Hetherington takes a look.



Memotech is no stranger to the home computer market. It began by supplying memory expansions for the ZX81 and has progressed to its own range of micros.

The MTX 500 and 512 started the range last year with limited success, but now the icing has been added to the cake with the launch of the RS128. It retains all the features of the earlier models including the Basic, built-in assembler and a text display language called Noddy, and adds an impressive 128k of memory, two RS232 interfaces and a cable to connect it to the FDX disk system. All this is available for a starting price of £399, which can be expanded, via the disk system, to a full CP/M micro for £1250.

Hardware

The RS128 is supplied in a box along with a power supply, leads, demonstration cassette and full documentation. Also supplied with the review machine was an FDX disk system, which converts the RS128 into a fully-fledged

CP/M system, and a Pascal ROM board.

The machine is housed in a beautifully-styled black brushed aluminium case with a sports car style stripe along the top.

The keyboard houses 79 keys divided into 57 keys which form the standard qwerty layout, a numeric keypad which doubles as cursor control and editing keys, and a group of eight function keys which, with the shift key, provide 16 programmable function keys. There are two additional unmarked keys at either side of the space bar which reset the computer when pressed simultaneously.

The keys are nicely spaced and have a good positive feel. It's obvious that some time has been spent on the board's design, for not only is it well laid out, but the F and J keys have deeper recessions for easy fingertip recognition during typing.

Aluminium is an unusual choice for a computer casing — it's normally plastic — but was presumably selected because of its ability to dissipate heat while shielding the electrical components from interference.

Along the back of the casing is an impressive array of outputs and interfaces, including two RS232 interfaces and a centronics printer port. Above the interfaces is a slot through which a ribbon cable connects the RS128 to the FDX disk system.

Both TV and composite monitor output are provided along with a hi-fi for channelling the sound through your amplifier. Power is fed into the computer via a din plug through an attractive power supply which has an on/off switch on one side. — it's surprising no one has thought of it before!

Two standard joystick interfaces, a cassette microphone and ear sockets complete the back of the micro. There's also a cartridge slot in the left-hand panel of the unit.

Unscrewing the side panels allows you to lift the hinged lid of the computer giving access to the inside, two thirds of which is dominated by the main circuit board featuring the now familiar Z80A processor. As in the MSX machines, the graphics capabilities are provided by the remarkable TMS 9918A series video chip from Texas Instruments. This time, however, the sound is supplied by another Texas chip, the SN76489A.

The main board comprises 24k of ROM. This also contains MTX Basic and, among other delights, a built-in assembler. The video chip is accompanied by its usual 16k of video RAM, but the user RAM is made up to the required 128k by an expansion board which plugs into the right-hand end of the main PCB. Another plug-in RS232 communications board completes the inside of the machine.

It's these two boards that form the difference between the RS128 and its predecessor, the MTX512. Indeed, it's from these boards that the computer's name is derived — RS(232) 128(k) = RS128. An MTX512 can be upgraded to an RS128 by the inclusion of these two boards — the review machine *was* such a hybrid. The boards are easy to fit or remove as they are guided into the right place by two grooves running the length of the computer's innards.

The Pascal ROM board is one of two boards available, the other being a ROM-based word processor called NewWord. Unfortunately, there's only room inside the machine for two boards, so if you wish to use the Pascal board you should substitute it for the RS232 board, as it's unlikely that you'll require both at the same time. You should, of course, replace the RS232 board when you wish to use the FDX disk system.

'The RS238 retains all the features of the earlier models including the Basic, built-in assembler and a text display language called Noddy, and adds an impressive 128k of memory, two RS232 interfaces and a cable to connect it to the FDX unit.'

The FDX is housed in a matching black brushed aluminium case and is large by any standards. Together with the RS128 and a monitor it forms a neat business system which would be equally at home in the office or on the dining room table. Set in the front of the FDX unit are two 500k 5¼in disk drives, an on/off switch and a fan. The FDX connects to the RS128 via a ribbon cable fitted into the bottom of the unit. A power lead runs from the back of the FDX to the RS128 which replaces the RS128's own supply. The video output is also via the FDX's 80-column board, and can deliver either monochrome or 16-colour RGB.



Two 500k 5¼in disk drives, an on/off switch and a fan sit at the front of the FDX unit

In addition to the disk drives, the review machine had a 256k silicon disk. This is basically an area of memory which the operating system treats as a disk drive. Consequently, applications software can be rapidly loaded and accessed at speeds that dramatically increase the package's performance. This can make the difference between a package that's useful but time consuming and an invaluable piece of software.

The review FDX system could be expanded by the addition of two further disk drives and up to three more silicon disks.

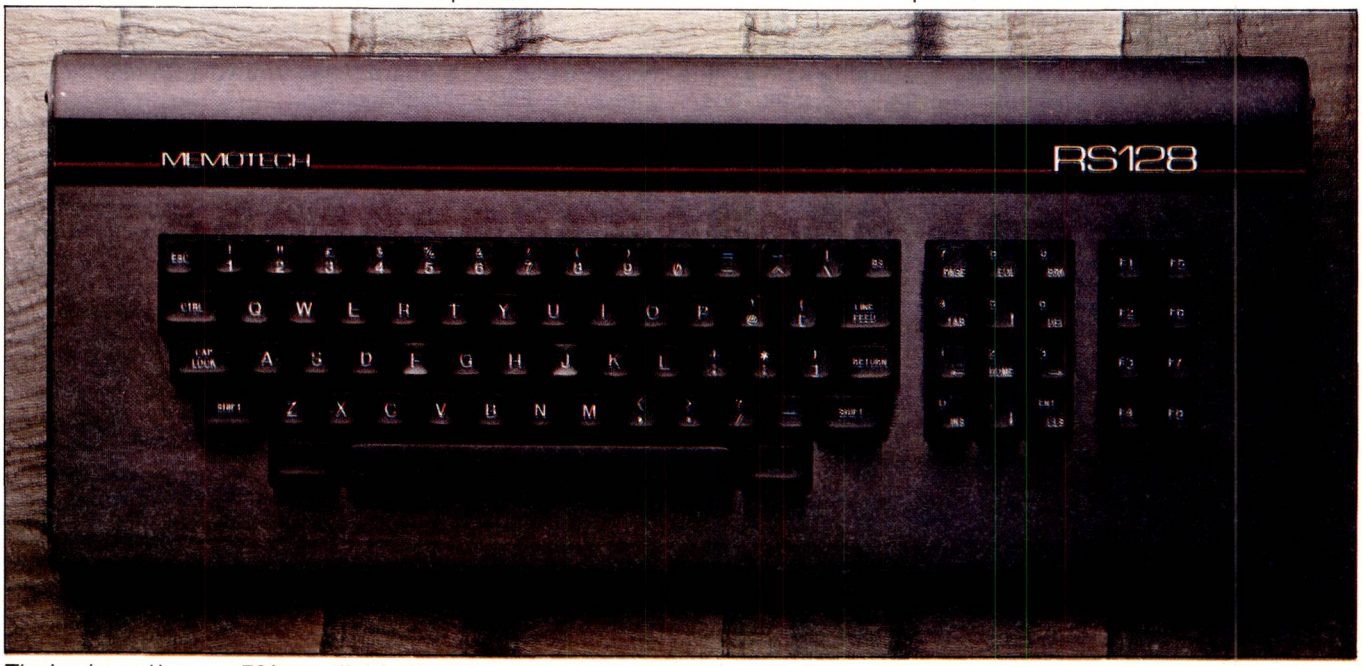
System software

When you switch on the RS128 you are faced with a dead screen — an all too common occurrence. The only movement is a flashing white cursor, below which appears the message 'Ready'. This is a shame since it hides the machine's best facilities: the RS128 user has access to MTX Basic or an interactive text language called Noddy, and a built-in assembler complete with display panel. According to Memotech, Noddy does for text what Logo does for graphics. I assume this means that the principles of programming are grasped through small, easy-to-learn steps.

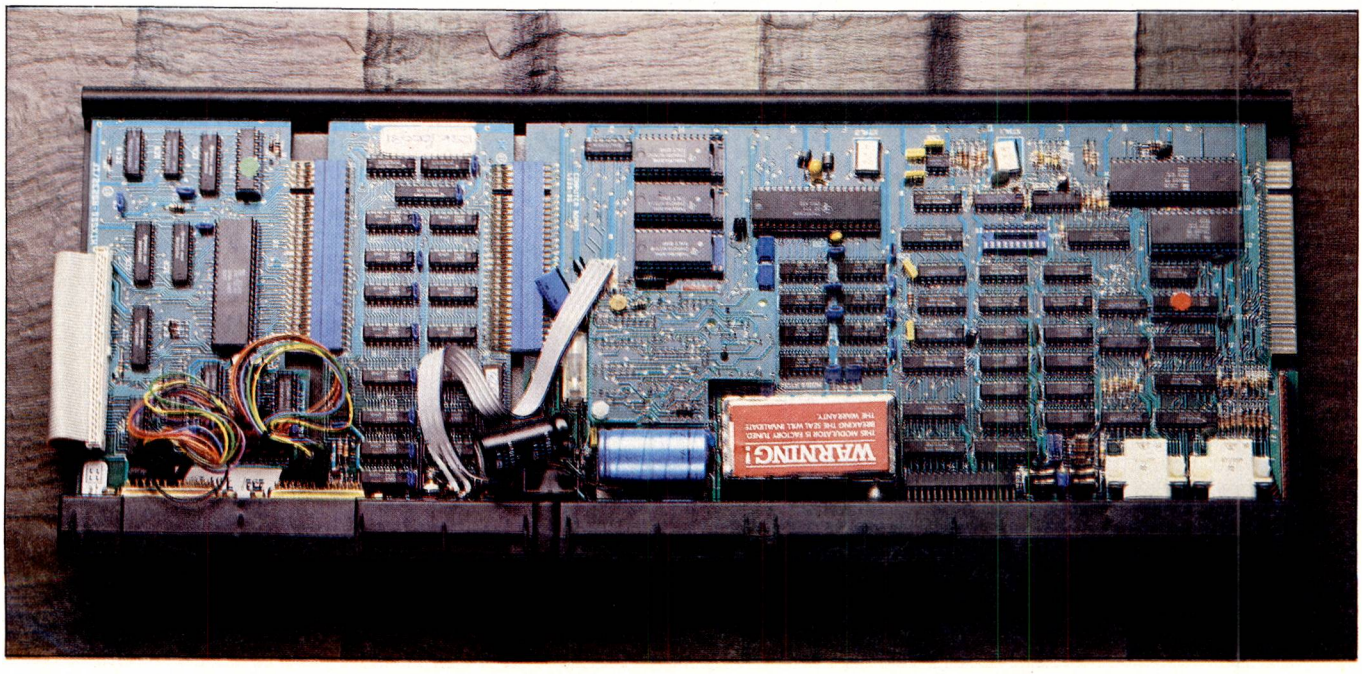
A Noddy program is a collection of pages that contain either data or programs. A data page is easy to create and once you've given it a title you're free to type any data you want, be it an address, recipe or menu.

A Noddy program is written on a program page and is constructed from only eleven commands. These are easy to understand and include DISPLAY to show a data page, ENTER to test for keyboard input, IF to test for a condition, and BRANCH and GOTO to jump to another part of the program. Noddy programs are run from Basic by the PLOD command (as in PC) and control is returned to Basic with the RETURN command. Each command is prefixed by an asterisk, so it's easy to distinguish a Noddy program from one written in Basic.

Noddy is a comparatively new language and is still in its infancy, conse-



The keyboard houses 79 keys, divided into three clearly-defined areas. They are nicely spaced and have a good positive feel



The machine's name is derived from the plug-in RS232 comms board and the (128k) RAM expansion board

quently little is known about it. It has some interesting aspects, particularly the ease with which pages of data can be displayed onscreen. The majority of RS128 users will skip Noddy and go straight into Basic, which is a shame for it certainly has potential. It will not replace Logo as a teaching aid for children, but it may be suitable for adults learning programming since it provides more useful examples than a turtle moving round a screen. If nothing else, you should bear it in mind for screen display subroutines to be incorporated into Basic programs: for example, a page of instructions or help screens.

'A Noddy program is a collection of pages that contain either data or programs. A data page is easy to create and once you've given it a title you're free to type any data you want, be it an address, recipe or menu.'

The next built-in feature will appeal to users at the other end of the computing spectrum, as it's an assembler/disassembler package.

You enter the assembler from Basic by simply typing ASSEM. Once in you are free to enter insert and delete assembly programs; CLS then returns you to Basic and assembles the code. The assembler is accompanied by a monitor, or front panel, which allows the user to inspect, edit and move blocks of memory. With the monitor you can also follow the contents of the machine's registers while a program is running. This will have Z80 machine code freaks champing at the bit, but the rest of us will be content with MTX Basic.

The RS128 relies on the Texas Instruments TMS 9918 chip for its graphics facilities, so in order to appreciate the machine's Basic graphics capabilities it's necessary to understand the workings of the chip.

The picture displayed on the screen is created from a sandwich of 35 display planes, the first 32 of which are the sprite planes where a single sprite roams. These sprites are usually 8 × 8 pixels square, although they can be 16 × 16 or even 32 × 32. Positioned behind the sprite planes are the multicolour or pattern plane, the backdrop plane and the external video or border plane.

Any fixed pattern is drawn onto the pattern plane which in high resolution mode is split into 256 × 192 pixels, therefore quite complex graphics can be created from moving sprites over the plane. If any pixels are left transparent the background colour of the backdrop plane will show through, thus completing the picture.

The sprite planes are larger than the screen area and the other planes. They are a massive 8196 × 8196 pixels, so you can move sprites around without them appearing on the screen: this is useful if you want to have something circling the screen which leaves one side of the screen and after a delay emerges at the other side.

The sprite planes are parallel to the pattern and backdrop planes, which are exactly what you see on the screen. You, therefore, see the pattern and backdrop planes overlaid by whatever section of the sprite planes you've selected with the 'VIEW' command. If there's any overlap between the sprites on different planes, precedence is given to the upper ones.

Surprisingly, all this is controlled by a handful of Basic commands. The patterns or shapes of the sprites are defined using the GENPAT command which forms a pattern table. Any of these patterns can be used by each sprite by substituting the correct number into the SPRITE command, which also defines each sprite's initial speed, position and colour. Sprites are moved by the MVSPR which tells a single sprite to move one step in a given direction. The step size is set in the sprite command. The ADJSPR command is used to adjust a sprite's parameters while a program is running instead of repeating the SPRITE command.

The final sprite command is probably the most powerful and complicated, and can be used to set the size of sprites, their total number, the number of circling sprites and their speed, and to move sprites set distances. Sprites can be ordered to follow points or lines drawn on the pattern plane. These points or lines are drawn by the machine's remaining high resolution graphics commands. These include PLOT to draw a point, LINE to etch a line, and CIRCLE.

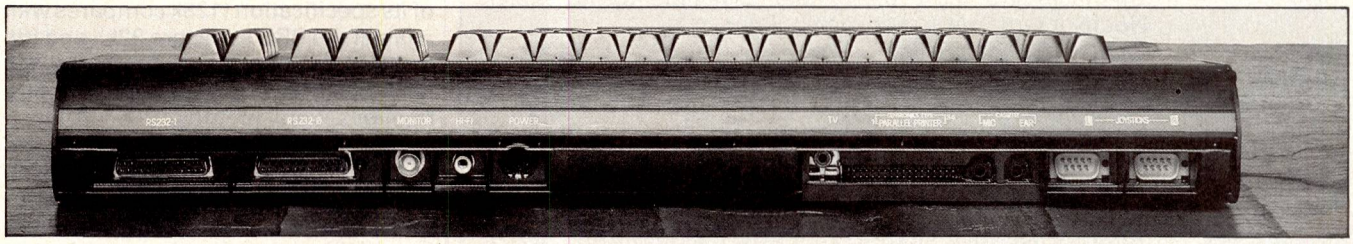
The Memotech's text screen has a resolution of 24 lines by 40 characters, but is split into eight virtual screens. MTX Basic uses five of these: the editor screen (four lines), the list screen (19 lines), the graphics screen, the whole screen (24 lines), and the one line message screen. These are numbered VS0, VS1, VS4, VS5 and VS7 respectively. These virtual screens can overlap each other and are selected by the VS command. MTX Basic only uses five, which leaves the other three for you to define as you wish through the CRVS command. Such virtual screens or windows can be set to any size and can be used for either text or graphics. You can redefine one of the screens used by Basic, but this will be taken from you whenever you return to Basic.

It's interesting to compare MTX Basic with MSX Basic since the RS128 has the same processor and video chip as found in MSX machines (for example, the Sony). Both Basics have excellent sprite facilities, but the RS128 forfeits powerful interrupt-driven commands in favour of screen windows. The sound differs as they use different chips.

The Memotech's sound is generated by the SOUND command and is specified in the command's seven parameters. These parameters include the channel number, the sound's frequency, volume and length. You can also specify the degree by which the volume and frequency will rise and fall. The machine loads this information into a special area of memory called the sound buffer, which allows the computer to perform other tasks while the sound is playing. As this uses memory the sound buffer can be accurately dimensioned by the SBUF command.

'Both TV and composite monitor output are provided along with a hi-fi for channelling the sound through your amplifier. Power is fed into the computer via a din plug through an attractive power supply which has an on/off switch on one side.'

An MTX Basic derivative is packaged with the FDX system and is logically called FDX Basic. This replaces the MBasic found on earlier FDX systems



An impressive array of outputs and interfaces including two RS232 interfaces and a centronics printer port

and is essentially MTX Basic with a few additional commands for disk access. These commands support both sequential and random access files which are compatible with CP/M and are self-explanatory.

Applications software

Also included with the FDX system are a word processor called NewWord, and SuperCalc which requires no introduction.

NewWord is available for the RS128 in two forms: as a disk supplied with the FDX system, and as a plug-in ROM board costing £75. The ROM version contains fewer features than the disk version and uses cassettes for storage of documents. It will, however, form a reasonable compromise between users who want a word processor but haven't the funds to buy the disk system. In essence, NewWord is WordStar configured for use with the Memotech's keyboard. The transition has been successful as it forms a pleasant word processing unit.

Pascal and Logo are also available in ROM boards, although only the Pascal was available for evaluation. It was written for Memotech by Hisoft, and as you can see from the Pascal Benchmarks it's a good performer. Like the ROM-based NewWord it uses cassettes for storage, but must still be considered an essential buy for Memotech owners wishing to experiment with this powerful language.

Other software will be plentiful both in disk and cassette form if early indications are proven reliable. A catalogue enclosed with the machine shows a healthy list of about 50 titles including business, educational and games programs. The games include some titles that have been successful on other machines, such as the Level 9 adventures and titles from Ocean and Lothlorien.

As the RS128 becomes a fully-fledged CP/M machine with the addition of the FDX system, it will soon be supported by a glut of CP/M packages.

Documentation

Three manuals were provided with the review machine: the Basic tutor operator's guide, the FDX system manual, and the Hisoft Pascal user's guide. The Pascal manual is, and is meant to be, a pure reference guide to be used by existing Pascal users, and directs beginners to a number of books referenced at the back. The other two manuals aim to provide tuition as well as being reference works for experienced users.

The Basic tutor manual takes the user from initial setting up on to the intricacies of MTX Basic, Noddy and the built-in assembler. At each stage in the tutorial section there are enough examples to get users happily tapping away at the keyboard; at every stage you are urged to experiment with the commands you have just learnt. It's left to experimentation to discover some of the features of the machine. For example, as in Acorn computers, keywords can be abbreviated with a full stop, as the Basic takes this as a keyword and searches through its list until it finds one that starts with the letter(s) before the full stop. This is a useful feature which greatly speeds up programming, but no mention of this is made in the manual.

The back of the manual includes a variety of technical information which will keep techno buffs happy for weeks. This is fine, but there seemed to be an unbridged gulf between the tutorial section and the technical details. The same problem exists with the FDX manual which contains sections on setting up, using NewWord, SuperCalc and FDX Basic, and the technical section.

The manual is supplied in a ring binder which folds into a stand for easy use at the keyboard. A nice final touch is the disk holders, which are in the front of the manual and ensure that the disks don't stray too far from the machine.

Prices

The Memotech RS128 costs £399 and as such is a direct price competitor to the BBC B, Advance 86 and Sinclair QL. The FDX disk system which converts into a fully-fledged CP/M system retails for £870, setting the total cost of the CP/M system at £1269. The silicon disks cost £385 extra.

The Pascal ROM will cost around £50, but the ROM version of NewWord is more expensive at £75.

Conclusion

The Memotech RS128 will be a very tempting prospect for anyone buying a home computer with a view to future expansion. The basic unit has a lot to offer with its 128k of memory, powerful graphics facilities, Noddy and the assembler. Add to this the FDX system and you have a powerful CP/M disk system complete with silicon disk for a competitive £1600. This also gives users access to the plentiful supply of CP/M packages.

This mirrors the facilities offered by the Advance, which provides users with IBM compatibility as opposed to CP/M. However, I feel that the RS128 has more appeal because of the quality of its construction and ease of use: for example, the keyboard is well suited for business use.

The RS128 may also convert some potential BBC and QL buyers by virtue of its specification (128k compares well against the BBC's meagre 32k), and the fact that its younger predecessors, the MTX 500 and 512, have operated bug free for several months.

The RS128 offers a total home computer package providing a wide range of games and educational programs, to a full CP/M system offering a formidable array of business packages.

END

Benchmarks

Pascal	
Magnifier	0.3
Forloop	3.0
Whileloop	4.6
Repeatloop	4.1
Literalassign	3.7
Memoryaccess	3.8
Realarithmetic	15.6
Realalgebra	16.1
Vector	8.7
Equalif	6.6
Unequalif	6.3
Non-parameters	3.1
Value	3.9
Reference	4.0
Maths	6.9
Basic	
BM1	1.9
BM2	5.3
BM3	11.7
BM4	11.4
BM5	13.3
BM6	22.6
BM7	40.8
BM8	43.7

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

Technical specifications

CPU:	Z80A processor running at 4MHz
ROM:	24k including MTX Basic, Z80 assembler/disassembler, Noddy interactive screen manipulator
RAM:	128k + 16k video RAM
Display:	Text 24 lines of 40 characters. High-res 192 × 256 pixels. 16 colours, 32 sprites
Sound:	Four channels via TV or hi-fi output
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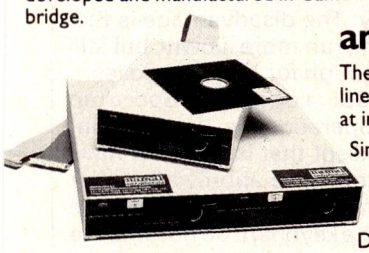

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SOFTWARE

Lesson in Logo

Mike Liardet experiments with LCSI Logo, a Sinclair-marketed version of the original language. Implemented on a 48k Spectrum it is designed to teach programming and mathematical skills to people of all ages.

Most home computer users hope to find some educational value in their machine, but can easily become bored with the rather limited role-learning software currently available. Regrettably the best software for home computers is for games; but while games software is undeniably entertaining, most of it provides about as much mental exercise as a pin-ball machine.

Unlike Basic, Logo has been developed with the premise that learning should be easy and *fun*, and that anyone having fun will learn much more rapidly. We all become literate, not by reading Shakespeare, but with books that are easy and enjoyable. The same should hold true for computer literacy, and Logo is certainly a major step in the right direction.

But it would be unfair to cast Logo as the programming language equivalent of Noddy and Big Ears — it's much broader than that. It can be used at the Noddy level but is also sufficiently interesting for adults to use, and can subsequently exercise computer literacy skills right up to, say, *Brighton Rock* level.

Logo is a spin-off product from Artificial Intelligence (AI) research, and was devised by Seymour Papert at the Massachusetts Institute of Technology. Other well-known Artificial Intelligence languages include Lisp and Prolog. Some of the list processing features originally designed for Lisp have found their way into Logo, but the whole philosophy behind Logo is different from its AI sister languages: whereas Logo makes the learning of programming and mathematics fun, Lisp and Prolog are designed as sophisticated tools for AI research.

Implementation

At £39.95 LCSI's (Logo Computer Systems Inc) Logo may seem rather pricey for Spectrum software, but it's a very comprehensive and well-presented package. It comprises two spiral-bound manuals, a reference card and an audio cassette, all elegantly housed in a library box. The first manual is a tutorial, the second is for reference.

The software is compatible with Sinclair microdrives but must be loaded from cassette (seasoned Spectrum users will be used to doing this). The tutorial manual gives comprehensive instructions on what to do, including instructions for connecting up a Spectrum. In general the Logo documentation is completely self-contained, and it shouldn't be necessary to consult other Spectrum documentation at any time during a Logo session. The tape takes just over four minutes to load, with some graphics onscreen to entertain you while you wait.

Like Basic (and other languages — Lisp, Forth and Prolog), Logo is interpretative. This means that you can enter commands and programs directly at the keyboard and they are executed or used immediately; the advantage being that if anything is wrong you'll quickly find out and be able to correct it immediately. The disadvantage is that the programs run more slowly, but still quite fast enough for most purposes.

Under LCSI Logo the Spectrum keyboard operation is largely unchanged, except that it does not have the single keystroke abbreviations for keywords: most of the Basic keywords marked on the keyboard do not apply to Logo. It does, however, recognise two-letter abbreviations in some cases (for example, 'FD 50' is the same as 'FORWARD 50').

Drawing

An interesting option and the ideal way to introduce Logo is with a 'turtle', a motorised plexiglass creature trailing a pen and connected to the computer. Under keyboard control the turtle can crawl around the floor leaving a trail behind it. For example:

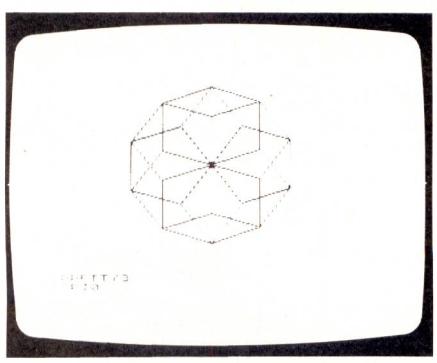
FORWARD 50

will cause the turtle to crawl forward 50 units leaving a straight line behind. Then typing:

RIGHT 90

will cause it to turn 90 degrees to the right and a further FORWARD will draw a line at right-angles to the first, and so on.

This turtle has obvious appeal for younger users, but does have the disadvantage of being slower and less precise than screen graphics. It also



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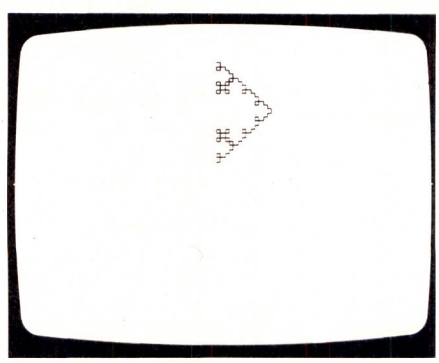
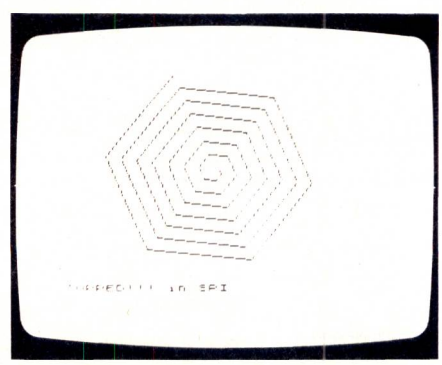


Drawing in Logo can be recursive



Parameters give different results

represents an added expense.

Most Logo users might prefer to forgo the expense, and make the small mental leap needed to work with a virtual turtle instead. With a virtual turtle the screen display shows a plan of the turtle's floor, with the turtle in the middle represented as an arrow. The arrow can be turned by commands such as RIGHT, and moved forward by using FORWARD. Following FORWARD, a line is left behind on the display. All the commands and effects are identical to a genuine turtle, so anyone used to the real thing can quickly get to grips with it.

The virtual turtle can be set to work immediately. Type:

```
FORWARD 30 RIGHT 90
FORWARD 30 RIGHT 90
FORWARD 30 RIGHT 90
FORWARD 30 RIGHT 90
```

and a square appears before your very eyes, with the turtle back where it started and pointing the same way (you see each side of the square appear as each line is typed). It's also interesting to note that LCSI Logo automatically selects graphics display instead of text as soon as the first line is typed. In text mode the entire Spectrum screen is used for text, but in graphics mode only the bottom two lines show text: the rest of the display is devoted to the turtle's floor. An added refinement from LCSI is that you should see a square and not a rectangle on your screen, due to the software having built-in compensation for your display's aspect ratio. If you have a peculiar TV you can tune this ratio with a Logo command until the display looks right.

To draw another square later, or for any other favoured sequence of commands, you must retype the above sequence again. This can get quite tedious, so Logo provides a facility for setting up any sequence of commands as a named procedure which is automatically executed every time you type the name:

```
TO SQUARE
FORWARD 30 RIGHT 90
FORWARD 30 RIGHT 90
FORWARD 30 RIGHT 90
FORWARD 30 RIGHT 90
END
```

After typing this no square is drawn, but the four lines to draw a square can be invoked at any time by typing the word SQUARE. This procedure TO SQUARE can also be used by other procedures. For example:

```
TO SQUARESTAR
REPEAT 12 [SQUARE RIGHT 30]
END
```

Typing SQUARESTAR produces the display in Fig 1 — a sequence of 12 squares each rotated 30 degrees round the previous one.

Logo is really designed to get you started with graphics as soon as possible (the LCSI tutorial manual introduces graphics as early as page five). Graphics is much more interesting and motivating than generating tables of numbers, but is just as mentally stimulating.

LCSI Logo has many more graphics facilities. The graphics screen can be printed on the Spectrum printer and the 'pen' set into different modes: rub-out, pen-up, pen-down and reverse. Pen-up allows the turtle to move without affecting the display, pen-down draws normally, rub-out does just that, and reverse interchanges black and white. There's also a choice of eight colours for both background and pen, and 34 turtle operations in total.

List processing

Logo's list processing facilities open the door to all kinds of interesting projects, and it can be argued that a new user will find lists a lot easier to handle than the nearest Basic equivalent — the array. In fact LCSI Logo does not have an array facility, so lists must be used instead.

A Logo list is a sequence of names, numbers or further lists enclosed in square parentheses. They can be manipulated in much the same way as Lisp lists but use more intuitive names for operators and, moreover, Logo does not suffer the confusing excess of parentheses for which Lisp is notorious.

```
FIRST [PCW ARTICLES [LISP LOGO]]
    returns PCW
BUTFIRST [PCW ARTICLES
    [LISP LOGO]] returns
[ARTICLES
    [LISP LOGO]]
FPUT "GOOD [PCW ARTICLES
    [LISP LOGO]] returns
[GOOD PCW ARTICLES
    [LISP LOGO]]
```

and other commands like LAST and BUTLAST have an equally obvious effect. (FPUT is an abbreviation for 'first put').

LCSI Logo doesn't provide quite as many list operations as Lisp. Notable omissions include RPLACA and RPLACD, which enable parts of an existing list to be overwritten ('RPLAC' means 'replaced' — typical Lisp obtuseness). Possibly this omission is intentional, as these so-called 'side-effect operators' have always been a controversial issue, at least in AI circles.

Arithmetic and variables

LCSI Logo provides a number of arithmetic functions which can handle both integers and floating point. The syntax for arithmetic expressions is much like other languages — and *not* like Lisp. There are, however, one or two surprising omissions such as exponention (for example, 2^4 = 16) and logarithms. The trigonometry functions operate, like the turtle, on degree quantities and not radians.

Like most languages Logo allows for variables, which can be used to store intermediate results, but in some respects I found Logo's use of variables a little confusing. The translation of the Basic statement:

```
LET X = Y + 3
```

into Logo is:

```
MAKE "X :Y + 3
```

which seems less intuitive.

Each word used in a command line can be preceded by a colon, quotation, or nothing. For example, applying the Logo PRINT procedure to each of these three possibilities for the word X:

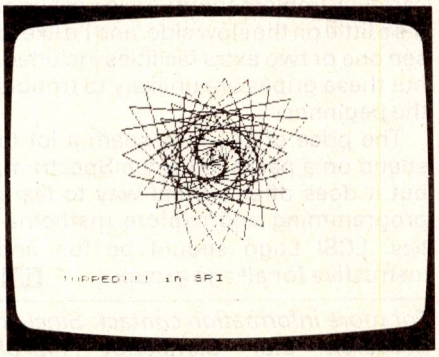
```
PRINT "X echoes just X on the screen.
PRINT :X prints the value of X.
PRINT X is an error, since Logo
        attempts to execute a (non-
        existent) procedure X.
```

LCSI Logo programs are built up out of simple procedures. Procedures can have parameters, thus the SQUARE procedure can be generalised to draw any size of square by the introduction of a :SIZE parameter:

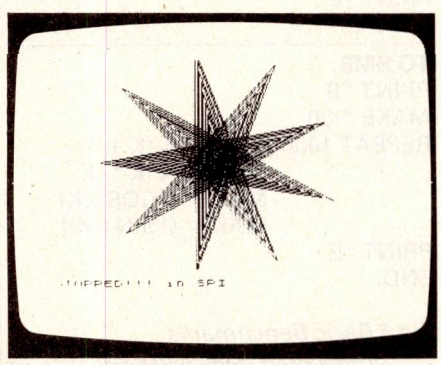
```
TO SIZEDSQUARE :SIZE
FORWARD :SIZE RIGHT 90
FORWARD :SIZE RIGHT 90
FORWARD :SIZE RIGHT 90
FORWARD :SIZE RIGHT 90
END
```

SIZEDSQUARE 30 draws a square of side 30

SIZEDSQUARE 40 draws a square of side 40, and so on.



Spiral with 125° turn



Spiral with 160° turn

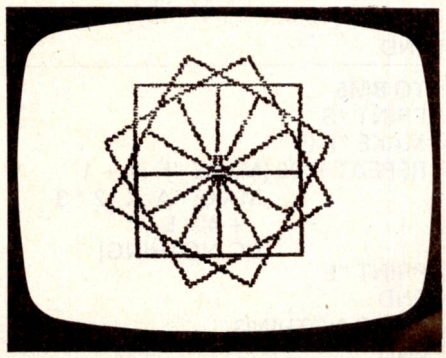


Fig 1 A sequence of 12 squares



LCSI Logo has a very poor supply of conditional operators—just two in fact. REPEAT is used to repeat a list of instructions a number of times, and IF is used to perform conditional evaluation.

```
TO DOHIL
SHOWTURTLE
CLEARSCREEN
PENUP
SETX 100
SETY -88
PENDOWN
HILBERT 3 6 1
END

TO HILBERT :SIZE :LEVEL :PARITY
IF :LEVEL = 0 [STOP]
LEFT :PARITY * 90
HILBERT :SIZE :LEVEL -1
  (- :PARITY)
FORWARD :SIZE
RIGHT :PARITY * 90
HILBERT :SIZE :LEVEL -1 :PARITY
FORWARD :SIZE
HILBERT :SIZE :LEVEL -1 :PARITY
RIGHT :PARITY * 90
FORWARD :SIZE
HILBERT :SIZE :LEVEL -1
  (- :PARITY)
LEFT :PARITY * 90
END
```

Fig 2 The Hilbert Benchmark

For example:
REPEAT 3 [MAKE "X BUTFIRST :X]
knocks the first three elements off the list X. And:
IF :Y < 0 [PR "ERROR] [PR SQRT :Y]
prints the square root of Y unless it's negative, in which case it prints ERROR.

There is a complete absence of FOR loops, DO-WHILEs, REPEAT-UNTILs, and so on—even the infamous GOTO is banned. It can be argued that these features are unnecessary or undesirable for the novice, but their omission does make complex tasks more difficult to program.

Logo supports recursion, which compensates somewhat for its dearth of conditional constructs. The Hilbert Benchmark (Fig 2) uses recursion, since it calls itself.

As procedures become more complex, an editor is necessary to create and correct them. Small simple procedures can be typed in at the keyboard and corrected by retyping from scratch, but in general most procedures should be worked on through the editor.

The editor is started by typing:
EDIT "PROCNAME
which enables the procedure PROCNAME to be edited. The screen clears and the current definition of PROCNAME is displayed. This can be freely modified by moving the cursor to the desired position and typing new text or deleting old. A couple of keystrokes finish the edit session and the new definition of the procedure is duly recorded.

There are no special sophistications in the editor and it can feel a little sluggish at times, but it's certainly adequate for the task, and preferable to the type of editing used by most versions of Basic.

Procedures can be saved, selectively if necessary, onto named files either on cassette or microdrive. It took just 25 seconds to save the eight Benchmarks (Fig 3) onto cassette. It's also possible to save variables, and since variables can contain lengthy lists, small databases can be readily saved in this fashion.

In order to test the performance of LCSI Logo, the eight Benchmarks used for testing Basic were translated into Logo (Fig 3) and a new Benchmark (Fig 2) introduced, specifically to test its graphics capabilities.

Not all the Benchmarks could be precisely translated into Logo, but the translation was close enough for comparisons to be made (Fig 4).

```
TO BM1
PRINT "S
REPEAT 1000 []
PRINT "E
END

TO BM2
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1]
PRINT "E
END

TO BM3
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1
                MAKE "A :K / :K * :K
                  + :K - :K]
PRINT "E
END

TO BM4
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1
                MAKE "A :K / 2 * 3
                  + 4 - 5]
PRINT "E
END

TO BM5
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1
                MAKE "A :K / 2 * 3
                  + 4 - 5
                DO.NOTHING]
PRINT "E
END
TO DO.NOTHING
END
```

```
TO BM6
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1
                MAKE "A :K / 2 * 3
                  + 4 - 5
                DO.NOTHING
                MAKE "M []
                  REPEAT 5 []]
PRINT "E
END

TO BM7
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1
                MAKE "A :K / 2 * 3
                  + 4 - 5
                DO.NOTHING
                MAKE "M [] REPEAT 5
                  [MAKE "M FPUT :
                  A :M]]
PRINT "E
END

TO BM8
PRINT "S
MAKE "K 0
REPEAT 1000 [MAKE "K :K + 1
                MAKE "A :K * :K
                MAKE "B COS (:K)
                MAKE "C SIN (:K)]
PRINT "E
END
```

Fig 3 Basic Benchmarks translated into LCSI Logo

	LCSI Logo	Spectrum Basic
BM1	3	4.8
BM2	90	8.7
BM3	230	21.1
BM4	290	20.4
BM5	300	24.0
BM6	360	55.3
BM7	550	80.7
BM8	670	253.0
Hilbert	1143	

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

Fig 4 Benchmark results

Conclusion

LCSI Logo is a well-presented and carefully implemented version of Logo. It's a little on the slow side, and I'd like to see one or two extra facilities included, but these gripes are unlikely to trouble the beginner.

The price of £40 may seem a lot to spend on a package for the Spectrum, but it does offer a great way to learn programming and explore mathematics. LCSI Logo should be fun and instructive for all age groups. END

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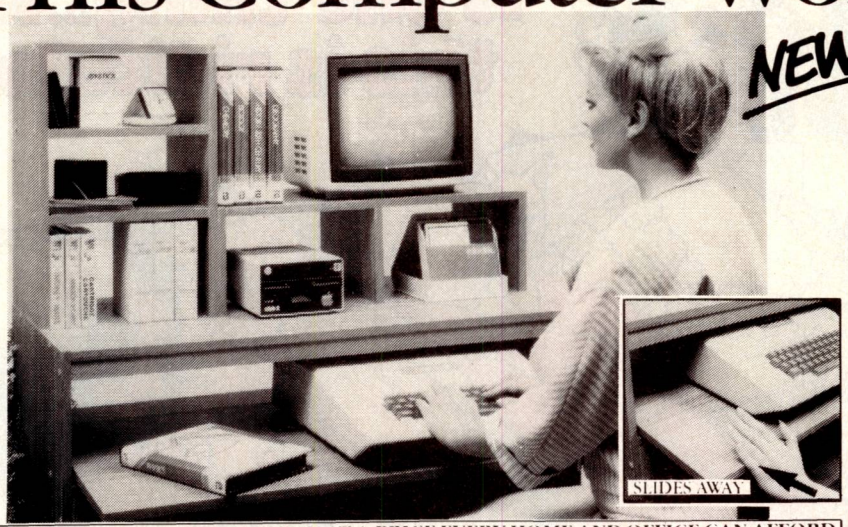

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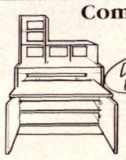

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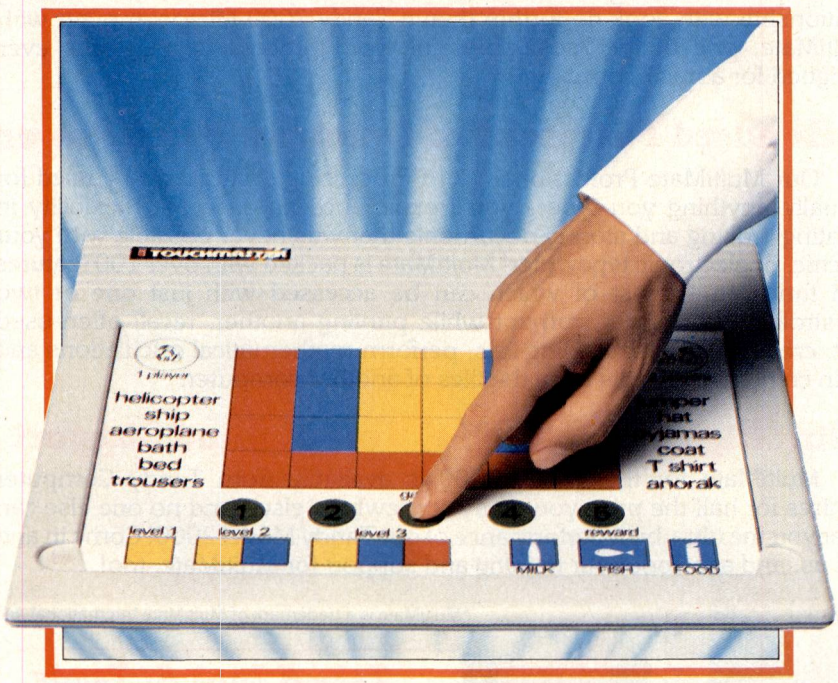

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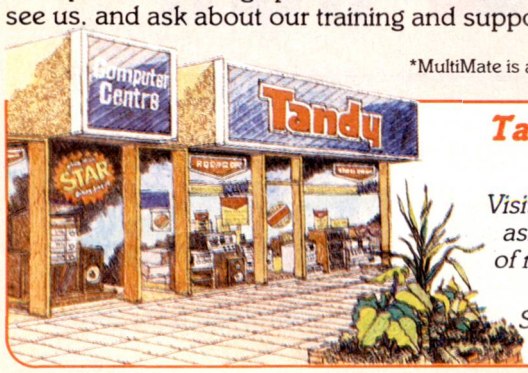

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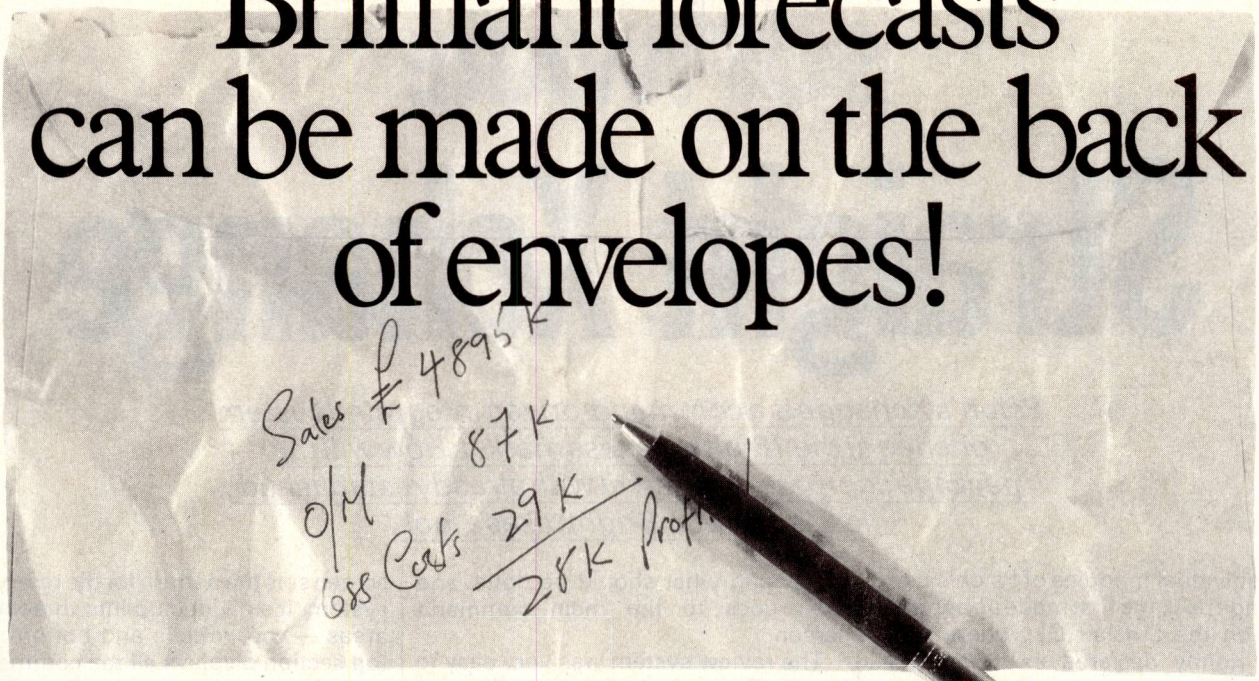

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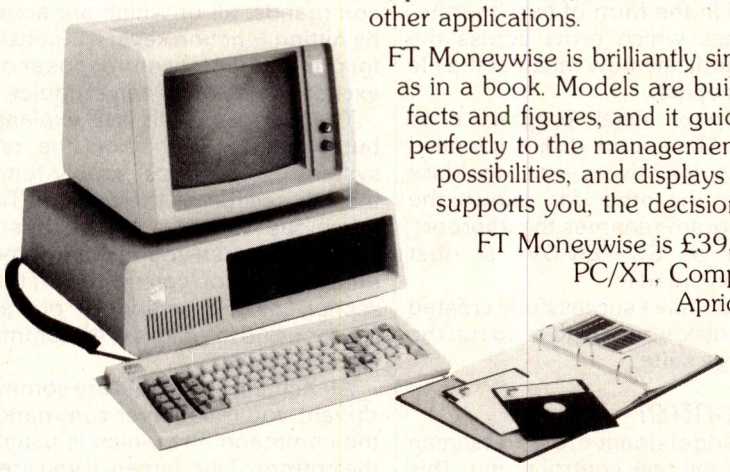

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SOFTWARE

Straight Xchange

Psion's Xchange is a command-driven integrated system pitched at the 16-bit business market. How will the package compete in a market with already established leaders? Peter Bright takes a look.

The individual modules of Psion's new Xchange package first made an appearance on the Sinclair QL, where they were rightly declared as more advanced than any other home-based software.

Now that Psion has released an integrated system containing these modules for a range of 16-bit business machines including the IBM PC and the ACT Sirius/Apricot range, I was interested to see how it compared with the 'big boys' of microcomputing, such as Symphony and Framework.

The most impressive aspect of the Psion software is the way that it's packaged. Instead of the usual IBM-style binder and box approach, each Xchange module is housed in a tough plastic case. To get inside you lift a catch and the top hinges up to reveal the documentation, which can be flipped up in the same way that you would use a flip chart.

If you buy the different modules separately, each case will contain a distribution diskette for that module. These are housed in a cunningly designed hatch under the lid — so cunningly designed, in fact, that it took me five minutes to find out how to get at the disks.

All the modules were included in the review system which was supplied on just two diskettes: one, labelled 'Source', contained all the program files and the other, labelled 'Utilities', contained the help files and the printer driver routines.

Installation

Before you can run Xchange for the first time you have to install it for your machine. The review system was designed for an IBM PC, so I had to tell it that my PC had a colour display and copy the files from the distribution disk to the work disk.

The 'Install' program is included on the 'Source' distribution disk. When it's first called it displays a screenful of text explaining what should be done, and then goes to the main command screen.

The review system was very easy to install. The only options I had to set were the screen type, and the drive to which program and help files were to be copied. When this is done, you have the option of either installing the whole system or just installing the monitor.

A full install copies the appropriate files from the distribution disk to the work disk. Install takes a long time to do this, but at least there is some compensation in the form of two 'thermometer' lines which grow across the screen to indicate how much of the file has been copied.

The monitor install program does very little. The source disk is supplied with two screen drivers — one for black and white, the other for colour; the install program renames the appropriate driver as SCREEN.OVL so that Xchange can read it.

When you have successfully created a working disk, you can go on to run the full Xchange suite.

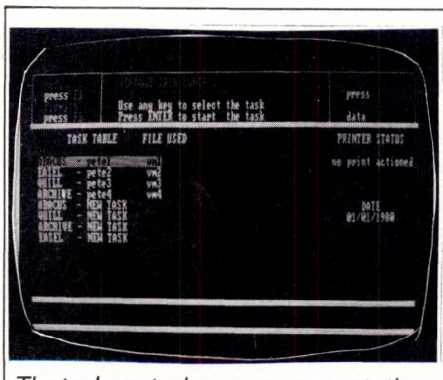
Task control

Once Xchange is loaded, the first screen you see is the task control menu. This screen sets the pattern for the rest of the system. It's divided up into three main areas — top, middle and bottom: the top section displays all the commands available at this level; the middle displays the name of each installed Xchange module along with the name of all currently active jobs, and also displays the current date and printer status; and the bottom forms the direct command line to enter Xchange commands.

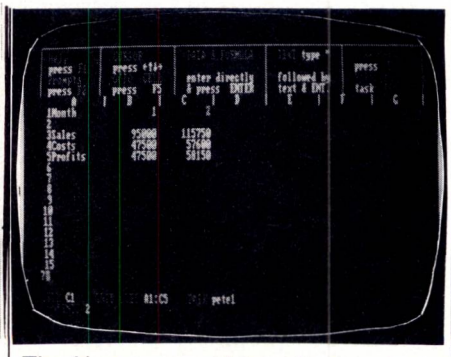
Initially, the top section of the screen gives you a choice of four task control commands, all of which are accessed by hitting function keys: F1 for help, F2 for prompts, F3 for commands and F6 to exchange data between modules.

The help option is self-explanatory but wasn't available on the review system. F2 (prompts) simply removes the top section of the display. This is much the same as WordStar's help screens — when you're accustomed to the package you can switch off the top section of the screen to prevent it cluttering up the display. All commands are still available.

All Xchange modules are command-driven: you must enter commands on the command line which is usually at the bottom of the screen. If you are new



The task control menu screen sets the pattern for the rest of the system. There are three main areas — top, middle and bottom



The Abacus spreadsheet first made an appearance on the Sinclair QL, but the IBM PC version is much more useful and comprehensive

to the package it can be difficult to remember all the available commands, but pressing F3 (commands) provides a complete list which is displayed in the top section of the screen.

Commands are usually issued by typing the first letter of the required command. The only exception is Archive, the database, where all commands have to be typed in full. If you want to get out of a command, ESCape will usually do the trick.

There are a total of 12 valid task control commands at the top level: BACKUP, CONTINUE, DELETE, LIST, NEW, OUTPUT, PRINTERS, QUIT, RENAME, SET, TSL and XCHANGE. Most are self-explanatory; CONTINUE is a way of restarting a frozen Xchange job and LIST is a disk directory program. In addition to producing a list of all the files on the disk LIST accepts wildcards, so LIST *.DOC will only display document files.

In theory, one of the nicer features of Xchange is its ability to print documents in the background while you get on with another task, which is a great time saver. This facility is activated by the OUTPUT command followed by the filename of the document to be printed, but on my version something was wrong. As soon as I tried to print and do something else at the same time, everything slowed down to such an extent that the system was virtually useless. Psion says that it's working on this.

All output to a printer from Xchange is via a 'printer driver'. This effectively generates all the appropriate control codes and means that the system can be used with a wide range of printers. The review system was supplied with drivers for Epson and Diablo printers, but I could have designed my own driver using the PEDIT utility. This produces a disk file which can then be used by Xchange; you can apparently install different printer drivers by using the PRINTERS command. When I tried this on the review machine it completely ignored me. Psion is working on this too.

The TSL (Task Sequencing Language) is Psion's version of the macro-type facility found on many modern packages. Using TSL you can store a sequence of key presses, do some rudimentary programming to obtain keyboard characters, and loop a sequence of instructions. This kind of facility is handy for direct access to a much used function, or for building small turnkey systems.

Virtual memory manager

The major difference between the 'big' version of Xchange and that supplied on the Sinclair QL is the integration of all the packages, and the use of a virtual memory manager.

Virtual memory managers use disks in much the same way that other programs use RAM. The advantage is that the program is not limited by the amount of RAM available for storage — if the RAM is full, it puts the data on the disk. The disadvantage of this approach is that it takes a great deal longer to access a disk than it does to get at RAM. To avoid this problem, Xchange's virtual memory manager is designed to handle three distinct types of memory: segment one, segment two and disk.

Segment one is the primary storage area and is made up of a 64k chunk of RAM. The size of segment two is calculated by taking your machine's RAM and subtracting the 64k taken by segment one: on a 256k machine segment two would be 192k. The slowest memory available to the memory manager is the disk drive.

When Xchange is running, the memory manager is constantly shuffling blocks of data between the three areas of memory. When a block is needed, it's located and moved up to segment one. Blocks are relegated to segment two and finally to disk on a 'least recently used' basis: first it's moved from segment one to segment two and if it still hasn't been used for some time, it's written out to disk. This system tries to ensure that frequently used data can be reached reasonably quickly.

The great advantage of having this amount of memory available is that you can hold more than one job in memory (not necessarily RAM) at the same time.

The review system allowed up to eight jobs to be open at any one time. If you're in the middle of a job and decide that you want to do something else, you simply hit function key 6 and the job is frozen, and you are returned to the task control menu. You can then start up another job, do that, hit F6 again, go back into your old job and carry on from where you left off.

The only restriction is that unlike Concurrent CP/M, for example, when you leave a job it's frozen — it doesn't carry on processing.

'The great advantage of having this amount of memory available is that you can hold more than one job in memory (not necessarily RAM) at the same time. The review system allowed up to eight jobs to be open at any one time.'

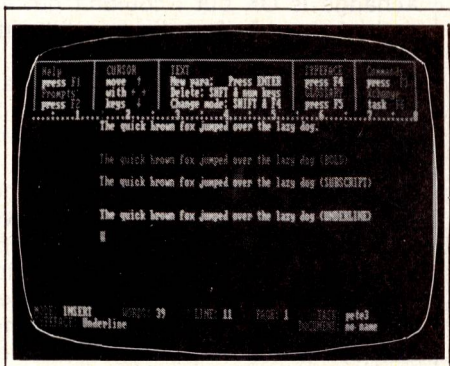
Speed

The speed with which you can switch from job to job is very much dependent on the amount of RAM you have. In general, the more RAM your machine has the larger segment two is, so the faster your system runs. However, Xchange's switching from module to module will never be as fast as Symphony's, because Psion decided to keep the program overlays permanently on disk rather than crowding RAM. This means that when you switch from module to module, there will be a small time delay as the overlay is loaded from disk.

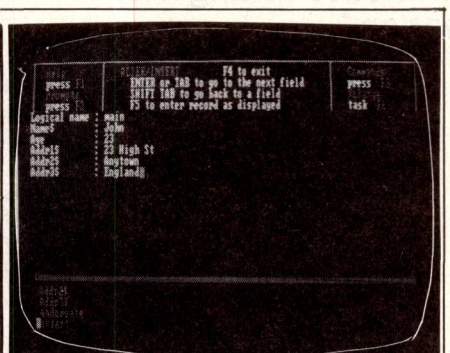
I was very interested to see how fast Xchange was at switching from module to module. I tried the program on three different machines: an Olivetti M24 with 256k of RAM, an IBM PC XT with 512k, and an IBM PC Portable with 256k. In theory, because the XT had more RAM it should have been the fastest at switching between jobs. In practice, they all worked at the same speed — slow. I couldn't understand this until I phoned Psion and discovered that the version I was supplied with locked out the whole of segment two of RAM. It didn't matter how much RAM the machine had, Xchange just used 64k and sent everything else straight to disk. Psion is working on this.

Facilities for moving data from one job to another are straightforward. To transfer data between two jobs which are already open on the system, hit function key 6 from the task control menu and Xchange will do most of the hard work for you.

Let's assume that you want to transfer data from the Abacus spreadsheet to the Easel graphics package, and that



The Quill word processor is not particularly impressive. The main typing area is cramped and restrictive but general editing is OK



The Archive database has an excellent programming language and its commands are similar to many Basic keywords

both jobs are open. When you hit F6 the system prompts for copy from name, and copy to name. It then displays the spreadsheet which asks for the range you want to copy from, and creates a temporary file for the transferred data. Next it goes into the word processor, gives itself an 'import' command and pulls in the data from the file. On my system this was all quite fun to watch, but slow.

If the job you want to copy to or from isn't open, you can manually create an export file and write to that; you can then load in the other job and read the data.

It isn't possible to move data from *any* job to *any* other because the data isn't always compatible. In the word processor, for example, you can only import data; you can't export because the data isn't structured.

Modules

Xchange is made up of four different modules: Abacus the spreadsheet, Quill the word processor, Archive the database, and Easel the graphics package. Abacus and Easel on the Sinclair QL were reviewed in the September issue, so I'll take a look at the differences on the IBM PC version.

The main difference on the spreadsheet is that the IBM PC version allows up to 255 columns by 999 rows, making Abacus into a much more useful spreadsheet allowing very complex models to be built up. The IBM PC version of Easel suffers from having to be printed on the PC's limited resolution graphics screen. Psion says that it's working on a version compatible with the Hercules graphics board, but it won't be available 'for a while'.

The least impressive of the four Xchange packages is Quill. The screen is divided up into three main areas: the top section is the usual command area; the middle section is the typing area; and the bottom gives general information on line, page, word count, typeface, and so on.

'The documentation accompanying Xchange was very good . . . many packages these days are supplied with tons of documentation which no-one reads. In contrast, the Xchange documentation was brief and to the point without omitting vital information.'

The main typing area is rather cramped. You can only edit in the central eight lines of the display when the top section is switched on, although the text is visible either side of the editing area. General editing is OK, but the fun starts when you try any block operations.

Let's take the example of a block copy. First you hit F3 and C for copy. The system then asks you to move the cursor to the start of the block to be copied and hit ENTER, then move to the end of the block and hit ENTER again. This is where you encounter the first problem: you can only move down one line at a time, so if you want to copy a large chunk of text you spend hours hitting the down arrow key. If you accidentally highlight a word, there's no way you can hit the left arrow key to remove it — you have to start again.

Assuming that you now have your block highlighted, you are then requested to move the cursor to where you want the text copied and press C (ENTER would have been a more logical choice, but it cancels the command). Finally, when you have copied the text you have to press ENTER yet again for confirmation that the job's been completed.

However, Quill is not all bad: it does have some powerful features, but unfortunately it's very annoying to use. My version was prone to crashing — I know it was a beta test version, but I hope Psion clears it up in time.

Those of you who read the QL Benchtest (*PCW*, June) will know that the Archive package is a very impressive database. Like the rest of Xchange it's command-driven, but in this case you have to enter the commands in full rather than just typing the first letter.

Although Archive is easy to use, it has some powerful built-in features. Two of the most useful are the advantage of having more than one file open at a time, and the ability to have multiple indexes pointing at the same data file.

Archive's strong point is its programming language. All Archive's commands are very like many common Basic keywords, and some of the control structures are similar to a structured Basic with extensive use being made of PROCedures, WHILE . . . ENDWHILE, and so on. This all adds up to a system which looks enough like Basic to make a Basic programmer feel at home, but which has powerful enough features to allow very complex databases to be built up.

My only reservation about Achive is that it's command-driven. A year or two ago command-driven databases were the norm, but now the trend is towards simple to use, more graphical databases which make it easy for Joe Average to sit down and bash out a database. Archive isn't so good in this area, but it's a great tool for building applications.

'A year or two ago command-driven databases were the norm, but now the trend is towards simple to use, more graphical databases which make it easy for Joe Average to sit down and bash out a database. Archive isn't so good in this area, but it's a great tool for building applications.'

Documentation

The documentation accompanying Xchange was very good. By some strange quirk I was given the Sirius documentation even though I had IBM PC software, but apart from that it was easy to follow and commendably short. Many packages these days are supplied with tons of documentation which no-one reads. In contrast, the Xchange documentation was brief and to the point without omitting vital information.

Prices

The suite of four packages costs £495 and is available for the Apricot, Apricot XI, Sirius, IBM PC and IBM XT. Individually, each package costs £175, except Archive which costs £250. Prices exclude VAT. Apple Macintosh and DEC Rainbow versions are planned for autumn release.

Conclusion

Xchange is OK but I couldn't get as excited about its features as I did with Symphony or Framework.

The review version wasn't at all reliable, mainly due to the fact that it was an early, heavily patched up beta test version.

Two of the modules — Abacus and Archive — are very good; the other two — Quill and Easel — are not so good. The overall integration was fairly basic, but it worked well enough. The user interface was fine except for niggling differences in the way identical operations are performed in the different packages. These things tend to annoy you after a while.

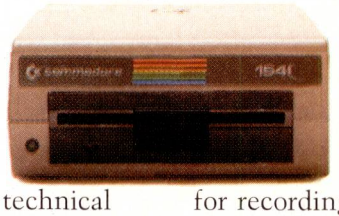
Xchange is competent, but it won't set the world on fire. END

Home computers.

The report you've been waiting for: simple, factual, honest, comprehensive and 100% biased.

ALL you need to know about computers can be summed up in one word: Commodore. (Well, we did tell you this would be biased).

We make everything you'll ever need to get the most out of home computing: all the *hardware* and all the *software*. (And if you don't understand what that means, simply look under "H").



That's what these three pages are all about: explaining what computers are (without the scientific jargon), how they work (without any technical mumbo-jumbo), and how you can get more enjoyment out of them (without much difficulty).

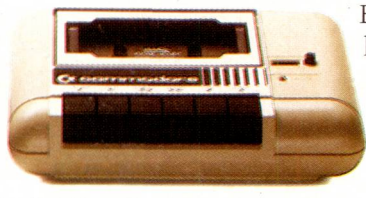
BASIC. Most home computers speak the same language. It's called BASIC. This is a friendly way of saying "Beginners All-Purpose Symbolic Instruction Code".

There are different kinds of BASIC and, like languages, some are a little easier to understand than others. Like, for instance, BASIC 3.5 in the *Commodore plus/4* and *Commodore 16* computers. BOOKS you can read: "Teach Yourself Computer Programming With The Commodore 64" and "Programmers Reference Guide".

CASSETTE. Just as you keep your favourite TV programmes on video cassette, and your favourite music on audio cassette, you can keep your favourite computer programs on cassette too. You can buy pre-recorded programs in a shop, or you can write them yourself. Cassettes are just one form of program storage and playback – see also *Cartridges* and *Disk Drive*.

The Commodore 1530 and 1531 cassette units have been specifically designed to get the very best out of our computers, and provide consistently reliable results.





CARTRIDGES. These are programs that plug directly into the back of the computer itself.

CPU stands for Central Processing Unit. This is the computer's "brain", and basically it's what does all the hard work.

CHIP: micro. A very complex electrical circuit that has been miniaturised in silicon. Unlike other home computer companies, Commodore manufacture their own chips, so first class quality can be maintained.

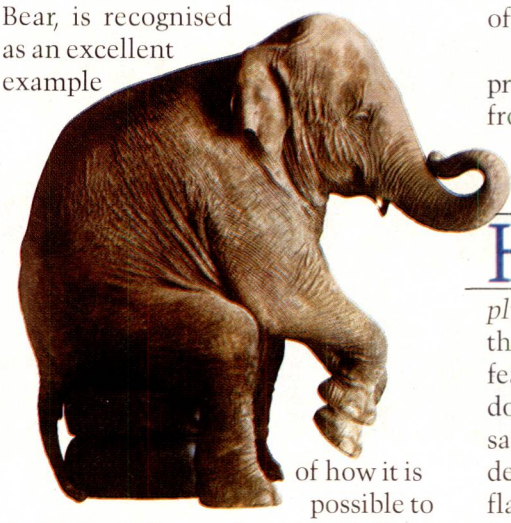
DISK drive. A program storage system, like *cassettes*, but much faster. You can find the program you're looking for in seconds instead of minutes. Disks, which can be used again and again for recording or re-recording programs, are placed in the disk drive which then transfers the information or instructions to the *CPU*.

EDUCATION software from Commodore. We are continually working with educationalists, improving our range of programs for the pre-school to "O" level age groups and beyond.

Many claim computers are an essential educational aid.

We tend to agree!

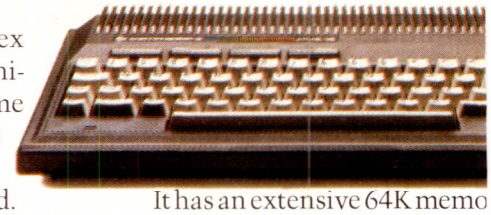
Our "Get Ready to Read" series, with a lovable character called B.J. The Bear, is recognised as an excellent example



of how it is possible to develop reading and writing skills in pre-school children.

ELEPHANT: well-known symbol of the *Commodore 64's* enormous 64K memory. And don't you forget it!

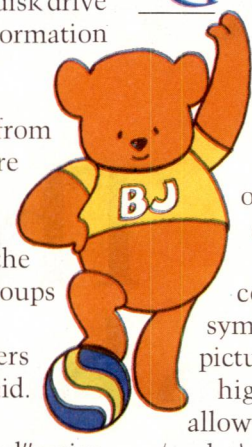
FOUR is for Commodore plus/4, our very latest home computer with four, very popular built-in programs: wordprocessing, spread-sheet (financial planning), database (filing), and graphics.



It has an extensive 64K memo with an exceptionally large 60K available for use. The plus/4 com equipped with the Commodore BASIC 3.5 with over 75 programmi commands.

Other features include comprehensive graphics, 121 colou and sound facilities.

GORTEK and the Microchips is unique programming cours for children of all ages, th links learning exercises with a space adventure sto GRAPHICS.



The pictures and diagran on a *monitor* or TV screen, either high or low resolutio

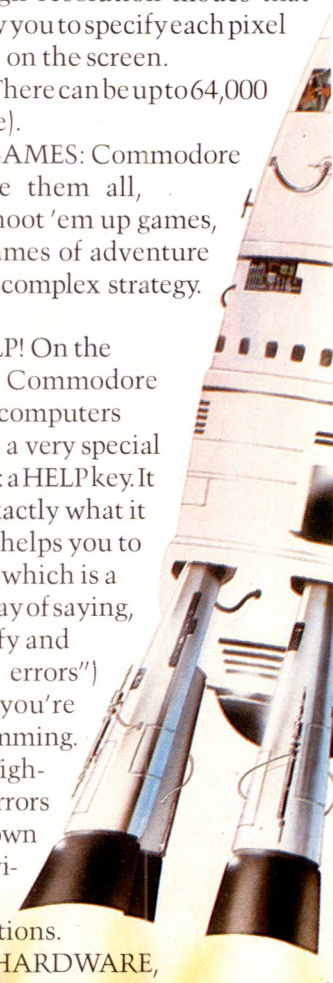
All Commodore home computers have 66 graphi symbols to create low resolutio pictures and diagrams, or high resolution modes that allow you to specify each pixel (or dot) on the screen.

(There can be up to 64,000 of these).

GAMES: Commodore produce them all, from shoot 'em up games, to games of adventure and complex strategy.

HELP! On the Commodore *plus/4* computers there is a very special feature: a HELP key. It does exactly what it says: it helps you to debug (which is a flash way of saying, "identify and correct errors") when you're programming.

It highlights errors right down to individual instructions.



HARDWARE, The computer itself – you can touch it. Whereas software's a program you can only see or hear (on the monitor) when it's running in the computer.

INTEGRAL software is software that's actually built into the computer, as on the Commodore *plus/4*, the very latest in home computing.

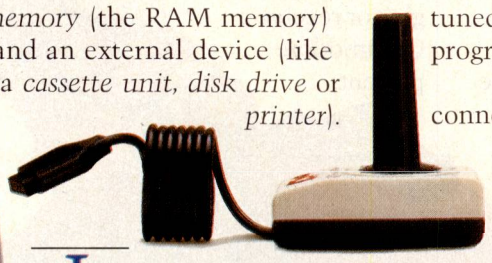
INTRODUCTION to BASIC. Just as you don't need to understand how a car works to be able to drive it, you don't have to understand how a computer works to be able to use one.

But you will definitely get more enjoyment out of it if you do have a basic knowledge of programming.

Which is why "Introduction to BASIC" has become the most popular software tutorial.

It comprises 2 cassettes and an easy-to-follow, step-by-step booklet.

INPUT/output: the part of the computer that allows data to be transferred between its own internal *memory* (the RAM memory) and an external device (like a *cassette unit, disk drive* or *printer*).



JOYSTICK and paddles. As well as improving speed and accuracy, these make games more real by putting the control of whatever it is on the screen directly into your hands.

KILOBYTE is 1,024 bytes. So "K" stands for a unit of 1,024 or 2^{10}. A 64K byte memory unit contains 64×2^{10} or 65,536 bytes of memory. And if you don't understand all that, don't worry.

All that's important is knowing you can run more complex programs through a computer with a large memory, than one with a small memory.

LANGUAGE. This is a system of coding that can be understood by a computer. It allows you to "speak" to the computer, and for the computer to "speak" to you. Most home computers speak *BASIC*, but there are also other languages available for Commodore computers that have been designed for specific uses. For example, LOGO and PILOT in *education*.

MONITOR: this is the screen on which you can see what you've typed into the computer, and also what the computer is saying back to you. You can use an ordinary TV screen, but more preferable is a colour video monitor, like the Commodore 1701.

This is a special device that produces much higher resolution than a TV, and so offers superb reproduction and clarity.

On top of which it allows the rest of the family to stay tuned-in to their favourite TV programme while you're tuned-in to your favourite computer program.

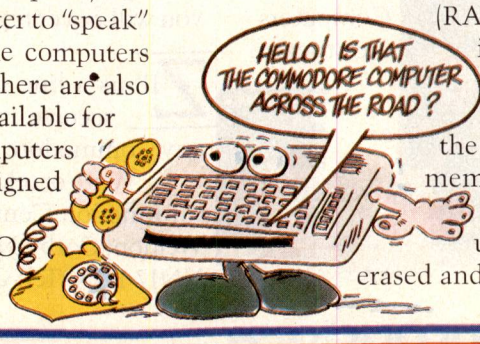
MODEMS allow computers to connect via a telephone line to other computer systems. Commodore 64 modem owners can communicate with other owners, join systems like Prestel/Micronet and an exciting new system called Compunet, where quality software is available cheaply or even free.

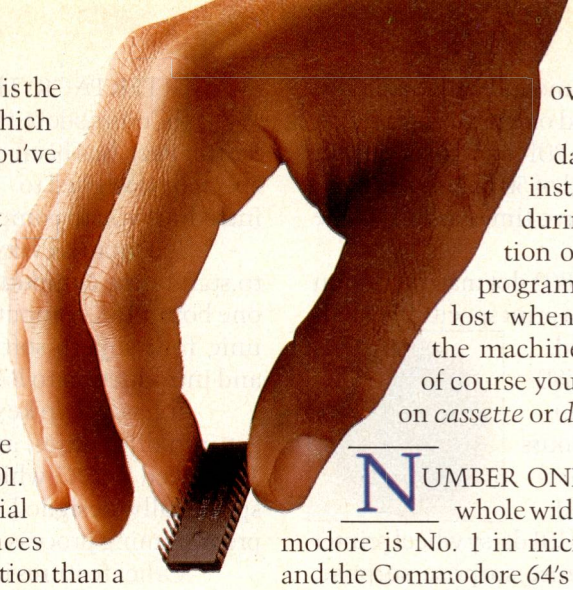


MEMORY. There are two basic types of memory: ROM and RAM.

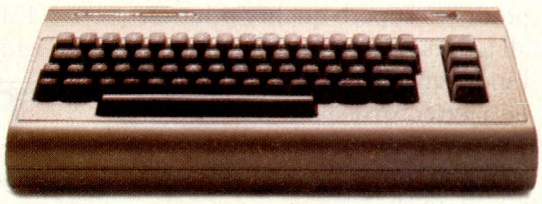
Read Only Memory (ROM) is the computer's permanent built-in memory which tells the computer what to do. It doesn't disappear when the computer's switched off.

Random Access Memory (RAM), however, is for temporary storage. It's the part of the computer's memory that's free for you to use. It can be erased and used over and over again. It stores data and instructions during the execution of a computer program. These are lost when you switch the machine off – unless, of course you store them on *cassette* or *disk*.





NUMBER ONE. In the whole wide world, Commodore is No. 1 in microcomputers, and the Commodore 64's the No. 1 best seller.



ORIGIN of the computer. In the 19th Century an Englishman, Charles Babbage, invented the first true computer. But his "Analytical Engine," was so ahead of its time, it turned out to be impossible to build!

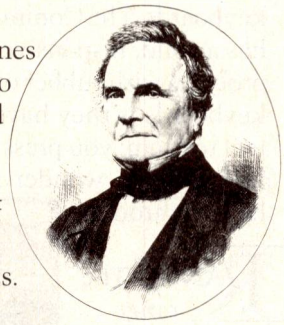
The modern computer first appeared around the time of World War II. Britain's "Colossus" was vast, consumed vast amounts of electricity, required its own air-conditioned room, was unreliable and difficult to operate.

It had its limitations.

Then came the amazing transistor... integrated circuits... and microcomputer.

The first desk top microcomputer in the world was the Commodore PET (a friendly name for Personal Electronic Transactor), in 1977.

In effect Commodore had taken hitherto huge, mysterious machines accessable only to eggheads, reduced the size and price, and put them into the hands of ordinary mortals in ordinary offices.



PERIPHERALS. These are outside the main body of the computer, but are connected to it.

They perform a definite function, which is usually *input* or output.

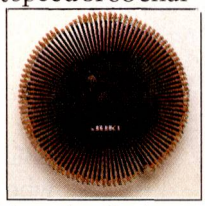
PRINTER: One of the ways a computer can "speak" to us.

It means you can actually keep, on paper, the fruits of all your labour.

The Commodore range includes four printers and one printer plotter.

The MPS 801 dot matrix printer has a print speed of 50 characters per second (about five times as fast as the fastest secretary).

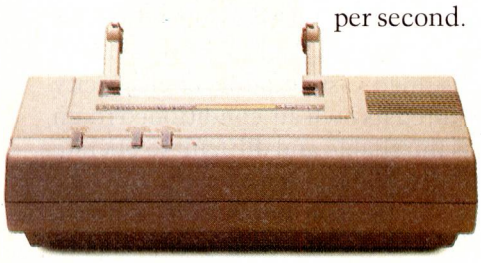
The MPS802 dot matrix friction feed printer has a print speed of 60 characters per second.



The MCS801 dot matrix colour printer has 7 colours and prints 38 characters per second.

The DPS1101 daisy wheel printer (called that because, surprise, surprise, the print wheel looks a bit like a daisy), produces superb quality print on all letters, reports and documents (the kind of quality one desperately requires on a letter to the bank manager). There's a range of alternative type faces available on additional print wheels. Speed: 18 characters per second.

And the 1520 printer plotter, (illustrated). This has 4 colours, and opens up a whole new world of graphic print-out ability. You can draw pictures, create graphic designs, plot graphs or construct bar and pie charts. Speed: 14 characters per second.



QWERTY – the top 6 letters on a typewriter. Unlike lesser machines, all Commodore computers have full-size, professional typewriter keyboards. The Commodore keyboard has a solid, responsive feel to it. (The problem with rubber or membrane keyboards is they have a soft, spongy feel to them: you press a key and immediately wonder if the message has got through).

RANGE. The range of Commodore software is enormous. There is something as they say, for everyone: educational, business, home and games.



STARTER PACK. The Commodore 16 Starter Pack has been specially designed to introduce you to computing.

It contains everything you need to start home computing, complete in one box: a 16K computer, cassette unit, four superb software programs, and Introduction to *BASIC* Part 1.

It has a *Help* key in case you get into difficulties, and incorporates Advanced *BASIC*, which has been specifically designed to simplify the programming process.

Other features include: 4 cursor keys, 2 joystick ports, an astonishing 121 colours, plus excellent sound and *graphics* capabilities.



TUNES. Commodore make software to help you compose your very own music.

All our home computers have great sound and music capabilities.

USER friendly. This is a program that explains itself as it goes along, or a computer that people can easily operate.

Every computer manufacturer now claims its products are "user friendly," but only Commodore really demonstrates it. For example, our *Help* key and use of Advanced *BASIC*.

VERTICAL integration is not as complicated as it sounds. All it means is that Commodore make everything to do with computers, from the *micro-chip* to the computer casing.

So we have complete control over everything, from design to distribution.

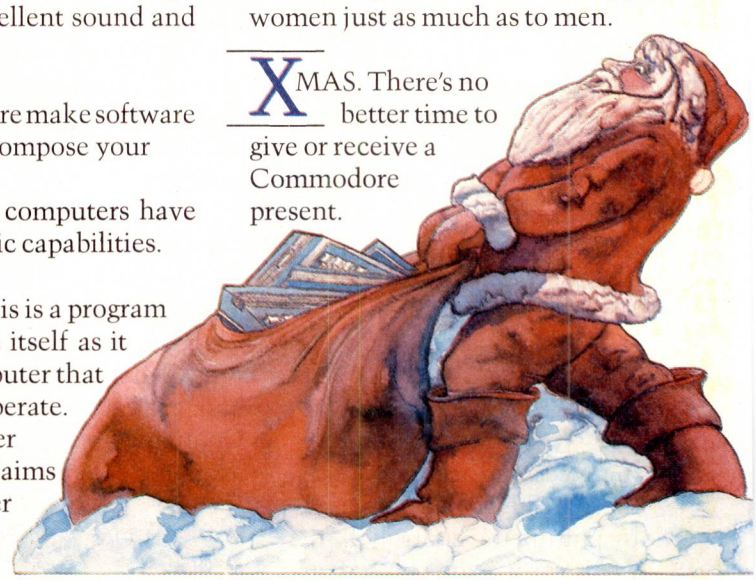
Also, everything has been specifically designed to get the very best out of your Commodore computer system.

WOMEN also are discovering computers – and not just in offices, but at home. Computers aren't sexist.



They were invented for everyone, and the fact that they're fun, exciting, educational, practical and time-saving are benefits that apply to women just as much as to men.

XMAS. There's no better time to give or receive a Commodore present.



YIPPEE! Yes, now you know (or should do) that computers are really interesting. They're not just about space games with horrendous monsters. Nor are they horrendously complicated machines that you need a maths degree to understand.

Computers are the future, and it's important that you and, even more so, your children don't get left behind in the past.

With a Commodore computer and a *peripheral* or two (and we now know what those are, don't we?) whole new leisure and business opportunities will immediately be opened to you.

Make the choice now and (just so long as it's Commodore) we promise you will never regret it.

ZIP us a line if you would like to receive more information on any Commodore products.

Write or telephone: Commodore Information Centre, 1 Hunters Road, Weldon, Corby, Northampton NN17 1QX. Tel: Corby (0536) 205252.

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The missing link

One way to write large programs easily is to break them into modules and then link the modules together. But problems often occur when deciding the address for each routine and making these addresses known to other modules for call purposes. JL Gordon examines a technique for module linking on the BBC Micro

Whether you know it or not, you're probably a run-time debugger. Micro users regularly write programs on the 'I'll sort out the bugs when I've written it' basis, taking advantage of the interactive editing facilities of Basic on most micros.

Programs written in this way usually work, which isn't surprising in view of the time and effort needed to get rid of all the error messages. The result is that a program performs something like the task for which it was intended, and is therefore used as is.

'Whether you know it or not, you're probably a run-timer debugger. Micro users regularly write programs on the "I'll sort out the bugs when I've written it" basis, taking advantage of the interactive editing facilities of Basic on most micros.'

However, if it's a good program and is used regularly, the time will come when modifications are required. At this point, the author (or, worse still, another programmer) finds the work unreadable.

A modular approach to programming may prove to be a more rewarding exercise. Initial breakdown of the problem may yield items such as:

A routine to input values.
A routine to select from menu.
A routine to do this.
A routine to do that.

The items represent convenient sections of code to be written. If, during the design of a program, you decide to keep each section small with sensible remarks included in the coding, it's likely that the program will remain readable after the passage of time, even by a third party.

Versatility

The approach offered here was specifically designed for a BBC Micro supporting a disk drive. The programs *may* be run on cassette, but the process will become very messy. (Users of other micros will be able to adapt the programs to their own machines.)

The method consists of a suite of five programs (Listing 1), one of which will be repeated for as many routines as are needed. Each routine exists in its own file, giving the advantage of versatility. The function of the suite of programs is to perform two passes across the files; the first pass will pick up all Global labels, and the second pass will assemble as normal but with access to Global labels from all other programs. Each program will also assemble its routine in the correct memory space, since the state of the assembly program counter is passed from one program to another.

The program 'LINKER' is used to generate a file on disk called W.VFILE, to initialise the file by inserting 'GOTO10', and to move up in memory the start address of the other programs to allow space for the target machine code. Space for these programs will not need to be extensive, since each one will be short and only one program at a time will reside in memory. The 'OUT' procedure is used to communicate with the EXEC file W.VFILE, and is included in each program. LINKER is used only once, at the setting up of the assembly.

'The program 'LINKER' is used to generate a file on disk called W.VFILE, to initialise the file by inserting "GOTO 10" and to move up in memory the start address of the other programs to allow space for the target machine code.'

'LINKS' is the start of the program assembly, and its main function is to set the program counter P%, (M%), to the base address for assembly. Another important function of LINKS is to install certain labels and their values in the file W.VFILE so that other routines may read them. The programmer may find that such things as operating system labels and addresses can be conveniently placed here, although they may be placed in any other routine. An important point, though, is that all zero page labels are declared and passed to W.VFILE by this routine: an example is to pass label names and values to W.VFILE. LINKS also changes the directory to 'W'; to keep work files as separate as possible from system files. CHAIN "FIRST ROUTINE" refers to the name of the first routine installed into the system.

The routines featured here must pick up the current variable name from W.VFILE, but Basic is not an easy language in which to do this. Consider a name 'A$' and a value 'B' which have been read from the label file: how can we make the value of 'A$' equal to the value of 'B'? Other languages like Lisp would take this problem well within their stride. The chosen solution is to 'EXEC' W.VFILE and then end the program. If the program is not ended, the EXEC will queue in the buffer until the program is finished. This results in the odd situation of an undefined label error stopping the program, and when this happens the label is defined on the screen by the EXEC file. Consequently, each time the EXEC file W.VFILE is updated, a new GOTO10 must be added at the end. Each routine will perform this function.

*FX119 closes the EXEC file and is

available in OS 1.2. GOTO10 is removed by altering the file pointer, so don't insert a space in the 'GOTO10' since GOTO10 plus one carriage return, seven characters in all, is part of the removal.

T% is the variable which keeps a record of what passes through the programs we are using.

'LINKW' is the work program, and space has been provided within this program to insert the assembly code required for each job. The name given to this program will be the one CHAINed by LINKS, which will in turn CHAIN the name of the next program until all code has been completed. The final work program will CHAIN"LINKEND". Each work program performs two local passes to pick up forward references to local labels. However, since 'OPTU%' is only three when both T% and Q% are three, an ERRORS assembly is only performed on the second local pass of the second program pass. All labels which are considered Global should be sent to W.VFILE in the manner previously described (Global labels are those which may be used by other routines in the assembly).

'LINKEND' is simply to change the directory back to the '$' directory and call 'LINKL'.

'LINKL' is the final program to be called, and is included to sort out the passes through the programs by testing the value of T%. The last routine has also proved useful to insert labels which may appear at the end of a code, but which may be needed by early routines when they are tested before the whole suite of programs is complete. Certain routines may also require Basic to insert text into memory at the end of code (this function may also be performed in LINKL).

A modification which may make the program more versatile is to include a further names file of all the work programs to be included in the pass. Each work program will then look at this open file to see which program should be chained next. If the file is ended, then LINKEND must be chained. The file must be initiated by LINKS.

'A modification which may make the program more versatile is to include a further names file of all the work programs to be included in the pass. Each work program will then look at this open file to see which program should be chained next.'

Zero page labels and variables needing to be declared in 'LINKS' are mentioned above, and in fact may prove essential if the following error is to be avoided.

Consider the assembly tester program in Listing 2. This is an assembly of two simple subroutines, the second of which sends the character contained in 'NUMBER' to 'OSWRCH' if the character is less than 128. The location 'count' is incremented to keep a record of how many characters are successfully sent to 'OSWRCH'.

The main routine is intended as an example: it should cause a 'BEEP' and place the letter 'B' on the VDU. The location count is situated between the two routines. The first reference to count in location &400C stores zero in the wrong address; the routine calls to 'SEND' are also incorrect.

Note that the second reference to count in location &401E gets it right, because the reference occurs after the location of 'count' has been corrected on the second pass.

On the first pass of the assembler, the table of labels will be built up from the program counter position. Since the label 'NUMBER' is not yet known, the address is assumed to be absolute and the program counter value is placed in the code. If the label 'NUMBER' is declared at the start of the program, the assembler will know that NUMBER is a zero page location on the first pass, and will not place the absolute address of the program counter in the code.

Thus, the shuffling of label values, caused by the change in the value of the label NUMBER on the second pass, will not occur. NUMBER is referred to twice, and the incorrect addresses are two out.

Many of the available 6502 two-pass assemblers will also produce this error. It may be avoided in the case of the BBC Micro by causing three passes through the code — two no-errors and one error assembly.

The system described here avoids the problem by stipulating that zero page declarations must be placed in LINKS.

Rewarding

A modular approach to programming in assembly language is far more rewarding than a do-it-all approach: the programmer may build up a library of routines.

If the assembler source code becomes long, or separate modules need uniting in a final program, thought must be given to the task of assembly in memory and to the label references which may be needed by many of the modules.

END

```
 10 REM 'LINKER' SET UP PROGRAM
 20 REM 2/3/84
 30
 40 MODE6
 50 REM M% &.P% ARE PROGRAM COUNTERS
 60 T%=0      :REM COUNT PASSES
 70 S%=OPENOUT("W.VFILE"):REM LABEL FILE
 80 PROCOUT("GOTO10")
 90 CLOSE#S%
 92
 93 REM MAKE SPACE FOR CODE AND START
100 PAGE=&3000:CHAIN"LINKS"
110
120 REM OUTPUT TO LABEL FILE PROCEDURE
130 DEF PROCOUT(X$)
140 FOR Q=1 TO LEN(X$)
150 BPUT#S%,ASC(MID$(X$,Q,1))
160 NEXT
170 BPUT#S%,13
180 ENDPROC
```

Listing 1 Set-up program

```
    FIRST PASS THROUGH CODE.
    ************************
4000
4000            OPT PASS
4000            .START
```

Listing 2 Assembly tester program

Listing 2..... continued

```
4000 A9 00      LDA #0
4002 8D 02 40   STA count
4005 A2 07      LDX #7
4007 8E 07 40   STX NUMBER
400A 20 0A 40   JSR SEND
400D A2 42      LDX #66
400F 8E 0F 40   STX NUMBER
4012 20 12 40   JSR SEND
4015 60         RTS
4016 EA         .count NOP \ USED AS COUNTER
4017            .SEND \ SUB ROUTINE USES OSWRCH_
4017 AD 17 40   LDA NUMBER
401A C9 80      CMP #128
401C B0 FE      BCS MISS
401E 20 1E 40   JSR OSWRCH
4021 EE 16 40   INC count
4024            .MISS
4024 60         RTS

    SECOND PASS THROUGH CODE.
    *************************
4000
4000            OPT PASS
4000            .START
4000 A9 00      LDA #0
4002 8D 16 40   STA count
4005 A2 07      LDX #7
4007 86 70      STX NUMBER
4009 20 17 40   JSR SEND
```

Listing 2..... continued

```
400C A2 42      LDX #66
400E 86 70      STX NUMBER
4010 20 17 40   JSR SEND
4013 60         RTS
4014 EA         .count NOP \ USED AS COUNTER
4015            .SEND \ SUB ROUTINE USES OSWRCH
4015 A5 70      LDA NUMBER
4017 C9 80      CMP #128
4019 B0 09      BCS MISS
401B 20 EE FF   JSR OSWRCH
401E EE 14 40   INC count
4021            .MISS
4021 60         RTS



 10 REM ASSEMBLY TESTER
 20 REM TO ASSEMBLE TWO SUB ROUTINES
 30 REM ONE AFTER THE OTHER.
 40 REM WITH ONE VARIABLE DATA BYTE
 50 REM IN BETWEEN.
 60
 70 FOR PASS = 1 TO 3 STEP 2
 80 P%=&4000
 90 [
100 OPT PASS
110 .START
120 LDA #0
130 STA count
140 LDX #7
150 STX NUMBER
160 JSR SEND
170 LDX #66
180 STX NUMBER
190 JSR SEND
200 RTS
210 .count NOP \ USED AS COUNTER
220 .SEND \ SUB ROUTINE USES OSWRCH
230 LDA NUMBER
240 CMP #128
250 BCS MISS
260 JSR OSWRCH
270 INC count
280 .MISS
290 RTS
300 ]
310 REM DECLARE LABELS HERE INSTEAD
320 REM OF AT THE START OF THE PROGRAM.
330 REM THEY WILL BE PICKED UP AT THE
340 REM END OF THE FIRST PASS.
350
360 OSWRCH = &FFEE:REM OUTPUT CHARACTER
370 NUMBER = &70:REM ZERO PAGE VARIABLE
380  NEXT PASS
390 END
```

```
 10 REM LINK START PROGRAM 'LINKS'
 20 REM SET ZERO PAGE LABELS & OS CALLS
 24
 26 REM SET START OF MACHINE CODE
 28 P%=&1900:M%=&1900
 30
 40 IF T%=0 THEN S%=OPENUP("W.VFILE") ELSE GOTO 150
 50
 60 REM VFILE POINTER TO END - 'GOTO10'
 70 PTR#S%=EXT#S%-7
 80
 90 REM   VARIABLES USED
100 PROCOUT("LABEL NAME = LABEL VALUE ")
110 REM + ALL OTHERS
120 PROCOUT("GOTO10")
130 CLOSE#S%
140
150 REM CHANGE TO WORKING DIRECTORY
160 *DIR W
170 CHAIN"FIRST ROUTINE"
180 END
190
200 DEF PROCOUT(X$)
210 FOR 0=1TOLEN(X$)
220 BPUT#S%,ASC(MID$(X$,0,1))
230 NEXT 0
240 BPUT#S%,13
250 ENDPROC
```

Listing 1a Start program

```
  5 *EXEC VFILE
  6 END
 10 REM  LINK WORK SKELETON 'LINKW'
 20 REM USED TO CONTAIN ALL ROUTINES
 22 REM ENSURE EXEC FILE CLOSED
 30 *FX119
 40
```

Listing 1b Work skeleton

Listing 1b ..... continued

```
 50 REM LOCAL TWO PASS ASSEMBLER PICKS
 60 REM UP LOCAL LABELS
 70 REM U% LEAVES NO ERRORS ASSEMBLY
 80 REM TO SECOND LINKER PASS
 90 FOR0%=0 TO 3 STEP 3
100 U%=T%AND0%
110 P%=M% :REM SET CONTINUOUS CODE
120 [
130 OPT U%
140
10000 ]
10001 NEXT0%
10002 M%=P% :REM PASS ON CODE POSITION
10003
10010 REM OUTPUT LABELS TO VFILE
10020 REM USING HANDLE S%
10030 IFT%=0 THEN S%=OPENUP("VFILE") ELSE GOTO11111
10038
10039 REM ADD ON LABELS - 'GOTO10'
10040 PTR#S%=EXT#S%-7
10041
10042 REM OUTPUT LABELS AS FOLLOWS
10043 REM WHERE XXX = LABEL NAME
10044 PROCOUT("XXX ="+STR$(EVAL("XXX")))
10998
10999 PROCOUT("GOTO10")
11000 CLOSE#S%
11001
11111 CHAIN"NEXT ROUTINE"
11112
11120 DEF PROCOUT(X$)
11130 FOR 0=1 TO LEN(X$)
11140 BPUT#S%,ASC(MID$(X$,0,1))
11150 NEXT
11160 BPUT#S%,13
11170 ENDPROC
```

```
 10 REM END OF LINKER ROUTINES 'LINKEND'
 20
 22 REM CHANGE BACK TO $ DIRECTORY
 23 REM TO PICK UP LAST CODE IN LINKER
 24 REM GROUP
 30 *DIR $
 40 CHAIN"LINKL"
```

Listing 1c End of routines

```
  5 *EXEC W.VFILE
  6 END
 10 REM LAST ROUTINE OF LINKER 'LINKL'
 20
 22 REM ENSURE EXEC FILE CLOSED
 30 *FX119
 40
 50 P%=M%
 60 [
 70 OPT T%
 80 \ FINAL CODE SPACE FOR LABELS AT
 90 \ END OF CODE OR RESERVE VARIABLE
100 \ SPACE
110 ]
120
130
140 REM IF SECOND PASS THEN CODE IS
150 REM COMPLELE
160 IF T%>0 THEN END
170
180 REM OUTPUT VARIABLES TO VFILE
190 REM USING HANDLE S%
200 REM WERE 'XXX' STANDS FOR THE
210 REM VARIABLE OR LABEL NAME.
220
230 S%=OPENUP("W.VFILE")
240 PTR#S%=EXT#S%-7 :REM SET POINTER
250
260 PROCOUT("XXX ="+STR$(EVAL("XXX")))
270
280 PROCOUT("GOTO10")
290
300 CLOSE#S%
310
320 REM AFTER FIRST PASS OF LINKER,
330 REM SET OPT TO ERRORS ASSEMBLY FOR
340 REM FINAL PASS
350 T%=3:CHAIN"LINKS"
360
370
380 DEF PROCOUT(X$)
390 FOR 0=1 TO LEN(X$)
400 BPUT#S%,ASC(MID$(X$,0,1))
410 NEXT
420 BPUT#S%,13
430 ENDPROC
```

Listing 1d Last routine

TEACH YOURSELF LISP

Dick Pountain's 'Teach Yourself' series goes one step further into the realm of recursion and factorial functions.

This month we look at recursion, the major form of repetition in Lisp.

Every general purpose programming language must provide the means to repeat a sequence of actions until a specified condition is fulfilled, and then to stop repeating. In Basic this mechanism takes the form of FOR . . . NEXT when you know in advance how many times you want to repeat, and IF . . . GOTO when you don't. Both can be understood as being a loop, in which the computer is made to go back to a previous instruction in the sequence which makes up the program. We sometimes refer to the way the computer's attention is directed as 'control flow', and you can trace the control flow with your finger in a listing of the program.

This image of control flow doesn't fit in very well with the way Lisp works, namely by applying functions. In a Lisp program we're concerned with evaluation and the flow of values; Lisp is further removed from computer hardware and the idea of execution of instructions than Basic is. There is, however, a means of repetition that fits Lisp very well, and that is *recursion*.

A definition is said to be recursive if it refers to itself (remember that hoary old joke about the dictionary which included 'Recursion: see under Recursion'?). In Lisp, recursion involves using the function being defined in its own definition. Most people have an uneasy feeling when they first encounter a recursive definition; either it defies common sense and thus can't be allowed, or it leads to an endless loop, as with the fabled dictionary entry.

In Lisp, the first objection is false. The Lisp interpreter is quite happy to allow references to a function which is in some sense not yet defined. (It's really no more of a paradox than Basic accepting GOTO 1500 before you've written line 1500; in both cases the anomaly is resolved before you actually run the program.)

The second objection carries more weight. It is indeed possible for a recursive definition to lead to an endless loop; this undesirable outcome can only be avoided on two conditions.

Firstly, each time the function calls itself it must be with an argument which is in some sense 'simpler' than before (perhaps smaller if it's a number, or shorter if it's a list). Secondly, there must be a test which is performed before recursion takes place, for a 'simplest' condition. When this condition is reached, the recursion ends. Rather than thinking of a loop or circle, think of a set of nested Russian dolls. Each doll contains one smaller than itself, but eventually you come to one which is solid, the end of the line.

Factorial function

An example should clarify this, and with depressing predictability I've chosen to use the factorial function. The factorial of N is defined to be 1x2x3x4x . . . N–1xN, so factorial 5 is 1x2x3x4x5 or 120. It's possible to define the factorial recursively thus: 'The factorial of a number is that number multiplied by the factorial of one minus that number. . .', or, in symbols: N!=Nx(N–1)!. Try working it through (don't hold your breath while doing so).

The simplifying condition is catered for in this definition by the 'one minus', but the simplest condition which ends the recursion hasn't been given. We need to add '. . . and the factorial of zero equals one'; this will now translate straight into Lisp (Fig 1).

```
(DEFINE FACTORIAL (NUM)
  (COND
     ((EQUAL NUM 0)      1 )
     (   T        (TIMES NUM (FACTORIAL (DIFFERENCE NUM 1))) )
  )
)
```

Fig 1 Lisp translation of factorial function

You could use ZEROP instead of EQUAL if you have it. Let's look in detail at how this works when (FACTORIAL 3) is evaluated.

NUM is made to equal 3 by the magic 'decanting' process I mentioned last month. The first COND clause says: 'If NUM is 0, then return 1 as the value of COND'. But NUM isn't 0, so this clause fails, and the next says: 'Otherwise, evaluate (TIMES NUM (FACTORIAL (DIFFERENCE NUM 1)))'. To do this, Lisp has to multiply 3 by (FACTORIAL (DIFFERENCE NUM 1)), whose value it doesn't know. But does it worry? No—it pluckily starts to work it out, putting the first job 'on hold'.

FACTORIAL is called again with the argument (DIFFERENCE NUM 1). The argument is always evaluated, and that's no problem here: it's simply 3 - 1, or 2. Now comes the trick shuffle. When FACTORIAL is entered the second time, NUM is made 2, but only for the duration of that evaluation. When it's finished and returns its value to the original job, the value of NUM will be restored to its original value of 3. Lisp 'remembers' the NUM value each time an evaluation is suspended for another recursive call. (Inquisitive individuals who like to know the nuts and bolts will have guessed by now that all the previous arguments are kept on a stack.)

The evaluation of FACTORIAL 2 proceeds as far as the TIMES expression, when it too is put on hold, and FACTORIAL 1 is evaluated. The same thing happens to this, and then FACTORIAL 0 is evaluated.

Now we have come to our solid doll. The first COND clause succeeds at last because NUM is indeed 0, so the evaluation immediately returns the value 1. NUM is restored to the value 1, and the calculation of FACTORIAL 1 can




```
FACTORIAL 3
does 3=0? NO
then do   3 x FACTORIAL 2
                does 2=0? NO
                then do   2 x FACTORIAL 1
                                  does 1=0? NO
                                  then do   1 x FACTORIAL 0
                                                    does 0=0? YES!!!
                                                    answer is 1
                                  answer 1
                answer 2
ANSWER 6
```

Fig 2 Diagrammatic form

```
(DEFINE HUNT-FOR-EGG  (LIST)
  (COND
    ((NULL LIST)  'EGGLESS!)
    ((EQUAL (CAR LIST) 'EGG)  'GOTTIT!)
    (   T    (HUNT-FOR-EGG (CDR LIST)) )     ) )
```

Fig 3 Search function using CDR recursively

```
(DEFINE WHERES-EGG? (LIST COUNT)
  (COND
    ((NULL LIST)  'EGGLESS!)
    ((EQUAL (CAR LIST) 'EGG)  COUNT)
    (   T    (WHERES-EGG? (CDR LIST) (PLUS COUNT 1)) )     ) )
```

Fig 4 Creating a local working variable, COUNT

be completed as (TIMES 1 1). The first 1 is the restored value of NUM, the second the value returned by COND. Now the evaluation of FACTORIAL 2 can be finished, so the recursion 'unwinds', restoring the original value of NUM at each level, and multiplying it by the value returned from the level below. In effect, all the work is done on the way back up: Fig 2 shows the diagrammatic form.

It isn't necessary to go into such detail every time you write a recursive Lisp definition, but it helps to do it once for clarification. The crucial fact is that the 'variables' used as formal arguments in a Lisp function are only given a value during its evaluation. They are local not merely to the function, but to each separate evaluation of the function.

What we have learned here about the behaviour of formal arguments during recursion is in fact true in every function call. The variables in the formal argument list are 'bound' to values, just as NUM is bound to 3 in Fig 2 upon entering the function, and their original values are restored upon leaving the function. In other words, variables cannot be permanently altered by a function call; those which don't appear in the formal argument list of a function can, however, be altered by its application. Try this:

```
*(SETQ NUM 10)
10
*NUM
10
*(DEF SQUARE (NUM)
  (TIMES NUM NUM))
SQUARE
*(SQUARE 12)
144
*NUM
10
```

NUM was temporarily bound to 12 while SQUARE was evaluated, but afterwards it retains its original value of 10.

Let's look at another example. Last month we defined a function called LOOK-FOR-EGG, which searched a list for the name EGG using a crude sequence of CARs and CDRs. Fig 3 shows a similar function which can search a list of any length, using CDR recursively.

Here the recursion is based on: 'Look at the first element; if it isn't EGG, then search the rest.' All the same principles apply: the list passed to each successive call of the function is one element shorter than the previous one. Unless it finds EGG, it runs out of elements and the terminating condition (NULL LIST) is triggered. Very little work is done upon unwinding, merely the passing back of one of the two messages. If we introduced a second variable argument in place of the constant 'EGG, and replaced the messages with T and NIL, we'd have the built-in Lisp function MEMBER. See if you can write it.

This function can search a whole list of any size, but unlike LOOK-FOR-EGG it doesn't tell us where it found EGG; this is easily remedied (Fig 4).

Here we've created a local working variable, COUNT, which is incremented each time the function recurses, and whose value is returned if the search is successful. At the moment, the only way we know to initialise the count to zero is to provide the zero as an

```
(DEFINE APPEND (LIST1 LIST2)
  (COND
     ((NULL LIST1) LIST2)
     (  T    (CONS (CAR LIST1)
                   (APPEND (CDR LIST1) LIST2) )    ) )
```

Fig 5 APPEND function

```
(DEFINE SWAP (NEW OLD LIST)
  (COND
     ((EQUAL LIST OLD) NEW )
     ((ATOM  LIST) LIST )
     (  T     (CONS (SWAP NEW OLD (CAR LIST))
                    (SWAP NEW OLD (CDR LIST))) )   ) )
```

Fig 6 '. . . lists of lists of lists without modification.'

argument:

```
* (WHERES-EGG?
   '(BEAN BARN 7 BORN EGG 12)
   0 )
4
```

In many dialects of Lisp it is legal to call WHERES-EGG? with only one argument (the list), and any excess formal parameters, in this case COUNT, would be automatically bound to NIL (that's no help to us here as NIL isn't the same as zero, and in particular we can't add 1 to it). Acornsoft Lisp requires any 'spare' formal arguments to be placed within extra pairs of brackets. (You'll have noticed that our function gives the wrong answer (one less than the actual position of EGG), but I'm sure you can fix that.)

Both these previous functions demonstrate an important Lisp programming construction called 'recursing with the CDR', which is a general technique for travelling down a list. A complementary technique is to 'CONS with the CAR', thereby building a second list on the 'return stroke' as the recursion unwinds (I always find that the image of a zip fastener springs to mind). The useful function APPEND , which joins two lists together, is a good example (remember that CONS only joins an atom to a list, and that (CAR LIST) is an atom (Fig 5)).

From recursing to plain cursing

Before you pass from recursing to plain cursing, let's step through it with two simple lists — (APPEND '(LISP IS FUN)' (MY BRAIN HURTS)).

On the first pass through the NULL clause won't be triggered, so the T clause tries to CONS LISP onto (APPEND '(IS FUN)' (MY BRAIN HURTS)). This leads to a second call which attempts to CONS IS onto (APPEND '(FUN)' (MY BRAIN HURTS)), and so on until LIST1 is empty, whereupon the NULL clause is triggered and returns as its value LIST2. The recursion then unwinds by successfully CONSing the pieces of LIST1 onto LIST2 (in reverse order, which is just what we require). The returned result is a new list; neither of the original lists are altered.

If you're still with me, try to step through this next program as your homework. It's a function which swaps a new word for every occurrence of an old word in a list, and could easily serve as a 'search-and-replace' command in that flashy Lisp editor you're going to write. It shows Lisp at its most daunting and most beautiful, in that it will handle lists of lists of lists to any depth without modification (Fig 6).

Note that the function has two recursive calls and two conditions. Which is the terminating condition for which call? Watch the type of LIST — it isn't always a list! Don't forget that () is NIL is an atom.

Extra dimension

Don't be discouraged if you've found this discussion difficult. Despite all propaganda to the contrary, recursion *is* difficult, compared to simple loops which you can trace with your finger.

Recursion has, so to speak, an extra dimension, more like a turning inside-out than going round in a circle, and it places correspondingly greater strain on your powers of visualisation. But it's also enormously powerful and concise, and will well repay a lot of practice.

END

This is part four of our six-part Teach Yourself Lisp series. Back issues can be obtained from our office at 53 Frith St, London W1A 2HG, tel: (01) 439 4242.

Lisp discount offer

To help you get the best from the Teach Yourself Lisp series, *PCW* has arranged special discounts on several Lisp packages. Identify your machine from the list below and send the offer tab at the corner of this page with a cheque for the full amount to the appropriate address, stating clearly which machine it is for.

Machine	Address	Cheque (includes VAT and p&p)
Spectrum NewBrain	Serious Software 5 Wimbourne Avenue Chislehurst Kent BR7 6RQ	£10.50 (Normal price £15.50)
CP/M-80: QX-10 Televideo Kaypro Sirius SuperBrain Apple II Lynx Laureate Transtec Tatung PC2000 NEC 8000 Pied Piper DRS-20 TAP3 & PC	Software Ltd, for... 2 Alice Owen Centre 251 Goswell Rd London EC1	Supersoft Lisp: £75 (Normal price £115)
	OR	
	Text 100, for... South Black Lion Lane Hammersmith London W6	Microsoft MuLisp: £112 (Normal price £170)
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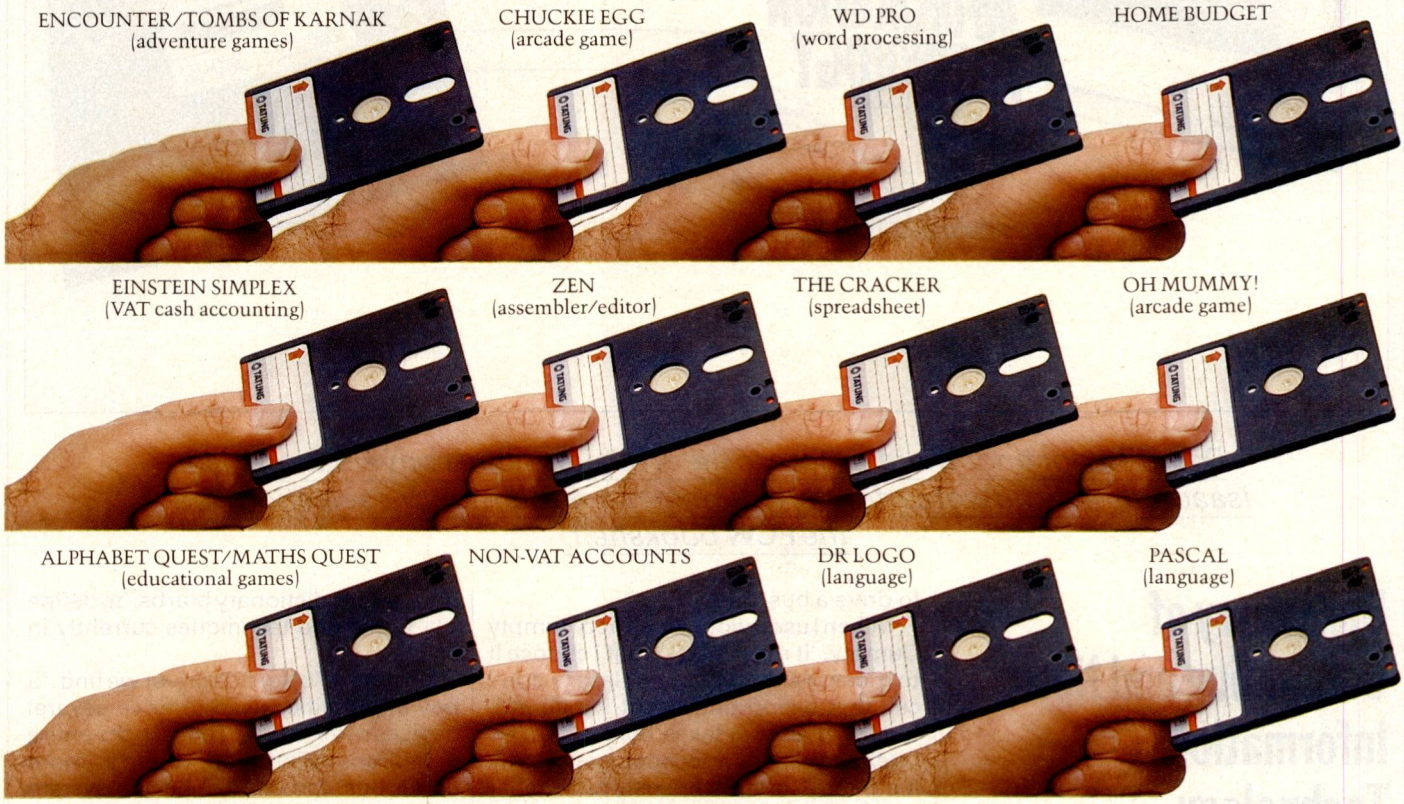

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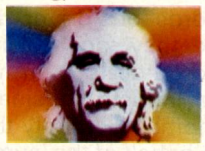

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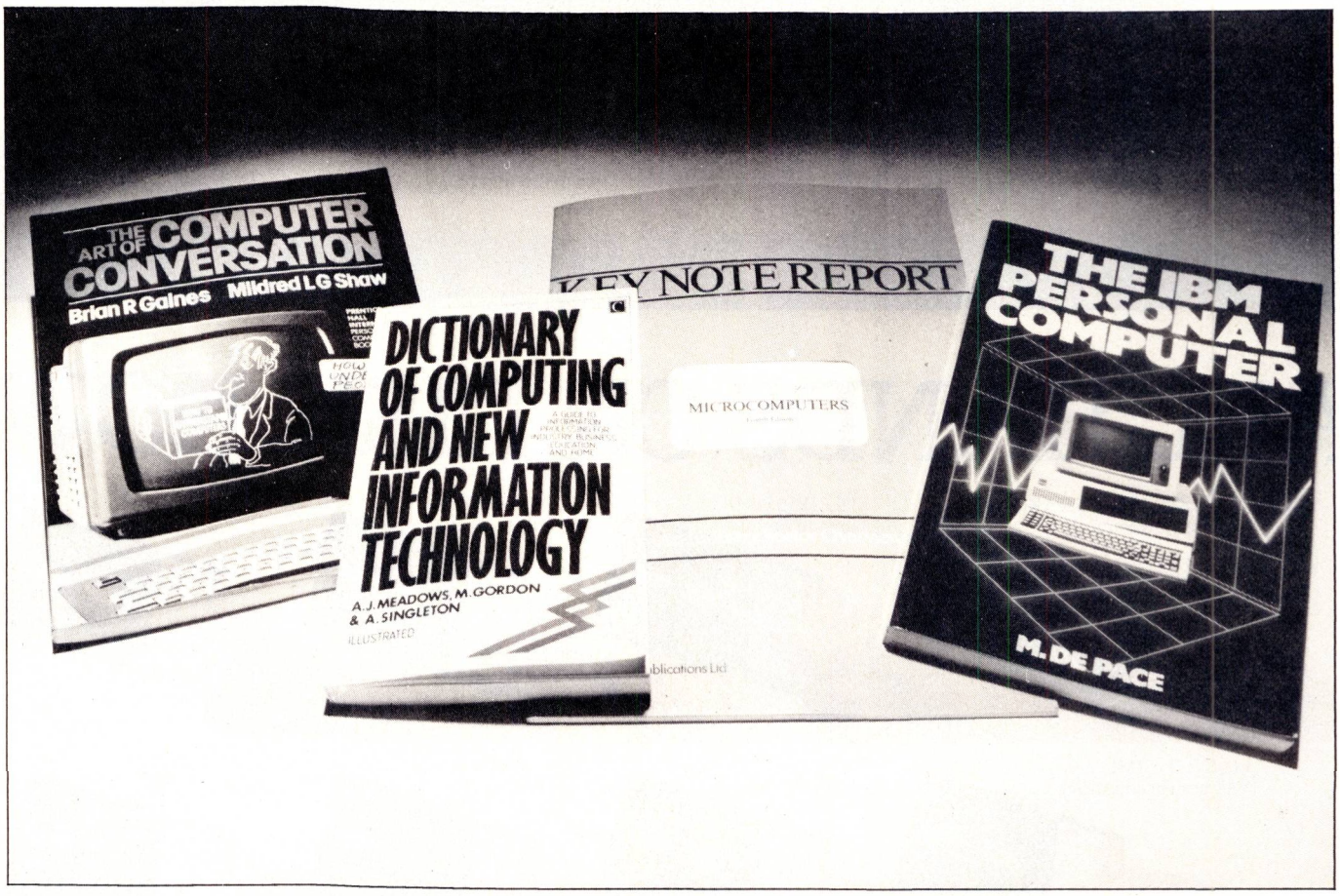


David Taylor finds there's more to the art of computer conversation than Isaac Asimov and wet cartoons, as he examines this month's selection from the PCW bookshelf.

Dictionary of Computing and New Information Technology

Authors: A J Meadows, M Gordon and A Singleton
Publisher: Century
Price: £2.95

'Do the words 'bus driver' mean what you think they do?' wonders this paperback 'guide to information processing for industry, business, education and home'. Certainly they do, I'd answer on behalf of the laymen it aims to enlighten. They mean a man who drives a bus. If computerniks want them to mean something else entirely, that's their business. End-users shouldn't have to know. You don't need to be able to strip a diesel engine, after all, in order to drive a bus.

'When I use a word,' asserted Humpty Dumpty, 'it means just what I choose it to mean, neither more nor less.' I don't call that user-friendly, but it's an attitude that always takes hold at the, er, *interface* with new technologies. Partly it's handy to stretch existing, familiar words to describe the previously undefined. Mostly it's just fun to be part of a specialist gang with its own secret language — especially if it gets witty, like DDT: 'a software package designed to assist the debugging of programs.'

What's difficult is to initiate outsiders, especially those whose technological know-how may start and end at working a paper-clip. Yet outsiders do want to know what the weird usages mean, supposing that they'll then soon master the science. Computers are now so buzzily fashionable that there's a jargon-smart army lining up, just bursting to teach the duffers one end of a bus driver from another, to 'cut through the bewildering jungle of computer jargon,' as this dictionary blurbs, 'to define key terms and techniques currently in use.'

Turning to 'b' for bus driver we find: 'a power amplifier used to drive several devices using a *bus*.' That's it: the entire definition. Mind you, there's more under bus: 'an interconnected system path over which information is transferred, from any one of many sources to any one of many destinations, the devices involved being connected in parallel.'

I find this about as helpful as defining Humpty Dumpty as 'a short, squat, egg-like being of nursery folklore' (Chambers). It's technically correct, but it doesn't get you far. Really, to know Humpty you have to read *Alice*. To get to grips with computers, your best bet is to use them.

Now and again, perhaps, a snappy dictionary definition might clear the fug on a one-off mystery, and you do get a few thousand chances here for under £3. Still, you'd have to be certifiably

computer-dumb to get much help from 'keyboard: a device equipped with an ordered array of keys', or 'system: an organised set of components (human beings, equipment, etc) which interact in a regulated fashion.'

QDOS, incidentally, which I imagine might easily stump those not accustomed to Sinclair, isn't in. Nor is the word Sir Clive recently told me came a close second when the company was fishing for a name for the QL's operating system, DOMESDOS. Kills all known bugs, it might have added.

The Art of Computer Conversation

Authors: Brian R Gaines and Mildred L G Shaw
Publishers: Prentice-Hall International
Price: £6.95

'We aim through this book,' say Brian and Mildred, a couple of Canadian electronics boffins with a numbingly prolix line in gee-whiz philosophy, 'to make specifiers of computer systems and programs aware of the need to devote as much effort to the human interface as they do to the data processing and storage algorithms.'

Oh yeah?

Now hear this. 'Transcendence of time and space adds new dimensions to the already dramatic powers of the human capabilities to learn from experience and to learn from conversation. New media provide new extension to ourselves and affect our, and our societies', modes of existence.'

Holy smoke, George and Mildred. Sorry, *Brian* and Mildred. This whole book could use a little work on its human interface. Even supposing readers can get the hang of the authors' tortured syntax, it takes real stamina to hang on in there when the simplest of notions are wrapped up into crazily affected examples and counter-proposals. I mean, try this: an assertion, Brian and Mildred style, that it's irritating when different computers have different operating commands — 'Perhaps someone who has a Chinese butcher, a French dressmaker and an Ethiopian barber has similar problems. Maybe even they would lose their cool if the butcher required Mandarin to be used when ordering beef and Cantonese for lamb. Such seems to be the world of the computer.'

They may have a point. But do we need the rigmarole of foreign traders to describe it? In fact, Brian and Mildred really only have one point throughout 200 dense pages, which is that computers are better when they're user-friendly. Yet on the way to convincing us of that, we get structured proverbs, we get wet cartoons, we get quotations from Dostoyevsky and Plato, we get a run-through of hip American medical diagnostics programs like SHRDLU and TEIRESIAS, we get chunks of Isaac Asimov and clips from *2001 — A Space Odyssey*, we get a peek at 'behaviourdyne vocational guidance by computer' and, before too long, we get the feeling that we're going to shriek and chuck this book at the nearest all-American analyst.

It isn't that Brian and Mildred cannot provoke useful thought around the concepts of 'people literate' computers or methods of 'user-computer dialog'. To the kind of Professor Brainstorm programmer who is fluent in two dozen operating systems but who has trouble writing an intelligible note for the milkman, their guidelines may well come as a revelation. But the irony for idle browsers is that so self-consciously intense is the approach, the book finishes up user-hostile. I think I'd have called it *The Art of Computer Conversation-Stopping.*

Microcomputers: An Industry Sector Overview

Publisher: Keynote Reports
Price: £60 (from Keynote Publications, 28/42 Banner Street, London EC1Y 8QE)

More fascinating facts and figures, this time from Keynote's team of hawk-eyed analysts who kick off with the quirky assertion: 'The performance of the microcomputer market in Britain can be gauged by a visit to either of W H Smith's bookstalls at Victoria Station.'

What they have in mind is that six per cent of the news shelves groan under the weight of micro mags, reflecting the fact that 1.2 million Britons bought a micro last year.

As sophisticated industrial indicators go, a newsagency's shelf space may not immediately strike you as a precise parameter. But it may have to do, since, as Keynote has the honesty to point out, 'statistics on the microcomputer market are notoriously inaccurate.'

What Keynote's report does, and does commendably well, is to present an overall digest of what micros are, what they do, who uses them, what for, and which brands are currently making the running. It then adds well-educated guesswork to such reliable figures as it can find to come up with a crisp survey of the market as is, take a squint into the future (and again see Japanese ahoy), and finally append a useful list for further reference.

The result is a lucid brief which, though it might send veteran home-hackers or the zap-kapow micro-nutters to sleep, does very smartly cover the essential ground for those who are pin-sharp in their own field, but who may still be a bit computer-vague. It's for intelligent but under-informed readers with a need to grasp the gist of what's happening out there in the volatile micro market — a sort of up-market school essay. I'd give it at least alpha minus.

The IBM Personal Computer

Author: M De Pace
Publisher: Granada
Price: £7.95 (paperback)

You'd need an XT version, I'd imagine, just to catalogue the books published to date on the Jolly Blue Giant's friendly micro. It seems that scarcely a week goes by without someone, usually called something very like M De Pace or Walt B Winchester, re-writing the PC's already lucid *Guide to Operations*, paraphrasing the DOS manual, or once more taking the bucket to the well of *IBM Basic.*

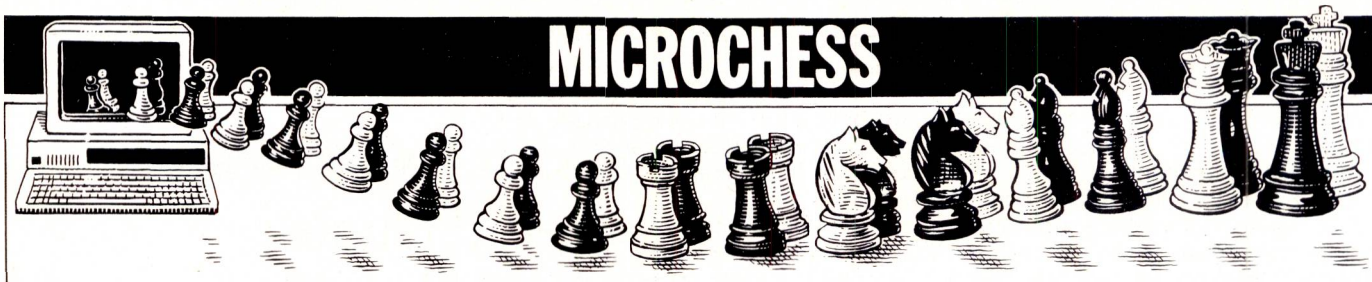
And yet, apparently, they sell like *Lotus 1-2-3.* A few PC add-on manuals, like the inestimable Peter Norton's which probes inside the thing's innards and conducts escorted treks through the darker thickets of DOS, are useful amplifications for the already adept applications user who might want to join the programming *cognoscenti.* But many more PC books tend only to run through the manuals one more time, then lash together little more than a guide to hardware expansion and software packages which is often out of date almost as soon as the book's published.

This latest falls between the two extremes. On the one hand it does provide, for example, a bit of handy hand-holding for database and spreadsheet first-timers (albeit through the silly example of costing a sponge cake), gives you an outline of such up-and-coming wonders as Unix, and helps you assess word processing and introduces mice.

On the other hand, it contains such ludicrous illustrations as a solid black circle with a hole in the middle, captioned: 'The inner diskette (courtesy of IBM (UK) Ltd)', and includes such fatuous insights as: 'A PC consists of screen, keyboard and system unit' and 'Having connected the units, it is now time to switch on. The power switch is located on the right-hand side of the system unit.'

Hang on, Mr De Pace, not so fast! You've not given us any step-by-step instructions yet on how to open the cardboard boxes!

One thing I would like to know, which neither this nor any other IBM user's handbook has explained to me, is why the fan on my own PC's power supply sounds like a Mississippi paddle-steamer struggling upstream. Not a fault, claims the maker: some fans just gurgle a bit. This won't do. I need a Helpful Hint that begins: 'the point at which to apply a sharp biff with a rubber-headed hammer is located at . . .' END



An elitist game

Apart from improvements in speed at the higher playing levels, there is not much more that the average chess player could possibly want from the best of today's chess computers. And as Tony Harrington notes, when it comes to new products Fidelity and Novag are way out in front.

By the time you read this the World Micro Computer Chess Championship (WMCCC), held this year in Glasgow, will be over. A full report will apear in December's *PCW*.

Without denigrating other suppliers' machines, the World Championship looks at the time of writing to be a two horse race between the Novag and Fidelity programs.

Fidelity won last year's WMCCC, but the Novag Super Constellation has had some very encouraging player-tournament results and the battle looks to be unpredictable.

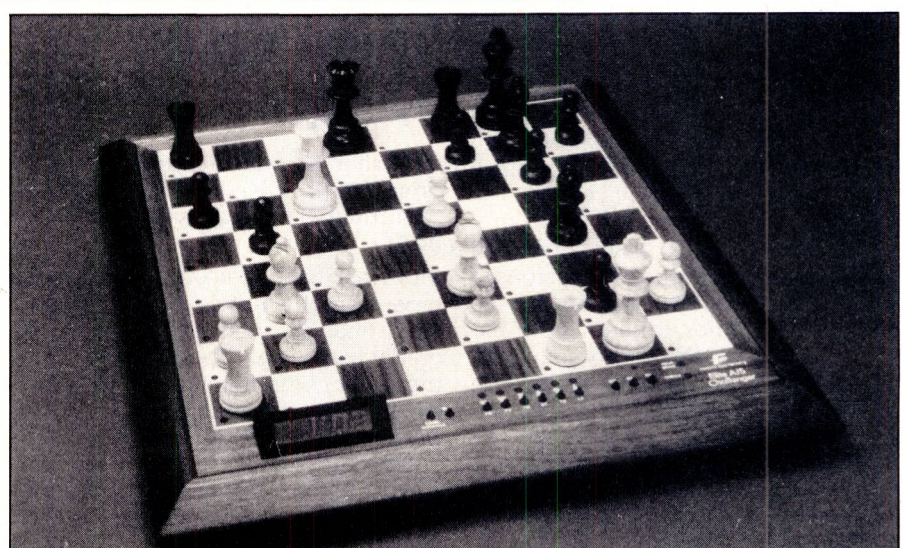
I have not yet had the opportunity to explore the Super Constellation, but I have, however, had Fidelity's Budapest program on trial for the last few weeks. Very impressive it is, too.

The Fidelity Elite Budapest program is a very expensive piece of equipment, costing nearly £600. It's a fine, auto-sensory wooden board and pieces with a manual comprising more than 50 pages!

But for those who don't have that sort of money, hang on for a bit, Fidelity will be launching the Sensory 12, priced at £295, in September, which will have the same program as the Elite (Budapest), and most of the features (though it will be a sensor board, not an auto-sensory board — in other words, touch-sensitive, and not automatically activated by magnets in the base of the pieces).

I was unable to establish whether or not it will have the Elite's glorious Blitz chess capability. It certainly won't have the full Blitz feature, since the little LCD display on the Elite, which, in Blitz games, shows the clocks for both players, is not on the Sensory 12.

The month of September will also see the release of Fidelity's Elegance Chess Challenger, the Fidelity Experimental. The Elegance will, however, have a removable EPROM program, so users will always be able to have the latest 'experimental' program.



The Fidelity Elite isn't cheap but it's worth its weight in gold for Blitzchess

For anyone under county strength who is keen on Blitz chess, the Elite AS (Budapest) is worth its weight in gold. Games are decided on time as well as on over the board play. The program has a very sure grasp of positional and tactical play and its blunders are as rare as they are surprising; but *when* they come, the blunders look as grotesque as any oversight made by a player. In complex mid-game positions, playing almost instantly under Blitz conditions it repeatedly found interesting attacking moves. In defence, it was resourceful. See the Blitz games (1 and 2) for evidence of its style in attack and defence.

My major criticism is that despite the pseudo sophistication of a voice chip, which computer speaks its way right through the game — even at Blitz chess — Fidelity is still sticking with a ludicrously complicated method of communication between user and processor.

Firstly, there are twelve little pins which form a sort of keyboard. You have to press the extreme left-hand pin, labelled 'game control', pick up and put down Black's Queen, which lights the LCD at d8, then press the pin marked 'cl' for 'clear'. This clears out the memory and sets all the values to zero ready for a new game. It has to be done each time you want to play a new game. To get to Blitz mode there is another rigmarole to be gone through. Pressing the 'lv' pin, ('level') gets you into 'level-setting mode'; picking up the pawn on b2 and replacing it lights the LCD on that square and causes 'HO:O5' to come up on the LCD display screen. This is your Blitz clock time.

It is adjusted by repeated pressings of the 'lv' key to add minutes to the time, the 'tb' ('take-back') key to add 10 minute chunks and the 'st' (time control/position score/level setting') pin to add one to nine hours to the clock. After all this, you are still not finished. There still remains the specifying of the computer's clock time, which is independently set. Picking up the pawn on b2 and replacing it once more changes the display to CO:OO and the pin pushing has to begin again to set this clock.

The process, once understood, is quick enough. It also has the great merit of allowing you to set the two clocks independently. This is useful not just for 'time-handicapping' but for strict fairness since, like all chess computers, the Elite 'steals' a little of its opponent's time during the piece moving operation — and in Blitz chess a half a minute or so over a whole game can often be the decisive factor.

But I am against the business of POKEing values into the processor by a whole host of complicated board-and-keystroke combinations. For a start it makes the process of learning to use all the functions available on the Elite AS unnecessarily complicated. And for a second, at that price I see no reason why a decent set of symbolic keys couldn't be provided for one-touch implementation of all the functions.

I would also have expected one or two additional functions to be present in such an expensive machine. It is perfectly possible to step back, move by move, all the way to the beginning of a game, but there is no facility for stepping forward. There is no 'replay' key, possessed by even the crudest home computer chess programs, which will automatically replay the game, move by move, from the beginning.

The voice chip is an unnecessary extra which can be irritating or endearing, depending on your mood.

Those are the grumbles. But on the positive side, the Elite AS (Budapest) program (not to be confused with the ordinary AS program which predates Budapest and is definitely weaker) *must*, with the possible exception of the Super Constellation, be the best thing on the market at the moment.

Game No 1: player versus Fidelity Elite AS (Budapest). Game time limit: five minutes (Blitz chess)

1	e2e4	e7e5	37	Rb2b5	Re6d6
2	Ng1f3	Nb8c6	38	h3h4	Rd6c6
3	Bf1b5	a7a6	39	h4h5	Rc6d6
4	Bb5a4	Ng8f6	40	Kg2h3	h7h6
5	O-O	Nf6xe4	41	kh3g4	Rd6d4
6	Rf1e1	f5f7	42	Rb5xb6	Rd4xa4
7	Ba4xc6	d7xc6	43	Kg4f5	Ra4b4
8	d2d3	Ne4f6	44	Rb6a6	Rb4b5+
9	Nf3xe5	Bf8e7	45	Kf5xf4	Rb5xh5
10	c2c3	O-O	46	Kf4g4	Rh5d5
11	Nb1d2	f5f4	47	f3f4	h6h5+
12	h2h3	Nf6d5	48	Kg4g3	Rd5c5
13	Nd2f3	a6a5	49	f2f3	Kg8f7
14	a2a4	c6c5	50	Kg3h4	g7g6
15	d3d4	c5xd4	51	Kh4g3	Rc5d5
16	c3xd4	Ra8a6	52	Kg3h4	Rd5b5
17	Bc1d2	Bc8f5	53	Kh4g3	Rb5c5
18	Bd2c3	Nd5xc3	54	Kg3h4	Rb5d5
19	b2xc3	Qd8d5	55	Kh4g3	Rd5f5
20	c3c4	Qd5d8	56	Ra6c6	Rf5f6
21	c4c5	Qd8d5	57	Rc6c5	Rf6a6
22	Qd1d2	Bf5e4	58	f4f5	a5a4
23	Qd2a2	Qd5xa2	59	f5xg6+	Kf7xg6
24	Ra1xa2	Be4d5	60	Rc5c2	a4a3
25	Ra2b2	Ra6e6	61	Rc2a2	Ra6a5
26	Rb2e2	Rf8e8	62	Kg3f4	h5h4
27	Nf3d2	Be7f6	63	Kf4g4	Ra5a4+
28	Nd2f3	Bd5c6	64	Kg4h3	Kg6f5
29	Re2a2	Bc6xf3	65	f3f4	Kf5xf4
30	g2xf3	Bf6xe5	66	Kh3xh4	Kf4e5(+)
31	Re1xe5	Re6xe5	67	Kh4g3	Ke5d4
32	d4xe5	Re8xe5	68	Kg3f3	Kd4c3
33	Ra2c2	Re5e1+	69	Kf3e3	Kc3b3
34	Kg1g2	Re1e6	70	Resigns	
35	Rc2b2	b7b6		O-1	
36	c5xb6	c7xb6			

Game No 2: Player versus Fidelity. Game time limit: five minutes each (Blitz chess). This time the Elite opts for a weak defensive line and pays the price.

1	e2e4	c7c5	12	b2xc3	Nh6f5
2	Ng1f3	Nb8c6	13	e4xf5	Bd7xf5
3	d2d4	c5xd4	14	O-O	e7e5
4	Nf3xd4	g7g6	15	Rf1d1	e5e4
5	c2c4	Bf8g7	16	Nf3d4	Nc6e7
6	Nd4f3	Ng8h6	17	Nd4b5	Ne7c8
7	Nb1c3	d7d5	18	Be3d4	a7a6?
8	Bf1e2	O-O	19	Bd4f6!	a6xNb5
9	h2h3	Bc8d7	20	Qd2h6	Bf5d7
10	Bc1e3	Qd8a5	21	Qh6g7	mate
11	Qd1d2	Bg7xc3		1-O	

Games section

The last two Micro Chess games have featured David Levy giving a superb demonstration of how to play against a computer (August & September issues).

This month's game is a sort of 'computer's revenge'. The Super Constellation is playing Black against five-times US Women's Champion Diane Savereide. Unlike David Levy, Diane entered into an ultra-sharp and highly theoretical opening variation. At the crucial moment she adopted a faulty continuation of the attack, easy to do in a very complex position. The Constellation took over the initiative and pressed its advantage home in ruthless fashion. Although the human played into the computer's hands by her choice of opening, this is nevertheless one of the most impressive games I have ever seen by a commercial machine.

White: D Savereide. Black: Super Constellation. (Level 7). Notes by Grandmaster Dr John Nunn

1	e2-e4	c7-c5
2	Ng1-f3	d7-d6
3	d2-d4	c5xd4
4	Nf3xd4	Ng8-f6
5	Nb1-c3	a7-a6
6	Bf1-c4	e7-e6
7	Bc4-b3	b7-b5
8	0-0	Bf8-e7
9	f2-f4	Bc8-b7
10	e4-e5	d6xe5
11	f4xe5	

(In this opening White stakes everything on a quick attack. If the assault founders White stands to lose the ending because of the weak pawn at e5.)

11		. . . Be7-c5
12	Bc1-e3	Nf6-d7

(The first new move of the game. 12 . . Nb8-c6 and 12 . . . Bc5xd4 are the accepted alternatives, but the Constellation strikes out on new paths.)

13	Qd1-h5	

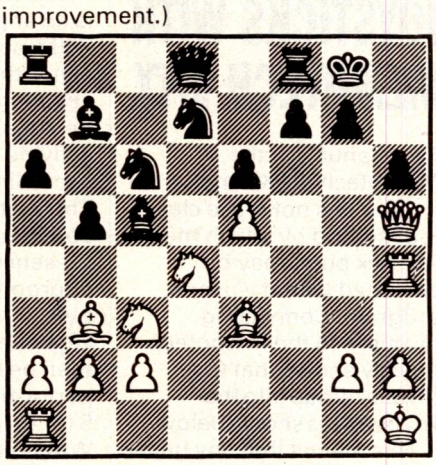
(All that is new is not necessarily good, and here White missed the chance to play 13 Rflxf7! Ke8xf7 14 Qd1-g4. The only reasonable defence is 14 . . . Qd8-b6, but then 15 Kg1-h1! gives White a tremendous attack for the sacrificed rook. After 15 . . . Bc5xd4 16 Be3xd4 Qb6-c6, for example, 17 Nc3-e4 leaves Black in dire straits.)

13		. . . 0-0
14	Rf1-f4?	

(This move is a serious error. White should have played 14 Kg1-h1 Nb8-c6 (14 . . . Qd8-b6 is met by 15 Rf1-f4, since the queen has given up the chance to move to g5 as in the game) 15 Be3-g5 Bc5-e7 (after other moves Black is crushed by the sacrifice Nd4xe6) 16 Nd4-f3 with dangerous threats on the kingside.)

14		. . . Nb8-c6
15	Rf4-h4	h7-h6
16	Kg1-h1	

(After this Black demonstrates a forced win, but there was no real improvement.)



16		. . . Bc5xd4
17	Be3xd4	Qd8-g5!

(A profound move. I commented earlier that an end game would favour Black and this move, which forces the exchange of queens, isn't easy for a machine to find.)

18	Qh5xg5	h6xg5
19	Rh4-g4	Nc6xd4
20	Rg4xd4	Nd7xe5

(White can regain the lost pawn, but only at the cost of allowing Black to develop a powerful counter attack.)

21	Ra1-e1	Ne5-g6
22	Rd4-g4	Ra8-d8
23	Rg4xg5	Ng6-f4

(The relative activity of the two bishops is the key to the position. White's cannot move, while Black's exerts terrible pressure against g2. Already 24 . . . Rd8-d2 is threatened.)

24	Re1-f1	Nf4xg2!

(This little combination finishes the game.)

25	Rg5xg2	Rd8-d2
26	Rf1-g1	Rf8-d8

(White cannot meet the threat of 27 . . . Rd2xg2 28 Rg1xg2 Rd8-d2.

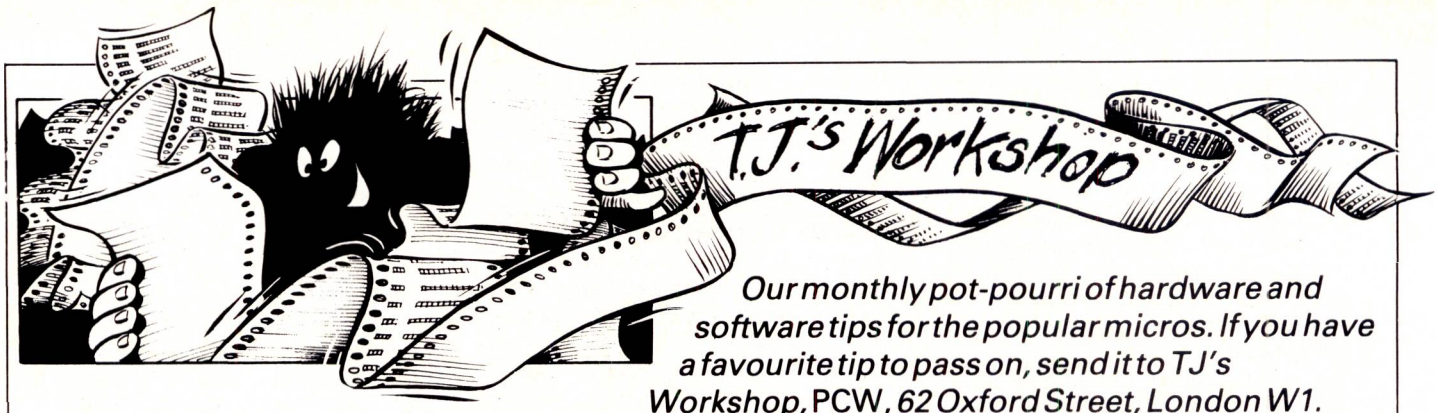
27	Bb3-d5	Rd8xd5
28	Rg2xg7+	

(After 28 Nc3xd5 Bb7xd5 White is utterly paralysed.)

28		. . . Kg8-f8
29	Rg7-g8+	Kf8-e7
30	Rg1-g3	Rd5-e5+
31	Resigns	

(White is mated in two more moves.)

END



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 W1. Please keep your contributions concise. We will pay £5-£30 for any tips we publish. PCW can accept no responsibility for damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

USE OF JOYSTICKS WITH MEMOTECH MTX

The manual for the Memotech MTX series micro does not make clear the method by which the joystick ports may be accessed within a user's program. Connecting joysticks to the Memotech quickly shows that the joysticks map into the keyboard as shown below.

This means that any game requiring joysticks can be played from the keyboard instead (albeit more clumsily). Also, it means that to use joysticks within your own programs, you need only read the keyboard (for example, with INKEY$ in Basic) to determine the joystick status.

The problem with using INKEY$ (or the CHARGET routine in machine code) is that multiple key closures cannot be sensed in this way, so one is confined to the four primary directions plus fire. It is frequently desirable in a game to permit diagonal movement on the screen or to allow firing while moving, making it necessary to sense a number of key closures simultaneously (right and up, for example). To do this on the Memotech, one first needs to understand how the keyboard may be read directly.

The Memotech keyboard is arranged on two of the Z80's ports, 5 and 6. To sense the status of the keyboard, a byte has first to be output on port 5 to activate the appropriate sense lines of the keyboard. These lines are active low, so are activated by the presence of a zero in the appropriate bit of this 'sense byte'. The status of the keyboard read lines may then be determined by performing an input on port 5 (or 6) to yield a 'read byte'. Wherever a read line is active (because a key has been pressed), a zero will appear in the corresponding bit of the read byte. The problem is to determine the appropriate sense/read byte combinations for the keys of interest. (Normally, of course, this is all handled for us by the CHARGET routine in ROM).

The Basic routine in Fig 1 will cycle through the sense bytes to set each sense line in turn and display the resulting read byte. By running this routine while holding down keys, one can determine the combination needed to examine specific keys. The routine only inputs from port 5 as the majority of keys appear here (note that the space bar is one exception).

It's a simple matter to change the routine to investigate port 6, too. Be aware, however, that only the bottom two bits of the read byte from port 6 are keyboard read lines.

Once the sense/read byte combinations have been determined, they can be incorporated into a user-written keyboard read routine. Machine code is best for this as it's much quicker than Basic, and avoids the timing problems which close examination of the output from the Basic routine will reveal.

Two machine code routines for reading the joysticks (or equivalent keys of the keyboard) are given here: one to look at the right-hand joystick, the other the left. Each is used from Basic in exactly the same way; the differences between the two routines merely reflect the different sense/read byte combinations required. Ironically, the left-hand joystick is the more convenient to code for. Each routine will scan the appropriate joystick and set bits of an internal byte (called KEYS) to reflect the joystick status. These bits are set as follows:

KEYS:
- BIT 4 set if FIRE pressed;
- BIT 3 set if DOWN pressed;
- BIT 2 set if UP pressed;
- BIT 1 set if RIGHT pressed;
- (LSB) BIT 0 set if LEFT pressed.

The final value of this byte will, therefore, be determined by the combination of joystick controls active. The value may be retrieved in Basic using a PEEK instruction.

The complete program (Fig 2) shows the routines as they may be used from Basic (note that the variables KEYR and KEYL point to the KEYS bytes within the routines). The exact values of these variables will depend upon the memory size of your Memotech (adjust the variable MTX as indicated in the program) and also upon the degree of comment included in the machine code routines. Adjust the values to equal those indicated by the appropriate assembler symbol table (lines 20 and 30).

When the program is RUN, a balloon will appear which can be moved around the screen with either joystick (although the right-hand one has priority) and will change colour whenever the fire key is pressed. This program shows how easy (and convenient) it is to blend machine code and Basic on the Memotech to impressive effect.

Steve Benner

```
Right-hand joystick    : FIRE  — HOME key;
 LEFT, RIGHT, UP, DOWN  — corresponding cursor keys.
Left-hand joystick     : FIRE  — SPACE BAR;
                         LEFT  — Z key;
                         RIGHT — C key;
                         UP    — B key;
                         DOWN  — M key.
```

```
290 REM *************
292 REM ** Routine to strobe keyboard
    ;
295 LET PORT=5
300 FOR S=0 to 7: LET SS=255-2^S: OUT (5),SS
305 LET R=INP(PORT): PRINT "Sense ";SS,"Read ";R
310 NEXT
315 PAUSE 1000: PRINT : PRINT : GOTO 300
```

Fig 1 Sense: read byte routine

```
1 GOTO 100
20 CODE
4010 GETRTJ:    XOR A      :Clear A
4011            LD HL,KEYS
4014            LD (HL),A  ;Clear KEYS
4015 FIRE:      LD A,£DF   ;Strobe for HOME
4017            CALL STROBE
401A            JR, NZ,LEFT
401C            SET 4,(HL)
401E LEFT:      LD A,£F7   ;Strobe for left
4020            CALL STROBE
4023            JR NZ,RIGHT
4025            SET 0,(HL)
4027 RIGHT:     LD A,£EF   ;Strobe for right
4029            CALL STROBE
402C            JR NZ,UP
402E            SET 1,(HL)
4030 UP:        LD A,£FB   ;Strobe for up
4032            CALL STROBE
4035            JR NZ,DOWN
4037            SET 2,(HL)
4039 DOWN:      LD A,£BF   ;Strobe for down
403B            CALL STROBE
403E            JR NZ,DONE
4040            SET 3,(HL)
4042 DONE:      RET
4043 KEYS       DB 0
4044 STROBE:    OUT  (5),A  ;Do joystick strobe
4046            IN A,(5)
4048            CP 127
404A            RET
```

Symbols

GETRTJ	4010	KEYS	4043
STROBE	4044	LEFT	401E
RIGHT	4027	UP	4030
DOWN	4039	DONE	4042
FIRE	4015		

```
21 RETURN
30 CODE
41A6GETLTJ:     XOR A ;Clear A
41A7            LD HL,KEYS
41AA            LD (HL),A ;Clear KEYS
41AB FIRE:      LD A,127 ;Strobe SPACE-BAR
41AD            OUT  (5),A
41AF            IN A,(6)
41B1            BIT 0,A
41B3            JR NZ,STROBE
41B5            SET 4,(HL)
41B7 STROBE:    LD A,127 ;Strobe left joystick
41B9            OUT (5),A
41BB            IN A,(5)
41BD            LD D,A
41BE            AND £F0 ;Check bottom row keys
41C0            CP £F0
41C2            JR, NZ,DONE  ;Ignore if not
41C4            LD A,D ;Restore A
41C5            CPL ;Set all bits in one go!
41C6            ADD A,(HL) ;Add in FIRE bit
41C7            LD (HL),A
41C8 DONE:      RET
41C9 KEYS:      DB 0
41CA            RET
```

Symbols

FIRE	41AB	STROBE	41B7
DONE	41C8	GETLTJ	41A6
KEYS	41C9		

```
31 RETURN
97 REM ******************
98 REM **
99 REM **   MAIN CODE STARTS HERE — SET UP
   SCREEN FIRST
  ;
100 GENPAT 3,0,24,60,60,24,00,24,24,00
110 VS 4: CLS : COLOUR 0,1: COLOUR 4,1
120 CTLSPR 2,1: CTLSPR 6,1
125 LET X=10: LET Y=8: SPRITE 1,0,X,Y,0,0,10
126 REM
127 REM ********************
128 REM ** Set up SPEED; & PEEK locations (MTX=8
    for 500); See M/C for values
  ;
130 LET SPEED=4: LET MTX=4
150 LET KEYL=MTX*4096+256*1+12*16+09: LET
    KEYR=MTX*4096+4*16+3
190 REM
191 REM
192 REM ********************
193 REM **
194 REM ** Poll keyboard and recalculate coordinates
      ;
200 GOSUB 20:  LET JOYS=PEEK (KEYR): IF
  JOYS=0 THEN GOSUB 30: LET JOYS=PEEK (KEYL)
210 IF JOYS=0 THEN GOTO 200
215 IF JOYS>15 THEN LET JOYS=JOYS-16: ADJSPR
  1,1,RND*14+1
220 IF JOYS>7 THEN LET JOYS=JOYS-8: LET
  Y=Y+SPEED* (Y>10)
225 IF JOYS>3 THEN LET JOYS=JOYS-4: LET
  Y=Y-SPEED* (Y<180)
230 IF JOYS>1 THEN LET JOYS=JOYS-2: LET
  X=X-SPEED*(X<250)
235 IF JOYS>0 THEN LET JOYS=JOYS-1: LET
X=X+SPEED* (X>10)
240 ADJSPR 2,1,X: ADJSPR 3,1,Y: GOTO 200
250 REM
251 REM ************************************
    ****************************
```

Fig 2 Complete program

SORD TIPS

If you ever get fed up waiting for long programs to load, then perhaps you haven't found the secret of changing the rate at which programs are saved.

Type POKE &7019,&12 before you save a program, and the cassette baud rate will be almost doubled. (This works on BASIC-I and BASIC-G). If your cassette recorder cannot cope with the given value of &12, try others until you find the fastest you can safely use. The higher the value POKEd, the slower the baud rate.

Note: You do not need to change the POKEd value to load in files recorded at different speeds—the computer works out what speed it was saved at.

The manual for BASIC-G gives the impression that you must save Basic programs by using LIST "name". This isn't necessary—SAVE will do the job just as well, and much faster.

The advantages of using LIST, however, are that only certain lines need to be saved, if required and, more importantly, programs can be merged. For instance, you could save a frequently used subroutine with LIST, and then OLD it whenever you need it. The merged program lines will replace anything with the same number in memory, so it is best to have your subroutine renumbered to, say, 10000 onwards.

Another advantage of files saved with LIST is that they

will be listed on verifying as well as loading. This means that even if you have a program in memory, you can list any programs on cassette without losing your current one.

Other functions which the BASIC-G manual omits are:
POSTAD(x): this returns the address of sprite post number x;
RETL: this returns the current loop-start line (for example, the line in which the FOR occurs in a FOR-NEXT loop);
RDST$(x): this reads characters off the screen; and
TERMC: I can't find out what this does. If you know, perhaps you could contact me at 5 Greenfield Link, Coulsdon Woods, Coulsdon, Surrey CR3 2SW.

A Hinkly

DRAGON COLOURS

Here is a short machine code routine for the Tandy Color Computer; it should also work on the Dragon 32, although one section may need to be relocated.

The program allows three new colour sets for the text screen: orange on black, green on black and black on orange; it slows down listing speed; allows the hi-res screen to remain in command mode; is relocatable, auto-executes, can be immediately switched on or off, and takes up no user memory — it fits into the second page of reserved memory.

To set it up:

(1) **Run**: 10 FOR T = 314 TO 334 : READ X : POKE T,X : NEXT
20 DATA 52,55,142,4,0,166,0,132,191,167,0
30 DATA 48,1,140,6,0,37,243,53,55,57

(2) **Set up interupts**: POKE 360,1 : POKE 361,58
POKE 363,1 : POKE 364,58

(3) **Save routine**: CSAVEM"FOSFOR",314,365,314
To switch off: POKE 314,57 & on : POKE 314,52
For orange ink/paper: SCREEN 0,1
For green ink/paper: SCREEN 0,0
Switch routine on for black paper, off for black ink. To regain text screen after hi-res screen: SCREEN 0. **For peculiar effects**: POKE 326,X (Try X=Z)

A disassembly of the routine is given below

```
013A   34 37      PSHS,X,Y,A,B,CC
013C   8E 0400    LDX#0000
013F   A6 00      LDA+0,X
0141   84 BF      ANDA#BF
0143   A7 00      STA+0,X
0145   30 01      LEAX+1,X
0147   8C 06 00   CMPX#0600
014A   25 F3      BLO$013F
014C   35 37      PULSCC,B,A,Y,X
014E   39         RTS
```

Disassembly routine

Jeffrey R Burrows

FORTH ERROR REPORTING

Here is a word which will improve error reporting and aid in the debugging of applications written in Acornsoft Forth. It works on the BBC but I see no reason why it should not function on Electron Forth, or even Atom Forth.

The word, ABORT", checks the stack and if a true value (1) is found, prints an error message, clears the computation stack, and returns to the keyboard interpreter via (WARM). Note that if you want to preserve the contents of the stack after an ABORT", omit the line which says:
COMPILE SP!

If the value passed to ABORT" is false, that is, zero, execution continues normally.

Here is the definition:

```
:  ABORT"     (flag . . . )
     ?COMP
     [COMPILE]  IF
       COMPILE  (.")
        34  WORD  COUNT
            TEXT,
       COMPILE  SP!
       COMPILE  (WARM)
     [COMPILE]  THEN
;  IMMEDIATE
```

To illustrate the effect of ABORT", here is an example. This loop should run from −10 to +10, but when the counter becomes greater than five the loop aborts.

```
:  LPTEST 11 −10 DO I . I
5> ABORT" TOO BIG"
LOOP ;
```

The closing quote is only a delimiter and needs no preceding space, rather like the word ." . I have found this to be a very useful definition, as it eliminates the need for IF . . . ELSE . . THEN-type range checks.

Richard Clarke

ORIC ROM CALLS

Here are a few more ROM calls which might be helpful to Oric owners.

The commands without a location may be shortened by typing DOKE#2F5, location of command.

For example, NEW would be
DOKE #2F5, #C71B
then typing 'I' would NEW the program in the memory.

T Latham

Command	Location	Values passed in
PING	#FA85	
HI-RES	#E9BB	
TEXT	#E9A9	
PAPER	#F17F	#2E1
INK	#F18B	#2E1
NEW	#C71B	
LIST	#C773	
LLIST	#C824	
LPRINT	#C832	
WAIT	#D89D	
GOTO	#C9AA	
CONT	#C970	
RUN	#C98B	

LYNX MULTI-PROGRAMS

Having read RP Freeman's subroutine for saving part of a Basic program on the Lynx (*PCW*, October, 1983), I realised that it would be possible to move a complete program around the Lynx's memory. The subroutine here does exactly that and is surprisingly fast.

```
DEFPROC MOVE
INPUT"New start address of
program";A
B=DPEEK(&61FA)
C=DPEEK(&61FC)
FOR N=B TO C
POKE A+N−B,PEEK(N)
NEXT N
PRINT"Moved from (";#B;"
up to";#C;") to (";#A;"up to
";#A+C−B;")"
DPOKE&61FA,A
DPOKE&61FC,A+C−B
ENDPROC
```

To use the subroutine, add it to the end of a program and call it with PROC MOVE. The whole program, including the subroutine, will be copied to the specified address. This can be entered as either a decimal number or a hex number by using '&'. When the program has been copied, access will be to the copied version (the original can be re-accessed by DPOKEing the start address (&694D) into &61FA.

By entering
DPOKE
&61FA,DPEEK(&61FC)+n
where n = the number of bytes between each program, it is possible to enter several programs and have them all in memory at once. This can be done either



through the keyboard or from tape and the command should be entered before each program. To find the start address of the program, enter
PRINT #DPEEK(&61FA).

Other programs can be re-accessed by DPOKE ing &61FA with the start address of the required program.

When using either of the above, remember the following:
(1) RESTORE statements should be used in programs where they would not normally be necessary. It's important to include the line number of the data because otherwise you're likely to get the wrong set of data.
(2) If you wish to adjust programs after storing in a sequence by the second method, space should be left by making the number 'n' fairly large. Otherwise the program immediately after will be corrupted.
(3) Listing memory that contains no Basic programs may result in a lot of junk being thrown up on the screen; this can usually be escaped from with normal listing.

Leo B Carlyon

FASTER SINCLAIR BASIC GAMES

Here is a tip for speeding up games written in Sinclair Basic, and probably most other Basics.

When writing board games or strategic games based on a matrix (*Connect-4, Othello, Draughts*), it is often necessary for the program to 'scan' a 2 or more dimensional array to check for validity of moves, winning combinations, and so on. How efficiently this is done greatly effects the response time of the game.

Usually, certain conditions must be tested for within the array and, if they are all true, a branch is made to another part of the program. For example,

```
IF A(N,1) = P AND A(N+1,1)
  = P AND A(N+2,1) = P
  THEN ... (BRANCH).
```

The problem with this method is that all three conditions are tested, even if the first one is false (which would clearly make the overall condition false). If the above statement were to appear within one or nested FOR ... NEXT loops, then considerable time would be wasted.

The example statement should be altered to:

```
IF A(N,1) = P THEN IF A(N+1,
  1) = P THEN IF A(N+2,1)
  = P THEN ... (BRANCH).
```

This may be considered bad programming practice, but by using it a condition is only tested if the previous one was true. By structuring the statement so that the least likely event is tested for first, a further reduction in scanning-time will be noted.

Using this technique, I have measured reductions in response time of up to 48%. That could mean the difference between a game being playable, or downright unbearable.

V J Chittenden

COMMODORE HINTS

Normally, when NEWing a program, the program written in Basic is cleared but not machine code, so one command can erase the entire RAM.

The following line:
SYS 64738
will erase all Basic listings and leave the machine code program (if any) on top of the RAM. It helps if you keep your finger away from the on/off button!

The Commodore 64 keyboard can be programmed to repeat graphics by typing:
POKE 650, 255
and can be reset by
POKE 650,0

The LOAD command appears automatically by pressing SHIFT + RUN/STOP but can be programmed to execute or load a nameless program (merge), by
SYS 63478
which will display
LOAD
PRESS PLAY . . . on the screen.

Other useful tips include (a) disabling the LIST statement in a program which is made possible by:
POKE 775,200
and
POKE 775,167
will allow LIST (resetting),
(b) disabling the keyboard which is made possible by:
POKE 198,0
(c) colour INK printing:
POKE 646,X
where x = 1 then ink colour = white
x = 2 then ink colour = red
x = 3 then ink colour = cyan
x = 4 then ink colour = purple
and so on
POKE 646,2 will change the cursor and print colour(s) to red.
(d) POKE 53272,99 will switch all characters (letters) to upper case.
(e) POKE 53272,31 will switch to lower case.
(f) SYS 64739 will not allow any entry — it disables every key on the board and only by switching off will you get access to the keyboard.
(g) FRE and any number in brackets will give you the number of bytes left in the memory and the syntax for FRE is:
PRINT FRE (x) where x is any number.

Abbiyyu Lulsegged

MACHINE CODE NUMBERS CHECK

Many of the programs in *PCW* contain lists of numbers. These have been carefully generated by the authors and are vital to the operation of the program.

I have on several occasions typed in such a list of values only to find that the program does not run correctly. The cause of the problem is invariably an error in typing the values. It would be very helpful if some mechanism could be added to these programs to check the validity of the data.

A simple way to perform such a check is to sum the data as it is read. In order to make it easier to find the number in error, the sum should be checked about every 10 times. The program below is an example of how a data initialisation routine could be coded.

D J Roberts

```
5 REM This program fills array x from the data starting at
  500
10 DIM x(34) : RESTORE 500 : REM prepare array and data
20 LET s=0 : LET c=0 : REM Prepare sum and element
  counter
30 FOR i=1 TO 34
40   READ v : c=c+1 : REM Get next data and increment
       sum counter
50   IF c<11 LET x(i)=v : LET s=s+v : GOTO 80 : REM
       Normal data value
60   LET i=i-1 : LET c=0 : REM Correct array place and
       zero sum counter
70   IF s<>v GOTO 200 : REM Sum should match value
       from DATA
80 NEXT i
90 READ v : REM Final check at the end or the list
100 IF s<>v GOTO 200 : REM The last part of the data was
  bad
110 PRINT "Array x correctly loaded" : END
200 PRINT "ERROR on line"; 500+INT((i-1)/10)*10 : END
500 DATA 164,56,142,109,185,30,131,87,40,216,1160
510 DATA 42,178,230,8,241,148,145,3,245,225,2625
520 DATA 152,55,148,238,117,1,78,240,253,131,4038
530 DATA 255,179,123,113,4708
```

This program will not detect all errors but should help with the most common errors; mistyped digits, missing data values and missing DATA lines.

Simple Checksum Program

COMPUTER ANSWERS

Send your queries to Tony Hetherington, PCW, 62 Oxford Street, London W1. Note that Tony cannot answer questions on an individual basis, so please don't send an SAE with your query.

Projected sales figures

I am writing a school project about the computer industry and the way in which it has boomed recently.

However, I need some facts and figures to help me complete this.
(1) How has the amount of software sold in Britain increased in the past five years?
(2) How do you expect software sales to increase/decrease in the future?
(3) How has the number of micros sold in the UK increased over the past five years?
(4) Approximately what percentage of computer owners use video game type software on their micros?
(5) Does the software industry have any future. If so, in what direction will it take us?
AP Tompkins, Purley, Surrey

(1) It is very difficult to give hard facts about software sales in the computer industry as the only source for this information are the software houses themselves. This confusion over levels of sales is illustrated by the number of games charts available, none of which can agree on more than a few chart positions.
(2) Undoubtedly software sales have boomed in the past five years, ever since the introduction of the Sinclair ZX81 into an otherwise expensive market. However, growth is now levelling out as the software buyer becomes more discerning and demands quality for his money.
(3) This levelling out has resulted in the demise of some companies and warnings that others will follow. However, successful companies producing only a handful of quality products a year are far from pessimistic and are looking forward to Christmas and the continuing expansion of the hardware and software markets.
(4) There is no doubt that the majority of computer owners have at least one game in their software library but this is rarely the sole use nor are the games as predictable as their video game counterparts. Indeed, there is a general move towards better and cheaper software which will ensure the continuing future of the software industry.
(5) The growth in hardware sales has mirrored the software development, and computer manufacturers confidently predict record sales this Christmas.

Finally, if figures on the business market alone are of interest, a market research company called EIU Informatics has recently released the results of its own survey. This puts dBase II at the top, followed by Multiplan, VisiCalc and WordStar.

Paging the Enterprise!

In *PCW*, July 1982, page 85 ["EXPANDA-BEEB"], the author writes 'The maximum amount of memory which one 8-bit processor can address is limited to 64k — and this has to include both ROM and memory-mapped input/output, as well as RAM.' He goes on to say 'One possible means of improving on this ... is the capacity for accessing an extra 64k of RAM, ROM or I/O in a "paged" mode' ... but goes on to explain that 'This is much slower than accessing the onboard RAM.' Finally, he explains that with a second processor, these restrictions are immediately lifted. (An extra 64k is immediately available if the second processor is 8-bit; and if the second processor is 16-bit, 'you are into the megabyte region in terms of memory capacity.')

Both the Amstrad CPC464 and the forthcoming Enterprise microcomputers [64k and 128k] have (as far as I know) only a single processor — the Z80A — and I understand this to be an 8-bit processor. Yet, in its brochures, Amstrad claims that the CPC464 is capable of adding an 'additional RAM of up to 8160k' and Enterprise claims that with both the 64k model and the 128k model, the RAM is expandable up to 3968k.

Can you explain how this Z80A processor can be made to address so very much more than the 64k + 64k described in EXPANDA-BEEB?

Will the extra RAM be addressed in a 'paged' mode?

Will this take longer than when addressing less than 64k?

When programming, will one be able to remain unaware of how much memory is being addressed. Or will one, on the contrary, have to use special programming techniques or operating techniques which are unnecessary when addressing less than 64k?
Daniel Reichenberg, Ealing, London

Such a memory expansion capability is achieved by organising the RAM into pages of 64k each. These are then paged in when they are required by the user. This is all done for you by RAM support chips and software; as far as you are concerned the machine can access the total memory.

The theoretical maximum RAM available would, therefore, be 64 pages of 64k which works out to be just under 4.2 megabytes. Enterprise's claim of 3.9 megabytes is credible but the company hasn't disclosed the cost of such a massive system.

The system you describe lacks these paging facilities and is restricted to the 64k available to each of the processors.

It is unlikely that the paging of this memory will have a significant effect on running speeds as such processes are completed in micro seconds. Take, for example, the Benchmarks for the Memotech RS128 Benchtest (see page 168) which illustrate this point well.

'Rare breed' of cat

I am one of those rare breed of micro owners who purchased a 48k Lynx. As is the case with all micros I could write glowing reports of its good points and similarly criticise its failings.

Unfortunately, for myself and the other purchasers of this brand, we appear to be left in the void as Camputers struggles through its final agonies.

Being totally ignorant of electronics I wonder: is it at all possible to replace the Lynx ROMs with some other Z80-based system ROMs in order to fool the hardware into thinking that it is something else. This would allow the machine to be expanded with surrogate peripherals as and when required. Or, must I throw away this micro and purchase another system if Camputers fails (or has it already?

If feasibility is confirmed, could someone suggest a suitable ROM.
FGM Ford, Stanford-le-Hope, Essex

I'm afraid that you're asking the impossible as not only do these machines have different ROMs but their circuit boards are completely different as well. It *would* be possible to relace the ROM chips but you would have to totally rewire the entire circuit board. This would be an impractical task for anyone to undertake and could easily cost you more than the price of a new computer.

Unfortunately, Camputers has failed and there do not seem to be any plans to relaunch the company or the machine.

However, I have passed your name on to some other Lynx owners who may be able to help you make the most of your machine.

It's all in a name

Recently I saw an Atari 800 and an Atari 800XL for sale. Could you please explain the difference between the two and say which is the better buy?
Pauline Walton, Southampton, Hants

The Atari 800 and Atari 800XL are very closely related, although there are some minor differences.
(1) The 800XL has so-called '64k' though no more is available to Basic.
(2) Some minor bugs in the 800 operating system have been corrected on the XL. This means that software that accesses the operating system directly will not work. However, Atari provides an 'official' way to access the OS and over 90 per cent of software uses this and will run OK. Disk drive users can boot in the old Atari operating system giving total compatibility with

all software.
(3) The XL has two joysticks compared with four on the 800, meaning that the few pieces of software that use four will not work nor will certain printer interfaces which use ports 3 and 4.
(4) The XL has Basic and some gimmicky 'Self Test routines' built-in, whereas Basic comes on cartridge on the old 800. This means that Basic must be disabled when loading machine code games from tape, by pressing both the "OPTION" and "START" simultaneously when switching on the machine.
(5) Finally, the XL has a processor bus expansion, Spectrum-style, giving greater scope for expansion. Also the unused second cartridge slot has been dropped. At the moment the only thing to fit this expansion port is Atari's own 64k to turn a 600XL to an 800XL.

Overall, I would recommend the 800XL as it is likely to have more of its additional features incorporated in future software. However, if the 800 is a lot cheaper it would still be a viable buy.

Joining in the demonstration

I have recently bought a 1541 disk drive to go with my Commodore 64 and was delighted to see that it was accompanied by a demonstration disk. Unfortunately, the manual contained no explanation of the programs on the disk or their uses. In fact, apart from a couple of listings in the back, the programs are not mentioned at all.

Could you please explain the uses of these programs or should I "NEW" the disk and use it with Easy Script.
R Fowler, Loughborough, Leics

The programs on the demo disk do, in fact, contain some useful utilities which you may wish to include in your programs. By far the most useful is the C-64 Wedge which greatly accelerates program development.

Here's a full list of the programs with a brief explanation and an indication of their worth:

Printer test
This program prints a listing of the character set to allow checking of the printer mechanism.

Display T and S
By specifying the track and sector of a block, the contents of a block can be examined on either screen or printer. The contents are displayed in hex. There is also the facility to examine subsequent blocks once loaded.

Check disk
This program writes to every block on the disk to check whether or not it will store data. It records any bad blocks so that the DOS will not use them. This test should be run just after formatting a new disk.

Performance test
This tests the mechanical and electrical capabilities of the drive. It does this by:
(1) NEWing the disk.
(2) Creating and reading a sequential file.
(3) Creating and reading a random file.
(4) Reporting any errors.

C-64 wedge
This loads the program DOS 5.1 into memory. It is a useful aid in program development and provides the following features:
(1) Programs can be LOADed using the format/progname
This saves having to type LOAD"progname",8 all the time. It can also be used in conjunction with the pattern matching characters '*' and '?'.
(2) '@' and '>' are used to preface disk commands. '>$' or '@$' will display the disk's directory without losing the program currently in memory.
(3) After a disk error (a flashing red light on the drive) '@' or '>' followed by RETURN will display the error message on the screen.

This program can be saved in with your own program using the following sequence of commands:
POKE 44,204:POKE 43,0
POKE 46,207:POKE 45,89
SAVE "DOS 5.1",8,1

The DOS can then be reloaded using LOAD "DOS 5.1",8,1.

COPY ALL and DISK ADDR CHANGE are used together to provide an easy method of backing up your disks. The only drawback is that you need two disk drives. The DISK ADDR CHANGE program is used to alter the device number of one of the disk drives. This is essential if you are using more than one drive in a program.

DIR allows you to:
(1) See the directory.
(2) Use > or @ as in the wedge program.
(3) Give the status of the disk by printing the error channel (00,OK,00,00 if no error).

The other programs on the demonstration disk are:
How To Use—an introduction to the programs on the disk;
V-20 Wedge—a wedge program for the VIC-20; and
View BAM—a program that draws a diagram of the BAM very slowly and then clears the screen before you have a proper chance to look at it.

Finally, there are two programs that illustrate how to create and use sequential and random files. These can be used as a core for your own programs.

Going up the wall

I have just received the Basic Converter Wallchart and was concerned to note that the Sirius was omitted from it. Could you give me the necessary information so that I may include it in my copy?
Ron Westerman, Exeter, Devon

The Sirius can easily be included in the same column as the IBM Basic A. There are only a few differences between the Basics which are listed below.

CLEAR [exp,exp]
GET [#]<file number>[,<rec number>]
LIST [lineno][–[lineno]]
LLIST [lineno][–[lineno]]
ON exp GOSUB
OPEN <mode>,
[#]<fileno>,[<rec length>]

Sharp answer

Information we've received from the BBC should help to answer some of the numerous questions we've received on Basicode.

BBC Support Services is releasing new, improved versions of Basicode in September. The machines covered are the Apple II, BBC, CBM 64, Pet, Vic-20, Dragon 32/64, MSX, Oric 1/Atmos, Electron, Sharp MZ80-A/K, Spectrum, TRS 80 1/111 and Video Genie. It is also looking at ways to help existing Basicode users, with one of the options being replacing old versions with new ones.

David Loverseed of David Computer Software has also written in with some advice for Sharp owners:

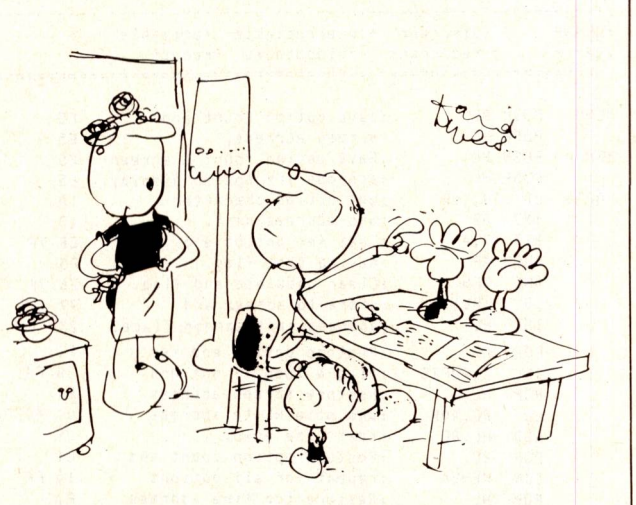
In Computer Answers, *PCW*, September, Trevor Escott wrote regarding Basicode for Sharp computers. Having collaborated with the BBC in producing the latest version, perhaps I can add to the answer given.

BBC Broadcasting Support Services of 252 Western Avenue, London W3 6XJ, supplies Basicode converters for the Sharp MZ-80A and MZ-80K, a handbook, and cassette of sample Basicode programs. A converter for the Sharp MZ-700 is available from my company, DCS, of 38 South Parade, Bramhall, Stockport, SK7 3BJ. All three converters take the form of 'toolkits' which are loaded after, and modify Basic to handle Basicode, the loading method being:
1. Load BASIC
2. Type BYE (MON on the MZ-80A) and press CR
3. Insert the Basicode cassette, type L and press CR, then PLAY as prompted

As Trevor noted, only half the tape is read; this is the case with all standard Sharp cassettes, as Sharp computers record programs twice without this being apparent to the user. If a bad read is obtained, the second recording is read automatically.

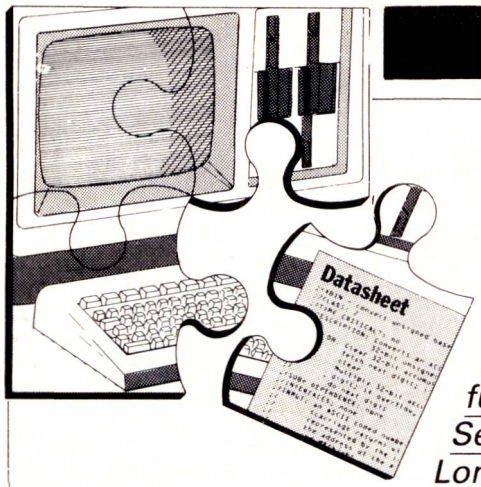
Once the toolkit is loaded, the Sharp will load and save both Basic and Basicode programs, the extra commands LOAD/B 1000– and SAVE/B being used for Basicode. The use of LOAD/B on its own, as referred to in your answer, is not recommended, since lines 1000 on are machine-specific and added to the program after loading by the command LOAD/2.
D Loverseed, David Computer Software

END



'Why don't you get a small computer to help with his homework? . . .'

SUBSET



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to Sub Set, PCW, 62 Oxford Street, London W1A 2HG.

Z80 LISTED OPTIONS

To save you having to continually type in execute commands, MENU from Geoffrey Ticehurst of Lutterworth lists the options available to you. It prompts your selection with a moving arrow and passes control to the program of your choice.

Although written for the TRS-80 keyboard input system, you should find that it will easily convert to the system used by your own computer.

DATASHEET

```
:=========================================================
:= MENU       Menu option select routine.
:=========================================================
:JOB          To display options, seek user choice and pass
:             control to option program.
:ACTION       Print options and address top option.
:             REPEAT UNTIL space bar pressed:
:             [ Highlight current option.
:               IF down-arrow pressed THEN:
:               [ De-highlight current option and address
:                 next wrapping from bottom to top option. ] ]
:             Jump to chosen option through jump table.
:---------------------------------------------------------
:CPU          Z80
:HARDWARE     TRS-80 Model 1 Keyboard buffer, and display.
:             Memory containing option list.
:SOFTWARE     "UNKEY" - local subroutine, to wait key release.
:---------------------------------------------------------
:INPUT        HL addresses screen RAM options destination.
:             DE addresses the first byte of the option list.
:             B = number of options.
:             Each option must have bit 7 of the end byte set.
:             Option jump table of 3-byte JP instructions must
:             follow immediately after CALL MENU.
:OUTPUT       All registers changed. Control is passed to the
:             program section dealing with the wanted option.
:ERRORS       No check for option list running off screen.
:REG USE      AF BC DE HL
:STACK USE    10
:RAM USE      None.
:LENGTH       81
:CYCLES       Not given.
:---------------------------------------------------------
:CLASS 2      -discreet  *interruptable  *promable
:-**---       -reentrant  -relocatable  -robust
:=========================================================
:
MENU    PUSH BC         :Save option count and          C5
        PUSH HL         :screen address.                E5
MENUA   PUSH BC         :Save option count & screen     C5
        PUSH HL         :address for option display.    E5
POPTS   LD   A,(DE)     :Get option character           1A
        INC  DE         :and address next.              13
        BIT  7,A        :Test for option end,           CB 7F
        PUSH AF         :saving test flag.              F5
        AND  7FH        :Clear possible end flag,       E6 7F
        LD   (HL),A     :store to screen and            77
        INC  HL         :address next screen place.     23
        POP  AF         :Restore option end test        F1
        JR   Z,POPTS    :flag & loop if not end.        28 F4
        POP  HL         :Restore screen address         E1
        LD   BC,40H     :and move HL to address         01 40 00
        ADD  HL,BC      :next line down.                09
        POP  BC         :Restore option count and       C1
        DJNZ MENUA      :repeat for all options.        10 EA
        POP  HL         :Restore top line address       E1
        DEC  HL         :Address place 2 chars to       2B
        DEC  HL         :left for arrow position.       2B
        POP  BC         :Restore option count,          C1
        LD   C,B        :saving it in C.                48
:
MENUB   PUSH HL         :Save top line address.         E5
MENUC   LD   (HL),5EH   :Display right arrow and        36 5E
        LD   A,(3840H)  :get any keyboard input.        3A 40 38
        BIT 7,A         :Test for space-bar and         CB 7F
        JR   NZ,MENUD   :exit MENUB if pressed.         20 13
        BIT  4,A        :Test for down arrow and        CB 67
        JR   Z,MENUC    :repeat if not.                 28 F3
        CALL UNKEY      :Wait down arrow release.       CD lo hi
        LD   (HL),20H   :Clear right arrow from         36 20
        LD   DE,40H     :display and address next       11 40 00
        ADD  HL,DE      :line down, repeating if        19
        DJNZ MENUC      :bottom option not passed.      10 E8
        POP  HL         :Else get top line address      E1
        LD   B,C        :and option count then          41
        JR   MENUB      :restart on top option.         18 E3
:
MENUD   CALL UNKEY      :Wait space-bar release.        CD lo hi
        POP  HL         :Tidy up stack.                 E1
        LD   A,C        :Compute: options - options     79
        SUB  B          :missed = option index.         90
        LD   B,A        :Multiply option index          47
        SLA  A          :by 3 for 3-byte JP             CB 27
        ADD  A,B        :instructions.                  80
        LD   B,0        :Move offset to required JP     06 00
        LD   C,A        :into BC, get return address    4F
        POP  HL         :as jump table base address,    E1
        ADD  HL,BC      :add offset to address JP       09
        JP   (HL)       :instruction and jump to it.    E9
:
:...Wait for release of key being pressed.
UNKEY   LD   A,(3840H)  :Get key store and test if      3A 40 38
        OR   A          :any bit set = key pressed.     B7
        JR   NZ,UNKEY   :Repeat until none pressed      20 FA
        RET             :then return to MENU.           C9
:=========================================================
```

6502 CONTROL LISTING

Code dump routines sometimes print the ASCII characters alongside the hex, in case data and not machine code is coming through.

Control codes are usually skipped or printed as spaces.

CTRPRT from Tim Herklots of Farnham intercepts these codes on their way to the print routine, and prints the standard two- or three-letter abbreviations. The result—readable hex dumps.

DATASHEET

```
:=========================================================
:= CTRPRT     Control character name print.
:=========================================================
:JOB          To intercept an ASCII control code destined for
:             a print routine, converting it to its three
:             letter abbreviation enclosed in brackets.
:ACTION       IF character is a control code, THEN:
:             [ Use code * 3 as index to abbreviation table.
:               Copy abbreviation to stack. Put "<" on stack.
:               FOR count of 4:
:               [ Pull byte. IF NOT "*" THEN: [ Print. ]. ]
:               Set character = ">".
:             Exit to Print routine.
:---------------------------------------------------------
:CPU          6502
:HARDWARE     None.
:SOFTWARE     "WRCHAR" - subroutine to print ASCII char. in A.
:---------------------------------------------------------
:INPUT        A contains ASCII character or control code.
```

```
:OUTPUT     If input is a character ($20+), A is unchanged.
:           If input is a control code, output A = ">".
:ERRORS     None.
:REG USE    A P
:STACK USE  4
:RAM USE    M0
:LENGTH     146 (Code: 50.  Data: 96).
:CYCLES     Not given.
:-----------------------------------------------------------
:CLASS 2    -discreet  *interruptable  *promable
:-***-*     *reentrant  -relocatable  *robust
:===========================================================
:
CTRPRT CMP  #32         :Pass straight through if      C9 20
       BCS  CPEND       :not a control code.           B0 2B
       STA  M0          :Else code table offset        85 M0
       ASL  A           :is 3 * code number.           0A
       ADC  M0          :                              65 M0
       STX  M0          :Save X and move offset        86 M0
       TAX              :to X as code index.           AA
       LDA  CTAB+2,X    :Get last letter               BD lo hi
       PHA              :to stack.                     48
       LDA  CTAB+1,X    :Get middle letter             BD lo hi
       PHA              :to stack.                     48
       LDA  CTAB,X      :Get first letter              BD lo hi
       PHA              :to stack.                     48
       LDA  #$3C        :Get LESS-THAN symbol          A9 3C
       PHA              :to stack.                     48
       LDX  M0          :Restore X.                    A6 M0
       LDA  #4          :Set count of stacked          A9 04
       STA  M0          :letters in M0.                85 M0
CPLP   PLA              :Get character off stack       68
       CMP  #42         :but if "*" space filler       C9 2A
       BEQ  CPLTST      :then miss printing it.        F0 03
       JSR  WRCHAR      :Go print character.           20 lo hi
CPLTST DEC  M0          :Repeat for four stacked       C6 M0
       BNE  CPLP        :characters.                   D0 F4
       LDA  #$3E        :End with GREATER-THAN.        A9 3E
CPEND  JMP  WRCHAR      :Exit to print last char.      4C lo hi
:
CTAB   .BYTE 78,85,76,83,79,72 :NUL SOH    4E 55 4C 53 4F 48
       .BYTE 83,84,88,69,84,88 :STX ETX    53 54 58 45 54 58
       .BYTE 69,79,84,69,78,81 :EOT ENQ    45 4F 54 45 4E 51
       .BYTE 65,67,75,66,69,76 :ACK BEL    41 43 4B 42 45 4C
       .BYTE 66,83,42,72,84,42 :BS* HT*    42 53 2A 48 54 2A
       .BYTE 76,70,42,86,84,42 :LF* VT*    4C 46 2A 56 54 2A
       .BYTE 70,70,42,67,82,42 :FF* CR*    46 46 2A 43 52 2A
       .BYTE 83,79,42,83,73,42 :SO* SI*    53 4F 2A 53 49 2A
       .BYTE 68,76,69,68,67,49 :DLE DC1    44 4C 45 44 43 31
       .BYTE 68,67,50,68,67,51 :DC2 DC3    44 43 32 44 43 33
       .BYTE 68,67,52,78,65,75 :DC4 NAK    44 43 34 4E 41 4B
       .BYTE 83,89,78,69,84,66 :SYN ETB    53 59 4E 45 54 42
       .BYTE 67,65,78,69,77,42 :CAN EM*    43 41 4E 45 4D 2A
       .BYTE 83,85,66,69,83,67 :SUB ESC    53 55 42 45 53 43
       .BYTE 70,83,42,71,83,42 :FS* GS*    46 53 2A 47 53 2A
       .BYTE 82,83,42,85,83,42 :RS* US*    52 53 2A 55 53 2A
:===========================================================
```

6502 SQUASH

Routines to compress and expand Z80 data held to 12-bit accuracy were given in the June issue.

David Heale of Bolton has converted them to 6502 code. David's SQSH preserves the source data, unlike the Z80 version.

As both routines use post-indexed addressing, the pointers (in M0 to M3) are unchanged. Any loop repeatedly calling them to deal with a long data list will have to increment them to the next four- or three-byte block.

DATASHEET

```
:===========================================================
:= SQSH     Squash Data.
:===========================================================
:JOB        To compress two 16-bit words of numerical data,
:           held to 12-bit accuracy, into 3 bytes.
:ACTION     Move source byte 1 to destination byte 1.
:           Discard s2-hi. Move s2-lo to d2-hi.
:           Move s3-hi to d2-lo. Move s3-lo to d3-hi.
:           Discard s4-hi. Move s4-lo to d3-lo.
:-----------------------------------------------------------
:CPU        6502
:HARDWARE   RAM: 4 bytes source, 3 bytes for destination.
:SOFTWARE   None.
:-----------------------------------------------------------
:INPUT      M0,1 addresses first byte of 4-byte source.
:           M2,3 addresses first byte of 3-byte destination.
:OUTPUT     M0,1 & M2,3 and source data are unchanged.
:           Y =3.  A = last squashed byte.
:ERRORS     No check for destination overwrite of source.
:REG USE    A Y P
:STACK USE  None.
:RAM USE    M0 M1 M2 M3
:LENGTH     41
:CYCLES     98
:-----------------------------------------------------------
:CLASS 2    -discreet  *interruptable  *promable
:-****-     *reentrant  *relocatable  -robust
:===========================================================
:
SQSH   LDY  #0      :Index first bytes.                A0 00
       LDA  (M0),Y  :Move source 1                     B1 M0
       STA  (M2),Y  :to destination 1.                 91 M2
       INY          :Index second bytes.               C8
       LDA  (M0),Y  :Get source 2,                     B1 M0
       ASL  A       :lo-nibble                         0A
       ASL  A       :into A                            0A
       ASL  A       :hi-nibble                         0A
       ASL  A       :and store                         0A
       STA  (M2),Y  :in destination 2.                 91 M2
       INY          :Index third bytes.                C8
       LDA  (M0),Y  :Get source 3,                     B1 M0
       LSR  A       :hi-nibble                         4A
       LSR  A       :into A                            4A
       LSR  A       :lo-nibble                         4A
       LSR  A       :and merge                         4A
       DEY          :(indexing second byte)            88
       ORA  (M2),Y  :with s2 lo-nibble                 11 M2
       STA  (M2),Y  :and store in destination 2.       91 M2
       INY          :Index third bytes.                C8
       LDA  (M0),Y  :Get source 3,                     B1 M0
       ASL  A       :lo-nibble                         0A
       ASL  A       :into A                            0A
       ASL  A       :hi-nibble                         0A
       ASL  A       :and merge                         0A
       INY          :(indexing fourth byte)            C8
       ORA  (M0),Y  :with s4 lo-nibble.                11 M0
       DEY          :Index third byte and store        88
       STA  (M2),Y  :in destination 3.                 91 M2
       RTS          :Exit, data compressed.            60
:===========================================================
:===========================================================
:= EXPD     Expand Data.
:===========================================================
:JOB        To expand 3 bytes of numerical data, compressed
:           by "SQSH", back to two 16-bit words with the
:           four most significant bits of each set to zero.
:ACTION     Move source byte 1 to destination byte 1.
:           Move s2-hi to d2-lo. Clear d2-hi.
:           Move s2-lo to d3-hi. Move s3-hi to d3-lo.
:           Move s3-lo to d4-lo. Clear d4-hi.
:-----------------------------------------------------------
:CPU        6502
:HARDWARE   RAM: 3 bytes source, 4 bytes for destination.
:SOFTWARE   None.
:-----------------------------------------------------------
:INPUT      M2,3 addresses first byte of 3-byte source.
:           M0,1 addresses first byte of 4-byte destination.
:OUTPUT     M0,1 & M2,3 and source data are unchanged.
:           Y =4.  A = last expanded byte.
:ERRORS     No check for destination overwrite of source.
:REG USE    A Y P
:STACK USE  None.
:RAM USE    M0 M1 M2 M3
:LENGTH     42
:CYCLES     100
:-----------------------------------------------------------
:CLASS 2    -discreet  *interruptable  *promable
:-****-     *reentrant  *relocatable  -robust
:===========================================================
:
EXPD   LDY  #0      :Index first bytes.                A0 00
       LDA  (M2),Y  :Move source 1 to                  B1 M2
       STA  (M0),Y  :destination 1.                    91 M0
       INY          :Index second bytes.               C8
       LDA  (M2),Y  :Get source 2,                     B1 M2
       LSR  A       :hi-nibble into                    4A
       LSR  A       :lo-nibble A,                      4A
       LSR  A       :clearing hi-nibble                4A
       LSR  A       :and store in                      4A
       STA  (M0),Y  :destination 2.                    91 M0
       LDA  (M2),Y  :Get source 2,                     B1 M2
       ASL  A       :lo-nibble                         0A
       ASL  A       :into                              0A
       ASL  A       :hi-nibble A,                      0A
       ASL  A       :clearing lo-nibble A,             0A
       INY          :(index third bytes)               C8
       STA  (M0),Y  :and store in destination 3.       91 M0
       LDA  (M2),Y  :Get source 3,                     B1 M2
       LSR  A       :hi-nibble                         4A
       LSR  A       :into                              4A
       LSR  A       :lo-nibble A                       4A
       LSR  A       :and merge with                    4A
       ORA  (M0),Y  :s2-lo, then store                 11 M0
       STA  (M0),Y  :in destination 3.                 91 M0
       LDA  (M2),Y  :Get source 3 lo-nibble,           B1 M2
       AND  #$0F    :clearing hi-nibble,               29 0F
       INY          :(index fourth byte)               C8
       STA  (M0),Y  :and store in destination 4.       91 M0
       RTS          :Exit, data expanded.              60
:===========================================================
```



Time for the show-down

Yes, it's PCW show-time, folks; Jerry Sanders raises the curtain at Olympia and invites you to step inside . . .

When you get to the Show and wonder where to start, try the Leading Edge feature on the *PCW* stand. The *PCW* team has put together a display of the most innovative products on the market, setting the scene for all that's best in microcomputing in 1984 — and that includes the QL, the Hewlett-Packard touch-screen machine, the new portable Apricot from ACT, together with Ashton Tate's Framework software and Lords of Midnight from Beyond.

Among the many firsts at the Show will be Acorn's range of seven machines under the ABC designator (Acorn Business Computer), plus the award by the British Standards Institute of the certificate marking A1 validation of Acornsoft Pascal. This is the first ROM-based Pascal that's ever approached validation quality, and also the first ISO 7184 level one Pascal implementation on any microcomputer. Watch out too for Sherlock Holmes and the new Mega-Game Time Race, commissioned by Domark from Andromeda and a team of Hungarian programming Wizards.

Graphics enthusiasts should look out for the winners of the *PCW* Micro-Animation Competition. Entries from home and abroad to a high standard compete for the top prize of a Fujitsu 16-bit micro, with a host of other prizes from Sinclair, Oric, Atari, Tradecom, Microvitec, Hantarex and Century Publications. The winners' handiwork on a variety of machines is on display at the *PCW* stand, and prizes will be presented at 4pm on Friday 21 September.

Also on display will be the much-renamed Enterprise. Yes, the machine you haven't been buying QLs for finally sees light of day with a full range of Enterprise-branded peripherals and software.

Media presence this year is greater than ever, with a Radio Four *Chip Shop* studio specially built inside the exhibition hall. *Chip Shop* shot to top audience ratings in its first year, and the *PCW* Show heralds the first Radio One billing for the series when the Mark Page show carries a Show report on Saturday 22 September at 7.30am. Radio Four plans include three regular slots every Show day, featuring interviews, panel sessions and a special slot for younger listeners.

A must for all games enthusiasts is the Top Twenty stand. This games arcade will have every one of the twenty best games set up and ready for you to play. Details of machine compatibility, price and chart positions will be kept up to date throughout the Show.

Finding the right books can be a headache, but not for visitors to the Mastering the Micro feature. From the hundreds of titles submitted, experts chosen by the Book Marketing Council have selected the 40 books no micro owner can afford to ignore.

Business users mustn't miss a free session at the Business Advisory Centre. Impartial advice from professional consultants on products and services will be available. Why not get your questions together in advance and save yourself the £50 an hour-plus that an equivalent service might cost you after the Show!

Every effort has been made to ensure the accuracy of the following entries. However, as the details were compiled before the Show, we would like to apologise for any changes made between going to press and the event itself.

ACT Stand No 721
Shenstone House
Dudley Road
Halesowen

ACT's first public showing of the Apricot F1, F1E and Portable computers, and the Apricot Point 7 and Point 32 network systems, all of which make ACT a UK leader with what is claimed to be Britain's biggest range of business micros. Special features on voice recognition and cordless connections.

Acorn Computers Stand No 208
Fulbourn Road
Cherry Hinton
Cambridge CB1 4JN

It's as easy as ABC: that's the theme of Acorn's new range of seven business machines based on the BBC Micro and its peripherals. The *PCW* Show is the first showing of the Acorn Business Computer range of two-box machines Z80, 16032 and a third (as yet unnamed) processor chip. Options include 10-20Mbyte winchester disks.

Addison Wesley Stand No 706
53 Bedford Square
London WC1

New software for Commodore 64; BBC & Electron Colouring Book software. New micro books on graphics, and an IBM PC adventure game book with software, The Secret of Arendarvon Castle.

Addictive Games Stand No 1205
7a Richmond Hill
Bournemouth BH2 6HE

Addictive Games, producer of Football Manager, is exhibiting the new version for the Commodore '64 featuring detailed graphics. Also demonstrated is a new range of games from Silicon Joy. Written by freelance programmers, these games have been specially chosen by Football Manager designer, Kevon Toms.

Activision UK Stand No 1033
15 Harley House
Marylebone Road
London NW1 5HE

The opportunity to try out all Activision's latest titles. Come and play Pitfall II, H.E.R.O., Zenji, Toy Bizzare and Beanrider, and try your hand at Desig-

ner's Pencil, a new device for drawing with a joystick.

Anirog Software Stand No 1313
29 West Hill
Dartford
Kent DA1 2EL

New games releases for the established and not so established machines, including the Amstrad CPC464 and the MSX breed, plus an adventure preview of Catacombs and Soul Gem of Martek.

Apple Computer Stand No 533
Eastman Way
Hemel Hempstead
Herts HP2 7HQ

Apple Macintosh has a fast-growing range of business software, with a level of integration that takes Apple further towards its goal of one person, one computer.

Argus Press Software Stand No 1509
1 Golden Square
London W1A 3AB

Argus Press Software, the adventure/strategy software company is publicly showing American Football for the first time. Overcoming all the usual constraints of Commodore 64 and Spectrum software, American Football delivers what it promises — a fully animated, live action graphic simulation.

The full range of Computer Tutor, Clever Clogs early learning games are on show, including Sam Safety, the revolutionary road training program.

Advance Electronics Stand No 531
PO Box 230
Wrexham
Clwyd LL14 3JR

Advance Electronics is showing its smaller range of Computer Power Conditioners. The new PC-compatible GT40 series and the extended WPC150 range are designed to filter and regulate the mains supply, ensuring complete protection against unpredictable variations in voltage and eliminating 'spikes'. These units are suitable for both home and office use.

Amstrad Consumer Electronics Stand No 1103
Brentwood House
169 Kings Road
Brentwood
Essex CM14 4EF

Amstrad is exhibiting its CPC464 computer and is launching at the Show its new disk drive which comes complete with interface, CP/M and Logo operating system all for £199.95.

Anagram Systems Stand No 723
60A Queen Street
Horsham
West Sussex RH13 5AD

Anagram Systems is showing the latest enhancements to its Integrated Accounting System. IAS now offers sales and purchase order processing with full or partial factoring, as well as sales, purchase, stock and nominal ledgers. The full package can perform some 200 accounting functions from just over 50 screen prompts.

Association of Computer Clubs Stand No 1525
ACC Chairman — Rupert Steele
22 Kempsford Gardens
London SW5 9LH

The Association came into being officially in February of this year when it took over the national work then being done by the Amateur Computer Club — It's a truly amateur organisation run by enthusiasts in their spare time.

Atari International (UK) Stand No 216
Railway Terrace
Slough
Berks

Atari makes its first public appearance since the Jack Tramiel takeover.

Audiogenic Stand No 1100
39 Suttons Industrial Park
London Road
Reading RG1 6AZ

See the Koala graphics pad and software for the Commodore 64. Plus, the Audiogenic Swift Spreadsheet system for the Commodore 64 offering Mac-style pop-down menus.

BBC Radio Stand No 1343
Broadcasting House
Langham Place
London W1

Visit the BBC Radio stand where a special studio is built to record and broadcast events from the Show live on Radio Four Chip Shop and other BBC radio programmes.

BBC Publications Stand No 330
35 Marylebone High Street
London W1

A new range of software is being launched including Game Core, Word Mover, Drawstick and Astronomy.

Bernard Babani (Publishing) Stand No 1506

Pick up your free copy of the 1984/85 Babani computer book catalogue and see, hot off the presses, *An Introduction To Programming The Sinclair QL.*

Bicc-Vero Electronics Stand No 409
Flanders Road Industrial Estate
Hedge End
Southampton SO3 3LG

All the connections you need: circuit boards, card frames, enclosures and housings for the construction of all types of electronic equipment.

Biodata Stand No 731
6 Lower Ormond Street
Manchester M1 5QG

On show is Microlink, a modular computer interface designed for connecting laboratory instruments to micros. It offers a wide range of modules including analogue digital inputs and outputs, timers and counters, RS232 and Thermocouple inputs. Microlink can operate with most popular micros including IBM, H-P, Apple, Commodore and BBC and software is available for these machines.

Boot Out Stand No 908
PO Box 47
Putney
London SW15 1AU

A large selection of business and leisure software for the Apple, Atari, Commodore 64, IBM, BBC and Spectrum are on sale at special Show prices.

Bubble Bus Software Stand No 306
87 High Street
Tonbridge
Kent

Bubble Bus Software is showing its latest 3D graphics war game for the Commodore 64, Strike Force, together with Cave Fighter, a prehistoric arcade game. Also Bubble Bus's first Spectrum effort — a conversion of the '64 pool game, Hustler. And don't miss the MSX display.

BusiSoft Stand Nos 716 & 718
2 Seagrave Road
London SW6 1SF

BusiSoft specialises in applications and technical software for the IBM PC, Apricot, Sirius and Rainbow micros. This year's Show is the first public appearance of its BusiLink database access software, plus demos of BusiPost for correspondence and mail management, Spellbinder with Wordplus, and Punctuation and Style for sophisticated word processing applications.

Byte Shop Stand No 730
173-175 Drummond Street
London NW1

If you're looking for advice on how

microcomputers could increase your company's efficiency, then visit the Byte Shop stand. Established for six years, the Byte Shop's portfolio of products comprises the leading names of the industry including IBM, ACT and Comart.

Cambridge Microcomputer Centre Stand No 128
153/154 East Road
Cambridge CB1 1DD

A type-and-talk speech computer, which includes centronics and serial (RS423) ports, is being demonstrated. Also on offer are a range of quality Teac disk drives and printers at competitive prices, as well as a selection of books.

Century Publishing Stand No 1404
Portland House
12-13 Greek Street
London W1V 5LE

Century offers a range of computer books and software with something for everyone.

Commodore Business Machines Stand No 202
675 Ajax Avenue
Slough SL1 4BG

Two new home computers, the C16 and the Plus/4, grace the CBM stand as well as the upgraded 8000 series for business users. The Commodore 64 communications modem and Compunet, the online service to rival Micronet, are being officially launched.

Computer Bookshops Stand No 807
30 Lincoln Road
Olton B27 6PA

Books on computers, languages, disk drives, databases, spreadsheets and simulations.

C/WP Computers Stand No 410
Willow House
Willow Place
London SW1P 1JH

Information on IBM, Apple, Osborne and Cortex systems, and details of modems and software to turn your micro into a telex terminal.

Computer and Video Games Stand No 1203
Priory Court
30-32 Farringdon Lane
London EC1R 3AU

Computer and Video Games adventure expert Keith Campbell is on hand with his computerised Adventure Helpline. Aided by a Tandy computer, Keith and his friends will be answering questions about the popular adventure games.

Creative Sparks Stand No 1342
Thomson House
296 Farnborough Road
Farnborough GU14 7NU

There are 15 new games titles on show here, from Danger Mouse heroics, Black Forest Chateau to a graphics/text adventure based on Macbeth.

CRL Stand No 1339
9 Kings Yard
Carpenter's Road
London E15 2HD

On display — CRL's most recent release, Magic Roundabout, based on the BBC TV series. The stand also features War of the Worlds and Glug Glug for the Commodore 64.

Crystal Computing (Design Design) Stand No 1508
4 Paton Street
Manchester M1 2BA

Design Design (formerly Crystal Computing) is attending the Show to launch its new game Darkstar. Written by Simon Bratell for the Spectrum 48k, it looks like being one of the most interesting games of the year. For the Commodore 64 there are Halls of Things and the Zeus Assembler.

Currah Computer Components Stand No 329
26a Danbury Street
London N1

Currah launches its latest speech synthesiser for the CBM 64, and follows up with a sneak preview of the MicroSource Forth/Assembler for the Spectrum. Also there — Currah's award winning MicroSpeech for the Spectrum together with the MicroSlot expandable motherboard.

Data Products Stand No 743
Data Products House,
136-138 High Street
Egham
Surrey TW20 9HL

Data Products has recently introduced the Paper Tiger 8000 series of microcomputer printers. These dot matrix machines feature a unique printhead design, and a method of forming characters which produce letter quality printing normally associated with more expensive daisywheel printers. They offer multiple print speeds, graphics and full colour capability.

Digital Equipment Stand Nos 405 & 433
Marketing Comms
PO Box 110
Reading RG2 0TR

Digital is showing a range of business solutions in cooperation with its third party companies. It feels that customer support is one key to success in the personal computer market and is strongly emphasising this at the Show.

Dimension Graphics Stand No 1308
Main Street
Chackmore
Buckingham MK18 5JF

Dimension is demonstrating its system for producing A3 full colour prints using its state-of-the-art ink-jet printer (Tektronix 4691). At present this service is available for BBC, Electron and Spectrum with others in the pipeline.

Disking International Stand No 428
Liphook
Hampshire GU30 7EJ

Disking claims to ship all floppy disk orders within four working hours, and is selling floppy disks at half price for this Show only.

Domark Stand No 1200
228 Munster Road
London SW6 6AZ

A prize of £25,000 is being offered to the first person who can unravel the mysteries and puzzles of a series of five real-time adventures and arcade games entitled 'Eureka'.

Duckworth Publishers Stand No 746
The Old Piano Factory
43 Gloucester Crescent
London NW1

On display will be books for all popular home computers covering a wide range of interest: user manuals, graphics, machine code and adventure games.

Ebury Software Stand No 101
National Magazine House
72 Broadwick Street
London W1V 2BP

Ebury Software is showing its *Good Housekeeping* range of Mr T early learning software for pre-school age children.

Previews will be shown of Ebury's new range of practical software products including garden planning, cookery and knitting.

Elite Systems Stand No 1404
55 Bradford Street
Walsall
West Midlands

Elite will be launching three new titles between September and Christmas for the Spectrum 48k and CBM 64.

Enterprise Computers Stand No 1133
31-37 Hoxton Street

London N1 6NJ

At last the Enterprise has landed and can be seen on the Enterprise stand. This 64k machine is supported with a range of Enterprise-branded peripherals and software, including a new version of Lisp. There's also a competition where you can win an Enterprise system valued at approximately £1000. Full details available at the Show, where working models of the machine will be on public display for the first time.

Hayden Book Company Stand No 813
1 Gower Street
London WC1E 6HA

The stand shows books published in the last 12 months with strong emphasis on the IBM PC, PC Junior, Apple machines and the CBM 64. Also included is a selection of book/software packages for Apple computers and a series of reference guides.

Granada Computer Books Stand No 1230
8 Grafton Street
London W1X 3LA

Granada's list of personal computing books caters for a variety of machines from the Spectrum to the Amstrad, and for different users, from the most basic to the most advanced.

Hill MacGibbon Stand No 910
St Bartholomew House
92 Fleet Street
London EC4

Hill MacGibbon launches its range of 'Games to Stretch the Mind'. The first four programs, Ballooning, Special Agent, Car Journey and Punctuation Pete, have been selected by the Book Marketing Council as programs 'which will make an outstanding contribution to home computer users' practical enjoyment of their machines.'

Hudson Soft Stand No 1209
4-7-5 Kojimachi
Chiyoda
Tokyo 102
Japan

Hudson is one of the top software developers in Japan, like Hubasic (Basic), Hucal (spreadsheet) and many games.

Incentive Software Stand No 1428
54 London Street
Reading GR1 4SQ

Incentive is showing the final part of the Ket trilogy, the Final Mission along with Backtrack, an animated 3D graphics adventure.

Interceptor Micros Stand No 907
Lindon House
The Screen
Tadley
Hants

Interceptor Micros is introducing Trollie Wallie, an arcade game with excellent graphics and music. Also to be released is a new utility, Super Basic. For the Spectrum new releases include an adventure game, At World's End, plus Tiler, an arcade game. Other releases are on view, plus special bargain packs on sale at the stand.

Interface Publications Stand No 1009
9-11 Kensington High Street
London W8 5NP

As well as its existing list, Interface has new titles appearing for the first time including Tim Hartnell's QL Games Compendium.

ICL Stand No 503
ICL House
Putney
London SW15 1SW

ICL is featuring its 16-bit personal computer. The system uses multi-user, Concurrent CP/M-86, which allows up to four users each to run up to three applications simultaneously. Selected ICL distributors are exhibiting a range of applications software.

IO Research Stand No 647
117-121 High Street
Barnet
Herts EN5 5UZ

IO Research is announcing Pluto II, the powerful new integrated single card, raster graphics system. Pluto II is compatible with hardware and software for the original Pluto board, and will be available for a range of microcomputers.

Kaypro (UK) Stand No 803
Elm House
19 Elmshott Lane,
Cippenham
Berkshire SL1 5QS

Kaypro is showing its range of portable microcomputers. The Kaypro 2 at £1095 + VAT was voted Portable Computer of the Year 1983; the Kaypro 4 at £1595 + VAT has twice the storage capacity and dBase software included; the Kaypro 10 offers 10 Mbyte hard disk drive and high resolution graphics capability for £2295 + VAT.

Kempston Micro Electronics Stand No 1143
Unit 30, Singer Way
Woburn Road Industrial Estate
Kempston
Bedford MK42 7AF

Kempston's latest addition to its range of Sinclair Spectrum peripherals, the Pro-joystick interface, is set to follow in the path of the earlier Kempston joystick interface. Priced at £19.95 it includes a cartridge slot for ROM-based software and three nine-way D sockets.

Kempston is also displaying its full range of joysticks, including a model for the BBC Micro, and offering special '84 Show prices.

KGB Micros Stand No 722
106 St Leonards Road
Windsor
Berks SL4 3DD

New at the Show, KGB has AutoCAD (Computer Aided Drawing) and Microsoft's Word (word processing) running off an Icon networking system. Icon's electronic mail facilities and fast data transfer rate make it suitable for users with multiple IBM PC's.

Kiltdale Stand No 1409
131 Liddington Estate
Old Station Drive
Leckhampton
Cheltenham
Gloucester GL53 0DL

Facilities are available from Kiltdale for duplication of up to 200,000 cassettes and 6000 diskettes per week. 5¼in and 3in diskettes can currently be accommodated. A printing and packaging service is also available.

K-tel International (UK) Stand No 1331
620 Western Avenue
London
W3 0TU

Front Runner (K-Soft Distribution) is showing a game to stretch your brain and beat your reflexes — Storm Worrier, an all-machine code Commodore 64 graphics adventure. Also from Front Runner is Space Professor, an educational, arcade-style game for the Spectrum 48k.

LBC News Radio Stand No 418
London Broadcasting Co Ltd
Gough Square
London EC4P 4LP

LBC is London's news and information radio station broadcasting 24 hours a day, seven days a week. Each day on the *PCW* stand a number of LBC's presenters will be meeting visitors and reporting from the Show. Clive Bull's Computer Club programme will be broadcasting live from the Show on Sunday.

Level 9 Computing Stand No 1030
229 Hughenden Road
High Wycombe
Bucks HP13 5PG

Experience Level 9's graphic adven-

tures, plus its acclaimed games for most popular micros.

Llamasoft Stand No 1303
49 Mount Pleasant
Tadley
Hants RG26 6BN

Llamasoft has two new releases at the Show. Come and find out what Jeff Minter's latest Commodore 64 design is, why it took so long to create, and which hairy beast stars in it.

Longman Software Stand No 1006
Longman House
Burnt Mill
Harlow
Essex

On show is a range of educational software for early learning and exam revision, along with titles such as Word Games and a slimming program. In addition Longman is offering a range of computer books.

Lothlorien Stand No 1424
56a Park Lane
Poynton
Cheshire SK12 1RE

Fancy winning a holiday for two? Why not enter the Lothlorien Special Operations competition. There are three first and three second prizes for Spectrum, Commodore 64 and Atmos owners. And launched at the Show, Lothlorien's £2.99 range of games known as T-riffic, and including Masters of Serbal, New Warmaster and Redcoats.

Lotus Development UK Stand No 633
Consort House
Victoria Street
Windsor
Berks SL4 1EX

Symphony is in action in public for the first time at the Show along with 1-2-3, running for the first time on the ACT Apricot. A team of Lotus experts are running full product demonstrations and hands-on sessions, ready to discuss any technical or training queries on either product.

Mannesmann Tally Stand No 708
Molly Millars Lane
Wokingham
RC11 2QT

Mannesmann Tally is showing its printers and plotters tailored for the home computer and small business market. The £249 MT80 is an 80cps 80-column machine with both friction and tractor ideally suited for home computer user.

Martech Stand No 113
Martech House
Bay Terrace
Pevensey Bay
East Sussex

See the Official Eddie Kidd Jump Challenge, based on a new game for the 48k Spectrum, Commodore 64, BBC B and Acorn Electron. One of the motorbikes which world record holder, Eddie, uses will also be on display, and Eddie will be putting in several appearances to talk to visitors.

Mayking Data Stand No 817
57 Portobello Road
London W11 3DB

Mayking Data offers tape duplication and related services. Engineers produce computer-generated master tapes ready for duplication; masters are kept secure and piracy protection techniques are available. The company's services also include artwork, printing inlays, labels, manufacturing booklets, slip covers and wallets.

MBS Microtex Stand No 447
Raychem House
Tangier Lane
Eton
Windsor
Berks SL4 6BD

MBS Microtex is the exclusive UK distributor for a new 16-bit single station microcomputer, the MAD-1. Based on the Intel 80186 processor, its features include compatibility with the IBM PC and a choice of MS-DOS Version 2 or Concurrent CPM-86 operating systems.

Melbourne House Stand No 1109
Castle Yard House
Castle Yard
Richmond TW10 6TF

Melbourne House is exhibiting its range of books and software for all the popular home computers, including the Spectrum and Commodore machines. The highlight of the stand is expected to be the showing of Sherlock Holmes, Melbourne House's most complex pieces of software since the Hobbit.

Memotech Stand No 1325
Station Lane
Witney
Oxon OX8 6BX

Memotech began by manufacturing peripherals for the ZX81. With the gradual decline of the ZX81, Memotech devoted its time to the development of the MTX computers now available at a starting price of £199 for the 48k MTX500. Products under development include the HRX high resolution graphics system for picture and image processing on the IBM PC.

Microdeal Stand No 1316
41 Truro Road
St Austell
Cornwall PL25 5JE

Microdeal is showing its future release Cuthbert in the Tombs for the Commodore 64. Also on show is a range of other software and utilities for the Commodore 64, Atari and Dragon computers..

Micro Power Stand No 122
Northwood House
North Street
Leeds LS7 2AA

Micro Power is giving the first public showing of its Christmas releases at the Show. These include titles for the Commodore 64, Electron, Amstrad and BBC Micro.

Microvitec Stand No 1043
Futures Way
Bolling Road
Bradford BD4 7TU

The new QL-compatible colour monitor heads the full display of Cub RGB monitors from Microvitec. New for the Show — Tecmar colour graphics cards — 980 pixels per line in a package which includes a high resolution, long persistence tube.

Mikro-Gen Stand No 928
44 The Broadway
Bracknell
Berks RG12 1AG

Wally Week's new mate stars in Pyjamarama and is shortly to be making his debut. Other new programs are Witches' Cauldron and Air Traffic Control.

Microvoice Corporation Stand No 413
Tetsuo Narita
Shinei Building
8-5 Nishishinjuku 3-chrome
Shinjuku-ku
Tokyo
160 Japan

Microvoice Corporation is introducing two portable computers — the Mugen and Formula-1. The Mugen is IBM PC compatible, Formula-1 is an all-in-one portable computer with a built-in EPROM programmer and thermal printer.

Miniature Tool Company Stand No 1305
27 Queensbury Station Parade
Edgware
Middlesex

On display are a range of plugs, sockets, connectors and cables suitable for most

home computers. The company also distributes Memorex floppy disks which are being offered at special exhibition prices.

Mirrorsoft Stand Nos 1047 & 1330
Mirror Group Newspapers Ltd
Holborn Circus
London EC1P 1DQ

Mirrorsoft is the software division of Mirror Group Newspapers, publishers of the *Daily Mirror, Sunday Mirror* and *Sunday People.* It is currently producing programs covering four categories.

Molimerx Stand No 117
1 Buckhurst Road
Bexhill-on-Sea
East Sussex TN40 1QF

Molimerx supplies software for a large number of machines, and has recently branched out into supporting the Sanyo 550 series. It is exhibiting its latest software for that machine, including a new graphics package.

NCC Stand No 414
11 New Fetter Lane
London EC1

The NCC is offering a businessman's advisory service.

New Generation Software Stand No 1025
The Brooklands
Sunnybank
Lyncombe Vale
Bath BA2 4NA

The sequel to Trashman, Travel with Trashman, is being previewed at the Show, with Cliffhanger, a new game for the Commodore 64.

Ocean Software Stand Nos 1324 & 1328
Ocean House
6 Central Street
Manchester M2 5NS

A range of games software gets its first showing at the *PCW* Show. Tie-ins with TV characters and follow-ups to Kong and Hunchback lead the new range, with adaptations of top-selling US games for British computers.

OE Limited Stand No 644
North Point
Gilwilly Industrial Estate
Penrith
Cumbria CA11 9BN

OEL designs and manufactures microcomputer communications hardware with software support. Featured at the Show are the Commodore 64 Teletext Adaptor, the Telemod series of modems and, for the Spectrum, the VTX 5000 modem and the TTX 2000 Teletext adaptor.

Prestel/Micronet, electronic mail and other home computer applications are being demonstrated.

Opus Supplies Stand No 1001
158 Camberwell Road
London SE5 0EE

Opus has a full range of disk drives available at the Show, all backed by a two year warranty, and disk interfaces are on sale for the Spectrum and BBC Micro. The JVC high resolution colour monitor is also available for use with the QL and BBC.

Oric Stand No 1317
Cowarm Park
London Road
Ascot
Berks

Oric is demonstrating its entire product range including the Atmos microcomputer, 3in Oric disk drive, MCP40 four-colour printer/plotter, a selection of the latest Oric software plus two new additions to the range — the Oric V23 communications modem and 80-column dot matrix printer.

Ozwise Computers Stand No 704
236 Imperial Drive
Rayners Lane
Harrow
Middlesex HA2 7HJ

From its range of Apple, Apricot, IBM, Epson, Sanyo and BBC products, Ozwise is displaying the latest and most innovative.

PC Engineering and Maintenance Stand No 630
Lansbury Estate
102 Lower Guildford Road
Knaphill
Woking GU21 2EP

PC Engineering and Maintenance specialises in nationwide maintenance and repair of all the popular business micros and peripheral equipment. Repairs are carried out on site.

Personal Computer World Stand No 108
VNU Business Publications
Evelyn House
62 Oxford Street
London W1

The Leading Edge feature on our stand provides a prelude to a tour of the Show, as it gives a chance to look at our selection of the most advanced products and best hardware and software available.

On sale is *PCW's* October issue — a special Show issue with the Show Catalogue bandwrapped to it — and a selection of back issues.

Subscribe to *PCW* at the Show and we will refund your entrance price, so you visit the Show free of charge and receive a copy of *PCW* delivered direct to you every month!

Phoenix Software Stand No 314
Spangles House
116 Marsh Road
Pinner, Middlesex

Phoenix presents its combined arcade/adventure tapes. You fight your way through the arcade game to gain entry to the adventure, but if you don't make it, open the panic packet for an admission ticket to the adventure.

Power Testing Stand No 530
23 Tallon Road
Hutton
Brentwood CM13 1TE

To protect your computer system and data from loss of power, and to prevent spikes and surges from reaching your hardware, consider the Power Bank. It connects between the mains and your machine, and is constantly maintained at a stabilised frequency and sine wave voltage regardless of the mains input.

Practicorp Stand No 739
Goddard Road
Whitehouse Industrial Estate
Ipswich
Suffolk IP1 5NP

Practicorp's new low integrated software range of database, word processor and spreadsheet for the IBM PC gets its first public outing at the Show. Also on display is PractiCalc II.

Prentice-Hall International Stand No 400
66 Wood Lane End
Hemel Hempstead
Herts HP2 4RG

Prentice-Hall International is the UK division of the US publishing company Prentice-Hall Inc of New Jersey. Many computing titles are published each year by Prentice-Hall and its associated imprints.

Protek Computing Stand No 1306
1a Young Square
Brucefield Industrial Park
Livingston EH54 9BX

The new Protek 1200 modem is now available at £59.95 retail. The 1200 modem is compatible with any RS234/RS423 computer interface. Interface packs, including cables, controlling software and serial interface (if required) are available for the BBC Model B, 48k Spectrum, Commodore 64 plus most popular micros.

Psion Stand No 432
22 Dorset Square
London NW1

Xchange is both a modular and integrated suite of business applications programs, covering word processing, database management, financial planning and business graphics. The stand also features the Psion Organiser pocket computer.

Quest International Computers Stand No 425
Quest PLC Group
Chandlers Ford
Hants

In addition to CP/M-86 for the Sinclair QL, Quest is showing its Firefly hard disk running on the BBC Micro for the first time. Quest also has the Firefly with optional tape streamer running under CP/M and MS-DOS on the IBM PC, DEC Rainbow, Sirius and Apricot. Details of a low cost network and a tape streamer developed for the IBM PC are also available on the stand. Disk and memory products for the QL are shortly to be announced.

Quicksilva Stand Nos 1413 & 1512
Palmerston Park House
13 Palmerston Road
Southampton
Hampshire SO1 1LL

Out in the loneliness of interstellar space a man needs something to do: the endless dust clouds, the occasional comet, the friendly sight of Captain Quicksilva picking at rocks. 'Yeah, sure is hard out here. Why, without my Game Lords club magazine to keep me company I'd have gone crazy years ago. And so would my friend, the garbage shoot, wouldn't you, Garb?'

Romantic Robot Stand No 1405
113 Melrose Avenue
London NW2 4LX

Romantic Robot offers a set of four machine code utilities called Trans-Express. Visitors to the *PCW* Show can buy a new upgraded version on cassette or microdrive cartridge. Trans-Express is a package for transferring and maintaining Spectrum programs/files.

Romantic Robot is also selling a music utility for the ZX Spectrum called The Music Typewriter and a program for the Amstrad CPC464.

Seescan Stand No 326
25 Gwydir Street
Cambridge CB1 2LG

Seescan designs, manufactures and consults on image processing systems. On display, high resolution stand-alone systems, the MkII digital camera and book, *Image processing for the BBC Micro* is launched at the Show, as are advanced user guides for the Electron, Oric, QL, BBC and Spectrum micros.

Shinecrest Products Stand No 228
Unit 14
Dicker Mill
Hertford
SG13 7AE

Shinecrest is showing its new range of computer furniture for home and small business users.

Shiva Publishing Stand No 1024
64 Welsh Row
Nantwich
Cheshire CW5 5RQ

The *Gateway to Computing* series of books for younger readers is featured on the Shiva stand. There are versions for the Commodore 64, BBC Micro, Spectrum and Dragon. Also, Shiva's number and logic educational software for 5-8 year olds is on display.

Silicon Valley Stand No 412
164 Grays Inn Road
London WC1

An authorised dealer for IBM, Compaq, ACT and Apple micros offering advice and support.

Sinclair Research Stand Nos 222 & 323
25 Willis Road
Cambridge CB1 2AQ

First time on-stand selling of the Sinclair QL professional computer for £399 inc VAT is the central feature of Sinclair Research's stands.

Softek International Stand No 1012
12/13 Henrietta Street
Covent Garden
London WC2E 8LH

Come to The Edge to discover this unique game along with the first ever Mega-Games. See the Softek Biltzware too, and, of course, MSX software.

Softsel Stand No 544
Central Way
North Feltham Trading Estate
Feltham
Middlesex

Softsel is promoting its product range and dealer services at the *PCW* Show. The company distributes business, recreation and education packages which run on Apple, Atari, DEC, IBM, Commodore, BBC and other leading makes of microcomputers.

Software Index Stand No 1142
IPC Magazine Ltd
Westover House
West Quay Road
Poole
Dorset BH15 1JG

Software Index is a listing of software available for the popular home micros. It includes information on prices, program operation, sound, memory required, colour, names and addresses of retailers and screen photographs.

Sportscene Specialist Press Stand No 1032
14 Rathbone Place
London W1P 1DE

Sportscene's stable includes *Microscope, Your Spectrum, Your '64* and *QL User*. The same group took *PCW* to its number one slot prior to selling it to present owners VNU, and is responsible for packaging the biggest selling computer publication in the world — *The Home Computer Course*.

On the stand end users can buy back numbers of all these papers, and more.

Stell Software Stand No 1209
36 Limefield Avenue
Whalley
Lancs BB6 9RJ

Stell displays its range of educational games for children. Titles are available to suit ages from two to 15-years-old and will run on most home computers.

Sunshine Stand No 1031
12-13 Little Newport Street
London WC2R 3LD

Sunshine is showing its four magazines — *Popular Computing Weekly, Dragon User, Micro Adventurer* and *Commodore Horizons*. It is also exhibiting its range of 50 books. New titles being launched at the Show include the first books for the new Commodore machines — the Plus /4 and the C16.

Sybex Stand No 416
Unit 4,
Bourne Industrial Park
Bourne Road
Crayford, Kent

Sybex titles include *Programming the Z80, Your First Basic* and *Micro Interfacing Techniques*. Sybex now announces the opening of its new UK branch office at Crayford, selling a full range of US titles direct to the trade from stock, as well as new ones aimed at UK micros.

Tandy Corporation Stand No 102
Tameway Tower
Bridge Street
Walsall
West Midlands WS1 1LA

In addition to launching new products, Tandy is showing its range of established machines.

Tansoft Stand No 1322
Units 1 and 2
Techno Park
Newmarket Road
Cambridge CB5 8PB

Tansoft's appearance at the *PCW* Show coincides with the release of a number of high quality titles for the Oric 1/ Atmos. Tansoft also announces its entry into the Commodore market with at least two new arcade games.

Oric Owner will be represented as will the Oric Club.

Tatung (UK) Stand Nos 1245, 1244 & 1135
Bridgnorth
Shropshire WV15 6BQ

Tatung (UK) marks its entry as a contender in the computer market with the exhibition of the Einstein colour microcomputer designed for the home, business and education markets; the PC 2000 small business computer; and a range of terminals offering standard emulations. In addition there will be a complementary range of printers, monitors and disk drives together with a range of software.

Thame Systems Stand No 431
Thame Park Road
Thame,
Oxon OX9 3XD

Thame is displaying its range of printers from Brother, NEC and Toshiba, and is introducing the new Mitsui Epson enhanced compatibles. This is your opportunity to evaluate the latest low-cost daisy and matrix ranges, as well as check out the advantages of the Toshiba dual-mode machines.

Time Computer Products Stand Nos 603 & 406
17 Liverpool Street
London EC2M 7PD

Stand No 603 has on sale 3M and Dysan Diskettes, cleaning products and the Box Clever library cases.

Stand No 406 is promoting the new diskettes, called Nashua Spinning Discs, available to both trade and retail customers.

Top Twenty Games sponsored by Websters Stand No 944

Try out the latest and most popular games in an arcade, purpose-built for the Show. The Top Twenty games are presented, one game per machine, with details of machine compatibility, price, and, of course, chart position.

Touchmaster Stand No 1017
PO Box 3
Port Talbot
West Glamorgan SA13 1WH

Touchmaster is an A4, touch-sensitive surface which allows a range of users to effectively bypass the keyboard. To operate Touchmaster, you slide an overlay onto its surface, load the matching software into your computer, touch the overlay with one finger — and your computer is at your command. Already available for the Commodore 64, BBC B, Spectrum, VIC-20, and Dragon 64, Touchmaster comes complete with relevant computer interface, instruction manual and a graphics software package.

Transam Microsystems Stand No 500
59/61 Theobalds Road
London WC1X 8SF

Transam is showing the new Trans-link low cost network system which allows networking of Wren, Epson QX-10, S100 systems and others. Transam is an authorised dealer for IBM, Epson, Wren, ACT, Sharp and NEC micros.

US Gold Stand No 1301
Unit 24
Tipton Trading Estate
Bloomfield Road
Tipton
West Midlands DY4 9AH

US Gold aims to license the best US software and bring it to the UK market at UK prices.

This autumn sees the release of more US Gold titles including Zaxxon for the Commodore 64. Selected titles will also be available for the Spectrum with the first release being Beach-head. A catalogue of the full range is available.

Virgin Games Stand No 1332
2-4 Vernon Yard
London W11

Virgin Games is showing the results of its re-structuring and programming team formation earlier this year. These include: for the Commodore 64 the sequel to Falcon Patrol; from Hungary a thinking man's arcade game, Terrorist; and a graphic arcade adventure, Sorcery. Also being shown is Strange Loop, a 240-room arcade adventure for the Spectrum 48k.

Visions Software Factory Stand No 1002
1 Felgate Mews
Studland Street
London W6 9JT

Visions is showing a range of home, educational and utilities software. Its software is currently available for the Spectrum, BBC, Electron, VIC-20, Commodore 64, Atari, Apple, QL. Packages include educational software in English and many other languages including Arabic, a new and powerful database, a program generator, QL products, a school management system and a Spectrum networking system.

VNU Business Publications Stand No Not known
62 Oxford Street
London W1

VNU Business Publications brings you a range of microcomputer titles, including:

Micro Decision — a microcomputer magazine for businessmen; written in non-technical, jargon-free language with applications directly related to readers' businesses.

What Micro? — a buyer's guide to microcomputer hardware and software; each month there are news, views, comparative reviews, Benchtests and user panels with editorial geared to the home, business and education buyer.

Sinclair Answers — a new quarterly aimed at the whole Sinclair market. All aspects of the spectrum from games to business, QL and ZX81, are covered. Also out soon is *BBC Computer Answers*, aimed at VIC and Commodore 64 owners; and

Personal Computer Games — a buyer's guide for games software.

John Wiley & Sons Stand No 601
Baffins Lane
Chichester
West Sussex PO19 1UD

Wiley publishes and distributes books and software to help users in business, at school, in industry and at home. Around 1000 titles are available from 13 publishers and software houses. You'll find the entire range from TABS, Acornsoft, National Computing Centre, Ellis Horwood, Mosaic Bookware, Sigma Press, Bourne Educational Software, ASK, Ebury Software, Ivanberg, Sinclair Computerguides, Microbooks, and Wiley's own comprehensive range.



NUMBERS

Binomial coefficients

by Mike Mudge

The Binomial Coefficients, variously denoted by ${}^{n}C_{r}$ or $\binom{n}{r}$ are defined by $\binom{n}{r} = \frac{n!}{r!(n-r)!}$ where integers n and r satisfy $0 \leq r \leq n$; and $r! = 1.2.3. \ldots .r, r>0$; $0! = 1$. For example. $\binom{20}{10} = 184756$.

These coefficients, whose common occurrences include the algebraic result $(A+B)^n = \sum_{1}^{n} \binom{n}{r} A^r B^{n-r}$ together with The Bernoulli Distribution in applied statistics are directly available (for sufficiently small n and r) on many scientific calculators.

However, since $\binom{n+1}{r} = \binom{n}{r-1} + \binom{n}{r}$ the Binomial Coefficients may be written down using Pascal's Triangle. Thus:

```
n=1          1   1
n=2        1   2   1
n=3      1   3   3   1
n=4    1   4   6   4   1
.....................................
```

The array is edged with ones, while each interior term is the sum of the two terms immediately above it; r is counted along the diagonals of the array.

Let's turn our attention to certain results concerning the number theoretic properties of the $\binom{n}{r}$ as distinct from their usage in other branches of mathematics.

(1) If the binomial coefficients are factorised thus: $\binom{n}{k} = U\,V$ where every factor of U is less than or equal to k while every factor of V is greater than k there are known to be finitely many coefficients with $n \geq 2k$ for which $U>V$. Determine such cases for $k = 3,5,7,\ldots$. *Note.* If $k=3$ then $n= 8,9,10,18,82$ and 162 while for $k=5$, $n= 10$, 12, and 28 are known to be the only cases for $n \leq 551$.

(2) If n is a prime number greater than 3, the Wolstenholmes' Theorem states that $\binom{2n-1}{n}$ is congruent to 1 modulo n^3:

that is $\binom{2n-1}{n} = An^3 + 1$, where A is an integer. Display empirical evidence for this theorem and consider the possible truth of its converse.

(3) What can be said about the largest divisor of $\binom{n}{k}$ which is less than n?

If $n \geq k^2 - 1$ there is a prime divisor less than or equal to n/k apart from $\binom{62}{6} = 61474519$.

If $n<k(k+3)$ there is a prime divisor less than or equal to $k+1$ apart from the cases $\binom{7}{3}, \binom{14}{9}, \binom{23}{5}, \binom{44}{8}$, and $\binom{47}{11}$.

How do we best generate such divisors?

(4) When is $\left(\binom{2n}{n}, 105\right) = 1$? That is, when do $\binom{2n}{n}$ and 105 have no common factor. RL Graham offered a prize of $100 for proving that this happened infinitely often. At least fourteen values of n are known $n = 1,10,756,\ldots$

If g(n) is the smallest prime factor of $\binom{2n}{n}$, then $g(3160) = 13$ and $g(n) \leq 11$ for $3160 < n < 10^{110}$. Does this help?

Readers are invited to investigate the above problems and results with an objective of extending empirical evidence and possibly generating new conjectures.

Submissions should include program listings, hardware description, run times and output. These will be judged for accuracy, originality and efficiency (not necessarily in that order) and a prize of £10 will be awarded to the 'best' entry received by 1 January 1985. Please address submissions to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffs.

Review—Repunits—April 1984

Repunits have found favour far and wide: a most elegant work, conjecturing the primality of $aR_k + b$ when

a	b	k
3	−2	50&60
5	−2	66
7	2	66

and establishing the primality of $6R_{66} + 1$ in less than three hours in Forth on a Jupiter Ace arrived from Denmark.

A Sharp PC3201 using Z80 machine code on The Isle of Mull suggests that a prime p greater than 3 will be a factor of $R_{n(p-1)}$ for $n=2,3,\ldots$

Substantial references on the subject of repunits are to be found in the paperback *Repunits and Repetends* by Samuel Yates published by The Star Publishing Company, Boynton Beach Florida 1982.

This month's winner is Robin Merson of 2 Vine Close, Wrecclesham, Farnham, Surrey, GU10 4TE. Robin appeals to any reader who has implemented the Primality Testing Algorithm described by H Cohen & HW Lenstra (*Mathematics of Computation*, vol.42. Jan 1984) to contact him on Frensham 3587 for an 'info' exchange with Hardy and Wright-type algorithms.

A summary of Robin's results follows. Further details are available from him or myself.

Using an Apple microcomputer several primes have been found of the form d(n)e, where d=5,6,7 or 8 and e has one or two digits. An embedded (n) in a number implies the previous digit is repeated n times. For example, 10(4)2 stands for 100002. The largest for each of the values of d are 5(92)21, 6(120)1, 7(99)1 and 8(138)1.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided. END

LEISURE LINES



by J J Clessa

Quickie

Here is a remark attributed to that famous geometrician, PI Thagorus: 'Now I have a rough predictor of circle areas and volume.'

Prize Puzzle

And now one for the micros.

In the annual festival games held at the village of Little Dingblat in West Sussex, the main event is the marathon.

This year, all the entrants were numbered sequentially (1, 2, 3 . . .).

By coincidence, all those who completed the race carried numbers which were either exact primes or exact powers of other numbers. Furthermore, the total of the race numbers of the finishers was exactly equal to the total of the race numbers of those who dropped out.

How many entrants were in the race?

Answers, on postcards only, to Leisure Lines, *PCW* Prize Puzzle, October 1984, 62 Oxford Street, London W1, to arrive not later than 31 October 1984.

July Prize Puzzle

The problem was quite easily cracked by micro and several people sent in their programs and printouts.

The winning entry came from Adam Jefferson of Bradford, Yorks. Congratulations, Adam, your prize is on its way.

The solution to the problem was that the Dawsons and the Firths were the R C families—the children of these families were given £31.25 each.

Keep puzzling.



TRANSACTION FILE

● CE-151 4k RAM. Module for PC1500, used once, as new, original packing £25. Also Sharp technical (machine code) manual for PC1500 £15. Tel: 0580 712019

● GEMINI Multiboard GM811 CPV card. GM812 IVC card. Both as new. Offers around £180, will separate. Tel: Potters Bar 0707 42065 after 7pm.

● RML 380Z, 32k memory. Dual disc drives, cassette controller, RS232 and Centronics ports. Assembler, Basic, Pascal, text editor, and many programs and utilities. Tel: 0742 (Sheffield) 488539.

● ACT SIRIUS 1. 256k, RAM. 1.2Mb, MSDOS86, CP/M86, Supercalc, Wordstar, Tate Dbase II, Victor Business Graphics. Also software, toolkit (cost £500) demonstration slides and system configurators £2,800. Tel: (0749) 75783.

● NEWBRAIN A: With manual, beginners guide, technical manual, word processor, pages, investment management. Little used, original packing, £140 ono. Tel: Brian, Eccleshall, Staffs (0785) 851010 After 6pm eve and weekends.

● SHARP MZ80K (48k). Excellent condition. Extended Basic, green screen, loads of arcade, adventure, utility software, books, manuals etc, with box. Nearest offer to £270 accepted. Tel: Tim on (0302) 840708.

● APPLE 11+ 48k. Twin discs, Visifile, Visicalc, word processors, manuals, other software, printer card, other software good condition. Tel: (051)-722 1813.

● CBM 4032 and 8050 double disc drive. Not used much £800 ono. Tel: 01-351 4228. Genuine reason for sale.

● MICROTAN 65. Graphics, lowercase, keypad, manual, Microtan Companion, Vero 5 volt power supply. Best offer accepted. Trevor Olsson, 111 Colin Road, Luton, Beds. Tel: Luton (0582) 410817.

● APPLE II Europlus 48k. £235. 80-col card with Applewriter II £50. Tel: D. Cheney 0303 60515 before 6.30pm.

● APPLE II CP/M software, Dbase II, Cobol, Pascal, Supersoft, and Datastar. Plus a selection of games, also Wordstar and Calcstar. £320 ono. Will separate. Tel: Daryl (0724) 720250, 7-9pm.

● TANDY Quick Printer, including cables and manuals for sale. Offers in writing only to Paul H. Charlton, 3 Holderness Cottages, Old Ellerby, Near Hull, North Humberside HU11 5AJ. Buyer must collect.

● APPLE II+ 48k. Disc drive, Dos 3.3, 80-column card, £80. Softcard + CP/M, Language. Parallel interface, RS232, Epromwriter, and Integer cards. Includes TV/monitor and joystick. £700 ono. Tel: Umesh after 6pm. Tel: 01-985 2548.

● SHUGART. 10 meg Winchester fixed disc and 8in disc drive. £475 for both or will split. Used with CP/M system, software included. Tel: (0703) 455909 After 6pm.

● SHARP PC1500 and CE150 printer, cassette interface. Immaculate condition. Still in original packaging. £175 ono. Tel: Frodsham (0928) 32307.

● SPECTRUM 48k+, (interface 1, microdrive + 4 tapes, brand new), + interface 2+, Prostick, + printer + prof k'board, + games and Serious software. Can deliver North London. Very reluctant sale. £340 ono. Tel: 01-385 1244 ext 2286 office hours.

● ORIC ATMOS 48k, Plus Oric microdrive, brand new, boxed, unwanted prize, Atmos £80, microdrive £100, or £160 pair. Tel: (0487) 822984 eve after 6pm or weekends.

● OHIO 2OEM 64k. Two 8in disk drives, word processor, database including mailing system, all manuals, £350 ono. Tel: 01-399 0208 (day), 01-549 3233 (eve). Ellis, Surbiton.

● APPLE II+ 64k. Twin drives & printer, language card, manuals, books, disks, various software etc. All as new. £850 ono. Tel: Bedford 55325.

● VIDEO GENIE 48k. Compatible with TR80 Model 1 but with a built-in cassette. £120. Write to 56a Kingswood Road, SW19 or try Tel: 01-543 5634.

● PET 3032 with 3022 printer and cassette deck, toolkit, books and software. Good condition, £350. Tel: Mansfield 823999.

● BARGAIN Bargain Bargain Bargain Bargain. Spectrum 48k plus ZX printer. Still in original box. Some games £120 or swap for zoom lens for Olympus OM10. Tel: 01-505 1144 after 6pm. Bargain.

● TRS80 Model 1 48k expansion interface, 2 disc drives, VDU, CGP115 graphic printer, RS232 NewDos 80, discs of software. All manuals. Bargain £425. Tel: Bampton (Devon) 31899.

● APPLE IIe. Apple disk II with controller. Epson RX80, Parallel interface, Novex monitor, colour modulator. Purchased January 1984. All under guarantee, £1,350. Could arrange delivery. Tel: Alex Lupton, Ipswich 219661 ext 305.

● BBC MICRO. 18 months old. Good as new with software and books, only £325 ono. Tel: Bristol (0272) 739803.

● APPLE II plus bits. Doublevision 80 column card, £20. Symtec light pen, £15. Tel: Slough 35195.

● DUAL 100k Cumana disc drives with PSU's for BBC. VGC including cable user guide and format disc £265 ono. Tel: Watton (0953) 883611.

● ITT-2020, with disk drive, 48k plus 16k RAM card and speech synthesizer. Monitor included plus documentation, circuit diagrams, and some software. £500 or swap for Hamradio Pentax accessories. Tel: Stourbridge 371248.

● TRS-80 Level II 16k, UHF modulator, power supply, manual, cassette lead, the custom TRS-80 and other mysteries, Assembly language programming on TRS-80, 3 80-micros, £100. Tel: 01-948 2630 eve.

● TANGERINE Mini-Rack micron (cased). 8k RAM, 15k ROM Basic, Tanbug, XBug, toolkit. ASCII, Hex + games keyboards. Five manuals, much software including Space Invasion. Very good condition. £200 ono. Tel: 01-668 3326, ask for Mark.

● SPECTRUM 48k, Cassette recorder, plus books and software covering machine code programming. Total cost new £230, £100 the lot. No offers. Tel: Harrison 01-892 2076.

● PET 3032, 4040 dual diskette drives, cassette deck, Mikro assembler in ROM, software and books £750. Also CBM 8032 plus cassette deck £450. Tel: Sutton-Elms (0455) 283365 (Home) — can deliver.

● NEWBRAIN AD, power supply, leads, beginner's guide, technical manual. Pristine £130. ITT 2020 64k disc, Silentype printer, £399. Epson HX20 intext ROM, unused £15. Tel: Crewe (0270) 780608.

● FREE 4032 Commodore PET and CZN tape, if you buy my manuals for £195. Brand new PET + stacks of software. Must sell. Any offers? Tel: 092684 2439. Will deliver.

● TANDY TRS80 Model 1 Level 2. Expansion interface, VDU, twin discs, double density, 48k, user notes, LDOS. Tel: 0992 441836 £500. Herts.

● PET 32k. With Basic, 4 Command-o Faster Basic, 3022 printer, 2031 disk drive, cassette and extensive software including spreadsheet and word processor. Complete system £540. Tel: Northwood 23659.

● TELETYPE ASR33. 110 Baud printer with paper tape punch and reader. Full working order, on stand and with three manuals. £80. Tel: Colchester (0206) 575887.

● NASCOM 2. With 32k RAM, extension basic and NAS-SYS3, Gemini Eprom programmer and full documentation £200 ono. Tel: Bedford (0234) 750994.

● COMPUCORP 625, 48k, with disk drives, 40 col printer, plus manuals, textwriter and Walters. PD80 printer £550 ono. Tel: 06667 364.

● SHARP MZ80K, 48k. Also Seikosha GP100A printer with interface. Both hardly used, includes manuals and books. Excellent value £260 ono. Tel: Dennis 01-445 0209 day, 01-452 1736 eve.

● TUSCAN S100. 2×5¼ disks 64k RAM CP/M2.2, DBase II. Fast WordStar etc. £650 ono. Plus Epson printer MX80 £150. All £750 ono. Tel: Pete on Bristol 426193.

● NEWBRAIN Model AD with built-in line display, technical manual, compatible cassette recorder, software, blank cassettes. Bought new in March 1983. Worth over £300, sell for £160. Tel: (051) 677 5334. Merseyside.

● MICROVITECH 1431, STD. RES. Mint condition, perfect £135. Prism acoustic modem plus Micronet software £40. Both for BBC. Gravesend area. Tel: 0474 83 2862 anytime. F. S. Tillaney, 6 Flowerhill Way, Istead Rise, Northfleet, Kent.

● NEWBRAIN AD with leads and manuals. Unused five year guarantee. £150. R. Wilcock. Tel: 01-889 3571.

● OSBORNE DDensity. Psystem, WordStar, Supercalc, Basics, Cobol, C, DBaseII, Osborne GL-AR-AP, Ramdisk, Speller, Versaledger, Graphix, Modem7. Over 18 utilities, including Uniform (read/writes >40 formats). Over 30 disks. £925. Tel: 01-543 6585.

● SIRIUS I. Little used, some software, £1450 ono. Epson RX80 printer. Near new. £200 ono. Tel: 0392 881102 after 6pm.

● VIC20 Computer, expansions and all cartridges and software to be sold off cheap. Disk VicWriter for VIC20 disk for 64 Easyscript etc. For details Tel: 0202 576767 ASAP.

● NEWBRAIN Model A 32k. Complete with leads, power pack, books and £180 approx software. £140 only. Also RQ8200 tape recorder £25. Currys Trophy recorder £12. Tel: (0202) 576767 anytime.

● NEWBRAIN software going cheap. Games and utility progs. Please Tel: for list. CP/M 2.2 progs badly needed for disk system. Please Tel: (0202) 576767 ASAP.

● SHUGART Model 450 dual disk drives. Not yet interfaced to any computer £225. Single Siemens disk drive for Apple computer £125. Tel: Leics 673536.

● APPLE Europlus 48k. Monitor, disk drive, printer interface, manuals and software £600. Tel: (051) 220 0963.

● NIXDORF 88/70 minicomputer. 2×10MB hard disk, 3 screens, 3 keyboards, printer 160CPS. Cost over £45,000 1977. Very powerful multiuser system, ideal for large mailshots. Includes accounts, stockcontrol, software, offers £4,500. Howard Radley. Tel: 01-286 7421.

● TANDY Model I Level II 48k. 3 disk drives complete with business software + Visicalc plus manuals, £1,000 ono. Tel: Boutall, 01-579 5756 weekdays or 01-455 2173 eve.

● EPSON HX-20. Portable. As new, complete with manuals, case, charger, paper and cassettes. £350 ono. Tel: (061)-440 8088 (Alan). If no reply Tel: (0257) 481241 (Mike).

● 48k SPECTRUM. With Cambridge joystick interface and joystick. Excellent condition, still under guarantee. Also £66 worth of software and machine code book. Only £132. Tel: Bookham 58711 (after 4.30pm).

● OSBORNE I wanted. Must be reasonable price. Ideally double density. Will collect anywhere in UK. Write to R. Dean, 50 Millfield, Sompting, Lancing, West Sussex BN15 0DW.

● SHARP MZ-731, database, word processor, and games software £325. Sharp PC-1500, with plotter CE-150, 8k RAM and RS-232C interface + database and other software £300. Both with complete manuals. Tel: Lymington 682758.

● APPLE II Europlus 64k. Twin disk drives + controller, sylentype printer + interface, 12in Kaga Denshi monitor, language card, manuals, leads etc. Privately owned, excellent condition, 1 year old, £1300. Tel: Harrogate 872964.

● COMMODORE PET 16k. For sale or swap Commodore 64. Offers, Tel: Plymouth 880674 after 6pm.

● APPLE II+ (3), disc drives (5), b/w monitors (3), printer interfaces (2), colour card, CP/M, integer cards (2). All manuals and assorted software. Will split Offers. Tel: Wrexham (0978) 840629.

● WANTED: BBC B micro, vital leads and manuals. Preferably 120S. Must be reliable and in generally good condition although age unimportant. Around £200. South East England, collection possible. Tel: (09592) 2391.

● WANTED: Appleworld (prefer DOS3.3), and Bill Budge's 3-D Graphics System. Tel: Bryn, 01-387 5064 after 7pm, or weekends.

● TANDY Model 100, 8k, £380. Sharp PC-1251 with CE-125, £130. Plotter A4 width, needs some work to get going £150. Superboard and other items, free with above. Tel: 01-431 0729.

● BOUGHT a PC Selling CP/M-80 software cheaply. For list write Norrie, 1 Bellard Road, West Kilbridge, KA23 9JT. All have manuals and original distribution diskettes on eight inch disks.

● OSBORNE 01, 80 col upgrade. One unused in box, another slightly used, £1,750 ono for both or might split. Tel: Flitwick (Beds) 0525 717257.

● ADVANCE 86a + Sony colour TV/monitor. Complete with boxes, leads and manuals. Will accept offers around £700 or will split! Tel: Mustafa on 01-274 8401.

● APPLE III 2nd disk drive, monitor, Olivetti ET121 daisy wheel printer. Apple Writer, Mail Manager, Basic, complete SOS pack, lots of ribbons, disks etc, £2,000. Tel: 01-627 4004.

● ANADEX DP9500, 150cps printer £375. Televideo 910 VDU £245. IEEE695/S100 boards; Compupro 6MHz Z80 £125. Compupro 10MHz 64k static RAM £180; Morrow DMA floppy controller + CP/M £150. Various others. Tel: 0670-712624 eve.

● SHARP MZ80K 48k, Excellent condition. Manual, plus at least 20 programs, £135. Tel: 01-435 8062 eve.

● WORD Processor, Supertyper FD85. Efficient professional system, Qume Sprint 345 CPS daisywheel printer tractor feed. Cut sheet feeder, dual disks 520k, manuals, leads. Delivery. Good condition. Urgent £950 ono. Robert. Tel: 01-626 1515 ext 2214.

● ADVANCE 86A. 256k + Zenith data monitor (Amber). Unwanted gift, almost new, ideal for upgrading to IBM compatible 86B. New £635, selling for £525 ono. Tel: Watford 37979 after 6.30pm.

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Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

ACC NEWS

You can't afford to miss out on inexpensive equipment insurance for your computer club. Rupert Steele is the man with the details.

One of the ACC's major activities is the Prestel database. Normally, it is extremely expensive to be an information provider on Prestel, but computer club members can become ClubSpot editors for virtually nothing. If you are interested in becoming a ClubSpot editor, the ACC is holding a training conference on Saturday 20 October at the British Telecom Technical College, Yarnfield, Stone, Staffordshire. For further information, contact Andy Leeder, Church Farm, Stratton St Michael, Norwich NR15 2QB (Systel: 050830355).

It is intended also to hold an editors' training conference at County Hall, London, some time during the next few months. At both conferences, delegates will be asked to make a small contribution towards the cost of running the conference and printing the manual: £10 for individuals, £5 for those attending on behalf of a club, and £2.50 for the first editor of an affiliated club.

Computer insurance

Equipment insurance is now available from the ACC in addition to the free public liability insurance announced earlier this year to the tune of £500,000 per incident. Unfortunately, the equipment insurance is not free, but it *is* very cheap.

The scheme covers equipment belonging to a club, or members' equipment at club meetings and is available to ACC clubs in 'units' of £2000 worth of cover for £4 per annum. The policy is underwritten by British Engine and insures against material damage to systems involving microchip technology, which consists of microprocessors with associated peripherals (such as disk drives, printers, modems, visual displays) and media (tapes and disks).

What does the policy cover?

Material damage — loss of or damage to all or part of the covered equipment, including tapes and disks, from any accidental cause such as fire, theft, impact, and so on, both on the 'premises' and in transit between locations.

What does the policy exclude?

* The first £25 of any claim.
* Normal wear and tear, electrical or mechanical breakdown, gradual deterioration, rust, and so on.
* War risks, riot, strike, civil commotion, nuclear risks, sonic boom.
* Theft from unlocked vehicles.

How many units of cover required?

You must take out at least two units at £4pa each if you choose to participate. This gives cover of £4000 total, which should represent the total new replacement value of all the computer equipment likely to be on the premises at any one time. If that is insufficient, you should add another unit for each £2000 (or part thereof) worth of equipment that you wish to cover. Remember that you should count equipment owned by the club plus the value of members' equipment likely to be at a meeting — you should not include (and the policy does not cover) members' equipment at individual homes. If you attend exhibitions with significant amounts of club and members' equipment on your stand, make sure that you have enough units to cover them as well as meetings.

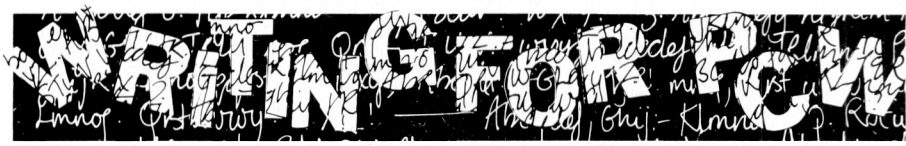
Definitions

(1) The premises — the address at which the club is holding an officially organised meeting, the club's part of any exhibition or function in which the club is participating or for equipment belonging to the club.

(2) The insured property consists of mini- and microcomputers including peripherals and media-owned, leased or hired by the insured and for which he is responsible. The insured is defined as the ACC, those affiliated clubs who have taken out units of cover and their individual members.

The ACC will make reasonable efforts to notify participating clubs in writing if the policy is discontinued either by the ACC or the Underwriters. The ACC is neither empowered nor able to accept responsibility for meeting any claims that may arise; the position of the Association being that of coordinator not insurer.

If you want to know about the ACC, contact me: Rupert Steele, 17 Lawrie Park Crescent, London, SE26 6HH or tel: (01) 370 0601.



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.

If your article is already written, send it in — taking care to ensure that your name and address, together with a daytime phone number if possible, appears on both the covering letter and the manuscript. Manuscripts should, preferably, be typed or printed out (dot matrix output is quite acceptable) but *must* be double line-spaced with ample margins top and bottom and on each side. Make sure you keep a copy of *everything* you send us.

We accept articles on ACT Sirius 1 (CP/M-86 or MS-DOS) single-sided. In an emergency 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! We can also accept material by Telecom Gold. 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 — that is, use your word processor to print the text to disk instead of to paper.

Please note that we cannot undertake to return manuscripts, diagrams and photographs, although we always try to return the latter. We can only return disks if they are accompanied by adequate postage *and* packaging.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one- or two-page synopsis giving the proposed structure, sequence and content is what we're looking for. But before you send anything to us, take a good look through *PCW* to see what sort of articles get published and to see what style or writing we prefer (basically, avoiding pomposity at one extreme and flippancy at the other). Also take a look through the Back Issues advert to see what sort of things we have already published — no point in re-inventing the wheel.

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 were to appear 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. END

BENCHMARKS

A listing of the Benchmarks used when evaluating micros is given below. An explanation can be found in the December '83 issue.

```
100 REM  Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT  K
140 PRINT "E"
150 END
```

```
100 REM  Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF  K<1000  THEN 130
150 PRINT "E"
160 END
```

```
100 REM  Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF  K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM  Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM  Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF  K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM  Benchmark 6
110 PRINT "S"
120 K=0
130 DIM  M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 220
170 FOR  L=1 TO 5
180 NEXT  L
190 IF  K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM  Benchmark 7
110 PRINT "S"
120 K=0
130 DIM  M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR  L=1 TO 5
180 M(L)=A
190 NEXT L
200 IF K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM  Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K^2
150 B=LOG(K)
160 C=SIN(K)
170 IF  K<1000  THEN 130
180 PRINT "E"
190 END
```

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printer's errors, etc.

London	(Olympia 2), Personal Computer World Show. Contact: Montbuild, (01) 486 1951	19-23 Sept
Brighton	(Brighton Centre), Computers In Communication & Control Exbn. Contact: Institute of Electrical Engineers, (01) 240 1871	26-28 Sept
Leeds	(Exbn Centre), Commodore Computer Show. Contact: Fiona Anderson, (01) 388 1675	27-29 Sept
Spenny Moor	Computer Technology Exbn. Contact: Industry Section, (0388) 816166	3-5 Oct
London	(Royal Garden Hotel), HOTECH — Computers in Hotel Industry. Contact: Reed Exbns, (01) 643 8040	3-4 Oct
Aberdeen	(Exbn & Conf Centre), Offshore Computer Exbn & Conf. Contact: Offshore Confs & Exbns, (01) 549 5831	8-10 Oct
London	(Novotel), Int Exbn of Products & Services for the Auto'd Factory. Contact: Industrial & Trade Fairs Int Ltd, (021) 705 6707	9-11 Oct
London	(Wembley Conf Centre), Computer Graphics FX Exbns. Contact: Online (01) 868 4466	9-11 Oct
Manchester	(New Century House), Apricot & Sirius Show North. Contact: Dennis Jarrett, (01) 241 2354	16-18 Oct
Brighton	(Exbn Hall), INTERNEPCON Exbn. Contact: P Spencer, (0734) 596 161	16-18 Oct
Surrey	(Sandown Exbn Centre), Surrey Business to Business Show. Contact: Marlowe Exbns, (01) 794 3551.	17-18 Oct
Doncaster	(Exbn Centre), Business & Technology Trade Fair. Contact: R & VG Exbns Ltd, (0273) 203601	21-24 Oct
London	(Earls Court), London Business Equipment Show. Contact: Christine Prentice, (01) 674 1001	23-26 Oct
London	(Alexandra Palace), Electron & BBC Micro Show. Contact: Susie Williams, (061) 456 8383	25-28 Oct

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PROGRAM FILE

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer. If possible, the printout format should match what appears on the screen. (Commodore 64 owners should use the Brackets program printed in the June issue to make control codes understandable.)
Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.
All programs should be fully debugged and your own original, unpublished work.
We'll do our best to return any submissions that are sent in with the appropriate postage and packing, but please keep a copy of everything yourself.
Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month. Send your contributions to Nick Walker, PCW Programs, 62 Oxford St, London W1A 2HG.

This month's selection features a host of useful programs for a variety of micros. Commodore 64 owners will appreciate the Program of the Month as it's a database. '64 programmers will also enjoy the powerful Sprite Editor and have fun with the Mouse Master, which brings a Macintosh-style mouse to the '64.

BBC owners writing serious applications will appreciate the screen designer and input validation programs, which will make user-friendly input screens easy to incorporate into programs. Also,there should be quite a following for 'G', a compiler for converting graphics programs into super-fast machine code.

Finally, there's Battle Stations, and a cribbage game for the Spectrum which features a computer opponent with some nasty human traits.


Games


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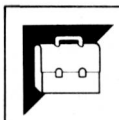

Program of the Month
Commodore 64 Superfile
by John Todd

Superfile is a disk-based database program for '64 owners which will satisfy most users' filing requirements. Using this program, you can create a file consisting of records of up to 30 fields of a maximum of 30 characters each. However, there's a maximum of 255 characters per record.

Once loaded, the program presents you with a menu of options which are:

1) Enter data — this allows the user to add a complete record to an existing file.

2) Amend data — this allows the user to change any individual field of any desired record. The record number required can be found using either of the following search options.

3) Item Search — any field can be searched for a desired item, or for anything not equal to the selected item.

4) Record Search — search for a specified record number.

5) Close files — this must be done after all sessions as it allows the program to access data created during the session.

PROGRAM FILE

```
10 REM*********************************
20 REM**   RANDOM  FILING PROGRAM    **
30 REM**            BY               **
40 REM**         JOHN TODD  (1984)   **
50 REM*********************************
100 CLR:POKE53272,23:POKE53280,11:POKE53281,11:PRINT"[CLS][GR2]"
104 MAX=500
105 DIMIX(3,MAX):DIMSR(MAX)
110 CR$=CHR$(13):X=0:T=1:S=1
120 PRINT"[5CD]":PRINTTAB(15)"[G>D]ISC [G>F]ILE[CD]"
130 PRINTTAB(14)"PLEASE WAIT"
135 PR=49152:IP=PR+26:IFPEEK(PR)=32ANDPEEK(PR+1)=253ANDPEEK(PR+26)=32THEN150
140 GOSUB7000:REM M/C FOR PRINT@+INPUT@
150 GOSUB6100:REM PRINT BLANK MENU PAGE
160 SYSPR,10,2,"[REV] [G>O]PTIONS AVAILABLE [OFF]"
170 SYSPR,7,6,"[REV](1)[OFF][7SPC][G>L]OAD FILE FROM DISC"
180 SYSPR,7,8,"[REV](2)[OFF][7SPC][G>C]REATE NEW FILE"
190 SYSPR,7,10,"[REV](0)[OFF][7SPC][G>Q]UIT"
200 GETK$:IFK$="1"THENGOSUB2500:GOSUB1200:GOTO300
210 IFK$="2"THENGOSUB2000:GOSUB1400:TX=X:X=MAX:GOSUB1000:X=TX:GOTO300
220 IFK$="0"THEN END
230 GOTO200
300 GOSUB6100:SYSPR,10,2,"[REV] [G>O]PTIONS AVAILABLE [OFF]"
310 SYSPR,10,5,"[REV](1)[OFF][7SPC][G>E]NTER DATA"
320 SYSPR,10,7,"[REV](2)[OFF][7SPC][G>A]MEND DATA"
330 SYSPR,10,9,"[REV](3)[OFF][7SPC][G>I]TEM SEARCH"
340 SYSPR,10,11,"[REV](4)[OFF][7SPC][G>R]ECORD# SEARCH"
345 SYSPR,10,13,"[REV](0)[OFF][7SPC][G>C]LOSE FILES"
350 GETK$:IFK$="1"THENGOSUB4000:GOTO300
360 IFK$="2"THENGOSUB4200:GOTO300
370 IFK$="3"THENGOSUB3000:GOTO300
380 IFK$="4"THENGOSUB3600:GOTO300
390 IFK$="0"THENGOSUB 1000:SYSPR,9,20,"RECORDS ON FILE [BLK]";X-1"[GR2]":END
400 IFX=MAX+1THEN5000
500 GOTO350
1000 REM*********************************
1010 REM*   CREATE SEQUENTIAL FILE    *
1020 REM*********************************
1040 OPEN4,8,4,"@0:"+NF$+",S,W"
1050 PRINT#4,X;CR$;F
1055 FORR=1TOF:PRINT#4,FP(R);CR$;FL(R);CR$;N$(R);CR$:NEXTR
1060 FORR=1TO X
1070 PRINT#4,IX(1,R);CR$;IX(2,R);CR$;IX(3,R)
1080 NEXTR:CLOSE4
1090 RETURN
1200 REM*********************************
1210 REM*    READ SEQUENTIAL FILE     *
1220 REM*********************************
1230 OPEN4,8,4,"0:"+NF$+",S,R"
1240 INPUT#4,X,F
1245 DIM Z$(F),N$(F),FL(F),FP(F)
1250 FORR=1TOF:INPUT#4,FP(R),FL(R),N$(R):NEXTR
1255 FORR=1TOX
1260 INPUT#4,IX(1,R),IX(2,R),IX(3,R)
1270 NEXTR:CLOSE4
1280 RETURN
1400 REM*********************************
1410 REM*     BLOCK PRINT TO DISC     *
1420 REM*********************************
1425 GOSUB1900
1430 OPEN15,8,15
1435 OPEN5,8,5,"#"
1437 PRINT#15,"B-P:";5;1
1465 FORY=1TOF:PRINT#5,Z$(Y);CHR$(13);:NEXT
1480 PRINT#15,"U2:";5;0;T;S
1490 IX(1,X)=X:IX(2,X)=T:IX(3,X)=S
1500 X=X+1
1510 CLOSE5:CLOSE15:RETURN
1600 REM*********************************
1610 REM*    BLOCK READ FROM DISC     *
1620 REM*********************************
1630 OPEN15,8,15
1635 OPEN5,8,5,"#"
1640 PRINT#15,"U1:"5;0;T;S
1644 PRINT#15,"B-P:";5;1
1645 FORY=1TOF
1650 INPUT#5,Z$(Y):
1655 NEXT
1660 CLOSE5:CLOSE15:RETURN
1900 REM*********************************
1910 REM*       SET TRACK + SECTOR      *
1920 REM*********************************
1930 OPEN15,8,15
1940 PRINT#15,"B-A";0;T;S
1950 INPUT#15,FA,FB$,FC,FD:IFFA=65THENT=FC:S=FD:GOTO1940
1960 CLOSE15:RETURN
2000 REM*********************************
2010 REM*     CREATE FILE ROUTINE       *
2020 REM*********************************
2030 GOSUB 2370: REM CREATE FILE NAME
2040 GOSUB6100:SYSPR,11,2,"[REV] [G>C]REATE NEW FILE [OFF]"
2050 SYSIP,10,6,"[G>H]OW MANY FIELDS[4SPC][4CL]";F
2060 IF F<1ORF>30THEN2050
2070 DIMFL(F),FP(F),N$(F),Z$(F)
2080 GOSUB6100:SYSPR,11,2,"[REV] [G>C]REATE NEW FILE [OFF]";F;"FIELDS"  :D=0
2085 FORY=1TOF
2090 IFY=19 THEND=-18:GOSUB6100:SYSPR,11,2,"[REV] [G>C]REATE NEW FILE [OFF]"
2100 SYSPR,4,Y+4+D,"FIELD";Y:SYSIP,13,Y+4+D,"NAME";N$(Y)
2110 IFLEN(N$(Y))>8THENN$(Y)=LEFT$(N$(Y),8)
2120 NEXTY:D=0:GOSUB6100:SYSPR,11,2,"[REV] [G>C]REATE NEW FILE [OFF]";F;"FIELDS"
2125 FORY=1TOF
2130 IFY=19 THEND=-18:GOSUB6100:SYSPR,11,2,"[REV] [G>C]REATE NEW FILE [OFF]"
2140 SYSPR,4,Y+4+D,"FIELD";Y
2145 SYSIP,13,Y+4+D,"LENGTH[6SPC][6CL]";FL(Y):IFFL(Y)>30THEN2140
2150 FP(Y)=FP(Y-1)+FL(Y-1)
2160 NEXTY:D=0
2165 FORY=1TOF:FP(Y)=FP(Y)+1:NEXTY
2170 TL=FP(Y-1)+FL(Y-1)
2180 IFTL<255THEN2220
2190 SYSPR,4,2,"[REV][BLK][2SPC]FILE TOO LONG:";
2195 PRINT"[3SPC]PRESS F1[4SPC][OFF][3SPC][3CL][GR2]"
2200 GET K1$:IFK1$<>"[F1]"THEN2190
2205 GOSUB6100
2210 SYSPR,4,2,"[REV][BLK][2SPC]FILE TOO LONG: AMEND[2SPC](A)[OFF][GR2]":GOTO2230
2220 GOSUB6100:SYSPR,11,2,"[REV] [G>C]REATE NEW FILE [OFF]"
2230 SYSPR,6,4,"[BLK]FIELD#[2SPC]LENGTH[GR2]"
2240 D1=0:D=0:FORY=1TOF:IFY=19 THEND=-18:D1=20:SYSPR,26,3,"FIELD#[2SPC]LENGTH"
2250 SYSPR,D1,Y+4+D,"[REV]"N$(Y):SYSPR,D1+8,Y+4+D,Y:SYSPR,D1+15,Y+4+D,FL(Y)
2260 NEXTY
```


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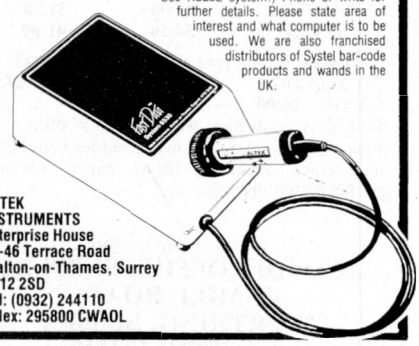

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PROGRAM FILE

```
2270 SYSPR,6,23,"[REV] A [OFF] AMEND[3SPC]OR[3SPC][REV] C [OFF] CONTINUE";
2280 GETK2$:IFK2$<>"A"ANDK2$<>"C"THEN2280
2290 IFK2$="C"ANDTL<255THEN2350
2300 SYSPR,6,23,"AMEND WHICH FIELD#[14SPC][6CL]";:INPUTAF
2310 IFAF<1ORAF>FTHEN2300
2320 SYSPR,6,23,"INPUT NEW FIELD LENGTH[9SPC][6CL]";:INPUTFL(AF)
2325 IFFL(AF)>30THEN2320
2330 TL=0:FORY=1TOF:FP(Y)=FP(Y-1)+FL(Y-1):NEXTY
2335 FORY=1TOF:FP(Y)=FP(Y)+1:NEXTY
2340 TL=FP(Y-1)+FL(Y-1)
2345 GOTO2180
2350 RETURN
2360 REM ******************************
2370 REM **        NEW FILE NAME       **
2375 REM ******************************
2380 GOSUB6100:SYSPR,11,2,"[REV] NEW FILE NAME [OFF]"
2390 SYSIP,2,5,"[G>P]LEASE ENTER FILE NAME[9SPC][9CL]";NF$
2400 IF LEN(NF$)>12THEN2370
2410 SYSPR,5,10,"[G>N]EW FILE NAME :-"
2420 SYSPR,5,12,"[REV]"NF$"[REV]"
2430 SYSPR,2,15," IS NAME OK:-[REV] F1 [OFF][6SPC]NOT:-[REV] F7 [OFF]"
2440 GET K3$:IFK3$<>"[F1]"ANDK3$<>"[F7]"THEN2440
2450 IFK3$="[F1]"THENRETURN
2460 NF$="":GOTO2370
2500 REM*******************************
2510 REM*      LOAD FILE FROM DISC      *
2520 REM*******************************
2530 GOSUB6100:SYSPR,8,2,"[REV] [G>L]OAD FILE FROM DISC [OFF]"
2540 SYSIP,5,5,"[G>W]HAT IS FILE NAME";NF$
2570 SYSPR,5,8,"[REV]"NF$"[OFF]";"[2SPC]OK:-[2SPC][REV] F1 [OFF]";
2575 PRINT"[6SPC]NOT:-[REV] F7 [OFF]"
2580 GETK$:IFK$<>"[F1]"ANDK$<>"[F7]"THEN2570
2590 IFK$="[F7]"THEN2530
2600 OPEN15,8,15: OPEN4,8,4,NF$+",S,R"
2610 INPUT#15,A,B$,C,D:SYSPR,5,11,"[REV]"B$"[OFF]":CLOSE4:CLOSE15
2615 IFB$="OK"THEN2650
2620 SYSPR,5,15,"[G>P]RESS [REV] F1 [OFF] TO TRY AGAIN":NF$=""
2630 GETK$:IFK$<>"[F1]"THEN2630
2640 GOTO2530
2650 SYSPR,5,15,"[G>P]RESS [REV] F1 [OFF] TO CONTINUE "
2660 GETK$:IFK$<>"[F1]"THEN2660
2670 RETURN
3000 REM*******************************
3010 REM*        SINGLE SEARCH        *
3020 REM*******************************
3030 GOSUB6100:SYSPR,10,2,"[2SPC][G>S]EARCH SUBJECTS[3SPC]":TC=0
3040 D=0:D1=0:FORY=1TOF:IFY=19THEND=-18:D1=22
3050 SYSPR,1+D1,Y+4+D,Y;"[REV]"N$(Y)"[OFF]":NEXT
3060 SYSPR,9,0,"[REV] [G>I]NPUT SEARCH SUBJECT [G>N]O.[OFF]";:SYSIP,33,0,"";SS
3070 IFSS<1ORSS>FTHEN3030
3080 N$=N$(SS)
3090 REM
3100 GOSUB 6100:SYSPR,4,2,"[24SPC]"
3110 SYSPR,4,2," [G>S]EARCH SUBJECT :- [REV]";N$"[OFF]"
3120 SYSIP,1,0,"[NAME=]= OR [NAME*]<> ";SN$
3125 Q$=RIGHT$(SN$,1):SN$=LEFT$(SN$,LEN(SN$)-1)
3130 IFLEN(SN$)>FL(SS)THENSN$=LEFT$(SN$,FL(SS))
3150 SYSPR,1,0," [REV]"SN$;"[OFF][28SPC]"
3160 SYSPR,(LEN(SN$)+3),0," OK (Y/N) ";
3170 GETK$:IFK$="Y"THEN3200
3180 IFK$="N"THEN3030
3190 GOTO3170
3200 SYSPR,4,5,"[G>S]EARCHING ***"
3210 R=0   :REM** NO OF RECORDS FOUND
3220 FORSR=1TOX-1:SYSPR,20,5,SR
3230 T=IX(2,SR):S=IX(3,SR)
3240 GOSUB1600:Z$=Z$(SS)
3250 IFZ$<>SN$ANDQ$="*"THEN3270
3255 IFZ$ =SN$ANDQ$="*"THEN3270
3260 R=R+1:SR(R)=SR
3270 SYSPR,10,11,"RECORDS FOUND = ";R:NEXT
3280 SYSPR,10, 9,"[REV] SEARCH COMPLETE [OFF]"
3290 SYSPR,10,11,"RECORDS FOUND = ";R
3300 IFR<>0THEN3340
3310 SYSPR,5,24,"PRESS [REV] F1 [OFF] FOR MENU";
3320 GETK$:IFK$<>"[F1]"THEN 3320
3330 RETURN
3340 SYSPR,0,13,,"PAGE THROUGH +1";"[REV](F1)"
3350 PRINT,"PAGE THROUGH +5";"[REV](F3)"
3360 PRINT,"PAGE THROUGH -1";"[REV](F5)"
3370 PRINT,"PAGE THROUGH -5";"[REV](F7)"
3380 PRINT,"EXIT TO MENU";"[3SPC][REV](←) [OFF]"
3390 GETK$:IFK$="[F1]"THENPG=PG+1:GOTO3450
3400 IFK$="[F3]"THENPG=PG+5:GOTO3450
3410 IFK$="[F5]"THENPG=PG-1:GOTO3450
3420 IFK$="[F7]"THENPG=PG-5:GOTO3450
3430 IFK$="←"THENRETURN
3440 GOTO3390
3450 IFPG<1THENPG=1
3460 IFPG>RTHENPG=R
3470 T=IX(2,SR(PG)):S=IX(3,SR(PG))
3480 GOSUB 1600
3490 RN=SR(PG):GOSUB 3800
3500 SYSPR,9,24,"PRESS (F1-F7) OR (←)";
3510 GOTO3390
3600 REM*******************************
3610 REM*       RECORD # SEARCH       **
3620 REM*******************************
3630 GOSUB6100:SYSPR,3,2,"[34SPC]"
3640 SYSPR,5,2,"ENTER RECORD # NO."
3650 SYSIP,0,0,"";SR
3660 IFSR>X-1THENSR=X-1
3670 IF SR<1THENSR=1
3680 T=IX(2,SR):S=IX(3,SR)
3690 GOSUB 1600
3700 RN=SR:GOSUB3800
3710 SYSPR,9,24,"PRESS (F1-F7) OR (←)";
3720 GETK$:IFK$="[F1]"THENSR=SR+1:GOTO3660
3730 IFK$="[F5]"THENSR=SR-1:GOTO3660
3740 IFK$="[F3]"THENSR=SR+5:GOTO3660
3750 IFK$="[F7]"THENSR=SR-5:GOTO3660
3760 IFK$="←"THENRETURN
3770 GOTO3720
3800 REM*******************************
3810 REM*    PRINT DATA TO SCREEN     *
3820 REM*******************************
3830 GOSUB6100:SYSPR,11,2,"[REV] [G>R]ECORD [G>N]O. :- ";RN"[OFF]":D=0
3835 FORY=1TOF
3840 IFY=19THEND=-18:GOSUB6100:SYSPR,11,3,"[REV] [G>R]ECORD [G>N]O. :- ";RN"[REV]
3845 IFF>18ANDY=18THENGETK$:SYSPR,5,23,"(F7) PAGE+":IFK$<>"[F7]"THEN3845
```

PROGRAM FILE

```
3850 SYSPR,0,Y+4+D,"[BLK]"N$(Y)"[GR2]",Z$(Y):NEXT
3853 IFF>18THEN SYSPR,5,23,"[REV] F1 [OFF] MENU[6SPC][REV] F7 [OFF] TURN PAGE";
3855 IFF>18THENGETK$:IFK$="[F7]"THEN3830
3860 IFF>18ANDK$<>"[F1]"THEN3855
3865 SYSPR,5,23,"[36SPC]";
3870 RETURN
4000 REM*******************************
4010 REM**      ENTER NEW DATA         **
4020 REM*******************************
4030 GOSUB6100:SYSPR,10,2,"[REV][2SPC]ENTER NEW DATA[2SPC][OFF]"
4040 SYSPR,12,4,"[REV] RECORD# ";X"[OFF]"
4050 D=0:FORY=1TOF
4060 IFY=19THEND=-18:GOSUB6100:SYSPR,10,2,"[REV][2SPC]ENTER NEW DATA[2SPC][OFF]"
4070 SYSPR,2,Y+4+D,"[REV]"N$(Y)"[OFF]":SYSIP,LEN(N$(Y))+6,Y+4+D,"";Z$(Y):NEXTY
4080 FORY=1TOF:IFLEN(Z$(Y))>FL(Y)THENZ$(Y)=LEFT$(Z$(Y),FL(Y)):NEXTY
4130 GOSUB1400
4140 RETURN
4200 REM*******************************
4210 REM*    AMEND RECORD ROUTINE     *
4220 REM*******************************
4230 GOSUB6100:SYSPR,11,2,"[REV] [G>A]MEND RECORD [OFF]"
4240 SYSIP,11,5,"[G>R]ECORD [G>N]O ";RN
4250 IFRN<1THENRN=1
4260 IFRN>X-1THENRN=X-1
4265 SYSPR,21,5,"[4SPC][4CL]";RN
4270 T=IX(2,RN):S=IX(3,RN)
4300 GOSUB1600:AF=1
4310 SYSPR,0,7,"[47SPC]"
4320 SYSPR,0,7,AF"[REV]"N$(AF)"[OFF]":SYSPR,10,7,Z$(AF)
4350 SYSPR,9,18,"[REV] F1 [OFF] TO PAGE FIELDS +"
4360 SYSPR,9,19,"[REV] F5 [OFF] TO PAGE FIELDS -"
4370 SYSPR,9,20,"[REV] ←[2SPC][OFF] [G>R]ETURN TO MENU"
4380 SYSPR,9,21,"[REV] F7 [OFF] [G>A]MEND FIELD "
4385 SYSPR,9,22,"[REV] F8 [OFF] [G>S]AVE NEW DATA"
4390 GETK$:IFK$="[F1]"THENAF=AF+1:GOTO4500
4400 IFK$="[F5]"THENAF=AF-1:GOTO4500
4410 IFK$="←"THENRETURN
4415 IFK$="[F8]"THEN4600
4420 IFK$<>"[F7]"THEN4390
4430 SYSIP,0,10,"[REV] [G>N]EW DATA ";Z$(AF)
4440 IFLEN(Z$(AF))>FL(AF)THENZ$(AF)=LEFT$(Z$(AF),FL(AF))
4450 SYSPR,0,10,"[62SPC]"
4500 IFAF<1THENAF=F
4510 IFAF>FTHENAF=1
4520 GOTO4310
4600 REM **       REPLACE DATA          **
4605 TX=X:X=RN
4610 GOSUB1430
4620 X=TX
4660 RETURN
5000 REM*******************************
5010 REM*        FULL DISC              *
5020 REM*******************************
5030 GOSUB6100:SYSPR,11,2,"[REV][BLK] DISC NOW FULL [OFF]"
5040 X=MAX:GOSUB1000
5070 SYSPR,5, 7,"[G>Y]OU NOW NEED AN EMPTY,FORMATTED"
5080 SYSPR,5, 9,"DISC WHICH MUST HAVE FILE NAME :-"
5085 SYSPR,16,11,"[REV]"NF$"[OFF]"
5090 SYSPR,5,13,"[OFF]CREATED [REV]BEFORE[OFF] ANY DATA"
5100 SYSPR,5,15,"CAN BE ENTERED"
5110 SYSPR,9,23,"[GR2][G>P]RESS [REV] F1 [OFF] TO CONTINUE"
5120 SYSPR,6,21,"[GR2][G>P]UT NEW DISC INTO DRIVE THEN"
5130 GETK$:IFK$<>"[F1]"THEN5120
5140 T=1:S=1:TX=1:X=MAX:GOSUB1000:X=TX:GOTO300
6100 REM ****     BLANK MENU PAGE    ****
6110 PRINTCHR$(147);
6120 PRINT"[CD][G<A][37G>*][G<S]"
6130 PRINT"[G>-][37SPC][G>-]"
6140 PRINT"[G<Z][37G>*][G<X]"
6145 SYSPR,19-LEN(NF$)/2,1,"[REV][BLK]"NF$"[REV][GR2]"
6150 RETURN
7000 REM**** M/C FOR SYSPR,IP *********
7010 D=0:PR=49152:IP=PR+26
7020 READA:IFA=-1THENRETURN
7030 POKE49152+D,A:D=D+1:GOTO7020
7040 DATA 32,253,174,32,158,183,138,72,32,253,174,32,158,183,104,168
7050 DATA 24,32,240,255,32,253,174,76,164,170,32,253,174,32,158,183
7060 DATA 138,72,32,253,174,32,158,183,104,168,24,32,240,255,32,253
7070 DATA 174,76,195,171,165,43,164,44,133,34,132,35,160,3,200,177
7080 DATA 34,208,251,200,152,24,101,34,160,0,145,43,165,35,105,0
7090 DATA 200,145,43,136,162,3,230,34,208,2,230,35,177,34,208,244
7100 DATA 202,208,243,165,34,105,2,133,45,165,35,105,0,133,46,76
7110 DATA 99,166,-1
7120 REM*******************************
```

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When entering real (decimal) numbers the input routine tests for the number of digits after the decimal point, and will only allow the number of digits that were entered into the 'lowest real number' when designing the input screen. If 10.00 is entered as the 'lowest real number', no more than two decimal places will be allowed by the input routine (and, of course, the input must be at least 10).

Inputs with a box length of zero are printed as text and no reply requested. This allows text to be used as subheaders and lines of, say, dashes used to improve the layout.

In 80-column modes the bottom line is used as a status line showing the input type and limits, and also any help message. In 40-column modes the help message is printed on the line above the status line. Therefore, if help messages are to be used in 40-column modes no input should be placed on this line.

In mode 7 colour may be placed in the text by use of function keys f1 to f7; a change of colour after the text will allow the input to be in a different colour to the text.

Screen Designer instructions are given on the status line in order that the screen layout can be seen as it's built up. Because of this, and the need to conserve memory, instructions are restricted to the minimum.

Input/validation

This is intended to be incorporated in your own programs. PROCinit loads the specified file, which includes the screen mode and number of items as well as input types and limits. PROCsetup-screen simply prepares the screen for input by printing the title, input text and boxes. It has been included as a separate routine so that in programs where information has been saved and is being retrieved, it can be presented on the screen in the same format as it was input.

PROCinput gets and checks each input, printing the limits and help message for each item on the status line, when the cursor is in the input box for that item.

Move down from item to item with the return key (the cursor keys will allow movement up as well as down). You won't be able to move from out of limit boxes except by cheating (press ^C)! When the screen has been completed, pressing 'TAB' will leave the procedure and continue the program. Any items out of limits will ring the bell and print a message on the status line and you'll be asked if you want to proceed with the program or continue the input.

PROCinput includes a REM showing how the 'TAB' can be replaced by another key to end the routine, and also a REM showing how to disable the 'cheating' control. It may be a good idea to use a 'text only' input to tell users how to leave the input routine.

PROCvariables takes the answers from the input routine and assigns them to your own variables for use in other parts of your program. This can be omitted and the answers used directly if required.

```
    10REM      DESIGN     BBC MICRO     32K
    20REM IF YOU HAVE DISCS AND WILL USE MODE0,1 OR 3 RELOCATE TO &1500
    30MODE6
    40PROCinit
    50PROColdnew
    60IF mode=99 PROCwhatmode
    70MODE mode
    80mchange=0
    90PROCrefresh
   100REPEAT
   110PROCeditor:IF mchange=1 MODE mode:mchange=0:PROCrefresh:GOTO110
   120I=I+1:IF I>=30 I=30:PROCnomore:IF mchange=1 MODE mode:mchange=0:PROCref
 resh:GOTO120
   130PROCmsg("CTL=CURSOR. MOVE TO TEXT START, RETURN")
   140PRINTTAB(0,0);
   150PROCcur
   160X(I)=X : Y(I)=Y
   170PROCmsg("CTL=KEYBOARD. ENTER TEXT, RETURN")
   180PRINTTAB(X,Y);
   190PROCget(11)
   200txt$(I)=T$
   210PROCmsg("CTL=CURSOR. MOVE TO BOX START, RETURN")
   220PRINTTAB(X+LEN(txt$(I)),Y);
   230PROCcur
   240VDUbxchr
   250XB(I)=X : YB(I)=Y
   260PROCmsg("CTL:CURSOR. MOVE TO BOX END, RETURN")
   270PRINTTAB(XB(I),YB(I));
   280PROCboxlen
   290PROCtype
   300PROCexplain
   310UNTIL FALSE
   320
   330DEFPROCtype
   340PROCmsg("1=INT 2=REAL 3=$ 4=SPECIFIC 5=NO TEST ")
   350REPEAT A=GET-48 : UNTIL A>0 AND A<6
   360IF A=3 PROCmsg("INPUT=STRING,  RETURN TO GO ON"):REPEAT T=GET:UNTILT=13
   370IF A=5 PROCmsg("NO TEST ON INPUT, RETURN TO GO ON"):REPEAT T=GET:UNTILT
 =13
   380typ(I)=A
   390X=XB(I)+1 : Y=YB(I)
   400IF A=1 PROCintlimit
   410IF A=2 PROCreallimit
   420IF A=4 PROCspecificlimit
   430ENDPROC
   440
```

PROGRAM FILE

```
450DEFPROCcur
460REPEAT
470A=GET
480IF A=139 AND VPOS>0 VDU11
490IF A=136 AND POS>0 VDU8
500IF A=137 AND POS<11 VDU9
510IF A=138 AND VPOS<(ls-1) VDU10
>
520X=POS : Y=VPOS
530UNTILA=13
540ENDPROC
550
560DEFPROCmsg(T$)
570PRINTTAB(0,ls);STRING$(11," ");TAB(0,ls);T$;
580ENDPROC
590
600DEFPROCboxlen
610L=0 : num=49
620IF mode=0 OR mode=3 PRINTTAB(60,ls);"LENGTH : ";L;"  ";
630PRINTTAB(X+1,YB(I));
640REPEAT
650A=GET
660IF A=136 AND L>0 VDU127 : L=L-1 : num=num-1
670IF A=137 VDUnum : L=L+1 : num=num+1
680IF L=0 num=49
690IF num<48 num=num+10
700IF num=58 num=48
710X=POS
720IF mode=0 OR mode=3 PRINTTAB(60,ls);"LENGTH : ";L;"  ";
730PRINTTAB(X,YB(I));
740UNTIL A=13
7501en(I)=POS-XB(I)-1
760VDUbxchr
770ENDPROC
780
790DEFPROCintlimit
800PROCmsg("LOWEST ALLOWABLE INTEGER, RETURN")
810PRINTTAB(X,Y);SPC(len(I));TAB(X,Y);
820PROCget(len(I))
830LIML$=T$
840PROCmsg("HIGHEST ALLOWABLE INTEGER, RETURN")
850PRINTTAB(X,Y);SPC(len(I));TAB(X,Y);
860PROCget(len(I))
8701im$(I)=LIML$+","+T$
880ENDPROC
890
900DEFPROCreallimit
910PROCmsg("LOWEST ALLOWABLE REAL, RETURN")
920PRINTTAB(X,Y);SPC(len(I));TAB(X,Y);
930PROCget(len(I))
940LIML$=T$
950PROCmsg("HIGHEST ALLOWABLE REAL, RETURN")
960PRINTTAB(X,Y);SPC(len(I));TAB(X,Y);
970PROCget(len(I))
9801im$(I)=LIML$+","+T$
990ENDPROC
1000
1010DEFPROCspecificlimit
1020T=0 : lim$(I)=""
>
1030REPEAT : T=T+1
1040PROCmsg("ENTER STRING No "+STR$(T)+" OR 'RETURN'")
1050PRINTTAB(X,Y);SPC(len(I));TAB(X,Y);
1060PROCget(len(I))
10701im$(I)=lim$(I)+T$+","
1080UNTIL T$=""
10901im$(I)=LEFT$(lim$(I),LEN(lim$(I))-2)
1100ENDPROC
1110
1120DEFPROCexplain
1130IF ll=79 PROCmsg("ENTER HELP MESSAGE : ")
1140IF ll=39 PROCmsg("ENTER HELP MESSAGE ON LINE ABOVE");PRINTTAB(0,ls-1);
1150PROCget(39)
1160h$(I)=T$
1170IF ll=39 PRINTTAB(0,ls-1);SPC(LEN(h$(I)));
1180ENDPROC
1190
1200DEFPROCget(mx%)
1210T$="" : A=0
1220REPEAT
1230A$=GET$
1240IF mode=7 AND A$<>CHR$13 AND A$>CHR$128 AND A$<CHR$136 GOTO1260
1250IF A$<>CHR$13 AND (A$<CHR$32 OR A$>CHR$127) UNTILFALSE
1260IF A$=CHR$13 A=1 : A$=""
1270IF A$=CHR$127 AND LEN(T$)>0 T$=LEFT$(T$,LEN(T$)-1);PRINT;CHR$127;:A$=""
ELSE IF A$=CHR$127 AND LEN(T$)=0 VDU7:A$=""
1280IF A=0 AND LEN(T$)=mx% VDU7 ELSE T$=T$+A$:PRINT;A$;
1290UNTIL A=1
1300ENDPROC
1310
1320DEFPROCeditor
1330FOR L=1 TO I
1340IF len(L)>0 PRINTTAB(XB(L)+1,YB(L));STRING$(len(L),STR$(L MOD10));
1350NEXT
1360items=I
1370PROCmsg("TAB=EDIT    RETURN=NEXT ")
1380I=items
1390*FX15,0
1400A=GET : IF A=13 : ENDPROC
1410REPEAT
1420PROCmsg("EDIT 0 TO "+STR$(I)+", (0=SAVE/PRINT/MODE/ETC)")
1430PROCget(2)
1440A=VAL(T$)
1450UNTIL A=0 OR A<=I
1460I=A
1470IF I=0 PROCeditor2:IF mchange=1 I=items:ENDPROC ELSE IF I=0 GOTO1370
1480REPEAT
1490PROCmsg("EDIT 1=TXT 2=POS 3=TYPE 4=LIMIT 5=MSG")
1500REPEAT A=GET-48 : UNTIL A>0 AND A<6
15100N A GOSUB 1570,1670,1930,1960,1990
1520PROCmsg("TAB TO EDIT ITEM "+STR$(I)+" MORE OR RETURN")
1530REPEAT A=GET : UNTIL A=9 OR A=13
>
1540UNTIL A=13
1550PROCrefresh
1560GOTO1370
1570PRINTTAB(X(I),Y(I));SPC(LEN(txt$(I)));
1580IF POS=XB(I) VDUbxchr
1590TBT=POS
1600PROCmsg("ENTER NEW TEXT, RETURN")
1610PRINTTAB(X(I),Y(I));
1620PROCget(11)
```


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PROGRAM FILE

```
1630txt$(I)=T$
1640IF POS>XB(I) XB(I)=POS:PRINTTAB(XB(I),YB(I));CHR$bxchr;SPC(len(I));CHR$
bxchr;
1650txt$(I)=T$
1660RETURN
1670PROCmsg("1=TXT POS 2=BOX POS 3=BOX LEN")
1680REPEAT A=GET-48 : UNTIL A>0 AND A<4
16900N A GOSUB 1710,1780,1850
1700RETURN
1710PROCmsg("CTL:CURSOR. MOVE TO TEXT START, RETURN")
1720PRINTTAB(X(I),Y(I));
1730PROCcur
1740PRINTTAB(X(I),Y(I));SPC(LEN(txt$(I)));
1750X(I)=X : Y(I)=Y
1760PRINTTAB(X(I),Y(I));txt$(I);
1770RETURN
1780PROCmsg("CTL:CURSOR. MOVE TO BOX START, RETURN")
1790PRINTTAB(XB(I),YB(I));
1800PROCcur
1810PRINTTAB(XB(I),YB(I));SPC(len(I)+2);
1820XB(I)=X : YB(I)=Y
1830PRINTTAB(XB(I),YB(I));CHR$bxchr;SPC(len(I));CHR$bxchr;
1840RETURN
1850PROCmsg("CTL:CURSOR. MOVE TO BOX END, RETURN")
1860PRINTTAB(XB(I),YB(I));SPC(len(I)+2);
1870PRINTTAB(XB(I),YB(I));CHR$bxchr;
1880X=POS-1
1890PROCboxlen
1900PROCmsg("CHECK INPUTS FIT IN NEW BOX, RETURN")
1910REPEAT A=GET : UNTIL A=13
1920RETURN
1930PROCtype
1940RETURN
1950REM BASIC2 ONLY, BASIC1 USERS REPLACE WITH M/C CALL
1960OSCLI("*FX138,0,"+STR$(typ(I)+48))
1970PROCtype
1980RETURN
1990PROCexplain
2000RETURN
2010
2020DEFPROColdnew
2030PROCmsg("LOAD A FILE Y/N ")
2040A=GET OR &20
>
2050IF A<>121 PROCnewscreen : ENDPROC
2060PROCmsg("FILE NAME : ")
2070PROCget(7)
20800N ERROR PROCnofile : GOTO2030
2090dfile$="D."+T$
2100F=OPENIN(dfile$)
2110INPUT#F,title$,mode,I
2120items=I : mchange=0
2130FOR L=1 TO I
2140INPUT#F,X(L),Y(L),txt$(L),XB(L),YB(L),len(L),typ(L),lim$(L),h$(L)
2150NEXT
2160CLOSE#0
21700N ERROR OFF
2180PROCscreensize
2190ENDPROC
2200
2210DEFPROCrefresh
2220REM green text, leave if not req'd
2230VDU19,1,2,0,0,0
2240CLS
2250PRINTTAB(11/2-LEN(title$)/2,0);title$
2260FOR L=1 TO items
2270PRINTTAB(X(L),Y(L));txt$(L);
2280IF len(L)>0 PRINTTAB(XB(L),YB(L));CHR$bxchr;STRING$(len(L),STR$(L MOD 1
0));CHR$bxchr;
2290NEXT
2300ENDPROC
2310
2320DEFPROCsave
2330PROCmsg("FILE NAME (RETURN to skip) ")
2340PROCget(7)
2350IF T$="" ENDPROC
2360I=items
2370dfile$="D."+T$
2380F=OPENOUT(dfile$)
2390PRINT#F,title$,mode,I
2400FOR L=1 TO I
2410PRINT#F,X(L),Y(L),txt$(L),XB(L),YB(L),len(L),typ(L),lim$(L),h$(L)
2420NEXT
2430CLOSE#0
2440I=0
2450ENDPROC
2460
2470DEFPROCeditor2
2480PROCmsg("1=TITLE 2=INS/DEL 3=PRINT 4=SAVE 5=MODE")
2490REPEAT A=GET-48 : UNTIL A>0 AND A<6
2500IF A=1 PROCnewscreen
2510IF A=2 PROCadditem
2520IF A=3 PROCscreendump
2530IF A=4 PROCsave
2540IF A=5 PROCwhatmode
2550IF mchange=0 PROCrefresh
>
2560ENDPROC
2570
2580DEFPROCnewscreen
2590PROCmsg("SCREEN TITLE:")
2600PROCget(11-13)
2610title$=T$
2620ENDPROC
2630
2640DEFPROCadditem
2650PROCmsg("1=INSERT ITEM 2=REMOVE ITEM ")
2660REPEAT A=GET-48 : UNTIL A>0 AND A<3
2670IF A=2 PROCremoveitem : ENDPROC
2680PROCmsg("INSERT AT WHICH ITEM ")
2690PROCget(2)
2700A=VAL(T$)
2710IF A>items PROCmsg("NOT THAT MANY ITEMS, RETURN TO GO ON"):REPEAT A=GET
:UNTIL A=13:ENDPROC
2720FORL=items TO A STEP-1
2730X(L+1)=X(L):Y(L+1)=Y(L):txt$(L+1)=txt$(L):XB(L+1)=XB(L):YB(L+1)=YB(L):l
en(L+1)=len(L):typ(L+1)=typ(L):lim$(L+1)=lim$(L):h$(L+1)=h$(L)
2740NEXT
2750X(A)=0 : Y(A)=0 : txt$(A)=""
2760XB(A)=0 : YB(A)=0 : len(A)=0
2770typ(A)=0 : lim$(A)="" : h$(A)=""
2780IF items<30 items=items+1 : I=A
```

PROGRAM FILE

```
2790PROCrefresh
2800PROCmsg("NOW EDIT ITEM "+STR$(A)+", RETURN TO GO ON")
2810REPEAT A=GET : UNTIL A=13
2820ENDPROC
2830
2840DEFPROCinit
2850*FX4,1
2860title$="" : ll=39 : ls=24
2870CLS
2880PRINT"SCREEN DESIGNER"
2890VDU23,130,16,0,16,0,16,0,16,0
2900I=31
2910DIM X(I),Y(I),txt$(I),XB(I),YB(I),len(I),typ(I),lim$(I),h$(I)
2920I=0 : items=0
2930mchange=0 : mode=99
2940ENDPROC
2950
2960DEFPROCwhatmode
2970REPEAT
2980PROCmsg("WHICH MODE (0,1,3,4,6 OR 7) ")
2990mode=GET-48
3000UNTIL mode>=0 AND mode<8 AND mode<>2 AND mode<>5
3010PRINT mode
3020PROCscreensize
3030mchange=1
3040ENDPROC
3050
3060DEFPROCscreensize
>
3070IF mode=0 OR mode=3 ll=79 ELSE ll=39
3080IF mode=3 OR mode=6 OR mode=7 ls=24 ELSE ls=31
3090IF mode=7 bxchr=58 ELSE bxchr=130
3100ENDPROC
3110
3120DEFPROCnomore
3130PROCmsg("EDIT/SAVE ONLY, RETURN TO GO ON")
3140REPEAT A=GET : UNTIL A=13
3150REPEAT
3160PROCeditor
3170UNTIL I<30
3180ENDPROC
3190
3200DEFPROCscreendump
3210VDU2
3220A%=135
3230FORY%=0 TO ls-1
3240FORX%=0 TO 11
3250VDU31,X%,Y%
3260C=(USR(&FFF4) AND &FFFF) DIV &100
3270IF C=130 C=58
3280IF C>126 C=32
3290PRINT;CHR$C;
3300NEXT:VDU13:NEXT
3310VDU3
3320ENDPROC
3330
3340DEFPROCremoveitem
3350PROCmsg("REMOVE WHICH ITEM ")
3360PROCget(2)
3370A=VAL(T$)
3380IF A>30 PROCmsg("TOO BIG. RETURN TO GO ON"):REPEATA=GET:UNTILA=13:ENDPR
OC
3390IF A>items PROCmsg("NOT THAT MANY ITEMS, RETURN TO GO ON"):REPEATA=GET:
UNTILA=13:ENDPROC
3400FOR L=A TO items
3410X(L)=X(L+1):Y(L)=Y(L+1):txt$(L)=txt$(L+1):XB(L)=XB(L+1):YB(L)=YB(L+1):l
en(L)=len(L+1):typ(L)=typ(L+1):lim$(L)=lim$(L+1):h$(L)=h$(L+1)
3420NEXT
3430txt$(L)="" : lim$(L)="" : h$(L)=""
3440items=items-1
3450IF items<0 items=0
3460PROCrefresh
3470I=0
3480PROCmsg("ITEM "+STR$(A)+" REMOVED RETURN TO GO ON")
3490REPEAT A=GET : UNTIL A=13
3500ENDPROC
3510
3520DEFPROCnofile
3530ON ERROR OFF
3540IF ERR<>222 END
3550PROCmsg("NO SUCH FILE - TRY AGAIN")
3560VDU7
3570A=INKEY(200)
3580ENDPROC
>
  10REM INPUT/VALIDATION ROUTINE
  20REM FILE NAME NEEDS TO GO IN QUOTES ON NEXT LINE
  30PROCinit("TEST1")
  40REM   MORE PROGRAM HERE
  50MODE mode
  60REM THIS MAKES TEXT GREEN LEAVE OUT IF NOT REQ'D
  70VDU19,1,2,0,0,0
  80PROCsetupscreen
  90PROCinput
 100*FX4,0
 110REM   MORE PROGRAM HERE
 120END
 130
 140DEFPROCsetupscreen
 150CLS
 160PRINTTAB(11/2-LEN(title$)/2,0);title$
 170FORL%=1 TO num
 180IF len(L%)>0 PRINTTAB(X(L%),Y(L%));tx$(L%);TAB(XB(L%),YB(L%));CHR$bxchr
;SPC(len(L%));CHR$bxchr; ELSE PRINTTAB(X(L%),Y(L%));tx$(L%);
 190PRINTTAB(XB(L%)+1,YB(L%));ans$(L%);
 200NEXT
 210ENDPROC
 220
 230DEFPROCinput
 240*FX4,1
 250I=0
 260PROCupdown(1)
 270REPEAT
 280*FX21,0
 290G=GET
 300IF G=127 AND (LEN(ans$(I))>0) ans$(I)=LEFT$(ans$(I),LEN(ans$(I))-1):PRI
NTTAB(XB(I)+1,YB(I));SPC(len(I));TAB(XB(I)+1,YB(I));ans$(I);
 310IF G=139 OR G=136 PROCchk :IF ok PROCupdown(-1)
 320IF G=138 OR G=137 PROCchk :IF ok PROCupdown(1)
 330IF G=3 PROCctlC
 340IF G=13 PROCchk :IF ok PROCupdown(1)
```


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PROGRAM FILE

```
  350REM next line ends proc, change 9 to use another key
  360IF G=9 PROCendchk :UNTILNOT(cheat) :ENDPROC
  370IF G<32 OR G>126 UNTILFALSE
  380IF stflg ans$(I)="":PRINTTAB(XB(I)+1,YB(I));SPC(len(I));TAB(XB(I)+1,YB(
I));:stflg=0
  3900N typ(I) GOSUB 410,490,610,690,740
  400UNTILFALSE
  410REM INTEGER
  420IF (G<48 OR G>57) AND G<>45 VDU7:RETURN
  430IF G=45 AND INSTR(ans$(I),"-") VDU7:RETURN
  440IF G=45 AND (INSTR(lim$(I),"-")=0) VDU7:RETURN
  450IF LEN(ans$(I))=len(I) ans$(I)=LEFT$(ans$(I),len(I)-1):VDU127
  460ans$(I)=ans$(I)+CHR$(G)
  470PRINT;CHR$(G);
  480RETURN
  490REM HERE FOR REALS
  500IF (G<48 OR G>57) AND G<>46 AND G<>45  VDU7:RETURN
  510IF G=45 AND INSTR(ans$(I),"-") VDU7:RETURN
>
  520IF G=45 AND (INSTR(lim$(I),"-")=0) VDU7:RETURN
  530IF G=46 AND INSTR(ans$(I),".") VDU7:RETURN
  540t1=INSTR(lim$(I),",")-INSTR(lim$(I),".")-1
  550t2=LEN(ans$(I))-INSTR(ans$(I),".")
  560IF INSTR(ans$(I),".") AND (t1<=t2) VDU7:PRINTTAB(0,ls);SPC(11);TAB(0,ls
);"** ONLY USE ";t1;" DECIMAL PLACES **";:G=INKEY(100):PROCcur:RETURN
  570IF LEN(ans$(I))=len(I) ans$(I)=LEFT$(ans$(I),len(I)-1):VDU127
  580ans$(I)=ans$(I)+CHR$(G)
  590PRINT;CHR$(G);
  600RETURN
  610REM HERE FOR STRING
  620REM IF G=(ALLOWABLE CHRACTER) GOTO620 (ALLOWS OTHER CHRS TO BE INPUT)
  630IF G=38 OR G=58 OR G=49 OR G=33 GOTO 650
  640IF ((G<65 OR G>90) AND (G<97 OR G>122)) AND G<>32 AND G<>44 AND G<>46 V
DU7:RETURN
  650IF LEN(ans$(I))=len(I) ans$(I)=LEFT$(ans$(I),len(I)-1):VDU127
  660ans$(I)=ans$(I)+CHR$(G)
  670PRINT;CHR$(G);
  680RETURN
  690REM HERE FOR SPECIFIC
  700ans$(I)=ans$(I)+CHR$(G)
  710IF (INSTR(lim$(I),ans$(I)))=0 ans$(I)=LEFT$(ans$(I),LEN(ans$(I))-1):VDU
7:RETURN
  720PRINT;CHR$(G);
  730RETURN
  740REM HERE TYPE 5
  750REM NO TEST AT ALL
  760IF LEN(ans$(I))=len(I) ans$(I)=LEFT$(ans$(I),len(I)-1):VDU127
  770ans$(I)=ans$(I)+CHR$(G)
  780PRINT;CHR$(G);
  790RETURN
  800
  810DEFPROCcur
  820PROCcoff
  830COLOUR129:COLOUR0
  840PRINTTAB(0,ls);SPC(11);TAB(0,ls);
  850IF typ(I)=1 PRINT;" Integer, range:";lim$(I);SPC(11-23-LEN(lim$(I)));
  860IF typ(I)=2 PRINT;" Decimal, range:";lim$(I);SPC(11-25-LEN(lim$(I)));
  870IF typ(I)=3 PRINT;" Alphabet only";SPC(11-14);
  880IF typ(I)=4 AND LEN(lim$(I))<33 PRINT;" Only :";lim$(I);SPC(11-7-LEN(li
m$(I)));: ELSE IF typ(I)=4 PRINT" SPECIFIED CHARACTERS ONLY";SPC(11-26);
  890IF typ(I)=5 PRINT;" Any characters and nums";SPC(11-27);
  900IF ll=39 AND hlp$(I)<>"" PRINTTAB(0,ls-1);SPC(39);TAB(0,ls-1);hlp$(I);
ELSE IF hlp$(I-1)<>"" COLOUR128:COLOUR1:PRINTTAB(0,ls-1);SPC(39);:COLOUR129:
COLOUR0
  910IF ll=79 PRINTTAB(40,ls);hlp$(I);
  920COLOUR128:COLOUR1
  930PRINTTAB(XB(I)+1,YB(I));
  940stflg=1
  950PROCcon
  960ENDPROC
  970
  980DEFPROCchk
  990ON typ(I) GOSUB1050,1050,1110,1150,1110
 1000IF ok ENDPROC
 1010VDU7
 1020PRINTTAB(XB(I)+1,YB(I));SPC(len(I));TAB(XB(I)+1,YB(I));
>
 1030ans$(I)=""
 1040ENDPROC
 1050REM CHECK INTEGER & REAL
 1060ok=TRUE
 1070IF VAL(ans$(I))<VAL(LEFT$(lim$(I),INSTR(lim$(I),",")-1)) ok=FALSE
 1080IF VAL(ans$(I))>VAL(RIGHT$(lim$(I),LEN(lim$(I))-INSTR(lim$(I),","))) ok
=FALSE
 1090IF ans$(I)="" ans$(I)="0":PRINTTAB(XB(I)+1,YB(I));ans$(I)
 1100RETURN
 1110REM CHECK STRING & NO TEST
 1120REM IF IT GETS HERE MUST BE OK
 1130ok=TRUE
 1140RETURN
 1150REM CHECK SPECIFIC
 1160ok=TRUE
 1170IF ans$(I)="" ans$(I)=CHR$35
 1180tmp1$=","+lim$(I)+","
 1190tmp2$=","+ans$(I)+","
 1200IF INSTR(tmp1$,tmp2$)=0 ok=FALSE
 1210RETURN
 1220
 1230DEFPROCinit(dfile$)
 1240CLS
 1250VDU23,130,16,0,16,0,16,0,16,0
 1260*FX214,1
 1270*FX213,200
 1280*FX229,0
 1290REM IF FX229,1 ESCAPE=DISABLED
 1300F=OPENIN("D."+dfile$)
 1310INPUT#F,title$,mode
 1320IF mode=0 OR mode=3 ll=79 ELSE ll=39
 1330IF mode=3 OR mode=6 OR mode=7 ls=24 ELSE ls=31
 1340IF mode=7 bxchr=58 ELSE bxchr=130
 1350INPUT#F,num
 1360I=num
 1370DIM X(I),Y(I),tx$(I),XB(I),YB(I),len(I),typ(I),lim$(I),hlp$(I),ans$(I)
 1380FOR L%=1 TO num
 1390INPUT#F,X(L%),Y(L%),tx$(L%),XB(L%),YB(L%),len(L%),typ(L%),lim$(L%),hlp$
(L%)
 1400NEXT
 1410CLOSE#F
 1420ENDPROC
 1430
 1440DEFPROCctlC
```

PROGRAM FILE

```
1450REM ENDPROC HERE TO STOP ^C CHEATING
1460T$=ans$(I)
1470PROCchk
1480IF ok PROCupdown(1):ENDPROC
1490PROCcoff
1500PRINTTAB(0,ls);SPC(11);
1510PRINTTAB(0,ls);" ** INPUT ";STR$(I);" OUT OF LIMITS **";
1520VDU7
1530G=INKEY(100)
>
1540PROCcon
1550PRINTTAB(XB(I)+1,YB(I));T$;
1560ans$(I)=T$
1570PRINTTAB(0,ls);SPC(11);
1580PROCupdown(1)
1590ENDPROC
1600
1610DEFPROCendchk
1620PROCcoff
1630cheat=FALSE
1640FORI=1 TO num
1650IF len(I)=0 GOTO1680
1660PROCchk
1670IF NOT(ok) PRINTTAB(0,ls);SPC(11);TAB(0,ls);" ** INPUT ";STR$(I);" OUT
OF LIMITS **";:VDU7:G=INKEY(100):cheat=TRUE
1680NEXT
1690PROCcon
1700IF NOT(cheat) ENDPROC
1710REM NEXT LINE PREVENTS LEAVING PROCinput WITH OUT OF LIMIT ITEMS
1720REM GOTO1750
1730PRINTTAB(0,ls);SPC(11);TAB(0,ls);" CONTINUE PROGRAM? Y/N ";
1740G=GET OR &20
1750IF G=121 cheat=FALSE
1760I=0 : PROCupdown(1)
1770PROCcur
1780ENDPROC
1790
1800DEFPROCupdown(N)
1810REPEAT
1820I=I+N
1830IF I<1 I=num
1840IF I>num I=1
1850UNTIL len(I)>0
1860PROCcur
1870ENDPROC
1880
1890DEFPROCcon
1900VDU23,1,1;0;0;0;
1910ENDPROC
1920
1930DEFPROCcoff
1940VDU23,1,0;0;0;0;
1950ENDPROC
1960
1970DEFPROCvariables
1980REM THIS IS AN EXAMPLE OF HOW TO GET YOUR OWN VARIABLES ASSIGNED
1990my_variable_string$=ans$(1)
2000my_variable_integer%=VAL(ans$(2))
2010my_variable_real=VAL(ans$(3))
2020REM AND SO ON
2030ENDPROC
>
```

BBC 'G'

by Phillip Wright

'G' is a compiler/interpreter for a simple graphics language, which allows complex graphics to be converted into fast machine code.

'G' programs consist of a series of graphics commands which are fully explained in the first program. This should be typed in and saved before the second program, called G-PART2.

When you have typed in a 'G' program (by typing "PROG", then return, and then entering your program), you can test it before compiling by typing "GO". Once you are satisfied with the program type "COMPILE" and follow the instructions.

As in Basic programs, single commands can be entered directly instead of as part of a program. To do this you must be in mode 5, then you should type "GRAPH".

Finally, even though 'G' allows * commands, you shouldn't *RUN a 'G' program as this will result in some curious errors.

```
10 REM G - The simple Graphics Language
20 REM Compiler/Interpreter V.1.6
30 REM Instructions V.1.2
40 REM Written by P.J.Wright AGE12.
50 REM
60 REM INSTRUCTIONS
70 REM ------------
80 *FX225,224
90 *FX226,234
100 *FX227,244
110 MODE7
120 PROCinst
130 CLS
140 PAGE=&1900
150 CHAIN"G-PART2"
160 REM
170 *FX15
180 DEFPROCinst
190 PRINT TAB(14,0);CHR$141;CHR$129;"** G **"
200 PRINT TAB(14,1);CHR$141;CHR$131;"** G **"
210 PRINT TAB(10,2);CHR$135;"Written By P.Wright"
220 FOR F%=0 TO 3
230 PRINT TAB(0,F%);CHR$132;CHR$157
240 NEXT
250 IF FNyn=0 THEN ENDPROC
```


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PROGRAM FILE

```
  260 CLS
  270 PROCre(23):*FX15
  280 *FX15
  290 REPEATUNTILGET=32
  300 PROCre(29):*FX15
  310 REPEATUNTILGET=32
  320 PROCre(31):*FX15
  330 REPEATUNTILGET=32
  340 PROCre(24):*FX15
  350 REPEATUNTILGET=32
  360 PROCre(25):*FX15
  370 REPEAT
  380 *FX15
  390 A=GET
  400 UNTIL A=89 OR A=78
  410 IF A=89 THEN RESTORE:CLS:GOTO 270
  420 ENDPROC
  430 DATA "#3","COMMANDS (These Can be compiled.)","#3","-------- "
  440 DATA"#6","MOVE [x] , [y]","As the BASIC command MOVE x,y"
  450 DATA"#6","DRAW [x] , [y]","As the BASIC command DRAW x,y"
  460 DATA"#6","PLOT [n] , [x] , [y]","As the BASIC command PLOT n,x,y"
  470 DATA"#6","WRITE ""[string]""","Like PRINT, but at graphics cursor."
  480 DATA"#6","CLR","Clears the screen."
  490 DATA"#6","FCOL [col. number]","Sets the FOREGROUND colour."
  500 DATA"#6","BCOL [col. number]","Sets the BACKGROUND colour."
  510 DATA"#6","SWAP [col. number],[col. number]","Like VDU 19 commands."
  520 DATA"#6","DCHAR [char num.] , [num] ,[num] ETC.","As VDU 23."
  530 DATA""
  540 DATA"#6","And any '*' command. e.g. *TAPE,*FX9,1"
  550 DATA"#5","      PRESS 'SPACE' TO CONTINUE"
  560 DATA "","","","","","","","","#3","COMMANDS (These Can't be compiled,"
  570 DATA "#3","-------- but are used in Direct mode.)"
  580 DATA"#6","DIR","Catalog Disk or Tape."
  590 DATA"#6","TXT","Clear the screen and enter Mode 7"
  600 DATA"#6","GRAPH","Clear the screen and enter Mode 5"
  610 DATA"#6","PROG","Lets you start, or continue a G Program"
  620 DATA"#6","EDIT","Edits a G program."
  630 DATA"#6","COMPILE","COMPILES a G program"
  640 DATA"#6","GO","INTERPRETS a G program."
  650 DATA"#6","LIST / LLIST","Lists your program to screen / printer."
  660 DATA"#6","BYE","Return to BASIC."
  670 DATA"","#5","      PRESS 'SPACE' TO CONTINUE"
  680 DATA "","","","","","","","","#3","COMMANDS (These Can't be compiled,"
  690 DATA "#3","-Cont.-- but are used in Direct mode.)",""
  700 DATA"#6","LOAD","Load a G. source program"
  710 DATA"#6","SAVE","Save a G. source program"
  720 DATA"",""
  730 DATA "#3","ERROR MESSAGES"," ----- --------"
  740 DATA "#2","Missing ""","e.g. WRITE HELLO"""
  750 DATA "","#2","Mistake at line xxx"
  760 DATA "Occurs when compiling or interpreting."
  770 DATA "correct the error using EDIT."
  780 DATA "","#2","Unknown Command.","An unrecagnised command has been given."
  790 DATA"","#5","      PRESS 'SPACE' TO CONTINUE"
  800 DATA"","","","#3","ERROR MESSAGES cont."," ----- -------- -----"
  810 DATA "#2","Missing sp. Character"
  820 DATA "ALL commands with parameters must have"
  830 DATA "a space between then command and the","first parameter."
  840 DATA "","#2","No program space.","No memory left for your program."
  850 DATA "","#2","No program.","You have tried to LIST or EDIT a non","existan
t program."
  860 DATA "","#2","OS ERROR:","All O.S. errors.e.g.Bad Filename,Escape."
  870 DATA"","","","","#5","      PRESS 'SPACE' TO CONTINUE"
  880 DATA"","","","#3","USER DEFINED GRAPHICS"
  890 DATA"","Although U.D.G.s can be defined using"
  900 DATA"DCHAR, no facility has been made for a "
  910 DATA"CHR$(x) command in WRITE. So,to print"
  920 DATA"a U.D.G. the red function keys have","been set to produce the charact
er ","codes 224 to 253. thus:"
  930 DATA "#1","f0 is CHR$(224)","#1","CTRL-f0 is CHR$(244)","#1","SHIFT-f0 is
CHR$(234)"
  940 DATA "","#3","N.B. The last line of any G program ","#3","must be ""END"""
  950 DATA "","","",""
  960 DATA "#6","PRESS ""N"" TO CONTINUE. ""Y"" TO READ THE","#6","INSTRUCTIONS
AGAIN."
  970 DATA "","","",""
  980 REM
  990 REM
 1000 DEFPROCre(X)
 1010 FOR LI=1 TO X
 1020 READ P$
 1030 IF LEFT$(P$,1)="#" THEN VDU (128+VAL(RIGHT$(P$,LEN(P$)-1))):GOTO 1020
 1040 PRINTP$
 1050 NEXT
 1060 ENDPROC
 1070 DEF FNyn
 1080 PRINT TAB(10,10);CHR$130;"Instructions (Y/N)?"
 1090 *FX15
 1100 A=GET
 1110 IF A=78 THEN =0
 1120 IF A=89 THEN =1
 1130 GOTO 1090



  0 *| G VERSION 1.6 |*
  5 *|                |*
 10 *|  Written By    |*
 15 *| P. J. Wright   |*
 20 *|                |*
 25 *| Save as        |*
 26 *|   "G-PART2"    |*
 30 *|                |*
 32IF PAGE<>&1900 THEN PRINT"Page should be &1900 !!!":END
 35DIM D$(60)
 40FORFX=0TO60:D$(FX)=STRING$(40," "):NEXT
 45ON ERROR GOTO 1115
 50MODE7:CO=FALSE:MX=7:FC=7:BC=1:PL%=0:PROCtitle
 55PROCinput:IF A$="" THEN GOTO55
 60ER=TRUE
 65PROCcommand:IF ER=TRUE THEN PROCERROR("Unknown Command.")
 70IF ER=7 THEN MODE7:MX=7
 75IF ER=2 THEN MODE5:MX=2:VDU 28,0,31,19,24
 80IF ER=3 THEN MODE5:PROCexec:A=GET:MODE7
 85PROCok:GOTO55
 90DEFPROCplot(V%)
 95[OPT2
100LDA#25:JSR&FFEE
105LDA#V%:JSR&FFEE
110LDA#W%:JSR&FFEE
115LDA#X%:JSR&FFEE
120LDA#Y%:JSR&FFEE
125LDA#Z%:JSR&FFEE
```

PROGRAM FILE

```
  130]
  135ENDPROC
  140DEFPROCpsep
  145V%=0
  150IF LEFT$(A$,5)="MOVE " THEN V%=4
  155IF LEFT$(A$,5)="DRAW " THEN V%=5
  160IF LEFT$(A$,5)="PLOT " PROCplo
  165IF V%=0 THEN PROCERROR("Missing sp Character"):ENDPROC
  170B%=FNfind(A$," ",1)
  175B$=RIGHT$(A$,LEN(A$)-B%)
  180D%=FNfind(B$,",",1)
  185Y%=VAL(RIGHT$(B$,LEN(B$)-D%)) MOD 256
  190Z%=VAL(RIGHT$(B$,LEN(B$)-D%)) DIV 256
  195W%=VAL(LEFT$(B$,D%-1)) MOD 256
  200X%=VAL(LEFT$(B$,D%-1)) DIV 256
  205IF C0=FALSE THEN P%=&1100
  210PROCplot(V%)
  215IF C0=FALSE THEN PROCcall
  220ENDPROC
  225DEF FNfind(C$,D$,E%)
  230A=1
  235IF MID$(C$,A,1)=D$ THEN =A
  240A=A+1
  245IF A>LEN(C$) THEN =0
  250GOTO 235
  255DEFPROCERROR(Z$)
  260PRINT
  265IF M%=7 THEN VDU129 ELSE COLOUR 1
  270PRINTZ$
  275IF M%=2 THEN COLOUR FC
  276C0=FALSE
  280ENDPROC
  285DEFPROCinput
  290PRINT":";
  295A$=""
  300AA=GET
  305IF A$="" AND AA=127 THEN GOTO 300
  310IF AA=127 THEN A$=LEFT$(A$,LEN(A$)-1):VDU AA:GOTO300
  315VDU AA
  320IF AA=13 THEN ENDPROC
  325A$=A$+CHR$(AA)
  330GOTO 300
  335DEFPROCtitle
  340PRINTCHR$131;"   *6* Version 1.6"
  345PRINTCHR$130;"Written by Phil Wright"
  350PROCok
  355ENDPROC
  360DEFPROCok
  365PRINT '"Ready."
  370ENDPROC
  375DEFPROCcall
  380?P%=&60
  385CALL&1100
  390ENDPROC
  395DEFPROCcommand
  400SOUND 1,-13,10,1
  405IF ASC(A$)=42 THEN ER=FALSE:PROCst
  410IF LEFT$(A$,4)="MOVE" OR LEFT$(A$,4)="DRAW" OR LEFT$(A$,4)="PLOT" THEN ER=F
ALSE:PROCpsep
  415IF A$="TXT"THENER=7
  420IF A$="GRAPH"THENER=2
  425IF A$="CLR"THENPROCclr:ER=FALSE
  430IF A$="DIR"THEN ER=FALSE:*.
  435IF A$="GO"THEN ER=3
  440IF A$="COMPILE"THENPROCcomp:ER=FALSE
  445IF A$="LLIST"THENPROCllist:ER=FALSE
  450IF A$="PROG"THENPROCprog:ER=FALSE
  455IF A$="LIST"THENPROClist:ER=FALSE
  460IF A$="EDIT" THEN ER=FALSE:PROCer
  465IF A$="END" THEN ER=FALSE:PROCERROR("Not in prog mode.")
  470IF LEFT$(A$,6)="DCHAR "THENPROCchar:ER=FALSE
  475IF LEFT$(A$,5)="SWAP "THENPROCswap:ER=FALSE
  480IF A$="CLEAR" THEN PRINT'"Clear?-----(Y/N)":ER=FALSE:IF GET$="Y" THEN RUN
  485IF A$="BYE" THEN PRINT'"Bye?-----(Y/N)":ER=FALSE:IF GET$="Y" THEN CALL!-4
  490IF LEFT$(A$,4)="SAVE" THEN PROCsave:ER=FALSE
  495IF LEFT$(A$,4)="LOAD" THEN PROCload:ER=FALSE
  500IF LEFT$(A$,5)="FCOL " THEN ER=FALSE:PROCfc
  505IF LEFT$(A$,5)="BCOL " THEN ER=FALSE:PROCbc
  510IF LEFT$(A$,6)="WRITE " THEN ER=FALSE:PROCprint
  515ENDPROC
  520DEFPROCfc
  525C%=VAL(RIGHT$(A$,LEN(A$)-4))
  530 FC=C%
  535IF C0=FALSE THEN P%=&1100
  540[OPT0
  545LDA#18
  550JSR&FFEE
  555LDA#0:JSR&FFEE
  560LDA#C%:JSR&FFEE
  565LDA#17
  570JSR&FFEE
  575LDA#C%
  580JSR&FFEE
  585]
  590IF C0=FALSE THEN PROCcall
  595ENDPROC
  600DEFPROCbc
  605C%=VAL(RIGHT$(A$,LEN(A$)-4))
  610IF C0=FALSE THEN P%=&1100
  615[OPT0
  620LDA#18
  625JSR&FFEE
  630LDA#0:JSR&FFEE
  635LDA#C%+128:JSR&FFEE
  640LDA#17
  645JSR&FFEE
  650LDA#C%+128
  655JSR&FFEE
  660]
  665IF C0=FALSE THEN PROCcall
  670ENDPROC
  675DEFPROCclr
  680IF C0=FALSE THEN P%=&1100
  685[OPT0
  690LDA#16
  695JSR&FFEE
  700LDA#12:JSR&FFEE
  705]
  710IF C0=FALSE THEN PROCcall
  715ENDPROC
  720DEFPROCswap
  725IF C0=FALSE THEN P%=&1100
  730B$=RIGHT$(A$,LEN(A$)-5)
```


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* = any string
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<n,>n = a numeric string<or>n

EXAMPLES:

dn???__<13→delete mdvn__???<13
Delete from both drives all 3 letter files whose extension is a numeric string<13.

c1*__doc→copy mdv1__*__doc
Copy from drive 1 to drive 2 all files (not already on 2) which end in '__doc'.

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PROGRAM FILE

```
735Z%=FNfind(B$,",",1)
740X%=VAL(LEFT$(B$,Z%-1))
745Y%=VAL(RIGHT$(B$,LEN(B$)-Z%))
750[OPTO
755LDA#19
760JSR&FFEE
765LDA#X%:JSR&FFEE
770LDA#Y%:JSR&FFEE
775LDA#0:JSR&FFEE:JSR&FFEE:JSR&FFEE
780]
785IF CO=FALSE THEN PROCcall
790ENDPROC
795DEFPROCchar
800A$=A$+","
805IF CO=FALSE THEN P%=&1100
810[OPTO:JMP P%+9:]
815PP%=P%
820B$=RIGHT$(A$,LEN(A$)-6)
825?P%=23:P%=P%+1
830FOR F%=1 TO 9
835B%=FNfind(B$,",",1)
840?P%=VAL(LEFT$(B$,B%-1))
845B$=RIGHT$(B$,LEN(B$)-B%)
850P%=P%+1:NEXT
855[OPTO
860LDX#0
865.L1
870LDA PP%,X
875JSR&FFEE
880INX
885CPX#10
890BNE L1
895]
900IF CO=FALSE THEN PROCcall
905ENDPROC
910DEFPROCprint
915B$=RIGHT$(A$,LEN(A$)-6)
920IF LEFT$(B$,1)="""" AND RIGHT$(B$,1)="""" THEN GOTO 930
925PROCERROR("Missing """):ENDPROC
930C$=RIGHT$(B$,LEN(B$)-1)
935B$=LEFT$(C$,LEN(C$)-1)
940IF CO=FALSE THEN P%=&1100:PRINT'
945[OPTO:JMP P%+LEN(B$)+3:]
950 PP%=P%
955$P%=B$:P%=P%+LEN(B$)
960[OPTO
965LDA#5
970JSR&FFEE
975LDX#0
980.L2
985LDA PP%,X
990JSR&FFEE
995INX
1000CPX#(LEN(B$))
1005BNE L2
1010LDA#4
1015JSR&FFEE
1020]
1025IF CO=FALSE THEN PROCcall
1030ENDPROC
1035DEFPROCst
1040B$=RIGHT$(A$,LEN(A$)-1)
1045IF CO=FALSE THEN P%=&1100
1050J%=P%+(LEN(B$)+4)
1055[OPT2
1060JMP J%
1065]
1070PP=P%:P%=J%
1075$PP=B$
1080[OPTO
1085LDX#(PP MOD 256)
1090LDY#(PP DIV 256)
1095JSR&FFF7
1100]
1105IF CO=FALSE THEN PROCcall
1110ENDPROC
1115PROCERROR("OS ERROR:"):REPORT
1120PRINT'
1125PROCok:GOTO 55
1130DEFPROCprog
1135IF M%=2 THEN PRINT "MUST be in TXT mode.":ENDPROC
1140PRINT''"Prog Mode. Type ""END"" to Finish."
1145IF PL%=0 THEN PRINT '"New program."' ELSE PROClist:PL%=PL%-1
1150REPEAT
1155IF PL%=60 THEN PROCERROR("No Program space."):ENDPROC
1160PRINT'CHR$131;PL%;CHR$133;:PROCinput
1165D$(PL%)=A$
1170PL%=PL%+1
1175UNTILA$="END"
1180A$=""
1185ENDPROC
1190DEFPROClis
1195IFPL%=0 THEN PROCERROR("No Program."):ENDPROC
1200PRINT'"User Program. ";PL%;" lines."'
1205FORF%=0 TO PL%-1
1210IFCL=1THENPRINTCHR$131;F%;CHR$133;D$(F%) ELSE PRINTF%;" -- ";D$(F%)
1215NEXT:ENDPROC
1220DEFPROCer
1225IFPL%=0 THEN PROCERROR("No Program."):ENDPROC
1230PROClist
1235PRINTCHR$130;"Edit which line? :";:INPUT""L%
1240IF L%<0 OR L%>PL% THEN PROCERROR("No such line."):GOTO 1235
1245PRINT'CHR$131;L%;CHR$133;:PROCinput:D$(L%)=A$:IF A$="END" THEN PL%=L%+1
1250A$="":ENDPROC
1255DEFPROCexe
1260FORF%=0TO PL%-2
1265ER=TRUE
1270A$=D$(F%):IF CO=TRUE THEN PRINT CHR$129;A$
1275PROCcommand
1276IF P%>&18E0 THEN PROCERROR("!!! MEMORY FULL. !!!"):ENDPROC
1280IF ER=TRUE THEN PROCERROR("Mistake at line "+STR$(F%)):VDU7,7:ENDPROC
1285NEXT
1290ENDPROC
1295DEFPROCsave:IFPL%=0 THEN PROCERROR("No Program."):ENDPROC
1300INPUT "FILENAME:"A$
1305X=OPENOUT(A$):PRINT#X,PL%:FOR F%=0 TO PL%-1
1310PRINT#X,D$(F%):NEXT:CLOSE#X:ENDPROC
1315DEFPROCload
1320INPUT "FILENAME:"A$
1325X=OPENIN(A$):INPUT#X,PL%:FOR F%=0 TO PL%-1
1330INPUT#X,D$(F%):NEXT:CLOSE#X:ENDPROC
1335DEFPROCexec:CO=FALSE
1340PROCexe
```

PROGRAM FILE

```
1345ENDPROC
1350DEFPROCcomp
1355P%=&D00:REM Disk users:P%=&1100
1360[OPT2:LDA#22:JSR&FFEE
1365LDA#5:JSR&FFEE:]
1370CO=TRUE
1375PRINT"Compiling, Please wait."'
1380PROCexe:IF ER=TRUE THEN ENDPROC
1385PRINT'
1390[OPT2:RTS:]
1395PRINT'CHR$131;"FINISHED."'
1400INPUT "FILENAME? :"N$
1405PRINT''"SAVING."'"Ready tape,then press ";
1410X%=0:Y%=&B
1415$&B00="SAVE "+N$+" 1100 18FF"
1420CALL&FFF7
1425CO=FALSE
1430A$="":PRINT'
1435ENDPROC
1440DEFPROCplo
1445A1=FNfind(A$," ",1)
1450A2=FNfind(A$,",",1)
1455V%=VAL(MID$(A$,A1,(A2-A1)))
1460B$=LEFT$(A$,A1)
1465B$=B$+RIGHT$(A$,A2-1)
1470A$=B$
1475ENDPROC
1480DEFPROClist
1485PRINT''"Printing...."''
1490CL=0:VDU2
1495PROClis
1500VDU3
1505ENDPROC
1510DEFPROClist
1515CL=1
1520PROClis
1525ENDPROC
```

48k Spectrum Crib Player

by Mike Williams

This version of the classic card game pits you against a Spectrum opponent with some nasty human traits. Throughout the game you'll be subjected to a series of comments designed to put you off. These range from: 'You can't see me for the dust' to 'This is so easy.' These wisecracks certainly add to the game's enjoyment, which also doubles as a cribbage tutor. All the rules are explained in the onscreen instructions which can be omitted from the code if you wish.

The game mechanics are simple but the play is far from easy as the Spectrum plays to win.

The code contains some user-defined graphics which are described in line 9800.

```
  1 REM ************************
  2 REM *                      *
  3 REM * CRIB PLAYER  Mk 1.1  *
  4 REM *                      *
  5 REM * Written by:-         *
  6 REM *      Mike Williams   *
  7 REM *                      *
  8 REM *       1984           *
  9 REM ************************
 10 RUN 8500
 97 REM ************************
 98 REM ***Deal the cards   ***
 99 REM ************************
100 FOR i=no TO fi
105 LET card=INT (RND*(LEN c$/tw))
110 LET h$(i*tw+on,on)=c$(card*tw+on): LET h$(i*tw+tw,on)=c$(card*tw+tw)
115 LET c$=c$( TO card*tw)+c$(card*tw+th TO )
120 LET card=INT (RND*(LEN c$/tw))
125 LET h$(i*tw+on,tw)=c$(card*tw+on): LET h$(i*tw+tw,tw)=c$(card*tw+tw)
130 LET c$=c$( TO card*tw)+c$(card*tw+th TO )
135 NEXT i
140 RETURN
147 REM ************************
148 REM ***Increment plsc     ***
149 REM ************************
150 LET plsc=plsc+inc: PRINT AT ii,18;"Your score:";plsc
155 IF plsc>=121 AND NOT mflg THEN PRINT )no;"You have won!": PAUSE hun: INPUT "
": LET mflg=on
160 RETURN
172 REM ************************
173 REM ***Increment spsc   ***
174 REM ************************
175 LET spsc=spsc+inc: PRINT AT ii,no;"My score:";spsc
180 IF spsc>=121 AND NOT mflg THEN PRINT )no;"I have won!": PAUSE hun: INPUT "
": LET mflg=tw
185 RETURN
197 REM ************************
198 REM ***Print pip count   ***
199 REM ************************
200 PRINT AT ei,ten;"Pip count:";AT ni,14;pip;
205 PRINT " ": RETURN
247 REM ************************
248 REM ***Redo pip and play***
249 REM ************************
250 LET pip=no: GO SUB 200
260 PRINT AT si,no;"          ";AT si,twe;"          "
280 RETURN
297 REM ************************
298 REM ***Initialisation   ***
299 REM ************************
300 PRINT AT fo,11;"Turn up:"
305 LET inc=no
310 GO SUB 150: GO SUB 175
315 GO SUB 250
320 RETURN
1997 REM ************************
1998 REM ***Score 4 card hand***
1999 REM ************************
2000 LET ta=no: LET tb=ta: LET tc=ta: LET td=ta: LET tsc=ta: IF s$(tw)=s$(fo) AN
D s$(fo)=s$(si) AND s$(si)=s$(ei) THEN LET tsc=fo: GO TO 2035
2005 IF s$(on)=s$(th) THEN LET tsc=tw
2010 IF s$(on)=s$(fi) THEN LET tsc=tsc+tw
2015 IF s$(on)=s$(se) THEN LET tsc=tsc+tw
2020 IF s$(th)=s$(fi) THEN LET tsc=tsc+tw
2025 IF s$(th)=s$(se) THEN LET tsc=tsc+tw
2030 IF s$(fi)=s$(se) THEN LET tsc=tsc+tw
2035 IF s$(on)="A" THEN LET ta=on
2040 IF s$(on)>"A" THEN LET ta=ten
2045 IF NOT ta THEN LET ta=VAL s$(on)
2050 IF s$(th)="A" THEN LET tb=on
2055 IF s$(th)>"A" THEN LET tb=ten
2060 IF NOT tb THEN LET tb=VAL s$(th)
2065 IF s$(fi)="A" THEN LET tc=on
2070 IF s$(fi)>"A" THEN LET tc=ten
2075 IF NOT tc THEN LET tc=VAL s$(fi)
2080 IF s$(se)="A" THEN LET td=on
2085 IF s$(se)>"A" THEN LET td=ten
2090 IF NOT td THEN LET td=VAL s$(se)
2095 IF ta+tb=fit THEN LET tsc=tsc+tw
2100 IF ta+tc=fit THEN LET tsc=tsc+tw
2105 IF ta+td=fit THEN LET tsc=tsc+tw
2110 IF tb+tc=fit THEN LET tsc=tsc+tw
2115 IF tb+td=fit THEN LET tsc=tsc+tw
2120 IF tc+td=fit THEN LET tsc=tsc+tw
2125 IF ta+tb+tc=fit THEN LET tsc=tsc+tw
```


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PROGRAM FILE

```
2130 IF ta+tc+td=fit THEN  LET tsc=tsc+tw
2135 IF ta+tc+td=fit THEN  LET tsc=tsc+tw
2140 IF tb+tc+td=fit THEN  LET tsc=tsc+tw
2145 IF ta+tb+tc+td=fit THEN  LET tsc=tsc+tw
2147 LET ta=no: LET tb=ta: LET tc=ta: LET td=ta
2150 IF s$(on)="A" THEN  LET ta=on
2155 IF s$(on)="@" THEN  LET ta=ten
2160 IF s$(on)="J" THEN  LET ta=11
2165 IF s$(on)="Q" THEN  LET ta=12
2170 IF s$(on)="K" THEN  LET ta=13
2175 NOT ta THEN  LET ta=VAL s$(on)
2180 IF s$(th)="A" THEN  LET tb=on
2185 IF s$(th)="@" THEN  LET tb=ten
2190 IF s$(th)="J" THEN  LET tb=11
2195 IF s$(th)="Q" THEN  LET tb=12
2200 IF s$(th)="K" THEN  LET tb=13
2205 NOT tb THEN  LET tb=VAL s$(th)
2210 IF s$(fi)="A" THEN  LET tc=on
2215 IF s$(fi)="@" THEN  LET tc=ten
2220 IF s$(fi)="J" THEN  LET tc=11
2225 IF s$(fi)="Q" THEN  LET tc=12
2230 IF s$(fi)="K" THEN  LET tc=13
2235 NOT tc THEN  LET tc=VAL s$(fi)
2240 IF s$(se)="A" THEN  LET td=on
2245 IF s$(se)="@" THEN  LET td=ten
2250 IF s$(se)="J" THEN  LET td=11
2255 IF s$(se)="Q" THEN  LET td=12
2260 IF s$(se)="K" THEN  LET td=13
2265 NOT td THEN  LET td=VAL s$(se)
2270 IF ta>tb THEN  LET t=ta: LET ta=tb: LET tb=t
2275 IF ta>tc THEN  LET t=ta: LET ta=tc: LET tc=t
2280 IF ta>td THEN  LET t=ta: LET ta=td: LET td=t
2285 IF tb>tc THEN  LET t=tb: LET tb=tc: LET tc=t
2290 IF tb>td THEN  LET t=tb: LET tb=td: LET td=t
2295 IF tc>td THEN  LET t=tc: LET tc=td: LET td=t
2300 IF ta=tb-on AND tb=tc-on AND tc=td-on THEN  LET tsc=tsc+fo: RETURN
2305 IF ta=tb-on AND tb=tc-on THEN  LET tsc=tsc+th
2310 IF ta=tc-on AND tc=td-on THEN  LET tsc=tsc+th
2315 IF tb=tc-on AND tc=td-on THEN  LET tsc=tsc+th
2320 RETURN
3997 REM ************************
3998 REM ***Play a round      ***
3999 REM ************************
4000 DIM h(fo,tw): LET spc=fo: LET ply=spc: LET pip=no: LET pass=pip: LET p$="
": LET q$=p$
4002 IF deal=-on THEN  GO TO 4500
4005 LET flg=no: LET spe=no: LET count=on: FOR i=no TO LEN y$/tw-on: LET temp=no
4007 LET chr=i*tw+on
4010 IF y$(chr)="A" THEN  LET temp=on
4015 IF y$(chr)="@" THEN  LET temp=ten
4020 IF NOT temp THEN  LET temp=VAL y$(chr)
4022 IF y$(chr)=q$(on) AND pip+temp<fit AND flg<tw THEN  LET flg=on: LET spe=i
4025 IF pip+temp=fit AND flg<th THEN  LET flg=tw: LET spe=i
4027 IF y$(chr)=q$(on) AND pip+temp>fit AND pip+temp<thon AND flg<fo THEN  LET f
lg=th: LET spe=i
4030 IF pip+temp=thon AND flg<fi THEN  LET flg=fo: LET spe=i
4035 IF pip+temp<=thon THEN  LET h(count,on)=i: LET count=count+on
4045 NEXT i
4050 IF flg THEN  LET card=spe: GO TO 4095
4055 IF count=on THEN  GO TO 4090
4060 PRINT )no;"I can't go.": PAUSE hun: INPUT ""
4065 LET p$=""
4070 IF pass THEN  GO TO 4800
4075 IF spc AND ply THEN  LET pass=-on
4080 IF ply THEN  GO TO 4500
4085 GO TO 4800
4090 LET card=INT (RND*(count-tw))+on: LET card=h(card,on)
4095 LET w$="": LET !card=-on
4110 FOR i=no TO spc-on: IF i=card THEN  LET p$=y$(i*tw+on TO i*tw+tw): GO TO 41
20
4115 LET w$=w$+y$(i*tw+on TO i*tw+tw)
4120 NEXT i: LET y$=w$: LET spc=spc-on
4125 LET tpi=no: IF p$(on)="A" THEN  LET tpi=on
4127 IF p$(on)>"A" THEN  LET tpi=ten
4127 IF NOT tpi THEN  LET tpi=VAL p$(on)
4130 LET co=no: IF p$(tw)<"♠" THEN  LET co=tw
4135 PRINT AT si,no;"I play;"; PAPER se; INK co;p$
4140 PRINT AT tw,twith*spc; PAPER se; INK co;p$: PAUSE twe
4145 LET pip=pip+tpi: GO SUB 200
4150 IF pip=fit THEN  PRINT )no;"I score 2 for 15!": PAUSE hun: INPUT "": LET in
c=tw: GO SUB 175
4155 IF p$(on)=q$(on) THEN  LET q$=" ": PRINT )no;"I score 2 for a pair!": PAUS
E hun: INPUT "": LET inc=tw: GO SUB 175
4160 LET not31=on: IF pip=thon THEN  PRINT )no;"I score 2 for 31!": PAUSE hun: I
NPUT "": LET pass=no: LET inc=tw: GO SUB 175: GO SUB 250: LET not31=pip: LET p$=
"
4170 IF pass AND spc THEN  GO TO 4005
4175 IF pass THEN  GO TO 4800
4185 IF ply THEN  GO TO 4500
4190 IF spc THEN  LET q$="  ": GO TO 4005
4195 IF not31 THEN  GO TO 4800
4200 RETURN
4500 INPUT "Which card ? "; LINE a$: IF LEN a$>on THEN  GO TO 4500
4505 IF NOT LEN a$ THEN  GO TO 4700
4510 IF a$<"A" OR a$>"D" THEN  GO TO 4500
4511 LET flg=no: FOR i=on TO fo: IF h(i,tw)=CODE a$-64 THEN  LET flg=on
4512 NEXT i
4513 IF flg THEN  PRINT )no;"You haven't got that card!": PAUSE hun: INPUT "": G
O TO 4500
4517 LET tem2=nor LET char=(CODE a$-65)*tw+on: IF h$(char,tw)="A" THEN  LET tem2
=on
4518 IF h$(char,tw)>"A" THEN  LET tem2=ten
4519 IF NOT tem2 THEN  LET tem2=VAL h$(char,tw)
4520 IF tem2+pip+thon THEN  PRINT )no;"C'mon! You can't play that.": PAUSE hun:
INPUT "": GO TO 4500
4525 LET q$=h$(char,tw)+h$(char+on,tw)
4527 LET co=no: IF q$(tw)<"♠" THEN  LET co=tw
4530 LET h(ply,tw)=CODE a$-64: PRINT AT si,twe;"You play;"; PAPER se; INK co;q$
4535 PRINT AT tw,fit+thz(CODE a$-64);"  ": LET !card=on: LET ply=ply-on
4540 PAUSE twe
4565 LET pip=pip+tem2: GO SUB 200
4570 IF q$(on)=p$(on) THEN  LET p$="  ": PRINT )no;"You score 2 for a pair!": PA
USE hun: INPUT "": LET inc=tw: GO SUB 150
4575 IF pip=fit THEN  PRINT )no;"You score 2 for 15!": PAUSE hun: INPUT "": LET
inc=tw: GO SUB 150
4580 LET not31=on: IF pip=thon THEN  PRINT )no;"You score 2 for 31!": PAUSE hun:
 INPUT "": LET pass=no: LET q$="  ": LET inc=tw: GO SUB 150: GO SUB 250: LET not
31=pip
4600 IF pass AND ply THEN  GO TO 4500
4610 IF pass THEN  GO TO 4800
4635 IF spc THEN  GO TO 4005
4640 IF ply THEN  LET p$="  ": GO TO 4500
4645 IF not31 THEN  GO TO 4800
4650 RETURN
4700 LET flg1=no: FOR i=no TO th: LET tema=no
4705 LET flg2=no: FOR i=on TO fo
4710 IF h(j,tw)=i+on THEN  LET flg2=on
4715 NEXT j
4720 IF flg2 THEN  GO TO 4740
4725 IF h$(i*tw+on,tw)="A" THEN  LET tema=no
4730 IF h$(i*tw+on,tw)>"A" THEN  LET tema=ten
4735 IF NOT tema THEN  LET tema=VAL h$(i*tw+on,tw)
4737 IF tema+pip<=thon THEN  LET flg1=on
4740 NEXT i
4745 IF flg1 THEN  PRINT )no;"I don't believe you!": PAUSE hun: INPUT "": GO TO
4500
4750 LET pass=on: PRINT )no;"You pass.": PAUSE hun: INPUT "": LET flg=no: FOR i=
no TO LEN y$/tw-on
4755 LET tem3=no: IF y$(i*tw+on)="A" THEN  LET tem3=on
4760 IF y$(i*tw+on)>"A" THEN  LET tem3=ten
4765 IF NOT tem3 THEN  LET tem3=VAL y$(i*tw+on)
4770 IF pip+tem3<=thon THEN  LET flg=on
4775 NEXT i
4780 IF flg THEN  LET q$="  ": GO TO 4005
4800 LET pass=no: LET p$="  ": LET q$=p$
4805 IF !card+on THEN  GO TO 4840
4810 PRINT )no;"I score 1 for last card!": PAUSE hun: INPUT ""
4815 LET inc=on: GO SUB 175
4820 GO SUB 250
4825 IF ply THEN  GO TO 4500
4830 IF spc THEN  GO TO 4005
4835 RETURN
4840 PRINT )no;"You score 1 for last card!": PAUSE hun: INPUT ""
4845 LET inc=on: GO SUB 150
4850 GO SUB 250
4855 IF spc THEN  GO TO 4005
4860 IF ply THEN  GO TO 4500
4865 RETURN
4997 REM ************************
4998 REM ***Score hands - crib***
4999 REM ************************
5000 pp=14: IF deal+on THEN  GO TO 5045
5010 PRINT AT pp,no;"Your hand; ";
5012 FOR i=no TO th
5014 LET co=no: IF h$(i*tw+tw,tw)<"♠" THEN  LET co=tw
5016 PRINT  PAPER se; INK co;h$(i*tw+on,tw);h$(i*tw+tw,tw);
5018 PRINT " ";: NEXT i
5020 FOR i=on TO ei: LET s$(i)=h$(i,tw): NEXT i: LET s$(ni TO )=f$
5025 LET m$="You": LET c$=c$+s$( TO ei): GO SUB 9000
5030 PAUSE twe: PRINT TAB tw;"Your total score=";tsc
5035 LET inc=tsc: GO SUB 150
5040 LET pp=pp+th: IF deal+on THEN  GO TO 5100
5045 PRINT AT pp,no;"My hand; ";
5047 FOR i=no TO th
5049 LET co=no: IF h$(i*tw+tw,on)<"♠" THEN  LET co=tw
5051 PRINT  PAPER se; INK co;h$(i*tw+on,on);h$(i*tw+tw,on);
5053 PRINT " ";: NEXT i
5055 FOR i=on TO ei: LET s$(i)=h$(i,on): NEXT i: LET s$(ni TO )=f$
5060 LET m$="I": LET c$=c$+s$( TO ei): GO SUB 9000
5065 PAUSE twe: PRINT TAB tw;"My total score=";tsc
5070 LET inc=tsc: GO SUB 175
5075 LET pp=pp+th: IF deal+on THEN  GO TO 5010
5100 PRINT AT pp,no;"The crib; ";
5102 FOR i=no TO th
```

PROGRAM FILE

```
5104 LET co=no: IF h$(i*tw+tw,th)<"♠" THEN  LET co=tw
5106 PRINT  PAPER se; INK co;h$(i*tw+on,th);h$(i*tw+tw,th);
5108 PRINT " ";: NEXT i
5110 FOR i=on TO ei: LET s$(i)=h$(i,th): NEXT i: LET s$(ni TO )=f$
5112 LET m$="I": IF deal+on THEN  LET m$="You"
5115 LET c$=c$+s$( TO ei): GO SUB 9000
5120 PAUSE twe: IF deal+on THEN  GO TO 5150
5125 PRINT TAB tw;"My total score=";tsc
5130 LET inc=tsc: GO SUB 175
5135 LET c$=c$+f$
5140 RETURN
5150 PRINT TAB tw;"Your total score=";tsc
5155 LET inc=tsc: GO SUB 150
5160 LET c$=c$+f$
5165 RETURN
5997 REM ***********************
5998 REM ***Throw 2 cards    ***
5999 REM ***********************
6000 PRINT 'TAB tw;"** ** ** **"
6005 FOR i=no TO fi
6007 LET co=no: IF h$(i*tw+tw,tw)<"♠" THEN  LET co=tw
6010 PRINT AT tw,fit+i*th; PAPER se; INK co;h$(i*tw+on,tw);h$(i*tw+tw,tw)
6015 PRINT AT th,14+i*th;"-";CHR$ (65+i);"-"
6020 NEXT i: LET comb=no: LET y$="": LET hscr=no
6025 PRINT )no;"    Consider your discard."
6030 FOR i=no TO 14
6035 LET a$=d$(i*fo+on TO i*fo+fo): LET s$=""
6040 FOR j=no TO th
6045 LET s$(j*tw+on)=h$(VAL a$(j+on)*tw+on,on): LET s$(j*tw+tw)=h$(VAL a$(j+on)*
tw+tw,on)
6050 NEXT j
6055 GO SUB 2000
6060 IF tsc=hscr AND RND>.5 THEN  LET comb=i
6065 IF tsc>hscr THEN  LET hscr=tsc: LET comb=i
6070 NEXT i
6075 LET a$=d$(comb*fo+on TO comb*fo+fo): LET count=on
6080 FOR i=no TO th
6085 LET y$=y$+h$(VAL a$(i+on)*tw+on,on)+h$(VAL a$(i+on)*tw+tw,on)
6090 NEXT i: LET a$=e$(comb*tw+on TO comb*tw+tw)
6095 FOR i=no TO on
6100 LET h$(i*tw+on,th)=h$(VAL a$(i+on)*tw+on,on): LET h$(i*tw+tw,th)=h$(VAL a$(
i+on)*tw+tw,on)
6105 NEXT i
6110 FOR i=on TO ei: LET h$(i,on)=y$(i): NEXT i
6120 INPUT "Your discard:- "; LINE a$
6125 IF LEN a$<>tw OR NOT LEN a$ THEN  GO TO 6120
6135 IF a$(on)<"A" OR a$(on)>"F" OR a$(tw)<"A" OR a$(tw)>"F" OR a$(on)=a$(tw) TH
EN  GO TO 6120
6140 PRINT AT tw,fit;"                    ";AT th,14;"                   "
6145 LET h$(fi,th)=h$((CODE a$(on)-65)*tw+on,tw): LET h$(si,th)=h$((CODE a$(on)-
65)*tw+tw,tw): LET h$(se,th)=h$((CODE a$(tw)-65)*tw+on,tw): LET h$(ei,th)=h$((CO
DE a$(tw)-65)*tw+tw,tw)
6150 LET count=on: FOR i=no TO fi
6155 IF i=CODE a$(on)-65 OR i=CODE a$(tw)-65 THEN  GO TO 6165
6160 LET h$(count,tw)=h$(i*tw+on,tw): LET h$(count+on,tw)=h$(i*tw+tw,tw): LET co
unt=count+tw
6165 NEXT i
6170 FOR i=no TO th
6172 LET co=no: IF h$(i*tw+tw,tw)<"♠" THEN  LET co=tw
6175 PRINT AT tw,18+i*th; PAPER se; INK co;h$(i*tw+on,tw);h$(i*tw+tw,tw)
6177 PRINT AT th,17+i*th;"-";CHR$ (65+i);"-"
6180 NEXT i: IF deal+on THEN  PRINT )no;"   Press any key for turn up": PAUSE no
: INPUT ""
6185 LET tu=INT (RND*(LEN c$/tw-on)): LET f$=c$(tu*tw+on TO tu*tw+tw): LET c$=c$
( TO tu*tw)+c$(tu*tw+th TO )
6190 LET co=no: IF f$(tw)<"♠" THEN  LET co=tw
6195 PRINT  PAPER se; INK co;AT fi,14;f$
6200 IF f$(on)<>"J" THEN  RETURN
6205 IF deal+on THEN  PRINT )no;"You score ""two for his heel.""": PAUSE hun: IN
PUT "": LET inc=tw: GO SUB 150: RETURN
6210 PRINT )no;"I score ""two for his heel.""": PAUSE hun: INPUT "": LET inc=tw:
 GO SUB 175
6995 RETURN
6997 REM ***********************
6998 REM ***Rules etc.       ***
6999 REM ***********************
7000 CLS
7005 LET dx=on: LET ink=on: PRINT AT tw,no; PAPER no; INK on;g$
7010 PRINT 'TAB 25; 1984"''"Written by;"''"   Michael Williams"''''"Press an
y key for instructions  (press P to play)"
7015 PRINT AT tw,no; PAPER no; INK ink;g$
7020 PAUSE th: IF LEN INKEY$ THEN  GO TO 7035
7025 LET ink=ink+dx: IF ink<tw OR ink>si THEN  LET dx=dx*-on
7030 GO TO 7015
7035 IF INKEY$<>"P" THEN  GO TO 7050
7040 IF LEN INKEY$ THEN  GO TO 7040
7045 RETURN
7050 CLS : PRINT '" INSTRUCTIONS FOR PLAYING CRIB"'" -------------------------
--"
7055 PRINT ''" This program plays a basic formof the game of CRIBBAGE ie-six  ca
rds are dealt, four cards in  hand and crib, the winner is thefirst person to re
ach 121 pointsor more."
7060 PRINT '" These instructions are not in- tended to be a comprehensive setfor
 playing crib, but the basicsso as to be able to use this    program. Your skill
 will improvethe more you play! Alternativelythere are books on the market   tha
t go into detail."
7065 PRINT )no;"  Press any key to continue.": PAUSE no: INPUT "": CLS
7070 PRINT "The Basic Game Details"'"----------------------"
7075 PRINT '" Initially you will be dealt sixcards from which you will have  to
pick two cards to put in the CRIB (of which more later)."
7080 PRINT '" When deciding which cards to   keep the basic idea is to keep  the
 most points in your hand    based on the following:-"
7085 PRINT '"Scoring;"'"--------"
7090 PRINT "Pairs  - score 2 for each pair,"'"15's   - score 2 for each total
     of fifteen possible,"'"Runs   - score for number of          cards in
each run,"'"Flushs - score 4 or 5."
7095 PRINT )no;"  Press any key to continue.": PAUSE no: INPUT "": CLS
7100 PRINT "Basic Rules;(contd)"'"-------------------"
7105 PRINT '" Then a card will be cut from  the remaining pack called the   TUR
N-UP. This card is included  when scoring the hands. If it isa Jack, you or the
Spectrum will score 2 points."
7110 PRINT '" After cutting for the Turn-Up  you will then play a hand. The  han
d consists of playing your   cards in any order. A running   total is kept of th
e pips (10   for a picture card)."
7115 PRINT '" The total cannot exceed 31 and if you cannot play a card with- out
 doing this you pass."
7120 PRINT )no;"  Press any key to continue.": PAUSE no: INPUT "": CLS
7125 PRINT "Basic Rules;(contd)"'"-------------------"
7130 PRINT '" If the total reaches 31 or    neither player can go then     poi
nts are scored- 2 for a totalof 31, or 1 for playing the lastcard and the total
is reset."
7135 PRINT '" Points are also scored if the  total is 15 or if the card play-ed
makes a pair with the last   one played."
7140 PRINT '" Then the hands are scored for  pairs, fifteens, runs, & flusheswit
h the Turn-Up being a fifth  card. The crib is also scored   and alternates betw
een the        players."
7145 PRINT )no;"  Press any key to continue.": PAUSE no: INPUT "": CLS
7150 PRINT "Key Inputs"'"----------"
7155 PRINT '" When you are prompted for your discard all you have to do is   ent
er the letters under the two cards you don't want, and press enter."
7160 PRINT '" While playing the hand to play a card you do the same ie- type the
 letter under the card and   press enter. If you have to passthen just press ent
er by itself."
7165 PRINT '" The rest of the time you will  just be prompted to hit any key whe
n you are ready!"
7170 PRINT '" The best way to improve your   game is to play again and again and
 again and again....."
7175 PRINT )no;"  Press any key to continue.": PAUSE no: INPUT "": CLS
7180 PRINT "Those are the basic outlines on how to play a game of crib."''"Do yo
u wish to see them again?  (Press Y or N)"
7185 PAUSE no: IF INKEY$="Y" THEN  GO TO 7050
7190 PRINT ''" Good luck player, and no cheat-ing!!": PAUSE hun
7200 RETURN
7997 REM ***********************
7998 REM ***Wisecracks etc.  ***
7999 REM ***********************
8000 IF spsc=plsc AND cou>th THEN  GO TO 8300
8002 IF spsc=plsc THEN  RETURN
8005 IF spsc>plsc THEN  GO TO 8250
8010 LET dif=plsc-spsc
8015 IF dif<=ten AND 121-plsc>twe AND msg<>on THEN  LET msg=on: PRINT )no;"It's
 anyones game.": PAUSE hun: INPUT "": RETURN
8020 IF dif>ten AND dif<thon AND 121-plsc>twe AND msg<>tw THEN  LET msg=tw: PRIN
T )no;"Is it worth me continuing !!": PAUSE hun: INPUT "": RETURN
8025 IF dif>=thon AND dif<=60 AND msg<>th THEN  LET msg=th: PRINT )no;"I might a
s well give up,oh well.": PAUSE hun: INPUT "": RETURN
8035 IF dif>60 AND msg<>fo THEN  LET msg=fo: PRINT )no;"How about a game of poke
r ??": PAUSE hun: INPUT ""
8040 IF 121-plsc>twe THEN  RETURN
8045 IF dif<=fit AND dif>fi AND deal+on THEN  PRINT )no;"Your in a strong positi
on (sob)!": PAUSE hun: INPUT "": RETURN
8050 IF dif<=fit AND dif>fi THEN  PRINT )no;"I'm close behind you !!": PAUSE hun
: INPUT "": RETURN
8055 IF dif<=fi AND msg<>fi THEN  LET msg=fi: PRINT )no;"It's gonna be a close f
inish !": PAUSE hun: INPUT "": RETURN
8060 IF dif>fit AND msg<>si THEN  LET msg=si: PRINT )no;"I'm only playing to ple
ase you..": PAUSE hun: INPUT ""
8065 RETURN
8250 LET dif=spsc-plsc
8255 IF dif<=ten AND 121-spsc>twe AND msg<>-on THEN  LET msg=-on: PRINT )no;"It'
s anyones game.": PAUSE hun: INPUT "": RETURN
8260 IF dif>ten AND dif<thon AND 121-spsc>twe AND msg<>-tw THEN  LET msg=-tw: PR
INT )no;"Can't see me for the dust eh ??": PAUSE hun: INPUT "": RETURN
8265 IF dif>=thon AND dif<=60 AND msg<>-th THEN  LET msg=-th: PRINT )no;"My ego
has gone up 10 points !": PAUSE hun: INPUT "": RETURN
8270 IF dif>60 AND msg<>-fo THEN  LET msg=-fo: PRINT )no;"Pity you can't resign,
 isn't it!": PAUSE hun: INPUT ""
8275 IF 121-spsc>twe THEN  RETURN
8280 IF dif<=fit AND dif>fi AND deal-on THEN  PRINT )no;"I'm in a strong positio
n(yaboo)!": PAUSE hun: INPUT "": RETURN
8285 IF dif<=fit AND dif>fi THEN  PRINT )no;"Yikes, your close behind !": PAUSE
hun: INPUT "": RETURN
8290 IF dif<=fi AND msg<>-fi THEN  LET msg=-fi: PRINT )no;"It's gonna be a close
 finish !": PAUSE hun: INPUT ""
```

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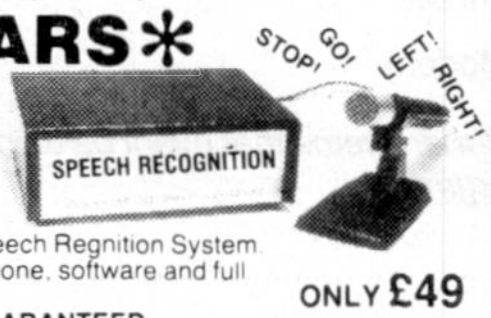

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```
8295 IF dif>fit AND msg<>-si THEN  LET msg=-si: PRINT )no;"This is oh so easy ..
8296 PAUSE hun: INPUT ""
8297 RETURN
8300 IF cou/tw=INT (cou/tw) THEN  PRINT )no;"Evens so far, a good game.": PAUSE
hun: INPUT "": RETURN
8305 IF deal=on THEN  PRINT )no;"I've been slipping!": PAUSE hun: INPUT "": RETU
RN
8310 PRINT )no;"Watch out, here I come...": PAUSE hun: INPUT "": RETURN
8497 REM ************************
8498 REM ***Main routine     ***
8499 REM ************************
8500 BORDER 4: PAPER 4: INK 0: CLS : GO SUB 9500: LET msg=no
8502 GO SUB 7000
8505 CLS : PRINT )no;" Press any key to cut for crib  ": PAUSE no: INPUT "": RAN
DOMIZE
8510 LET yc=INT (RND*52): LET s$( TO tw)=c$(yc*tw+on TO yc*tw+tw)
8511 PRINT '''"You cut the ";
8512 LET co=99: IF s$(tw)<"4" THEN  LET co=tw
8513 PRINT PAPER se; INK co;s$( TO tw)
8514 LET sc=INT (RND*52): IF sc=yc THEN  GO TO 8514
8515 LET s$(th TO )=c$(sc*tw+on TO sc*tw+tw)
8516 PRINT '"I cut the ";
8517 LET co=99: IF s$(fo)<"4" THEN  LET co=tw
8518 PRINT PAPER se; INK co;s$(th TO fo)
8520 LET ta=no: IF s$(on)="A" THEN  LET ta=on
8525 IF s$(on)="0" THEN  LET ta=ten
8530 IF s$(on)="J" THEN  LET ta=11
8535 IF s$(on)="Q" THEN  LET ta=12
8540 IF s$(on)="K" THEN  LET ta=13
8545 IF NOT ta THEN  LET ta=VAL s$(on)
8550 LET tb=no: IF s$(th)="A" THEN  LET tb=on
8555 IF s$(th)="0" THEN  LET tb=ten
8560 IF s$(th)="J" THEN  LET tb=11
8565 IF s$(th)="Q" THEN  LET tb=12
8570 IF s$(th)="K" THEN  LET tb=13
8575 IF NOT tb THEN  LET tb=VAL s$(th)
8580 IF ta=tb THEN  PRINT '''It's a draw!!";)no;" Press any key to cut for crib
": PAUSE no: INPUT "": CLS : GO TO 8510
8585 LET deal=on: LET f$="your": IF tb>ta THEN  LET deal=-on: LET f$="my"
8590 PRINT '"It's ";f$;" crib."
8591 PAUSE two: LET cou=on
8592 GO SUB 100: CLS : GO SUB 300: GO TO 8600
8595 LET cou=cou+on: GO SUB 100: PRINT AT fi,14;"  ": FOR i=14 TO 21: PRINT AT i
,no;"                ": NEXT i
8600 IF deal+on THEN  GO TO 8605
8602 PRINT AT no,no;"      "; INK se; PAPER on;"MY CRIB"; PAPER fo;"

8604 GO TO 8610
8605 PRINT AT no,no;"                    "; INK se; PAPER on;"YOUR CRIB"
8610 GO SUB 6000
8615 GO SUB 4000
8620 GO SUB 5000: PAUSE two
8625 IF NOT mflg THEN  GO SUB 8000: LET deal=deal*-on: PRINT )no;"Press any key
for next hand.": PAUSE no: INPUT "": GO TO 8595
8630 PRINT )no;"Press any key to continue.": PAUSE no: INPUT ""
8635 CLS : IF mflg=on THEN  PRINT '''Hard luck-I won.": GO TO 8645
8640 PRINT '''Well done-you won!"
8645 PRINT '''Do you want another game(Y or N)"
8650 LET msg=no: LET mflg=no: LET plsc=no: LET spsc=no
8655 PAUSE no: IF INKEY$="N" OR INKEY$="n" THEN  GO TO 8502
8660 GO TO 8505
8997 REM ************************
8998 REM ***Score 5 card hand***
8999 REM ************************
9000 LET ta=no: LET ts=ta: LET tb=ta: LET tc=ta: LET td=ta: LET te=ta: LET tsc=t
a: IF s$(tw)=s$(ten) AND s$(on)="J" OR s$(fo)=s$(ten) AND s$(th)="J" OR s$(si)=s
$(ten) AND s$(fi)="J" OR s$(ei)=s$(ten) AND s$(se)="J" THEN  PRINT )no;m$;" scor
e one for his nob.""": PAUSE hun: INPUT "": LET tsc=on
9002 IF s$(tw)=s$(fo) AND s$(fo)=s$(si) AND s$(si)=s$(ei) AND s$(ei)=s$(ten) THE
N  LET tsc=tsc+fi: PRINT )no;m$;" score 5 for a flush!": PAUSE hun: INPUT "": GO
 TO 9060
9005 IF s$(tw)=s$(fo) AND s$(fo)=s$(si) AND s$(si)=s$(ei) THEN  LET tsc=tsc+fo:
PRINT )no;m$;" score 4 for a flush!": PAUSE hun: INPUT ""
9010 IF s$(on)=s$(th) THEN  LET ts=ts+tw
9015 IF s$(on)=s$(fi) THEN  LET ts=ts+tw
9020 IF s$(on)=s$(se) THEN  LET ts=ts+tw
9025 IF s$(on)=s$(ni) THEN  LET ts=ts+tw
9030 IF s$(th)=s$(fi) THEN  LET ts=ts+tw
9035 IF s$(th)=s$(se) THEN  LET ts=ts+tw
9040 IF s$(th)=s$(ni) THEN  LET ts=ts+tw
9045 IF s$(fi)=s$(se) THEN  LET ts=ts+tw
9050 IF s$(fi)=s$(ni) THEN  LET ts=ts+tw
9055 IF s$(se)=s$(ni) THEN  LET ts=ts+tw
9057 IF ts THEN  PRINT )no;m$;" score ";ts;" for pairs!": PAUSE hun: LET tsc=tsc
+ts: INPUT "": LET ts=no
9060 IF s$(on)="A" THEN  LET ta=on
9065 IF s$(on)>"A" THEN  LET ta=ten
9070 IF NOT ta THEN  LET ta=VAL s$(on)
9075 IF s$(th)="A" THEN  LET tb=on
9080 IF s$(th)>"A" THEN  LET tb=ten
9085 IF NOT tb THEN  LET tb=VAL s$(th)
9090 IF s$(fi)="A" THEN  LET tc=on
9095 IF s$(fi)>"A" THEN  LET tc=ten
9100 IF NOT tc THEN  LET tc=VAL s$(fi)
9105 IF s$(se)="A" THEN  LET td=on
9110 IF s$(se)>"A" THEN  LET td=ten
9115 IF NOT td THEN  LET td=VAL s$(se)
9120 IF s$(ni)="A" THEN  LET te=on
9125 IF s$(ni)>"A" THEN  LET te=ten
9130 IF NOT te THEN  LET te=VAL s$(ni)
9135 IF ta+tb=fit THEN  LET ts=ts+tw
9140 IF ta+tc=fit THEN  LET ts=ts+tw
9145 IF ta+td=fit THEN  LET ts=ts+tw
9150 IF ta+te=fit THEN  LET ts=ts+tw
9155 IF tb+tc=fit THEN  LET ts=ts+tw
9160 IF tb+td=fit THEN  LET ts=ts+tw
9165 IF tb+te=fit THEN  LET ts=ts+tw
9170 IF tc+td=fit THEN  LET ts=ts+tw
9175 IF tc+te=fit THEN  LET ts=ts+tw
9180 IF td+te=fit THEN  LET ts=ts+tw
9185 IF ta+tb+tc=fit THEN  LET ts=ts+tw
9190 IF ta+tb+td=fit THEN  LET ts=ts+tw
9195 IF ta+tb+te=fit THEN  LET ts=ts+tw
9200 IF ta+tc+td=fit THEN  LET ts=ts+tw
9205 IF ta+tc+te=fit THEN  LET ts=ts+tw
9210 IF ta+td+te=fit THEN  LET ts=ts+tw
9215 IF tb+tc+td=fit THEN  LET ts=ts+tw
9220 IF tb+tc+te=fit THEN  LET ts=ts+tw
9225 IF tb+td+te=fit THEN  LET ts=ts+tw
9230 IF tc+td+te=fit THEN  LET ts=ts+tw
9235 IF ta+tb+tc+td=fit THEN  LET ts=ts+tw
9240 IF ta+tb+tc+te=fit THEN  LET ts=ts+tw
9245 IF ta+tb+td+te=fit THEN  LET ts=ts+tw
9250 IF ta+tc+td+te=fit THEN  LET ts=ts+tw
9255 IF tb+tc+td+te=fit THEN  LET ts=ts+tw
9257 IF ts THEN  PRINT )no;m$;" score ";ts;" for fifteens!": PAUSE hun: LET tsc=
tsc+ts: INPUT "": LET ts=no
9259 LET ta=no: LET tb=ta: LET tc=ta: LET td=ta: LET te=ta: LET flg=ta
9260 IF s$(on)="A" THEN  LET ta=on
9265 IF s$(on)="0" THEN  LET ta=ten
9270 IF s$(on)="J" THEN  LET ta=11
9280 IF s$(on)="Q" THEN  LET ta=12
9285 IF NOT ta THEN  LET ta=VAL s$(on)
9290 IF s$(th)="A" THEN  LET tb=on
9295 IF s$(th)="0" THEN  LET tb=ten
9300 IF s$(th)="J" THEN  LET tb=11
9305 IF s$(th)="Q" THEN  LET tb=12
9310 IF s$(th)="K" THEN  LET tb=13
9315 IF NOT tb THEN  LET tb=VAL s$(th)
9320 IF s$(fi)="A" THEN  LET tc=on
9325 IF s$(fi)="0" THEN  LET tc=ten
9330 IF s$(fi)="J" THEN  LET tc=11
9335 IF s$(fi)="Q" THEN  LET tc=12
9340 IF s$(fi)="K" THEN  LET tc=13
9345 IF NOT tc THEN  LET tc=VAL s$(fi)
9350 IF s$(se)="A" THEN  LET td=on
9355 IF s$(se)="0" THEN  LET td=ten
9360 IF s$(se)="J" THEN  LET td=11
9365 IF s$(se)="Q" THEN  LET td=12
9370 IF s$(se)="K" THEN  LET td=13
9375 IF NOT td THEN  LET td=VAL s$(se)
9380 IF s$(ni)="A" THEN  LET te=on
9385 IF s$(ni)="0" THEN  LET te=ten
9390 IF s$(ni)="J" THEN  LET te=11
9395 IF s$(ni)="Q" THEN  LET te=12
9400 IF s$(ni)="K" THEN  LET te=13
9405 IF NOT te THEN  LET te=VAL s$(ni)
9410 IF ta+tb THEN  LET t=ta: LET ta=tb: LET tb=t
9412 IF ta+tc THEN  LET t=ta: LET ta=tc: LET tc=t
9414 IF ta+td THEN  LET t=ta: LET ta=td: LET td=t
9416 IF ta+te THEN  LET t=ta: LET ta=te: LET te=t
9418 IF tb+tc THEN  LET t=tb: LET tb=tc: LET tc=t
9420 IF tb+td THEN  LET t=tb: LET tb=td: LET td=t
9422 IF tb+te THEN  LET t=tb: LET tb=te: LET te=t
9424 IF tc+td THEN  LET t=tc: LET tc=td: LET td=t
9426 IF tc+te THEN  LET t=tc: LET tc=te: LET te=t
9428 IF td+te THEN  LET t=td: LET td=te: LET te=t
9430 IF ta+tb-on AND tb+tc-on AND tc+td-on AND td+te-on THEN  LET tsc=tsc+fi: PR
INT )no;m$;" score 5 for a run!": PAUSE hun: INPUT "": RETURN
9432 IF ta+tb-on AND tb+tc-on AND tc+td-on THEN  LET ts=ts+fo: LET flg=ta
9434 IF ta+tb-on AND tb+tc-on AND tc+te-on THEN  LET ts=ts+fo: LET flg=ta
9436 IF ta+tb-on AND tb+td-on AND td+te-on THEN  LET ts=ts+fo: LET flg=ta
9438 IF ta+tc-on AND tc+td-on AND td+te-on THEN  LET ts=ts+fo: LET flg=ta
9440 IF tb+tc-on AND tc+td-on AND td+te-on THEN  LET ts=ts+fo: LET flg=ta
9444 IF flg THEN  PRINT )no;m$;" score ";ts;" for runs!": PAUSE hun: LET tsc=tsc
+ts: INPUT "": RETURN
9442 IF ta+tb-on AND tb+tc-on THEN  LET ts=ts+th
9444 IF ta+tb-on AND tb+td-on THEN  LET ts=ts+th
9446 IF ta+tb-on AND tb+te-on THEN  LET ts=ts+th
9448 IF ta+tc-on AND tc+td-on THEN  LET ts=ts+th
9450 IF ta+tc-on AND tc+te-on THEN  LET ts=ts+th
```

PROGRAM FILE

```
9452 IF ta=td-on AND td=te-on THEN  LET ts=ts+th
9454 IF tb=tc-on AND tc=td-on THEN  LET ts=ts+th
9455 IF tb=tc-on AND tc=te-on THEN  LET ts=ts+th
9456 IF tb=td-on AND td=te-on THEN  LET ts=ts+th
9458 IF tc=td-on AND td=te-on THEN  LET ts=ts+th
9460 IF ts THEN  PRINT "no;m$;" score ";ts;" for runs!": PAUSE hun: LET tsc=tsc+
ts: INPUT ""
9462 RETURN
9497 REM ************************
9498 REM ***Set up variables ***
9499 REM ************************
9500 POKE 23658,8: DIM s$(10): DIM h$(12,3)
9502 LET m=0
9505 LET c$="54J♠3♠4♠8♥J♥3♠2♠0♠3♥6♦K♥0♠5♠8♦J♠0♦A♦J♦6♠A♠2♥0♠8♠9♥K♠3♠0♥5
♠A♥2♠2♠9♦K
9510 LET d$="0123012401250134013501450234023502450345123412351245134523 45"
9515 LET e$="4595945252345134134120504030201"
9520 FOR i=USR "a" TO USR "a"+7: READ a: POKE i,a: NEXT i
9525 LET thon=31: LET twe=20: LET fif=15: LET si=6: LET ei=8: LET ni=9: LET ten=
10: LET fo=4: LET fi=5: LET se=7: LET hun=100: LET lcard=0: LET no=0: LET th=3:
LET on=1: LET tw=2: LET spsc=0: LET plsc=spsc
9550 LET g$="
                                                                    "
9600 RETURN
9800 REM ************************
9805 REM ***    UDG's A=♥     ***
9810 REM *** B=♦ C=♣ D=♠ E=● ***
9815 REM ************************
9900 DATA BIN 00111110,BIN 01111111,a,BIN 00111110,a,BIN 00011100,BIN 00001000
9905 DATA BIN 00001000,BIN 00011100,BIN 00111110,BIN 01111111,a,BIN 00111110,BIN
 00011100,BIN 00001000
9910 DATA BIN 00001000,BIN 00011100,BIN 00111110,BIN 01111111,a,BIN 00101010,BIN
 00001000,a
9915 DATA BIN 00001000,BIN 00011100,BIN 00001000,BIN 00101010,BIN 01111111,BIN 0
0101010,BIN 00001000,a
9920 DATA 0,BIN 10011100,BIN 10100110,BIN 10101010,a,BIN 10110010,BIN 10011100,0
9999 SAVE "crib 1.1" : PRINT "01 FLASH 1;"                    Rewind tape!          : PAUS
E 0: INPUT "": VERIFY "crib 1.1"
```

Commodore 64 Sprite Editor

by Robert Whittaker

This useful utility allows the user to create and store up to 55 sprite patterns, which can be either created from scratch or edited at a later date.

The sprite you wish to work on is selected by entering a block number between 200 and 255; this loads the block of data into the editor frame where it can be easily created or altered. This is simply done using the cursor keys and the 'A' key to set a pixel in the sprite pattern, and the space bar to erase a pixel previously set.

Other options available in this menu-driven program include the facility to load and save sprite data from tape, and inversion of an existing sprite to form another one.

```
  5   POKE55,194:POKE56,49:CLR
 10   DIMP$(21):POKE649,1:V=53248:POKEV+32,0:POKEV+33,0:GOSUB1500
 15   PRINT"(CLR)(RVS)(BLU)                                        ";
 20   POKEV+21,0:PRINT"(RVS)(PUR)          SPRITE EDITOR                ";
 25   PRINT"(RVS)(BLU)                                          (GRN)";
 30   PRINT"(RVO)(CUD)(CUD)LAST DATA BLOCK WORKED ON=";B;CHR$(13);"LAST LOAD/
      SAVE BLOCK = ";B1
 35   PRINT"(CUD)(RVS)(BLU)1.(GRN)(RVO)ENTER EDITOR";CHR$(13);"(RVS)(BLU)2.
      (GRN)(RVO)DISPLAY LAST SPRITE";CHR$(13);
 40   PRINT"(RVS)(BLU)3.(GRN)(RVO)DISPLAY ANY DATA BLOCK";CHR$(13);
      "(RVS)(BLU)4.(GRN)(RVO)SEE DATA FOR ANY BLOCK";
 42   PRINT CHR$(13);"(RVS)(BLU)5.(GRN)(RVO)INVERSE SPRITE";
      CHR$(13);"(RVS)(BLU)6.(GRN)(RVO)ANIMATE SPRITE";
 45   PRINT CHR$(13);"(RVS)(BLU)7.(GRN)(RVO)LOAD SPRITE DATA FROM TAPE";
      CHR$(13);"(RVS)(BLU)8.(GRN)(RVO)";
 48   PRINT"SAVE SPRITE DATA TO TAPE";CHR$(13);"(RVS)(BLU)9.(GRN)(RVO)
      EXIT EDITOR"
 50   PRINT:PRINT:PRINT "(PUR)PRESS APPROPRIATE KEY": GOTO227
 90   :
 91   :
 92   :
 95   PRINT"(CLR)"
100   PRINT"(GRN)BLOCK TO WORK ON?":GOSUB 270:GOSUB 300
115   B=BL:X=24:Y=74:POKEV+21,61:CHAR =160:FG=0:POKEV,X:POKEV+1,Y
118   GOSUB 200
120   IFX>211ORX<24 THENX=PEEK(V)
125   IFY>234ORY<74 THENY=PEEK(V+1)
128   POKEV,X:POKEV+1,Y
130   IFFG=1 THENGOSUB160
133   IFFG=2 THENGOTO352
135   IFFG=3 THENGOTO15
155   GOTO118
160   XX%=(X-12)/8:YY%=(Y-46)/8:S=1024+XX%+40*YY%:POKES,CHAR:POKES+54272,2:
      FG=0
165   RETURN
170   :
175   :
176   :
200   GETK$:IFK$=""THEN200
205   IFK$="(CUL)"THENX=X-8:RETURN
208   IFK$="(CUR)"THENX=X+8:RETURN
210   IFK$="(CUP)"THENY=Y-8:RETURN
215   IFK$="(CUD)"THENY=Y+8:RETURN
218   IFK$="A"THENCHAR=160:FG=1:RETURN
220   IFK$="(SPC)"THENCHAR=32:FG=1:RETURN
222   IFK$=CHR$(13)THENFG=3:RETURN
225   IFK$="(F1)"THEN PRINT"(HOM)(BLU)(RVS)CREATE SPRITE":FG=2:RETURN
226   RETURN
227   GETK$:IFK$=""THEN227
228   IFK$="1"THEN95
230   IFK$="2"THENFG=4:PRINT"(CLR)(GRN)BLOCK TO WORK ON?":GOSUB270:
      GOSUB300
235   IFK$="3"THEN600
237   IFK$="4"THEN502
238   IFK$="5"THEN705
239   IFK$="6"THEN875
240   IFK$="7"THEN820
249   IFK$="8"THEN858
250   IFK$="9"THENEND
253   GOTO227
254   :
255   :
256   :
270   INPUT"(PUR)(RVS)BLOCK(RVO)";BL$:BL$=LEFT$(BL$,3):BL=VAL(BL$)
272   IFBL>255ORBL<200THEN PRINT"OUT OF RANGE"          ":GOTO 270
275   RETURN
```


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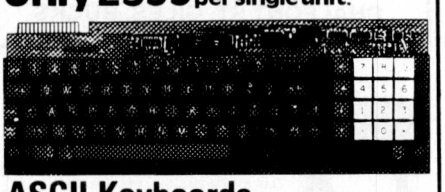

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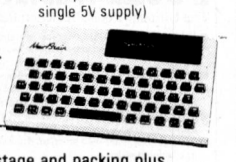

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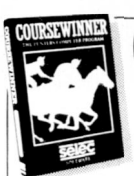

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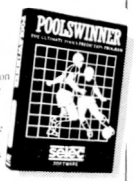

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PROGRAM FILE

```
 276  :
 277  :
 278  :
 280  PRINT"(GRN)O,K,FINISHED,ANY KEY RETURNS TO MENU":POKE198,0:WAIT
      198,1:RETURN
 290  :
 291  :
 292  :
 300  PRINT"(CLR)(CUD)(CUD)(GRN)";FORL=0TO18:PRINTTAB(28)"(RVS)              "
      NEXTL:PRINT"(MOM)(CUD)(CUD)(BLU)";
 318  PRINT"(RVS)                              ":FORL=0TO20
 320  PRINT"(RVS)(SPC)(RVO)                              (RVS)(RVO)";"(CUR)
      (CUR)(CUR)(CUR)(CUR)(CUR)(CUR)(CUR)(CUR)(CUR)(CUR)(CUR)":NEXTL
 330  PRINT"(RVS)                              ";
 335  PRINT"(HOM)";"(RVS)(BLU)PLOT";"                              BLOCK";BL;
      "(CUL)  "
 338  IFFG=4THENGOTO345
 340  RETURN
 345  PRINT"(HOM)(CUD)(CUD)(CUD)(RED)";FORL=0TO20:PRINT"(CUR);P$(L):
      NEXTL:FG=0:GOTO115
 349  :
 350  :
 351  :
 352  M=BL*64:R=0:FORL=0TO20:P$(L)="":NEXTL:FORL=0TO62:POKEM+L,0:NEXTL
 353  FORRY=0TO20:YY=1145+40*RY:RX=0
 365  FORC=0TO2
 368  FORN=7TO0STEP-1:P=PEEK(YY+RX)
 370  IFP=160THENPOKEM,(PEEK(M)+2↑N)AND255:P$(R)=P$(R)+"(RVS)(SPC)(RVO)"
 400  IFP=32THENP$(R)=P$(R)+" "
 402  RX=RX+1:NEXTN:M=M+1:NEXTC:R=R+1:NEXTRY
 405  FORC=0TO3:POKE2042+C,BL:NEXTC
 450  PRINT"(HOM)(CUD)";:GOSUB280:GOTO15
 480  :
 485  :
 486  :
 502  PRINT"(CLR)(GRN)SEE DATA FOR WHICH BLOCK?"
 505  GOSUB270:M=BL*64:PRINT"(CUD)(CUD)";:FORL=MTOM+62:PRINT"(GRN)(CUR)";
      PEEK(L);",";
 508  NEXTL:PRINTCHR$(20);CHR$(13):GOSUB280:GOTO15
 575  :
 576  :
 578  :
 600  PRINT"(CLR)(GRN)DISPLAY WHICH BLOCK?":GOSUB270:M=BL*64:P=PEEK(M):
      POKEV+21,61:B=BL
 602  FORL=2042TO2045:POKEL,BL:NEXTC:GOSUB300: FORRY=0TO20:YY=1145+40*RY:
      RX=0
 605  FORC=0TO2:FORN=7TO0STEP-1
 618  IFP>=2↑NTHENP=P-2↑N:POKE54272+YY+RX,2:POKEYY+RX,160:
 625  RX=RX+1:NEXTN:M=M+1:P=PEEK(M):NEXTC: NEXTRY
 630  GOTO15
 700  :
 701  :
 702  :
 705  PRINT"(CLR)";"(GRN)INVERSE WHICH BLOCK?":GOSUB270:M=BL*64:B=BL
 710  FORL=MTOM+63:POKEL,255-PEEK(L):NEXTL
 720  GOSUB280:GOTO15
 800  :
 802  :
 803  :
 820  PRINT"(CLR)";(RVS)(GRN)LOAD DATA INTO WHICH BLOCK?":GOSUB270:
      M=BL*64:B1=BL
 825  OPEN1,1,0,"":FORL=0TO62:INPUT#1,X:POKEM,X:M=M+1:NEXTL:CLOSE1:
      GOSUB280
 850  GOTO15
 851  :
 852  :
 853  :
 858  PRINT"(CLR)";(RVS)(GRN)SAVE WHICH BLOCK?":GOSUB270:M=BL*64:
      B1=BL
 860  OPEN1,1,1,"SPRITE DATA":FORL=MTOM+63:X=PEEK(L):PRINT#1,X:NEXTL
 865  CLOSE1:GOSUB280:GOTO15
 868  :
 869  :
 870  :
 875  POKEV+21,0:PRINT"(CLR)(GRN)TYPE IN THE BLOCK NO'S YOU WISH
      TO     ANIMATE"
 876  PRINT"'E'STARTS/ENDS THE ANIMATION":PRINT"'SPACE' SLOWS ANIMATION"
 877  FORL=0TO10:GOSUB270:AN(L)=BL
 878  FORT=0TO500:NEXTT:GETK$:IFK$="E"THENP=L:GOTO880
 879  NEXTL:P=10
 880  INPUT"(RVS)(GRN)ENLARGE X,Y,NO,B(RVO)";OP$:OP$=LEFT$(OP$,1)
 881  IFOP$="X"THENPOKEV+29,1
 882  IFOP$="Y"THENPOKEV+23,1
 883  IFOP$="B"THENPOKEV+23,1:POKEV+29,1
 884  X=24:POKEV+1,140:R=0:POKEV+21,1
 885  POKE2040,AN(R):R=R+1:IFR>PTHENR=0
 886  IFX>320THENPOKEV+16,0:X=24
 888  POKEV+16,INT(X/256):POKEV,XAND255:X=X+2
 890  GETK$:IFK$="E"THEN900
 892  IFK$=" "THENGOSUB895
 893  FORT=0TO30:NEXTT:GOTO885
 895  FORT=0TO700:NEXT:RETURN
 900  POKEV+23,20:POKEV+29,24:GOSUB280:POKE2040,11:POKEV+16,60:
      X=24:POKEV,X
 905  GOTO15
1000  :
1001  :
1002  :
1500  POKEV+16,60:POKEV+39,4:FORL=41TO44:POKEV+L,6:NEXTL:POKEV+23,20:
      POKEV+29,24
1515  POKEV+4,10:POKEV+5,70:POKEV+6,10:POKEV+7,115:POKEV+8,10:POKEV+9,140
1518  POKEV+10,10:POKEV+11,188:POKE2040,11: FORL=704TO704+63:READDPOKEL,D:
      NEXTL
1530  RESTORE:RETURN
1535  DATA0,255,0,0,255,0,0,255,0,0,255,0,0,255,0,0,255,0,0,255,0,0,255,0
1540  DATA ,,,
```

PROGRAM FILE

Commodore 64 Mouse Master

by Stephen Howard

This program imitates an Apple-style computer mouse. Using a joystick to move a white cross around the screen, the user can select an option or screen position by pressing the fire button, thus eliminating the need to use the keyboard; this extends the versatility of the machine. A sprite is used instead of a cursor because it can move independently of any text or graphics and is unaffected by clearing the screen. The program is intended as a subroutine for the user to put in his own programs. To create or reset the mouse a GOSUB 40000 is executed. The mouse is then initialised, but is not displayed on the screen. After this initialisation the program will return to the user's program.

The second routine is enabled by a GOSUB 50000 and the user can then move a cross around the screen using the joystick, and can input a position, which is then returned to the user's program as screen coordinates in X1 and Y1. The user's program then interprets these as either positions in text, program options or whatever the program intended. Further GOSUB calls to 50000 will enable the user to move the mouse from its last position, and input a new position.

All the REMs in the program need not be typed. Turn off the sprite before saving the programs, as sprites can interfere with cassette operation.

By adding the line 30000 GOTO 52000 and lines from 52000 onwards, a small demonstration program is formed. This takes the form of a screen control menu, altering different attributes of the screen. After entering the time, you are given a menu from which you can choose items by moving anywhere within the surround and pressing the fire button.

```
40000 V=53248                          :REM START OF VIDEO CHIP
40001 JOY=56320                        :REM JOYSTICK PORT 2
40005 F=8                              :REM DISTANCE IN EACH MOVE  (TRY F=4)
40010 POKE2040,192                     :REM SPRITE POSITION IN MEMORY
40020 FORT=12285TO12338:POKET,0:NEXT   :REM CLEAR SPRITE MEMORY
40025 FORT=12320TO12338STEP3           :REM DEFINE SPRITE - CROSS SHAPE
40026 POKET,24:NEXT:POKE12323,255      :REM FINISH DEFINING SPRITE
40030 POKEV+39,1                       :REM SPRITE COLOUR - WHITE
40040 POKEV+21,0                       :REM TURN SPRITE OFF
40050 POKEV+1,42:POKEV,8:X=8:Y=42:     :REM POSITION SPRITE AT HOME POSITION
40055 RETURN                           :REM RETURN TO USERS PROGRAM
40060 :                                :
40061 :                                :
50000 POKEV+21,1                       :REM TURN ON SPRITE
50005 P=15-(PEEK(JOY)AND15)            :REM READ JOYSTICK
50010 IF(PAND1)THENY=Y-(1*F)           :REM JOYSTICK MOVED UP ?
50020 IF(PAND2)THENY=Y+(1*F)           :REM JOYSTICK MOVED DOWN ?
50030 IF(PAND4)THENX=X-(1*F)           :REM JOYSTICK MOVED LEFT ?
50040 IF(PAND8)THENX=X+(1*F)           :REM JOYSTICK MOVED RIGHT?
50043 IFX<8THENX=8                     :REM IS SPRITE OFF LEFT OF SCREEN ?
50044 IFX>320THENX=320                 :REM IS SPRITE OFF RIGHT OF SCREEN ?
50045 IFY<42THENY=42                   :REM IS SPRITE OFF TOP OF SCREEN ?
50046 IFY>234THENY=234                 :REM IS SPRITE OFF BOTTOM OF SCREEN ?
50050 POKEV+1,Y                        :REM POKE 'Y' CO-ORDINATE
50051 POKEV+16,1+(X<=255)              :REM POKE MSB OF 'X' CO-ORDINATE
50052 POKEV,X+(X)255)*255              :REM POKE 'X' CO-ORDINATE
50054 IF(PEEK(JOY)AND16)=0THEN50070    :REM IF FIRE PRESSED GOTO DECODE ROUTINE
50060 GOTO50005                        :REM START MOVEMENT LOOP AGAIN
50070 X1=X-8:Y1=Y-42                   :REM SUBTRACT ZERO OFFSETS
50080 Y1=INT(Y1/8+1)                   :REM WORK OUT 'Y' CO-ORDINATE
50081 X1=INT(X1/8+1)                   :REM WORK OUT 'X' CO-ORDINATE
50090 RETURN                           :REM RETURN TO USERS PROGRAM
50091 :                                :
50092 :                                :
52000 PRINT"JJ"                        :REM CLEAR SCREEN, TEXT LT.BLUE
52090 INPUT"JTIME:HH/MM/SS";TI$:       :REM INPUT THE TIME
52095 PRINT"J"                         :REM HOME
52100 PRINT"┌──────┐"                  :REM NOW THE 'ICONS'.THESE ARE THE
52110 PRINT"│  ┌─┐ │"                  :REM PICTURES ON THE SCREEN WHICH YOU USE
52120 PRINT"│  │L│ │"                  :REM TO SELECT THE OPTIONS.
52130 PRINT"│  └─┘ │"                  :REM
52131 PRINT"│      │"                  :REM THIS ONE IS A CLOCK!
52150 PRINT"│CLOCK │"                  :REM
52160 PRINT"└──────┘"                  :REM
52190 PRINT"■■■■■■■"                   :REM HOME, 6* CURSOR DOWN
52200 PRINTTAB(7);"┌──────┐"          :REM
52210 PRINTTAB(7);"│■■■■■■│"          :REM CTRL CYAN, SHIFT Q/W, CBM BLUE
52220 PRINTTAB(7);"│■■■■■■│"          :REM RVS DIAMOND IS CBM BLUE
52229 PRINTTAB(7);"│      │"          :REM
52230 PRINTTAB(7);"│CHANGE│"          :REM
52250 PRINTTAB(7);"│BORDOR│"          :REM
52260 PRINTTAB(7);"└──────┘"          :REM
52290 PRINT"■■■■■■■■■■■■■■■"          :REM HOME, 13* CURSOR DOWN
52300 PRINTTAB(15);"┌──────┐"        :REM
52310 PRINTTAB(15);"│▒▒▒▒▒▒│"        :REM CHEQUERS ARE CBM '£'
52320 PRINTTAB(15);"│▒▒▒▒▒▒│"        :REM
52329 PRINTTAB(15);"│      │"        :REM
52330 PRINTTAB(15);"│ LIST │"        :REM
52350 PRINTTAB(15);"│PROGRAM│"       :REM
52360 PRINTTAB(15);"└──────┘"        :REM
52370 :                                :
52390 GOSUB40000                       :REM DO SETTING UP
52400 GOSUB50000                       :REM GET A POSITION
52410 IFX1>8ANDX1<8ANDY1>8ANDY1<8THEN53000    :REM IN CLOCK POSITION ?
52420 IFX1>7ANDX1<16ANDY1>7ANDY1<15THEN53200  :REM IN BORDER CHANGE POSITION ?
52430 IFX1>15ANDX1<30ANDY1>14ANDY1<22THEN53400 :REM IN LIST POSITION ?
52440 GOTO52400                        :REM NOT IN POSITION - TRY AGAIN ?
52999 :                                :REM PRINT TIME ROUTINE
53000 PRINT"■■■■■■■■■■■■■■■■■■■■■";    :REM ) POSITION CURSOR. 23* CURSOR DOWN
53001 PRINT"■■■■■■■■■■■■■■■";          :REM ) POSITION CURSOR. 12* CURSOR RIGHT
53020 PRINTMID$(TI$,1,2)":";           :REM PRINT HOURS
53030 PRINTMID$(TI$,3,2)":";           :REM PRINT MINUTES
53040 PRINTMID$(TI$,5,2)":";           :REM PRINT SECONDS
53050 GOTO52400                        :REM FINISHED - START AGAIN
53199 :                                :REM BORDER CHANGE ROUTINE
```


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PROGRAM FILE

```
53200 B=B+1:IFB>15THENB=0          :REM NEXT COLOUR
53210 POKE53280,B                  :REM POKE COLOUR
53220 GOTO52400                    :REM FINISHED - START AGAIN
53400 :                            :REM LIST PROGRAM ROUTINE
53401 PRINT"Q"                     :REM CLEAR SPACE TO PRINT THE LIST COMMAND
53402 POKE631,ASC("L")             :REM PUT 'L' IN KEYBOARD BUFFER
53410 POKE632,ASC("I")             :REM PUT 'I' IN KEYBOARD BUFFER
53420 POKE633,ASC("S")             :REM PUT 'S' IN KEYBOARD BUFFER
53430 POKE634,ASC("T")             :REM PUT 'T' IN KEYBOARD BUFFER
53440 POKE635,13                   :REM PUT 'RETURN' IN KEYBOARD BUFFER
53450 POKE198,5                    :REM TOTAL OF 5 CHARACTERS IN BUFFER
53455 POKEV+21,0                   :REM TURN OFF SPRITE
53460 END                          :REM ABORT PROGRAM TO ALLOW LISTING
READY.
```



Spectrum Battle Stations

by Robert Higgins

An arcade-type game written in Sinclair Basic. You are a fighter pilot and the object is to shoot down the enemy aircraft. If 10 aircraft fly past you, your aerodrome will be bombed and destroyed.

```
    1 REM "BATTLE STATIONS"
    2 REM BY ROBERT HIGGINS
    3 GO SUB 5000
    4 GO SUB 4000
    5 POKE 23658,0  LET y=16: LET
 x=11:
    6 LET diff=.2: LET num=10: LE
T ax=3: LET ay=INT (RND*25)
    8 LET score=0: LET hiscore=10
00: LET A$="HIGGINS": LET s$="WI
NG COMMANDER": LET ammo=100:
    9 LET wave=0: LET tan=0: LET
shot=0: BORDER 1: PAPER 5: INK 0
: CLS
   10 GO SUB 8000
  102 PRINT AT x-1,y;"   "
  105 PRINT AT x,y-1;"   "
  110 PRINT AT x+1,y-1;"   "
  115 PRINT AT x,y+2;"   "
  120 PRINT AT x+2,y;"   "
  125 PRINT AT x+1,y+2;"   "
  130 IF INKEY$="p" AND y<29 THEN
 LET y=y+1: PRINT AT x,y;"   "
  135 IF INKEY$="P" AND y<29 THEN
 LET y=y+2: PRINT AT x,y;"   "
  140 IF INKEY$="o" AND y>2 THEN
LET y=y-1
  145 IF INKEY$="O" AND y>2 THEN
LET y=y-2
  150 IF INKEY$="z" AND x<12 THEN
 LET x=x+1
  155 IF INKEY$="Z" AND x<12 THEN
 LET x=x+2
  160 IF INKEY$="q" AND x>2 THEN
LET x=x-1
  165 IF INKEY$="Q" AND x>2 THEN
LET x=x-2
  180 PRINT AT INT ax,INT ay;"   "
  190 PRINT AT INT ax+1,INT ay;"
"
  195 INK 0
  200 PRINT AT x-1,y; OVER 1;"▽"
  210 PRINT AT x,y-1; OVER 1;"N"
  215 PRINT AT x+1,y-1; OVER 1;"V
"
  220 PRINT AT x,y+2; OVER 1;"△"
  225 PRINT AT x+2,y; OVER 1;"△"
  230 PRINT AT x+1,y+2; OVER 1;"N
"
  240 IF INKEY$="m" THEN FOR n=1
TO 3: BEEP .3,-40+n: NEXT n: LET
 ammo=ammo-2: IF x=INT ax AND y=
INT ay THEN GO SUB 1000
  241 IF INKEY$="M" THEN FOR n=1
TO 3: BEEP .3,-40+n: NEXT n: LET
 ammo=ammo-2: IF x=INT ax AND y=
INT ay THEN GO SUB 1000
  242 IF ammo<=0 THEN GO TO 7000
  245 LET ay=ay+INT (RND*3)-1
  246 IF ay<3 THEN LET ay=ay+1
  247 IF ay>27 THEN LET ay=ay-1
  248 BEEP .025,-INT (RND*40)
  250 LET ax=ax+diff
  260 IF ax>15 THEN GO SUB 2000
  300 INK 1: PRINT AT INT ax,INT
ay; OVER 1;"╋";
  305 PRINT AT INT ax+1,INT ay; O
VER 1;"╋";
  310 INK 0: PRINT AT 1,2;"SCORE:
";score: PRINT AT 0,2;"AMMO:";am
```

PROGRAM FILE

```
mo: PRINT AT 1,21;"PASSED:";lan;
  IF ammo<=99 THEN PRINT AT 0,9;"
  ": IF ammo<=9 THEN PRINT AT 1,8
  ;" "
  315 PRINT AT 0,11;"SHOTDOWN:";s
hot: PRINT AT 0,24;"WAVE:";wave+
1: PRINT AT 1,13;"HI:";hiscore
  999 GO TO 100
1000 PRINT AT x,y; OVER 1;" ± ";
PRINT ; OVER 1; FLASH 1;AT x,y;
INK 2; PAPER 6;"▄▀▄"
1010 PRINT AT x+1,y; OVER 1;"▀▀▀"
: PRINT ; OVER 1; FLASH 1;AT x+1
,y; PAPER 6; INK 2;"▀▄▀"
1030 FOR n=1 TO 10: OUT 254,RND*
7+16: OUT 254,RND*7: NEXT n
1040 PRINT AT x,y;"   ": PRINT AT
  x+1,y;"   "
1050 LET ax=3: LET ay=INT (RND*2
6)
1060 IF x<=7 THEN LET score=scor
e+200
1070 IF x>7 THEN LET score=score
+100
1073 LET ammo=ammo+7
1074 LET shot=shot+1: IF shot>=n
um THEN GO SUB 9000
1075 BORDER 1
1080 RETURN
2000 LET lan=lan+1
2010 IF lan>=10 THEN GO TO 7000
2015 LET ax=3: LET ay=INT (RND*2
6)
2020 RETURN
4000 REM INTRO
4001 PAPER 0: INK 7: BORDER 0: C
LS
4005 BEEP .25,10: BEEP .25,20: P
RINT AT 1,9; INVERSE 1;"BATTLE S
TATIONS!";AT 3,4;" ± ";AT 4,4;"▀▄▀
";AT 3,15;"BY";AT 5,9;"ROBERT HI
GGINS";AT 3,27;" ± ";AT 4,27;"▀▄▀"
4010 PRINT AT 9,0; INVERSE 1;"SC
ENARIO:": PRINT INVERSE 0;"YOU A
RE A FIGHTER PILOT          PATRO
LLING THE SKIES ABOVE YOUR AEROD
ROME. IT IS BEING ATTACKED BY EN
EMY FIGHTER-BOMBERS. IT IS YOUR
TASK TO STOP THEM FROM      FLYIN
G PAST YOU TO BOMB THE      AEROD
ROME. IF TEN FLY PAST YOU, YOU W
ILL HAVE FAILED YOUR        MISSI
ON!"
4012 PRINT '''"  PRESS ANY KEY TO
  CONTINUE"
4013 IF INKEY$="" THEN GO TO 401
3
4015 POKE 23692,255: PAUSE 0: CL
S : PRINT ' INVERSE 1;"CONTROLLI
NG YOUR SIGHT:": PRINT AT 4,4;"U
SE "; INVERSE 1;"O"; INVERSE 0;"
 TO MOVE LEFT ) USE": PRINT AT 5
,23;")": PRINT AT 6,4;"USE "; IN
VERSE 1;"P"; INVERSE 0;" TO MOVE
 RIGHT) SHIFT": PRINT AT 7,23;")
": PRINT AT 8,4;"USE "; INVERSE
1;"Q"; INVERSE 0;" TO MOVE UP
) FOR +"
4016 PRINT AT 9,23;")": PRINT AT
 10,4;"USE "; INVERSE 1;"Z"; INV
ERSE 0;" TO MOVE DOWN ) SPEED":
PRINT AT 13,4;"USE "; INVERSE 1;
"M"; INVERSE 0;" TO FIRE GUNS":
PRINT AT 17,4;"PRESS ANY KEY TO
CONTINUE"
4017 IF INKEY$="" THEN GO TO 401
7
4020 CLS : PRINT ' INVERSE 1;"AT
TACK WAVES:": INVERSE 0: PRINT "
EACH WAVE CONSISTS OF TEN ENEMY
PLANES. EACH TIME YOU SHOOT DOWN
TEN PLANES A NEW WAVE BEGINS.
EACH WAVE IS HARDER TO SHOOT
DOWN THAN THE LAST!"
4023 PRINT '' INVERSE 1;"SCORING
:": PRINT "YOU SCORE 200 IF YOU
SHOOT A     PLANE UP HIGH, BUT ON
LY 100 DOWNLOW. EACH TIME YOU SH
OOT DOWN ANATTACK WAVE YOU GET A
  BONUS!"
4025 PRINT '''; INVERSE 1;"END OF
  GAME:": PRINT "THE GAME ENDS WH
EN TEN AIRCRAFT FLY PAST OR WHEN
  ALL AMMO IS     SPENT"
4030 PRINT '"    PRESS ANY KEY TO
  BEGIN"
4035 PAUSE 0
4040 BEEP .25,10: BEEP .25,20
4999 RETURN
5000 REM GRAPHICS
5010 DATA 0,0,0,1,1,15,0,3
5011 RESTORE 5010
```


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PROGRAM FILE

```
5012 FOR n=0 TO 7: READ j
5015 POKE USR "a"+n,j: NEXT n
5020 DATA 0,0,0,0,0,224,0,128
5021 RESTORE 5020
5022 FOR n=0 TO 7: READ j
5025 POKE USR "b"+n,j: NEXT n
5030 DATA 5,7,255,97,3,1,0,0
5031 RESTORE 5030
5032 FOR n=0 TO 7: READ j
5035 POKE USR "c"+n,j: NEXT n
5040 DATA 64,192,255,6,128,0,0,0
5041 RESTORE 5040
5042 FOR n=0 TO 7: READ j
5045 POKE USR "d"+n,j: NEXT n
5050 DATA 255,64,32,16,8,4,2,1
5051 RESTORE 5050
5052 FOR n=0 TO 7: READ j
5055 POKE USR "e"+n,j: NEXT n
5060 DATA 255,2,4,8,16,32,64,128
5061 RESTORE 5060
5062 FOR n=0 TO 7: READ j
5065 POKE USR "f"+n,j: NEXT n
5070 DATA 128,192,160,144,136,13
2,130,129
5071 RESTORE 5070
5072 FOR n=0 TO 7: READ j
5075 POKE USR "g"+n,j: NEXT n
5080 DATA 1,3,5,9,17,33,65,129
5081 RESTORE 5080
5082 FOR n=0 TO 7: READ j
5085 POKE USR "i"+n,j: NEXT n
5090 DATA 129,130,132,136,144,16
0,192,128
5091 RESTORE 5090
5092 FOR n=0 TO 7: READ j
5095 POKE USR "h"+n,j: NEXT n
5100 DATA 129,65,33,17,9,5,3,1
5101 RESTORE 5100
5102 FOR n=0 TO 7: READ j
5103 POKE USR "j"+n,j: NEXT n
5110 DATA 1,2,4,8,16,32,64,255
5111 RESTORE 5110
5112 FOR n=0 TO 7: READ j
5115 POKE USR "k"+n,j: NEXT n
5120 DATA 128,64,32,16,8,4,2,255
5121 RESTORE 5120
5122 FOR n=0 TO 7: READ j
5125 POKE USR "l"+n,j: NEXT n
5130 DATA 18,84,169,114,252,249,
252,114
5131 RESTORE 5130
5132 FOR n=0 TO 7: READ j
5135 POKE USR "m"+n,j: NEXT n
5200 RETURN
7000 REM END
7006 PRINT AT 0,2; INK 1;"AMMO:"
;ammo: PRINT AT 1,21; INK 1;"PAS
SED:";lan
7007 FOR i=1 TO 5: FOR j=20 TO 4
0 STEP 5
7008 BEEP .005,j: NEXT j
7010 FOR j=40 TO 20 STEP -5
7015 BEEP .005,j: NEXT j: NEXT i
7020 BEEP .05,-50: BEEP .05,-40:
 BEEP .05,-50: BEEP .05,-40: PRI
NT AT 19,28; PAPER 6; FLASH 1; I
NK 2;"*"
7025 BEEP 0.05,-50: BEEP .05,-40
: BEEP .058,-50: BEEP .05,-40: P
RINT AT 19,4; PAPER 6; FLASH 1;
INK 2;"*"
7030 BEEP 0.05,-50: BEEP .05,-40
: BEEP .05,-50: BEEP .05,-40: PR
INT AT 19,23; PAPER 6; FLASH 1;
INK 2;"*";AT 18,23; PAPER 6; INK
 2; FLASH 1;"*"
7035 BEEP 0.05,-50: BEEP .05,-40
: BEEP .05,-50: BEEP .05,-40: PR
INT AT 17,27; PAPER 6; FLASH 1;
INK 2;"*"
7040 PRINT AT x-1,y;"   "
7045 PRINT AT x,y-1;"   "
7050 PRINT AT x+1,y-1;"   "
7055 PRINT AT x,y+2;"   "
7060 PRINT AT x+2,y;"   "
7065 PRINT AT x+1,y+2;"   "
7070 INK 0: PRINT AT 3,2; FLASH
1;"YOU HAVE FAILED YOUR MISSION!
"
7075 PRINT AT 5,10;"SCORE:";scor
e
7084 IF score>=6000 OR score<700
0 THEN LET r$="WING COMMANDER"
7085 IF score=0 THEN LET r$="GRO
UND STAFF!!"
7086 IF score>0 AND score<1000 T
HEN LET r$="TRAINEE PILOT"
7087 IF score>1000 AND score<=20
00 THEN LET r$="FLT. LIEUTENANT"
:
7088 IF score>2000 AND score<=30
00 THEN LET r$="SERGEANT"
7089 IF score>3000 AND score<=40
```

PROGRAM FILE

```
00 THEN LET r$="CAPTAIN"
7090 IF score>4000 AND score<=50
00 THEN LET r$="GROUP CAPTAIN"
7091 IF score>5000 AND score<=60
00 THEN LET r$="FLIGHT OFFICER"
7092 IF score>=7000 THEN LET r$=
"SQUADRON LEADER"
7093 PRINT AT 7,2;"YOUR RANK IS
";r$:
7094 IF score>hiscore THEN PRINT
 AT 9,7;"NEW HIGH SCORE!": LET s
$=r$
7095 POKE 23658,8: IF score>hisc
ore THEN INPUT "INPUT YOU SURNAM
E (MAX.10)",A$: LET hiscore=scor
e
7096 PRINT AT 11,9;"HI-SCORE ";h
iscore
7097 PRINT AT 13,3;"BY ";s$;" ";
A$
7098 PRINT AT 15,4;"PRESS A KEY
TO PLAY AGAIN"
7099: PAUSE 0: IF INKEY$="" THEN
 GO TO 7097
7100 POKE 23658,0: LET y=16: LET
 x=11:
7110 LET diff=.2: LET num=10: LE
T ax=3: LET ay=INT (RND*26)
7120 LET score=0: LET ammo=100:
7130 LET wave=0: LET lan=0: LET
shot=0: BORDER 1: PAPER 5: INK 0
: CLS
7999 GO TO 10
8000 REM BACKGROUND
8010 PLOT 126,47: DRAW -37,-47:
PLOT 144,47: DRAW 37,-47
8015 PLOT 0,47: DRAW 255,0
8020 PLOT 64,0: DRAW 0,8: DRAW -
1,0: DRAW 0,-8: CIRCLE 64,10,PI:
 PLOT 64,14: DRAW OVER 1;13,5: D
RAW 2,0: DRAW 0,-1: DRAW -11,-10
8025 PLOT 204,15: DRAW -16,-2,PI
: DRAW -10,14: PLOT 188,34: DRAW
 -10,-8,PI: PLOT 187,34: DRAW 18
,-19: DRAW -19,-2
8030 PLOT 232,33: DRAW -16,0,PI:
 DRAW 16,0: PLOT 216,33: DRAW -6
,4: PLOT 226,39: DRAW -16,-2,PI
8035 PLOT 232,12: DRAW 8,2: DRAW
 1,-2: DRAW -7,-2: DRAW -2,2: PL
OT 236,13: DRAW 0,2: DRAW 1,0: D
RAW 0,-2
8040 PLOT 234,12: DRAW -10,10: D
RAW 2,2: DRAW 10,-11: PLOT 226,2
1: DRAW -8,-5: DRAW 1,-2: DRAW 9
,3
8041 PLOT 136,47: DRAW 0,-5: PLO
T 136,35: DRAW 0,-10: PLOT 136,1
5: DRAW 0,-15
8042 PLOT 42,12: DRAW -10,10: DR
AW 2,2: DRAW 10,-11: PLOT 34,21:
 DRAW -8,-5: DRAW 1,-2: DRAW 9,3
8043 PLOT 42,12: DRAW -10,10: DR
AW 2,2: DRAW 10,-11: PLOT 34,21:
 DRAW -8,-5: DRAW 1,-2: DRAW 9,3
8044 PLOT 40,12: DRAW 8,2: DRAW
1,-2: DRAW -7,-2: DRAW -2,2: PLO
T 44,13: DRAW 0,2: DRAW 1,0: DRA
W 0,-2
8045 PLOT 34,20: DRAW 8,4: DRAW
3,-1: DRAW -10,-6
8046 PLOT 226,20: DRAW 8,4: DRAW
 3,-1: DRAW -10,-6
8047 PLOT 40,47: DRAW -40,-16: P
LOT 224,47: DRAW 31,-16
8050 PRINT AT 16,0; INK 4; OVER
1; PAPER 0;"
[redacted]
"
8998 PAPER 5: BORDER 1:
8999 RETURN
9000 REM WAVES
9001 FOR n=10 TO 40 STEP 3: BEEP
 .05,n: NEXT n
9002 PRINT AT 0,11; INK 1;"SHOTD
OWN:";shot
9003 LET wave=wave+1: LET diff=d
iff+.2: LET num=num+10: LET sco
re=score+500*wave
9005 PRINT AT 5,7; INK 2; PAPER
6; FLASH 1;"WAVE ";wave;" COMPLE
TED!":
9006 PRINT INK 2; PAPER 6;AT 7,2
;"PRESS ANY KEY TO CONTINUE!"
9007 IF INKEY$="" THEN GO TO 900
7
9008 CLS
9010 GO SUB 8000
9020 RETURN
```


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J

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M

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W X

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SOFTWARE

PROGRAM	ISSUE
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1–2–3	November 1983
1982 Database Roundup	December 1982
1983 Database Roundup	December 1983
1983 Spreadsheet Roundup	December 1983
A	
Accountancy Programs (General)	June 1983
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B	
Benchmarks Explained (Reference Article)	January 1984
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Databases (Choosing One)	March 1982
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Expert-Ease	June 1984
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Homeword	February 1984
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PROGRAM	ISSUE
I L	
Information Management	April 1984
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Scred	August 1983
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Vu-Calc (for Spectrum)	September 1983
W	
Word Handler II	March 1983
Word	June 1984
Wordspell	March 1984
Workslate	January 1984
dBase II	May 1982

Personal Computer World Specials: 1984 Microcomputer Benchtest Special: (£2.40 inc p&p)—20 leading micros reviewed by the PCW team. Desktop Computing: (£2.25 inc p&p)—comprehensive guide to using micros in your business. Binders: (£3.95 each inc p&p)—keep your copies in order with these strong, attractive yellow binders.

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spending money

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The 10 Runners-Up each get a

£100 Voucher

to spend in any Spectrum store – anywhere in the country.

Just look at the fabulous 1st prize in this new competition – a super holiday for you and 3 friends among the sun, sea and palm trees of Florida, PLUS an incredible £2,500 to spend when you get there.

There's exciting day trips too to the Kennedy Centre, the famous DISNEY WORLD and more!

The competition closes on December 31st 1984 – call into your Spectrum dealer NOW and collect an entry form - you could win the holiday of a lifetime!

MICRO UPDATE

– Spectrum's own magazine for home and small business computers

AUTUMN ISSUE

Have you seen our MICRO UPDATE magazine yet? It's Spectrum's own computer guide, published by the experts for YOU – and the Autumn issue will be out soon.

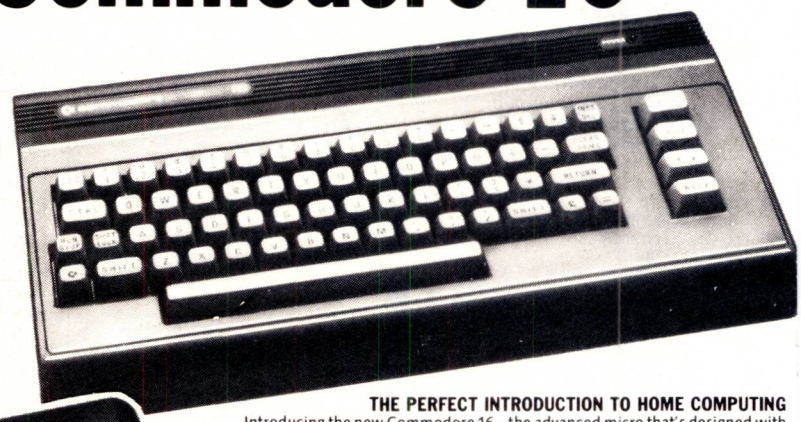
It's packed with illustrations and descriptions of just about everything you're likely to meet in home micro hardware, add-ons and accessories. Plus there's information on current software, and hints and tips from experts about home computing.

Call in to your local Spectrum dealer and get YOUR copy – it's great!

Just Arriving

New! Commodore 16

Including Commodore 1531 Cassette Recorder





THE PERFECT INTRODUCTION TO HOME COMPUTING

Introducing the new Commodore 16 – the advanced micro that's designed with the beginner in mind.

This brand new micro features a powerful 16K RAM, a full professional keyboard, superb graphics with 121 colours, plus terrific built-in sounds.

In its 32K ROM is a new BASIC 3.5 with over 75 commands including graphics plotting and program editing. There's a unique HELP key that highlights errors when you're learning to program.

It's a tremendous new micro and the Spectrum package includes a Commodore Model 1531 Cassette Data Recorder too. See it at your local Spectrum dealer now!

SPECTRUM PRICE ONLY

£139.99

Add-ons

Simon's Basic	£50.00
Intro to Basic Pt 1	£14.95
Intro to Basic Pt 2	£14.95
MPS801 Printer Ribbon	£9.95
MPS802 Printer Ribbn	£12.95
64 Magic Voice Speech Synthesiser	£50.00

Sensational Value!

Commodore 64

Compatible Data Recorder

ONLY

£34.99

Commodore SX64

Portable Package



SAVE £525

Includes:

● Commodore SX64 Portable Computer Plus! ● MPS 801 Printer & ● 3 Popular Business programs; Easy file Easy script & Easy stock

All this for only £799

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for up to date news, information & offers from SPECTRUM - see PRESTEL page 600181 for details

248PCW

See the super new Commodore Range at your local Spectrum Dealer - Now!



Just Arriving New!

Commodore Plus/4

Commodore's new, advanced Plus/4 bridges the gap between home and business micros in a way that's unique – and at a price that's unbelievable!

The Plus/4 features, besides its powerful 64K of RAM memory, has a host of features to make computing easier.

For starters, there are four popular software packages built-in – Word Processing, Spreadsheet, Database and a Business Graphics program. That's all a small businesses needs – in a budget-priced micro!

Besides that, there's a HELP key that highlights errors in program lines, plus built-in graphics, advanced BASIC 3.5 with over 75 commands, separate cursor controls, a full 32K ROM and 4 programmable function keys.

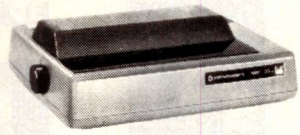
SPECTRUM PRICE

£299.00

Commodore MPS802 Printer

SPECTRUM PRICE

£345.00



MPS801 Printer

SPECTRUM PRICE



£230

1542 Disk Drive

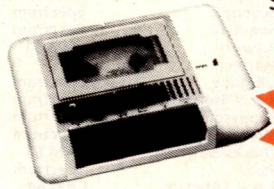
SPECTRUM PRICE

£229



1530 Data Recorder

SPECTRUM PRICE



£44.95

1531 Data Recorder

SPECTRUM PRICE

£44.95



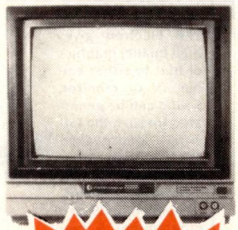
New! DPS1101 Printer



SPECTRUM PRICE

£399.99

Commodore 1701 Monitor



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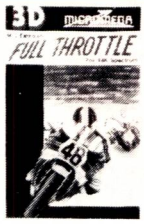
Micro Dealer UK's top 50
Britains No.1 Weekly Software Chart







PROGRAM	SUPPLIER	MACHINE	PRICE
Daley Thompson's Decathlon	Ocean	CBM 64	£7.90
Full Throttle	Micromega	Spectrum	£6.95
Jet Set Willy	Software Projects	Spectrum	£5.95
Sabre Wolf	Ultimate	Spectrum	£9.95
Olympicon	Mitec	Spectrum	£5.95
Astro Chase	Statesoft	CBM 64	£8.95
Flip & Flop	Statesoft	CBM 64	£8.95
Frak!	Aardvark	BBC	£8.95
Decathlon	Activision	CBM 64	£9.99
Beachead	Access	CBM 64	£9.95
Matchpoint	Psion	Spectrum	£7.95
Evil Dead	Palace S/W	CBM 64	£6.99
Potty Pigeon	Gremlin Graphics	CBM 64	£7.95
Tales of the Arabian Knights	Interceptor	CBM 64	£7.00
Mr Wiz	Superior	BBC	£7.95
Zalaga	Aardvark	BBC	£8.95
Football Manager	Addictive	CBM 64	£7.95
Lords of Midnight	Beyond	Spectrum	£9.95
Tornado Low Level	Vortex	Spectrum	£5.95
Star Trader	Bug-Byte	Spectrum	£6.95
Hero	Activision	CBM 64	£9.99
Monty Mole	Gremlin Graphics	Spectrum	£6.95
Deathstar Interceptor	System 3	CBM 64	£9.95
Stop the Express	Psion	Spectrum	£5.95
Worse things happen at Sea	Silversoft	Spectrum	£5.95
Monty Mole	Gremlin Graphics	CBM 64	£7.95
Giants Revenge	Thor	Spectrum	£6.95
World Cup	Artic	Spectrum	£6.95
Pitfall	Activision	CBM 64	£9.99
Star Striker	Superior	BBC	£7.95
Beamrider	Activision	CBM 64	£7.95
Psytron	Beyond	Spectrum	£7.95
Rapscallion	Bug-Byte	Spectrum	£6.95
Strip Poker	Artworx	CBM 64	£9.99
Gisburnes Castle	Martech	BBC	£7.95
Atic Atac	Ultimate	Spectrum	£5.50
Mission 1	R & B Software	Spectrum	£7.95
Factory Breakout	Poppysoft	Spectrum	£7.95
Automania	Mikrogen	Spectrum	£7.95
Trashman	Quicksilva	CBM 64	£7.95
Chequered Flag	Psion	Spectrum	£6.95
Mission 1	R & B Software	CBM 64	£8.95
Encounter	Novagen	CBM 64	£9.95
Valhalla 64	Legend	CBM 64	£14.95
Android 11	Ocean	CBM 64	£6.90
Titanic	R & R Software	Spectrum	£6.95
Jack & the Beanstalk	Thor	Spectrum	£5.95
The Count	Adventure International	BBC	£7.95
The Hulk	Adventure International	CBM 64	£9.95
Dare Devil Dennis	Visions	CBM 64	£7.95

Amstrad Software all at £8.95

EDUCATIONAL SOFTWARE	Time Man 2	Roland on the Ropes	3-D Invaders
Wordhang	Map Rally	Alien break-in	
Happy Numbers	ARCADE GAMES	Electron 22622	Atom smasher
World Wise	Home Runner	Gems of Stradus	Electro Freddy
Animal, Vegetable, Mineral	Harrier Attack	Chess	Fire Blaster
Happy Letters	Sultans Maze	Laser Wrap	Admiral Graf Spee
Happy Writing	Spanner Man	Haunted Hedges	Star Commands
Time Man 1	Oh Mummy	Codename Matt	Crazy Golf
	Roland in Care	Xanagrams	Punchy
		Hunter Killer	

BBC Model B
Package Offer



HURRY! Offer extended WHILE STOCKS LAST

Including FREE!

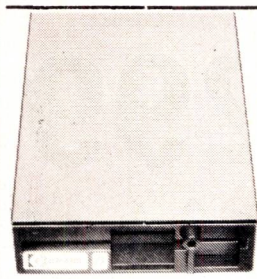
• Cassette recorder • 5 pieces of software

when you purchase a BBC 'B' from Spectrum.

The BBC MODEL B, probably the most flexible personal microcomputer available today. Using powerful BBC BASIC, the BBC B is widely accepted as providing the educational standard for computer learning.

The model B features a variety of interface ports allowing easy connection not just of ordinary peripherals but also second processors or devices to give access to teletext or prestel services.

£399



Cumana Disc Drives

CSX 100 £129.95

CS100 £159.99

Acorn Electron

The Electron gives high quality graphics output to either colour TV or monitor. Sound can be generated through the internal loudspeaker. The Electron comes complete with a free introductory cassette, containing 19 free programmes & two manuals - the User Guide and Start programming with the Electron."



SPECTRUM PRICE £199.95

Shado Data Recorder



Compatible with Acorn/ BBC & Electron Micros

SPECTRUM PRICE £32.95

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The New Sinclair QL

ARRIVING SOON!



32-bit power . . . 128K RAM . . . business software . . . it's the amazing QL!

The QL is a ready-to-go small business /office system, with a 32-bit 68008 microprocessor for rapid data processing and a huge 128K of RAM memory - twice as much as any other micro at the price, and expandable to 640K. Then there's the 2 built-in Microdrives, a full keyboard and 3 'bundled' business programs - Archive (database), Abacus (spreadsheet) and 'Easel' (business graphics). With the 'Quill' program, it becomes a wordprocessor. Its Basic is superior to Spectrum Basic; graphics resolution is high at 512 x 256 with a multiple-screen window facility, and there's multi-tasking capability. In short, a superb machine - at an incredible price!

SPECTRUM PRICE

£399

Sensational Sinclair Offer

ZX Spectrum 48K



Including

FREE!

Software 6 pack

Containing: ● Computer Scrabble ● Computer Chess ● Survival game ● Chequered Flag game ● Horace goes Skiing game ● Make-a-Chip

Worth £56.70

SPECTRUM PRICE

£129.95

ARRIVING SOON!

Sinclair Flat-Screen TV

SPECTRUM PRICE

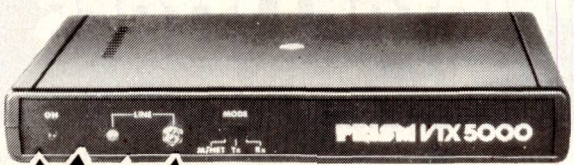
£99.95



NEW!

Here it is - the incredible new TV that's a revolution in technology . . . available from Spectrum NOW! The amazing Flat-Screen TV has a picture that's 3 times brighter AND half the bulk of an ordinary screen of the same size - yet it uses between 1/4 and 1/10 the power! The new front-coated phosphor screen gives a pin-sharp image despite its pocketable size. The set uses just one tiny Lithium battery for long life and comes with a pouch case and earphone.

Prism VTX5000 Modem



£79.95

● Versatile modem for ZX Spectrum (16K or 48K) versions ● Slim design fits easily, matches your micro ● Instant access to Prestel™ & Micronet 800 information services ● Instant communication with other ZX Spectrum users.

DK'Tronics Keyboard

D'Ktronics Lightpen £19.95
D'Ktronics Dualport Joystick Interface £13.00
D'Ktronics Programmable Joystick Interface £22.95

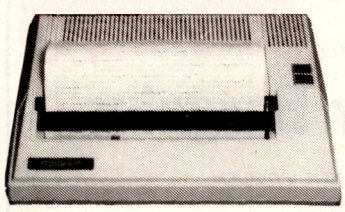
SPECTRUM PRICE

£45



Plus! FREE 4 GAMES CASSETTE

Alphacom 32 Printer



ALPHACOM 42 For Dragon, BBC, Commodore, Atari (Interfaces extra)
SPECTRUM PRICE £79.95

SPECTRUM PRICE

£79.95

Paper Rolls for Alphacom Printers
Box of 5 Rolls £6.00

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Juki 6100

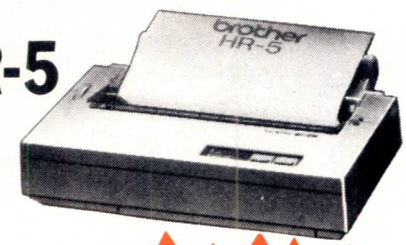
Super Value! **Daisy Wheel Printer**



This fabulous new printer is a real breakthrough in the performance/value stakes! For a remarkably low price you get all these great features:
● Daisywheel printing ● 20cps (av. 18cps Shannon Text) ● 10/12/15 or Proportional character spacing ● Bi-directional friction-feed ● Tractor feed or cut paper ● Centronics as standard; RS232C optional ● 2K byte print buffer

£399

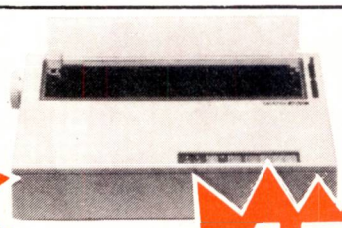
Brother HR-5



Super value printer that prints on plain paper, yet still fits in your briefcase.
● Operates on 4 standard batteries
● Incorporates Centronics or RS232C
● Bidirectional or unidirectional
● High quality Thermal head
● Prints at 30cps on plain paper (with ribbon) or directly onto thermal paper
● Weighs under 2kg

SPECTRUM PRICE **£159.95**

Brother HR-15



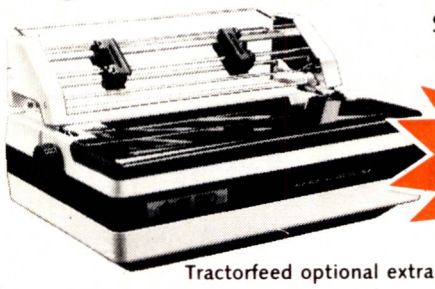
A great printer at a top-value price from Spectrum. Here's what you get:
● Letter-quality daisy-wheel printing
● Between 13 and 18cps
● Bi-directional printing
● Tractor-fed paper or single sheets
● Super low price!

SPECTRUM PRICE **£458.85**

Sensational Printer Offers from Spectrum

Quendata

Just look at this for value - a true daisy-wheel printer offering top quality printing at a remarkably low price. Print speed is 18/20cps, uni-or bi-directional printing (depends on software), variable pitch.



SPECTRUM PRICE **£289.95**

Tractorfeed optional extra

Brother EP-44



"Transforming Office Machines", runs Brother's slogan – with these super-compact battery powered typewriters, it's easy to see why!
● Top quality thermal printing head
● 4K of text memory (3 A4 pages)
● Text centring if required
● 15-digit LCD display for pre-printing corrections
● Line-by-line edit facility

SPECTRUM PRICE **£249.95**

Smith-Corona D100



This superb dot matrix printer from Smith-Corona is a sleek, well-made machine that'll work with either tractor- or friction-fed paper. It offers a fast 120cps print speed, with 80 characters per line and a choice of well-defined typestyles. The D-100 incorporates a Centronics parallel interface.

Also available **Fastex 80 £225.17**

SPECTRUM PRICE **£286.35**

Other Printer Bargains

SEIKOSHA			
GP50A	£99.95	GP100VC VIC 20/64	£199.95
GP50S Spectrum	£99.95	Friction Feed GP100/250X	£28.75
GP500A	£179.95	EPSON	
GP550A	£229.00	FX80	£503.70
GP100A MkII	£199.95	RX80T	£286.35
		RX80FT	£327.75

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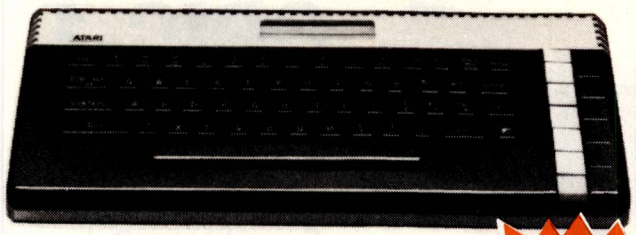
Atari

A great line up from one of the first names in home computing... ...Now at Super New Low prices from Spectrum

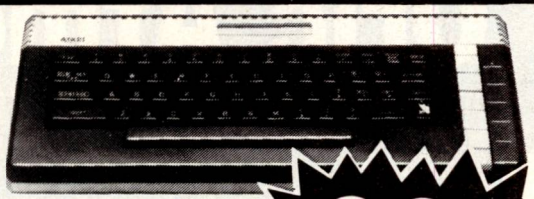
Atari 800XL



● Powerful 64K RAM ● Full-stroke keyboard ● Full sound with 3½ octave range ● 11 Graphic Display modes ● Full colour (256 Colours - 128 colours can be diplayed at one time) Ask to see this super new micro at your local SPECTRUM dealer NOW!

SPECTRUM PRICE £199.99

Atari 600XL



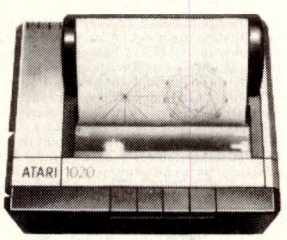
The 600XL features a 16K RAM, expandable to 64K with the memory expansion module. There's a 24K ROM operating system including ATARI BASIC. Plus 16 colours, 11 graphic modes and 4 independent 3½-octave sound synthesisers. It really is a top-value micro – come in and see for yourself!

SPECTRUM PRICE £99.99

Atari 1020 Printer/Plotter

Using 4 colour graphics and text, the 1020 colour printer/plotter is perfect for creating charts, graphs & even artistic designs. Very quiet operation.

SPECTRUM PRICE £99.99



Atari 850 Interface



Essential for more advanced work with their Atari computers. It provides 1 parallel output for a huge range of printers, and no less than 4 serial outputs which can be individually programmed for different purposes. It comes with a comprehensive manual, power pack & interconnecting cable to the computer.

SPECTRUM PRICE £99.99

Atari 1010 Program Recorder



Add storage and retrieval capability to your Computer system without spending a lot of money. Uses cassettes to store text, programs & other information.

SPECTRUM PRICE £34.99

Atari 1050 Disk Drive



Add the Atari 1050 Disk Drive for fast, convenient data access by storing on compact, easy-to-handle 5¼" disks. Storage capacity with DOS 11 up to 127K bytes, (around 100 pages) of information per disk.

SPECTRUM PRICE £199.99

Atari 1027 Letter Quality Printer

This superb Letter Quality Printer prints fully-formed letters just like a quality electric typewriter, making it the ideal word-processing companion for business correspondence. The Atari 1027 accepts single sheets of paper so you can even use your own letterhead paper.



SPECTRUM PRICE £249.99

Atari Software

Entertainment

Asteroids	£9.99
Basketball	£9.99
Caverns of Mars	£9.99
Centipede	£9.99
Chess	£9.99
Galaxian	£9.99
Jungle Hunt	£9.99
Pac Man	£9.99
Lone Raider	£9.99
Missile Command	£9.99
Pengo	£9.99
Qix	£9.99
Space Invaders	£9.99
Star Raiders	£9.99
Super Breakout	£9.99
Tennis	£9.99
Defender	£14.99
Dig Dug	£14.99
Donkey Kong	£14.99
Donkey Kong JR	£14.99
Joust	£14.99
Ms pac Man	£14.99
Pole Position	£14.99
Robotron	£14.99
Logo & Manuals	£59.99
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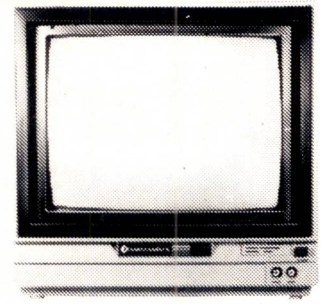

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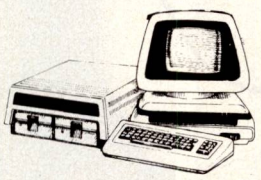

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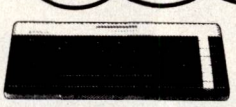

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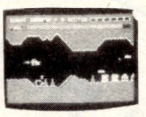



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The L32ICQ is a full width, dual mode printer with a 36 × 16 matrix printer font in correspondence quality, which is selectable at the touch of a button.

	Honeywell L32ICQ	Epson LQ1500	OKI ML93
Full PC printer compatibility	√	×	×
MTBF (hrs)	6500	2500	4000
Parallel interface	√	√	√
Noise level (dBA)	59	64	65
Single sheet inserter	√	√	×
Added hidden extras	×	√	√
Speed draft - correspondence quality	150 50	200 65	160 60
RRP	£675	£1,100	£675

THE HONEYWELL L32I COMPARED TO ITS NEAREST EQUIVALENTS

The L32I is a high duty cycle printer with a printhead life of 500 million characters, capable of printing 1 original plus 4 copies.

	Honeywell L32I	Epson FX100	OKI ML83
Full PC printer compatibility	√	×	×
MTBF (hrs)	6500	2500	4000
Parallel interface	√	√	√
Noise level (dBA)	59	64	65
Added hidden extras	×	√	√
Speed draft	150	160	120
RRP	£535	£569	£489

THE HONEYWELL L12ICQ COMPARED TO ITS NEAREST EQUIVALENTS.

The L12ICQ is an 80 column, dual mode printer offering cut sheet feeding, IBM PC printer compatible (character set 1 & 2), incl. IBM line graphics, IBM mosaics, 3 grey tones and math. character set plus Bit image graphics.

	Honeywell L12ICQ	Epson FX80	OKI ML92
Full PC printer compatibility	√	×	×
MTBF (hrs)	6500	2500	4000
Parallel interface	√	√	√
Noise level (dBA)	58	64	65
Single sheet inserter	√	×	×
Added hidden extras	×	√	√
Speed draft - correspondence quality	150 50	160 ×	160 60
RRP	£449	£438	£449

All competitive data in this advertisement obtained from published information.

THE HONEYWELL L111 COMPARED TO ITS NEAREST EQUIVALENTS.

The L111 offers full IBM compatibility, incl. IBM line graphics and mosaics, as well as an exceptionally quiet machine with no duty cycle limitations.

	Honeywell L111	Epson RX80FT	OKI ML82A
Full PC printer compatibility	√	×	×
MTBF (hrs)	6500	2500	4000
Parallel interface	√	√	√
Noise level (dBA)	58	64	65
Single sheet inserter	√	×	×
Added hidden extras	×	√	√
Speed draft	80	100	120
RRP	£349	£285	£299

.....and you can see for yourself exactly why we were delighted to accept their offer to become their UK distributors. Because model for model, performance for performance, feature for feature, price for price, their nearest competitors don't even come close. And that applies all the way down the range, from the top professional L32ICQ model to the entry-level L111.

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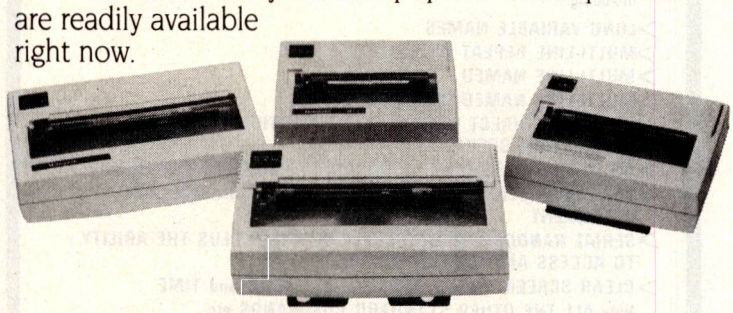

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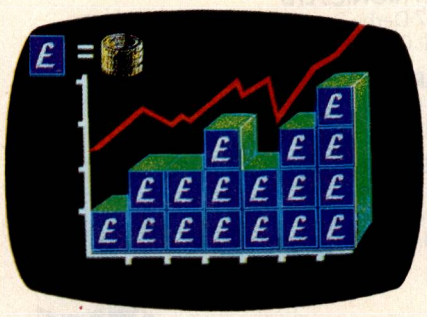

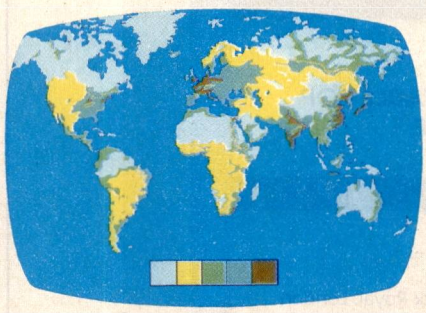

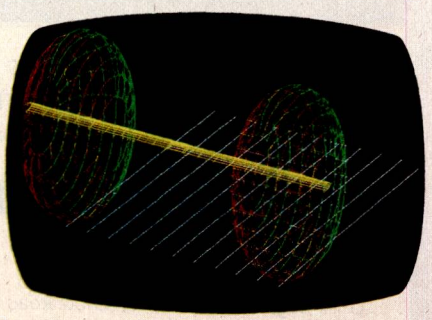

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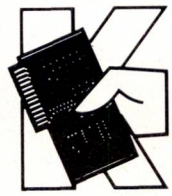

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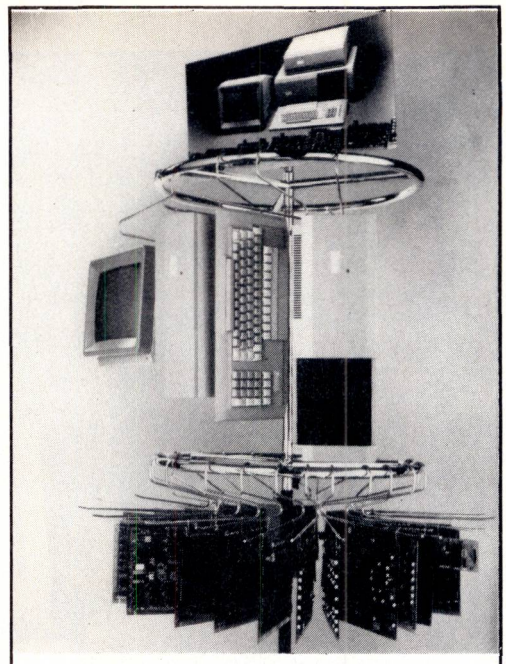

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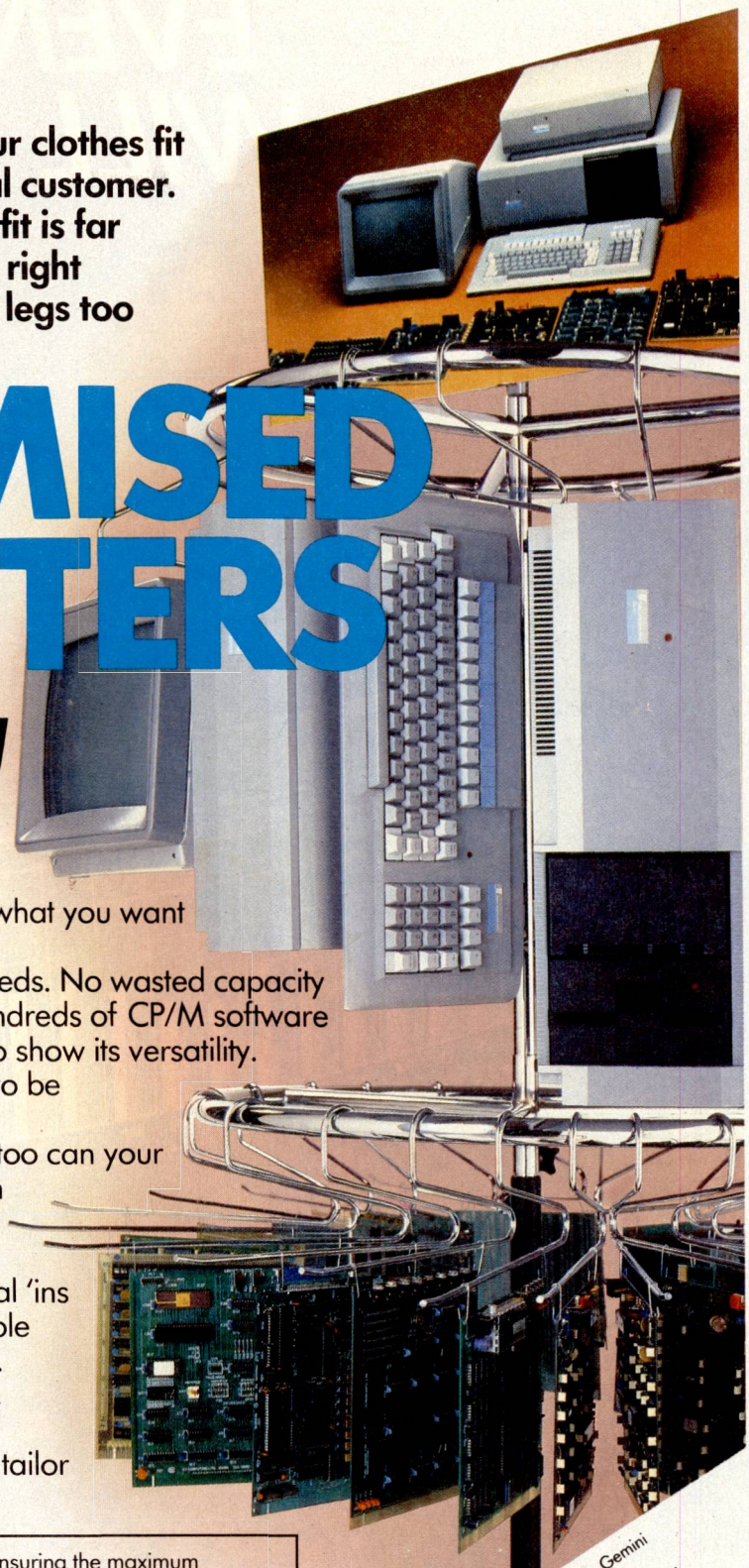

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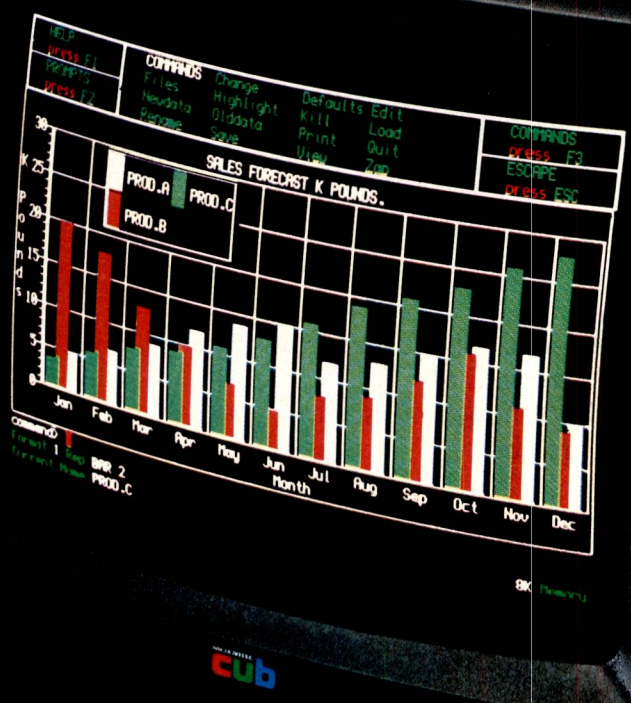

Specification

Model:
CUB 1451/DQ3
14" Q.L. Monitor
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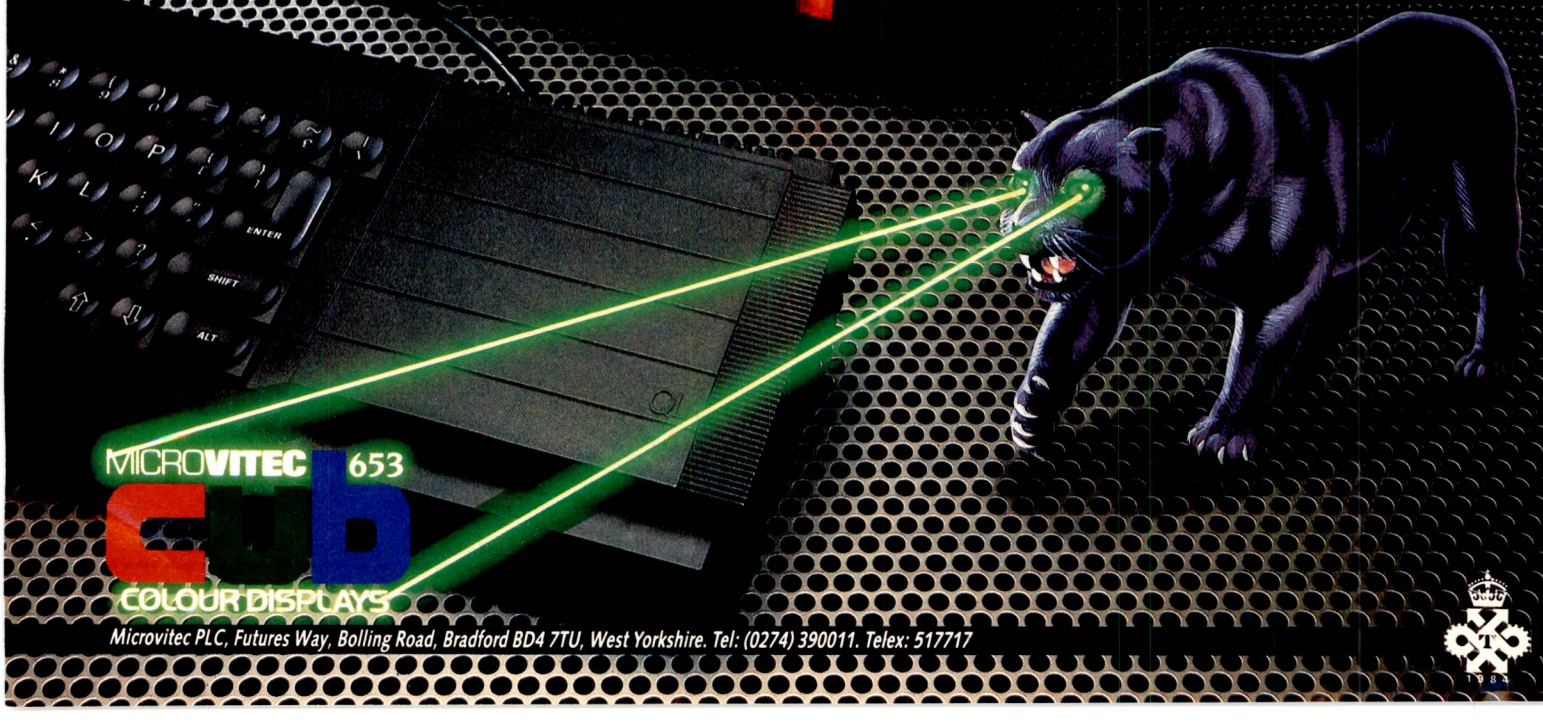
Tube Resolution (pixels)
653(H) x 585(V)
Dot Pitch 0.43mm
Bandwidth 18 MHz

Also available in Standard Resolution version for only £225 inc. VAT.



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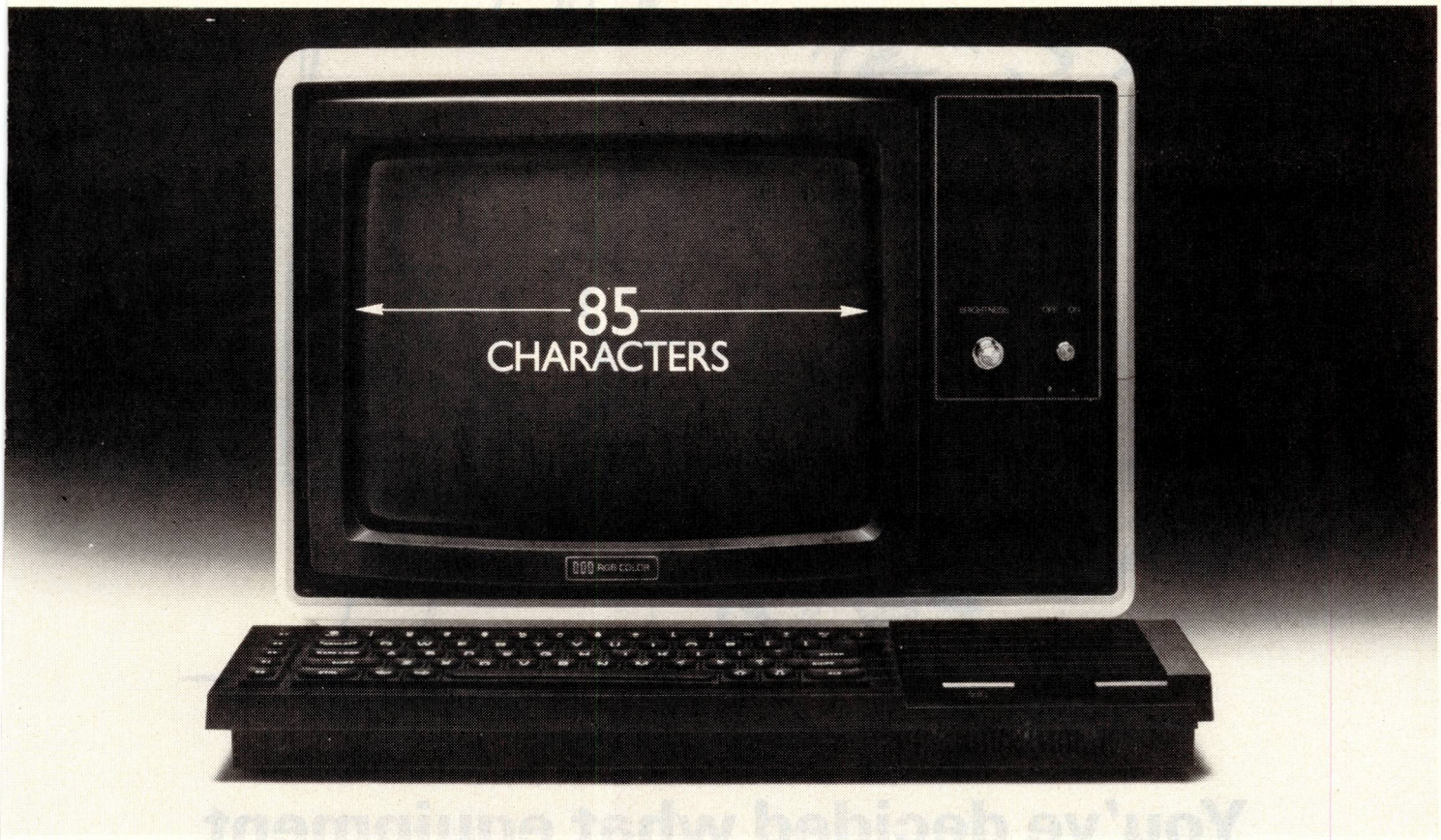

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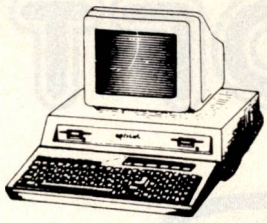

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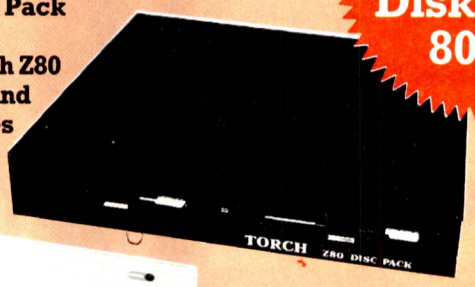

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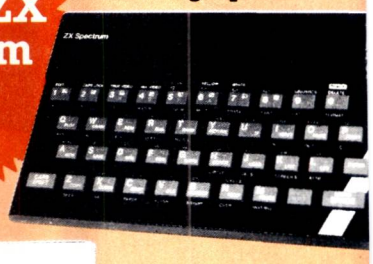



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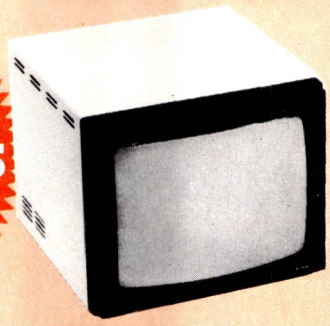

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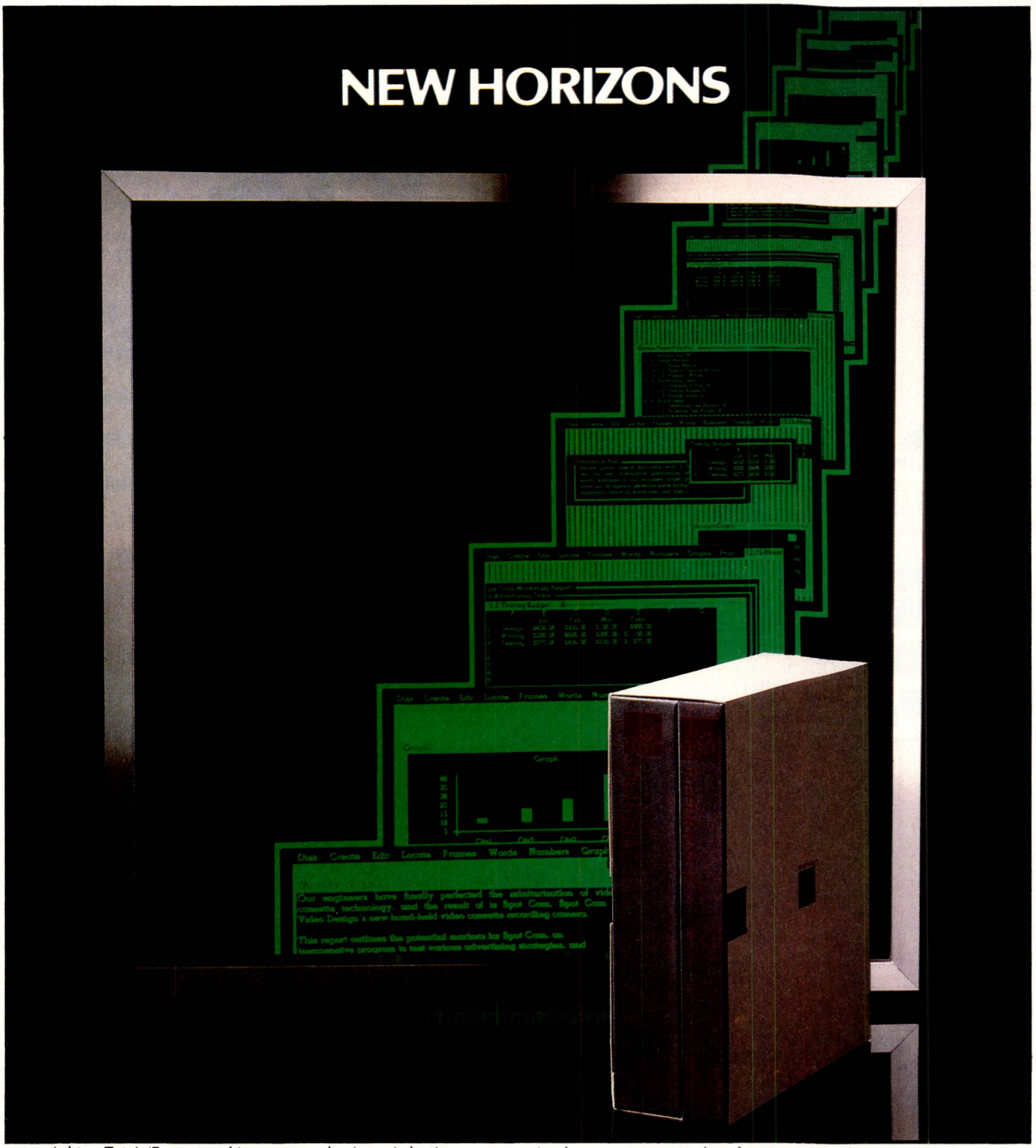

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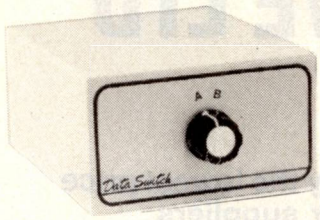

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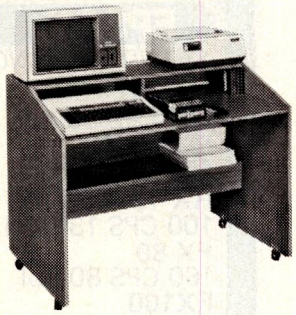

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* MANUFACTURERS
* MODELS
* SPECIFICATIONS
* PRICES

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—understanding logic elements

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M82A 120CPS 80 Col	299	259
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BYTE SHOP News

We'll be exhibiting at the PCW Show at Olympia 2 and look forward to seeing customers both old and new. Our stand is No. 730, level 1.

Two major introductions to report this month are one on the hardware side and one software. Catching most people somewhat by surprise is the new portable PC from IBM – see 'Spotlight' for details. Ashton-Tate have also been busy with Framework, an integrated package that is billed as the ultimate in user friendliness and a logical extension of dBase II.

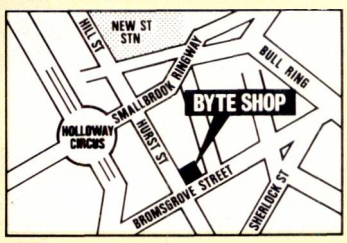
The Byte Shops are now part of Kode International plc Group which, with Kode's complementary interests in microcomputers generally, should enable us to offer an even better service to our customers.



Getting the right computer

At the Byte Shops we've helped countless companies of all sizes improve their efficiency by the introduction of microcomputers. Generally these are required to perform routine business tasks – but, however similar the application, we invariably find that no two customers have *exactly* the same requirements. When you come to the Byte Shop, you'll find that we are far more interested in finding out what jobs you require the computer to do both now and in the future. We then tailor a complete system including not only the hardware but the software, and the peripherals to meet your individual needs. We believe this is the only sensible way to sell computers. On this spread you'll find a number of 'Typical Ready To Run' systems. However we won't sell one to you – unless you force us – without asking a few questions first.

WHERE TO FIND US: BIRMINGHAM



Our Birmingham Business Centre situated in Hurst Street opposite the Hippodrome Theatre, is one of the longest established Byte Shops. Manager, Jim Attfield and his experienced staff are always available to discuss specific applications and to arrange demonstrations from the wide range of micros in stock.

PROGRAMMERS CORNER
Wide selection of programming languages, plus utilities and tools from Microsoft, Digital Research, Microfocus, Xitan and Pulsar, incl. Basic, Fortran, Cobol, Pascal, Assembler, C&PL1.

The BYTE SHOP
COMPUTERS FOR PEOPLE WHO AREN'T PLAYING

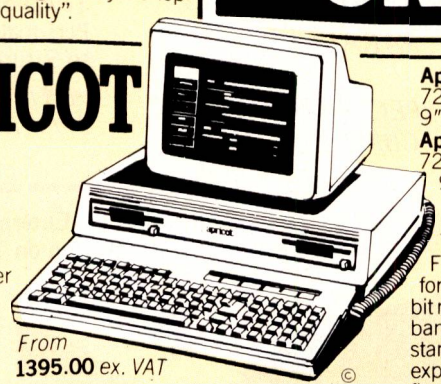
HOW COMMUNICATORS HELP SPEED THE MAIL FOR LAURENCE RICHARDS

Laurence Richards are a successful word-processing bureau/mailing house based in the Midlands. Such is the prodigious number of individual mailings they handle – this can be as high as 20,000 in one run – that clearly they could not operate without computerisation.

Equipment consists of two Communicator microcomputers, one recently upgraded to a hard disk version for faster working and extra storage capacity, two portables and three Diablo printers. The Communicator's reliability, capacity for upgrading and wealth of software options have proved great assets. Software run on the Communicators include those old favourites WordStar and MailMerge for word-processing and labelling. They are also used to communicate with ICL mainframes to extract names and addresses from mailing lists using BSTAM. Service and support from the Nottingham Byte Shop "has always been of the highest quality".

THE BYTE SHOPS - W ON GETTING THE R

ACT APRICOT



Already an outstanding success, the transportable Apricot offers a comprehensive specification at very low cost, making it a perfect system for the small businessman. The Xi models offer the advantages of Winchester disks in their most compact size yet – the revolutionary 3½" disk. New 12" screen is an optional extra for all models at a cost of £100. Included in the price are three operating systems MS/DOS 2.0, CP/M-86+, Concurrent CP/M-86 together with Microsoft and Personal BASICs, SuperCalc, SuperWriter, SuperPlanner and Asynchronous File Transfer Software.*

From **1395.00** *ex. VAT*

* Subject to availability

Apricot; single 315Kb floppy disk drive; 9" monitor.....**1395.00**
Apricot; twin 315Kb floppy disk drives; 9" monitor.....**1595.00**
Apricot; twin 720Kb floppy disk drives; 9" monitor.....**1795.00**

Apricot Xi; 5Mb hard disk & 720Kb floppy disk drives; 9" monitor.....**2495.00**
Apricot Xi; 10Mb hard disk & 720Kb floppy disk drives; 9" monitor.....**2795.00**

Apricot F1 (not illus.)
The revolutionary, transportable F1, offers the small businessman, for the first time, a full featured 16-bit micro that won't break the bank. Top specification includes standard 256Kb RAM expandable to 768Kb, 1×720Kb floppy disk drive, MS-DOS and Concurrent CP/M compatibility, remote operation, full featured keyboard, optional 'mouse' facility, ultra high resolution colour graphics. The stylish F1 comes with three popular software packages, SuperCalc, SuperWriter and SuperPlanner **995.00**

Apricot Portable (not illus.)
A range of three highly innovative portable models with memory options from 256-512Kb standard RAM and 720Kb single floppy disk storage. Stunning specification includes sophisticated speech recognition system, cordless full function keyboard, cordless 'mouse' (top models as standard) and flat LCD screen. Complete with SuperCalc, SuperPlanner and SuperWriter software. Stylish matching printer. 10Mb storage unit and carrying case are available as extras .....from **1695.00**

ALL PRICES EX. VAT

TYPICAL APRICOT BUSINESS SYSTEMS

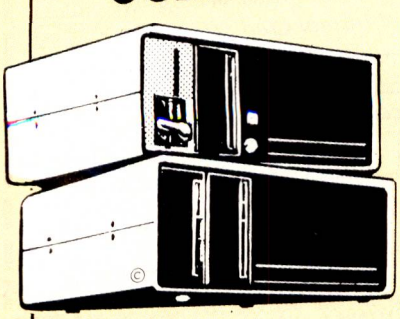
Word Processing
Apricot F1; SuperWriter; letter quality printer.....**1480.00**

Financial Planning
Apricot; SuperCalc 3 upgrade; dot matrix printer.....**2299.00**

Database Management
Apricot Xi; dBase II; dot matrix printer.....**3335.00**

Small Business A/C System
Apricot Xi; Pulsar Sales, Purchase and Nominal Ledgers and Invoicing; dot matrix printer.....**4379.00**

COMART



Comart Communicator multi-user systems have expandability built in and are the most cost-effective way of sharing computer power amongst your staff. You can start with a Communicator system to suit your current requirements – up to nine people can share – and simply add new terminals as you grow. A considerable saving over buying a complete new computer each time.

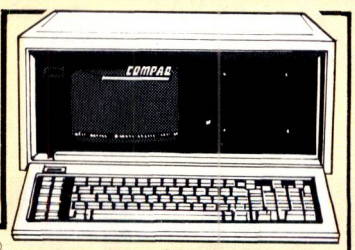
COMMUNICATOR MULTI-USER/MULTI-PROCESSING SYSTEMS

£2119 per user

Communicator CP1525M with M-BOS operating system, including 5 display terminals, dot matrix printer and cables **10595.00**

£1800 per user

Communicator CP520MP including 5 display terminals, cables 6×processors and 6×64Kb memory **9095.00**



COMPAQ

Following phenomenal success in America, you can now find the portable, fully IBM PC compatible, Compaq micros at your local Byte Shop. Spec. for the Standard model includes 256Kb RAM, twin 360Kb floppy disc drives, high resolution screen and tough carry case.....**2195.00**
'Plus' model as above but with single 256Kb floppy and 10Mb hard disk drives.....**3945.00**

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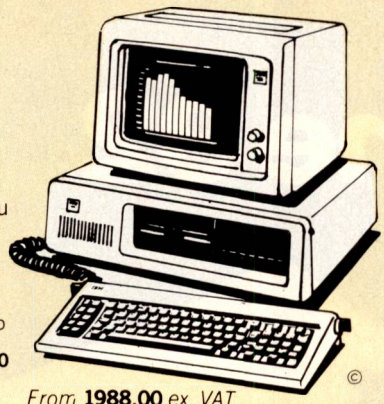
IBM/PC

The IBM PC's versatility means that it's equally at home in a small business or as a stand alone desk top in a large corporate company linked to a main frame. Should you require extra performance or speed, the IBM PC XT is an obvious choice.



From **1988.00** *ex. VAT*

IBM PC; dual 320Kb disk drives; 64Kb RAM; UK keyboard and screen **1988.00**

IBM PC; dual 320Kb disk drives; 128Kb RAM; DOS 2.1; UK keyboard and screen **2149.00**

IBM PC XT; 1 × 320Kb floppy disk plus 1 × 10 Mb hard disk; 128Kb RAM; ASYNCH COMMS; DOS 2.1; UK keyboard and screen **4141.00**

PC/XT ADD-ON'S & ADD-IN'S

Alloy PC-Backup – cartridge tape unit for backing up, storing and retrieving data from hard disk **1,750.00**

Microvitec 1446 – 14" colour monitor **495.00**

Expansion Unit 1 – 10 Mb hard disk unit for PC **2,172.00**

Expansion Unit 2 – 10 Mb hard disk unit for PC/XT **1,978.00**

Tallgrass Datasave – 5¼" hard disk mass storage unit with 12, 20 or 35 Mb capacity plus integral streamer tape cartridge backup..from **2,820.00**

Hercules Graphics Card – allows high resolution bit mapped graphics on monochrome display **395.00**

AST Megaplus Card – includes 64 Kb RAM, 1 serial port plus clock/calendar + RAM spooler software **319.00**

AST 3780 Card & Software – allows PC to communicate with m/f in bisynch protocol **875.00**

AST 5251 Card & Software – allows interactive m/f comms with IBM Systems 34, 36 & 38 ..... **835.00**

Orchid PC Net Starter Kit – local area network allowing file and disk sharing plus optional electronic mail from **1350.00**

PC Net Cards – to link additional terminals to network from **675.00**

Quadram Cards – full range available inc. memory expansion & colour graphics from **194.00**

IBM colour monitor plus adapter card **685.00**

IBM printer inc. cable **469.00**

Epson FX80 printer inc. cable. **478.00**

Brother Letter Quality Printer.. **445.00**

See Microserve panel for details of full maintenance and service facilities for the IBM PC/XT nationwide.

ALL PRICES EX. VAT

TYPICAL IBM BUSINESS SYSTEMS

Word Processing
IBM PC; Multimate, letter quality printer **3135.00**

Colour Spread Sheet
IBM PC; colour monitor; Symphony; full width dot matrix printer; 2 pen plotter **4999.00**

Information Management
IBM PC XT; dBase II; dot matrix printer **5119.00**

Accounting System
IBM PC XT; Sales, Purchase and Nominal Ledgers. Invoicing and Payroll; dot matrix printer **5720.00**

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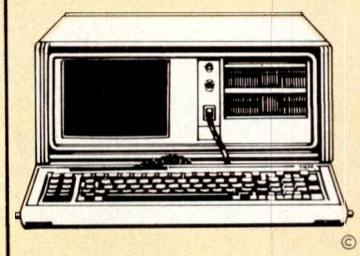
SYSTEM SPOTLIGHT

IBM PORTABLE PC

Logical development offering the benefits of PC computing in a self-contained portable package weighing in at a mere 30lb (13.6kg). Features 256Kb RAM expandable to 512Kb, 360Kb dual floppy disk drives, the latest DOS 2.1 operating system, 9" amber anti-glare screen (colour display optional) five expansion slots, and compatibility with the large and growing list of IBM PC software. Smart custom system carrying bag is included in the price **2254.00**



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HERE YOU CAN COUNT IGHT COMPUTER.

At a glance Computer Checklist

	Act Apricot	IBM PC/XT	Comart	Compaq
Colour graphics	●	●		●
Multi-user			●	
Hard disk storage	●	●	●	●
Upgradeable	●	●	●	●
Expandable	●	●	●	●
Communications	●	●	●	●
Transportable	●			●
Networking	●	●	●	

TOP 20 SELLING SOFTWARE

1. **Lotus 1-2-3** – Remarkable integrated spreadsheet and information management package incorporating colour graphics for the IBM PC **375.00**
2. **dBASE II** – Powerful database management and applications generator with optional graphics and development tools **365.00**
3. **Symphony** – Complementary follow-up to 1-2-3 from Lotus including word processing, integrated spreadsheet, communications, database and colour graphics.. **550.00**
4. **SuperCalc 3** – Latest SuperCalc version with colour graphics rivalling Lotus 1-2-3 ..... **295.00**
5. **WordStar** – Most popular wordprocessing program, easily integrated with MailMerge, SpellStar, Star index and SuperSort enhancements **295.00**
6. **Pulsar Accounts** – Complete integrated business accounting system includes sales, purchase, nominal ledgers, data analysis, stock control, invoicing and payroll – for Apricot and IBM PC ..... per module **195.00**
7. **SuperCalc 2** – Sophisticated, easy to use financial spreadsheet for in depth analysis, modelling and forecasting **195.00**
8. **Multi-Mate** – New standard in fast, easy to use, function key driven wordprocessing for the IBM PC **330.00**
9. **Open Access** – Exciting new integrated business package rivalling Lotus 1-2-3 with WP, Database, comms and 3-D graphics **450.00**
10. **CBASIC** – Widely used commercial programming language for business applications development, interpreter also available **115.00** (CP/M86.250.00)
11. **Friday** – Personal file management package for the novice with quick custom reporting **195.00**
12. **GraphStat** – Up and coming statistics and colour graphics package for the IBM PC **195.00**
13. **Cardbox** – Simple to use data retrieval and information management tool **155.00**
14. **Level II Cobol** – Mainframe level II compiler, well suited for new applications development: tools and utilities available **965.00**
15. **dBASE III** – Powerful easy to use database with enhanced reporting facilities and ability to print mailing labels from files **495.00**
16. **Framework** – Integrated package featuring word processing, spreadsheet, graphics, data management **495.00**
17. **Delta** – Comprehensive and sophisticated database program with '3-D' file structures, links to Lotus 123, MultiPlan and WordStar **495.00**
18. **BSTAM** – Communications package for sending and receiving CP/M files over telephone lines. **133.00**
19. **Flight simulator** – Full colour game for both the novice and the potential fighter pilot on the IBM PC **37.00**
20. **Pascal MT+** – Comprehensive integrated language for developing production quality software **269.00** (CP/M86.462.00)

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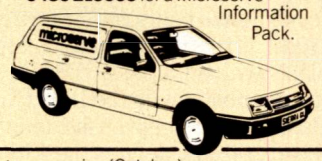
microserve

An integral part of the Byte Shops, **Microserve** provides a complete range of servicing and maintenance plans nationwide for computers such as the IBM PC and Communicator plus peripherals from Epson, Anadex, Qume, Wyse and Volkercraig. **'Microsure'** – our speedy nationwide on site maintenance contract for a 'once only' annual fee. **'Microswap'** – component exchange service. **'Micromend'** – workshop repair and up grades. **'Microcall'** – on site maintenance and repair charged on a time and materials basis. **'Microtrain'** – runs product training courses for your own service engineers. Call into your local Byteshop for further details or 'phone **0480 215005** for a Microserve Information Pack.



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OKI Microline 92
So fast – and NLQ



NLQ = Near Letter Quality.

It's just one of the many outstanding features which put the OKI Microline 92 matrix printer at the top of the 80 column league. Add to this standard print at 160 cps, high resolution graphics, downline-loadable character sets, subscript, superscript and underline capability, and you will see why the Microline 92 is an unbeatable price/performer.

The Microline 93 offers the same unrivalled specification to users requiring a full 136-column format.

And if all this is not enough, both machines are available with our unique IBM Plug 'n' Play Kit, ensuring full compatibility with the IBM PC.

An even more impressive feature list, including a print speed of 200 cps, defines the 136-column Microline 84. In addition to its increased throughput capability, the optional Automatic Cut Sheet Feeder permits maximum use of the near-letter-quality print mode.

Quality, reliability and unbeatable price/performance are of course hallmarks of the entire OKI Microline range, including the ever popular Microline 80, still a best-selling entry-level printer.

The range is completed by the Microline 82A (80 col) and the Microline 83A (136 col) which offer a print speed of 120 cps amongst a host of other features.

OKI Microlines – the unbeatable printer family!



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Either 80-bus format board enables retention of the Z80 card to run your existing software. Both cards will read or write IBM PC compatible discs and all Gemini formats. A 8088 bus expansion connector is also provided.

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Coming soon, Concurrent CP/M-86

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Measures temperature, light, resistance, power, volts, current and time.
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Measures concentration in p.p.m. of 6 different gases.
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Response DC & AC to 5kHz or above
Three ranges:— 0-10mV; 0-1V; 0-10V
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All units are extremely accurate and have fully supporting software on 40 or 80 track disc or tape. All with a screen dump facility and audio/visual variable alarm levels. Display is in graphical form, extra-height characters or tabular display with variable sample rate from 0.1 secs to 1,000 hrs with print out option.

All prices exclusive of V.A.T.

Demonstration video film showing the Excet EMU3 under working conditions available for free hire. Video film of other units to follow shortly.

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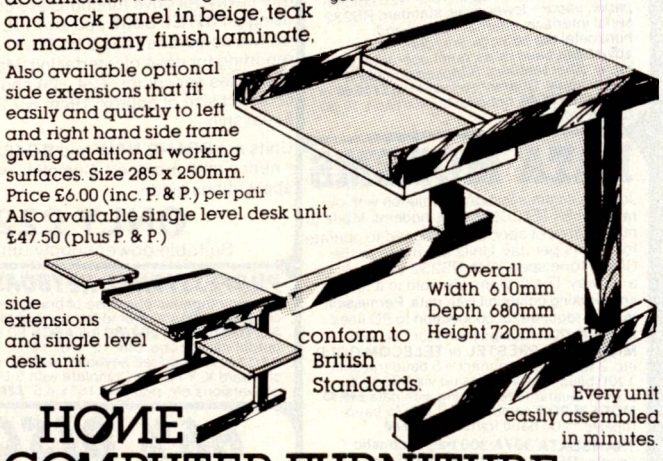
44 FORE STREET
ILFRACOMBE, NORTH DEVON
Tel: (0271) 62801

APOLLO
Unit Desk/Table for Home Computer
£49.50 (plus P. & P.)

Money refunded if not completely satisfied and goods returned undamaged within 14 days.

Designed to accommodate Home Computers and their associated peripherals. Adequate work space allows convenient positioning of display and keyboard units enabling sensible positioning of source and other reference documents. Working surfaces and back panel in beige, teak or mahogany finish laminate.

Also available optional side extensions that fit easily and quickly to left and right hand side frame giving additional working surfaces. Size 285 x 250mm. Price £6.00 (inc. P. & P.) per pair
Also available single level desk unit. £47.50 (plus P. & P.)



side extensions and single level desk unit.

Overall
Width 610mm
Depth 680mm
Height 720mm

conform to British Standards.

Every unit easily assembled in minutes.

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The environment your computer deserves

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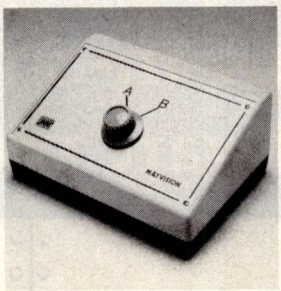

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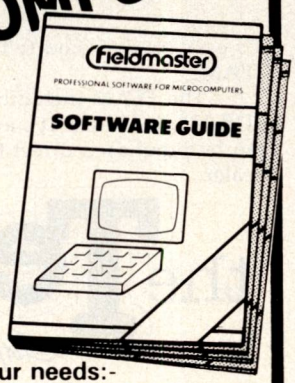

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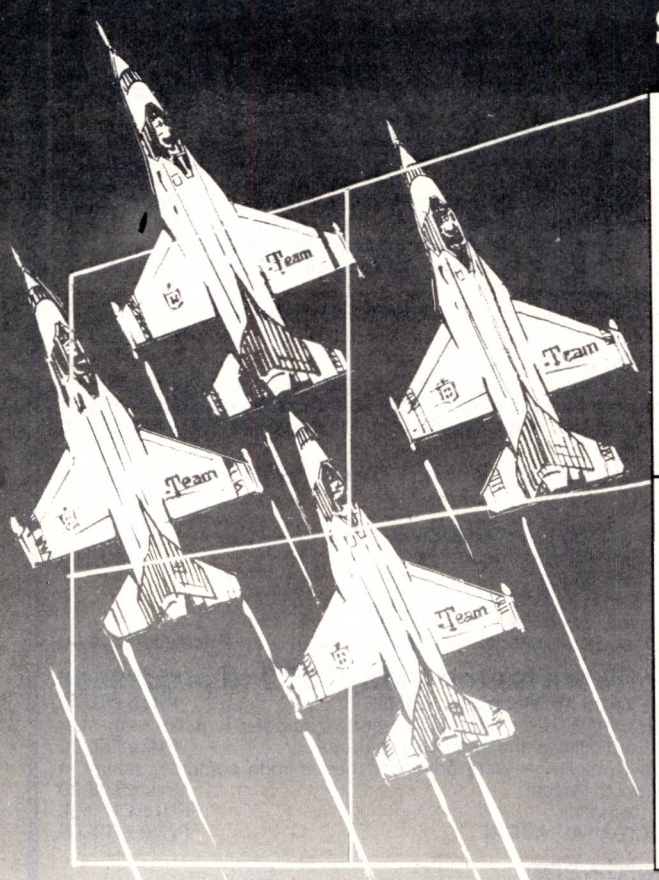

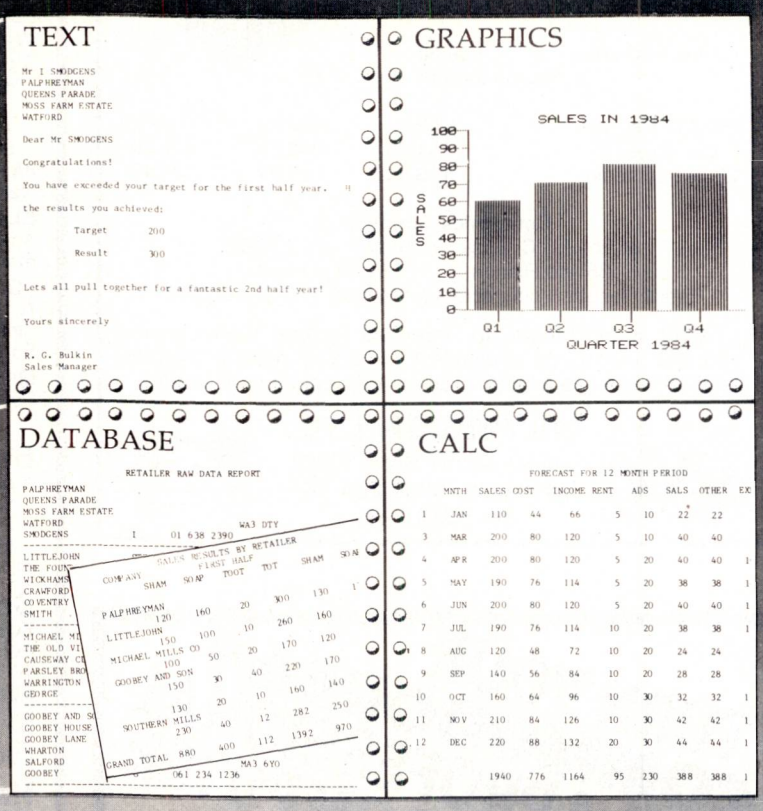

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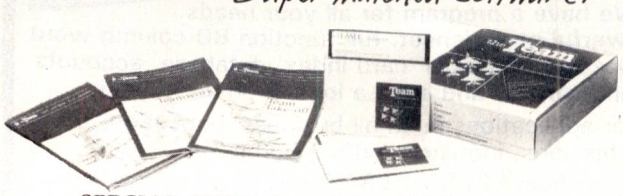

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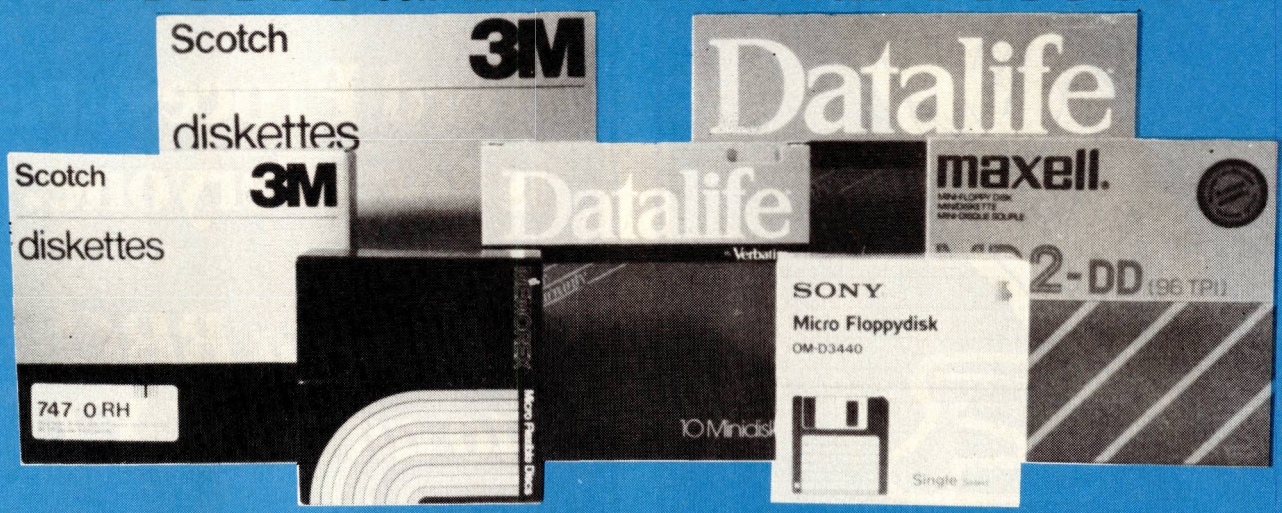

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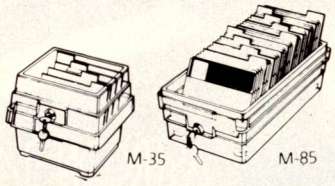

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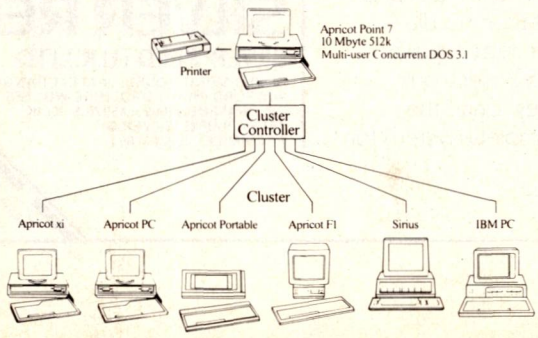

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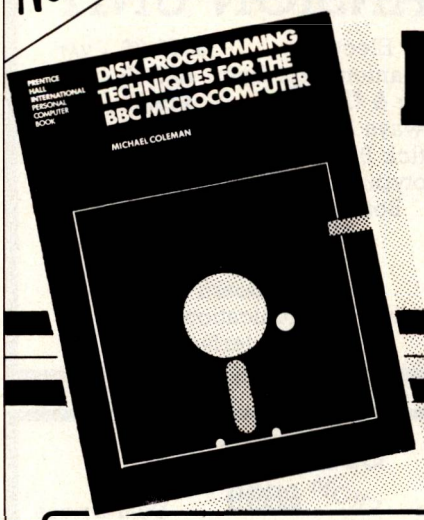



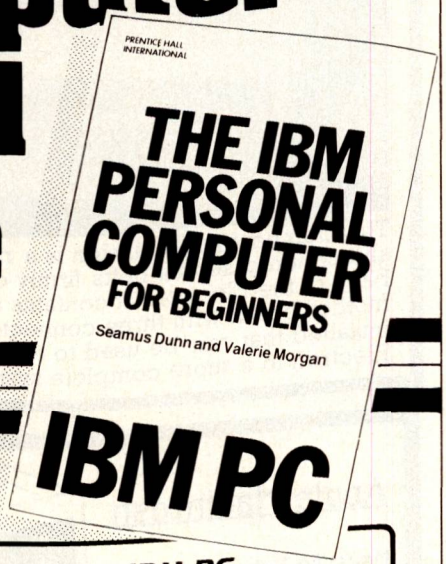

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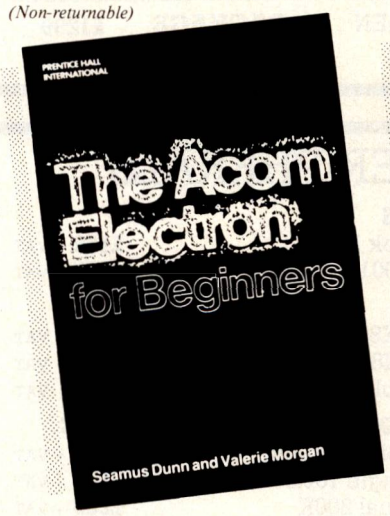

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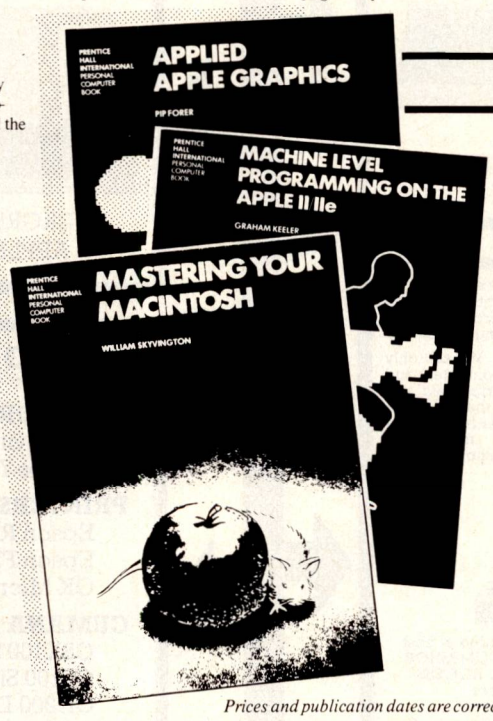

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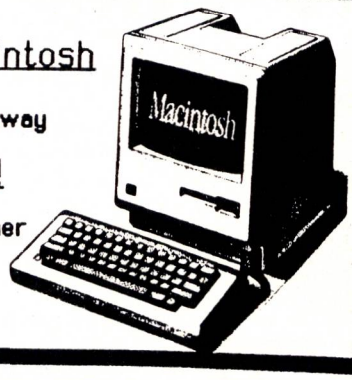

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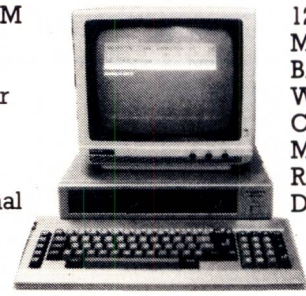

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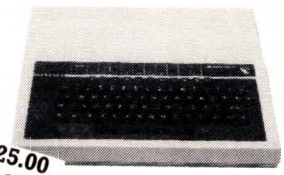

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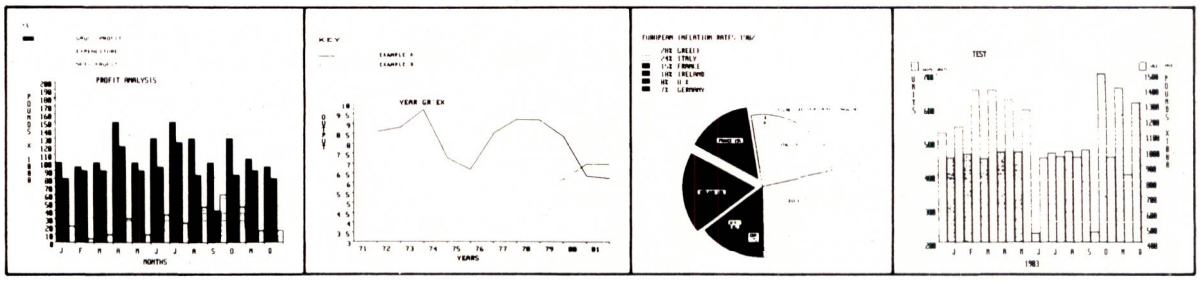

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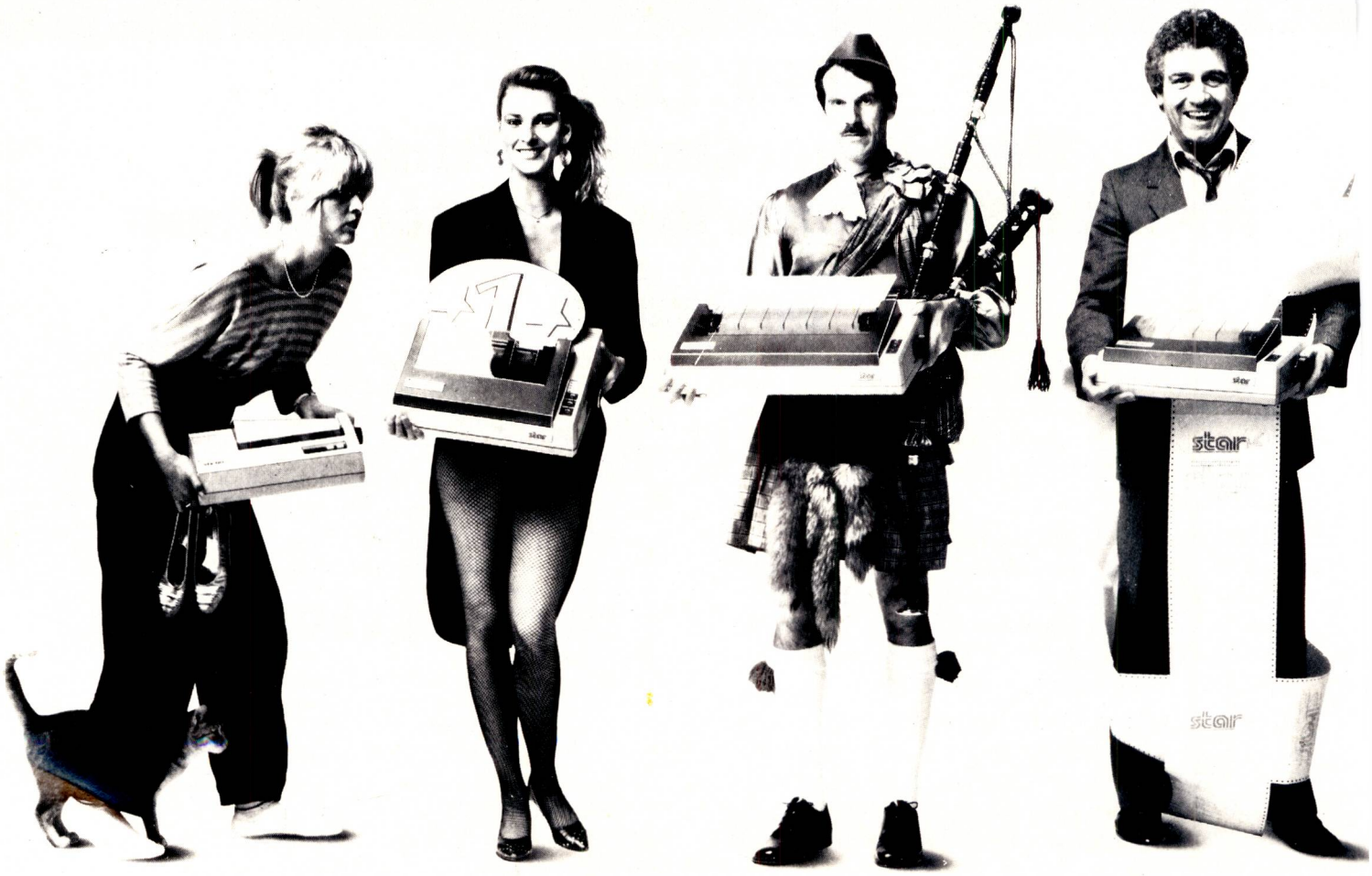

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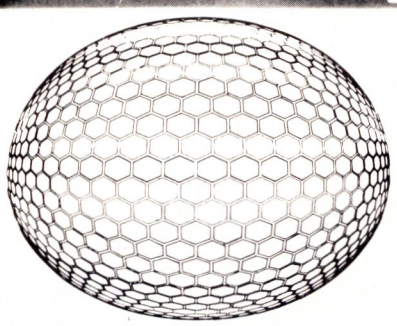

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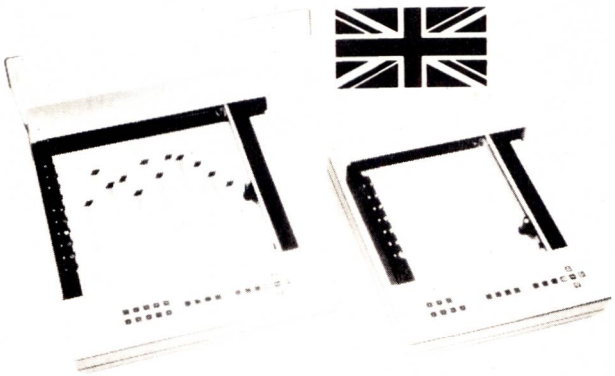

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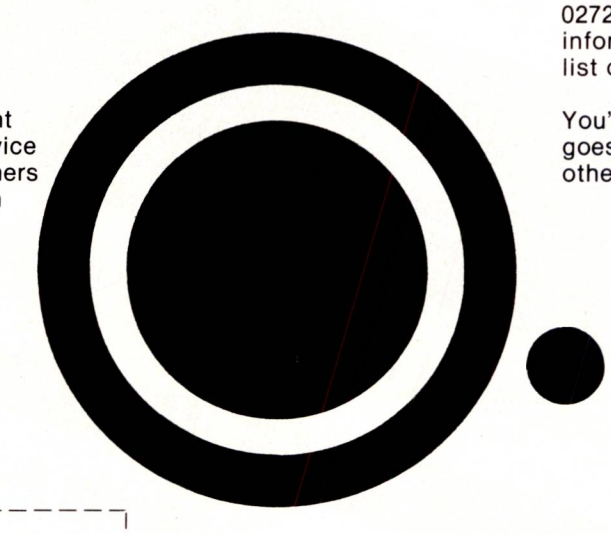

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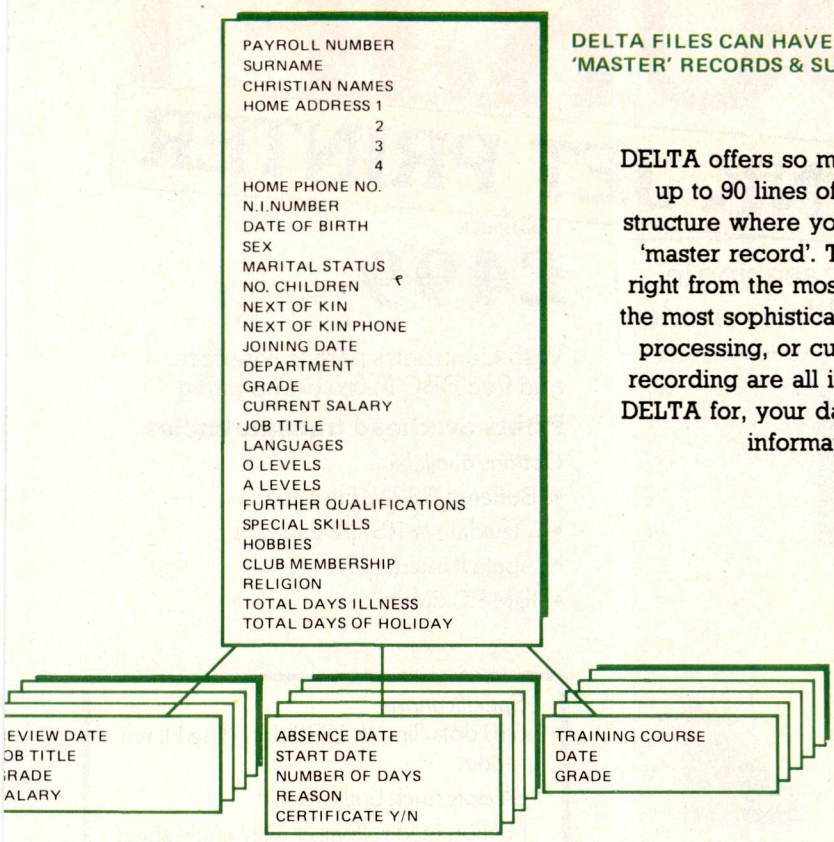

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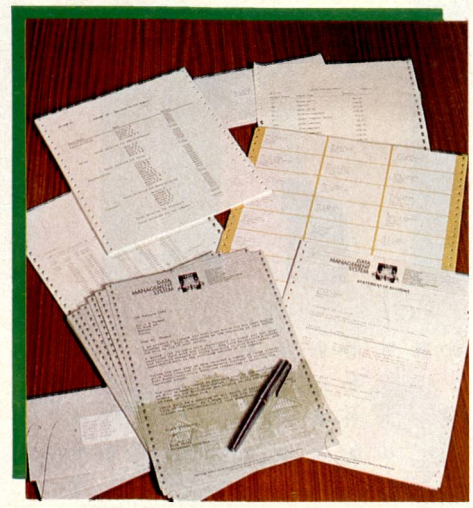

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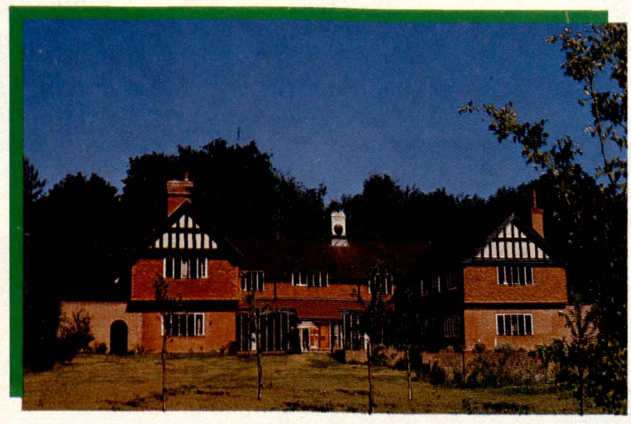

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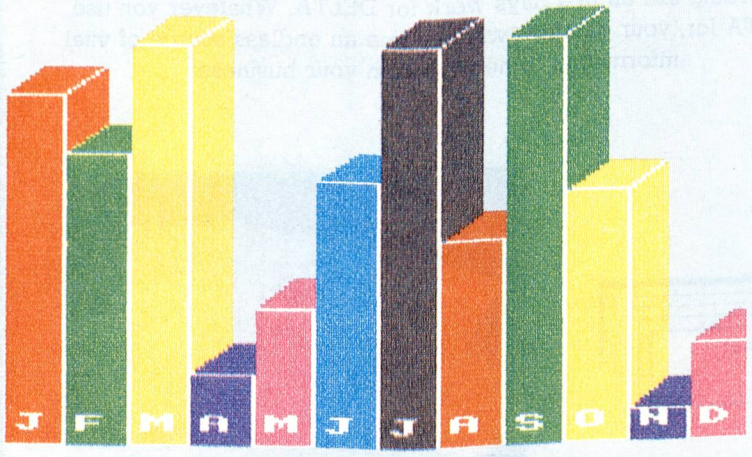

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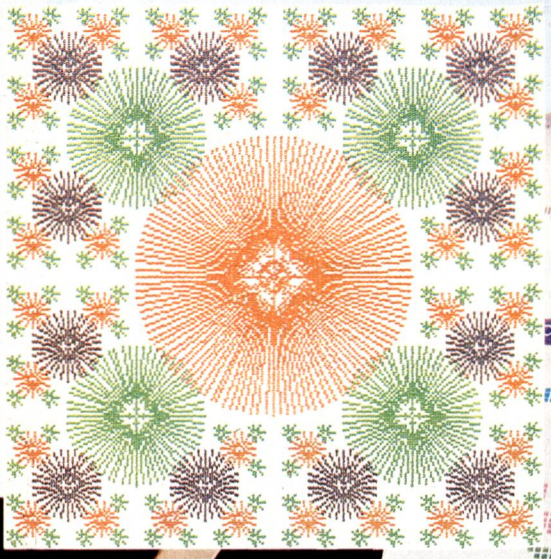



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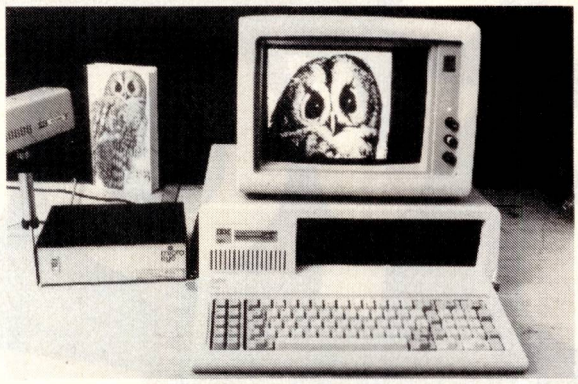

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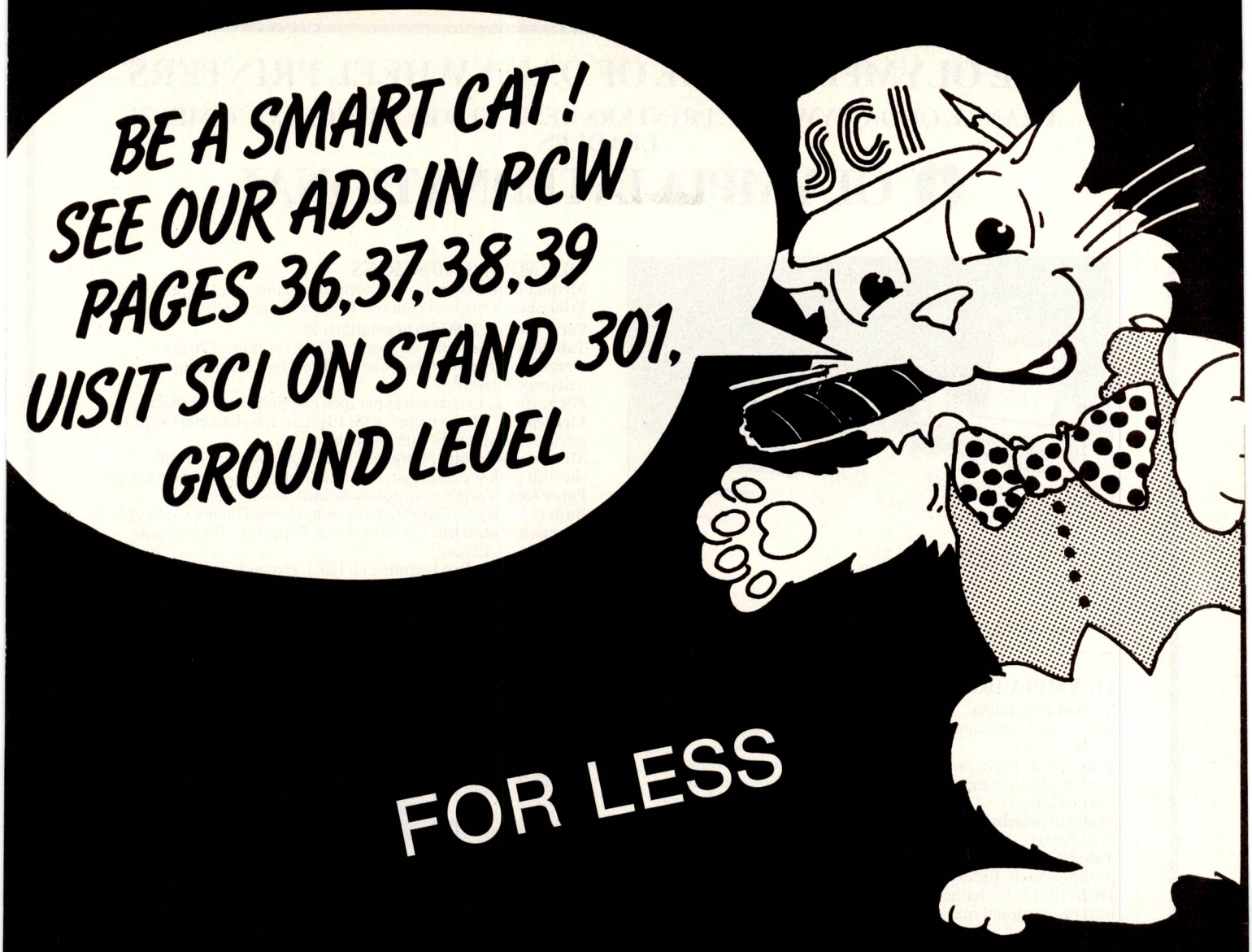

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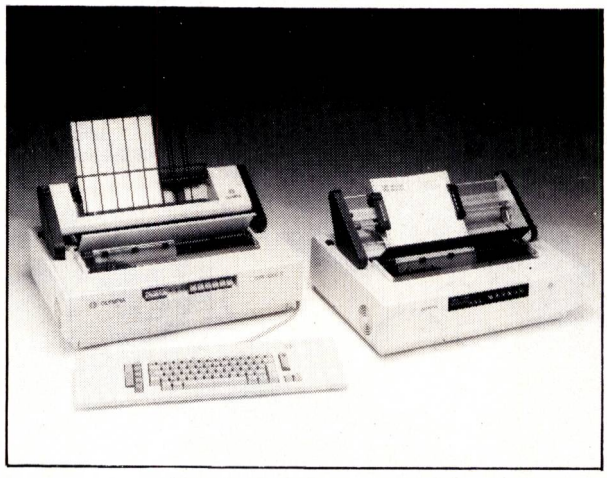

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Function control led: ON/OFF-Line. Paper out. Ribbon out. Cover open. Error.
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Interface: RS232 IEEE, Centronics.

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Line length:
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Buffer: 4 k byte. Keyboard option. Qume control code. Option for Wordstar.
Function controls led:
102 ON/OFF-Line. Error.
103 ON/OFF-Line. Error.
Bold print.
Expand print. Double print.
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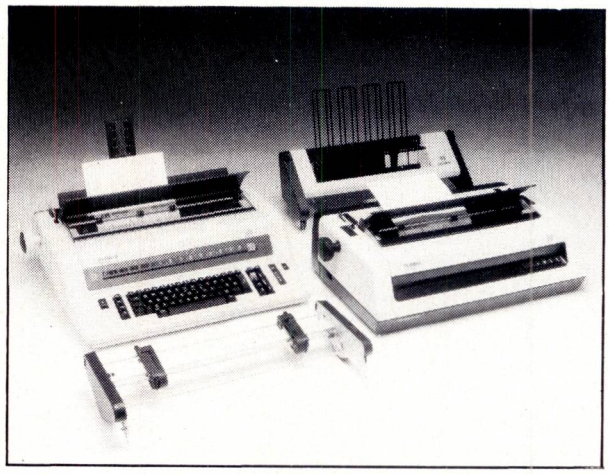

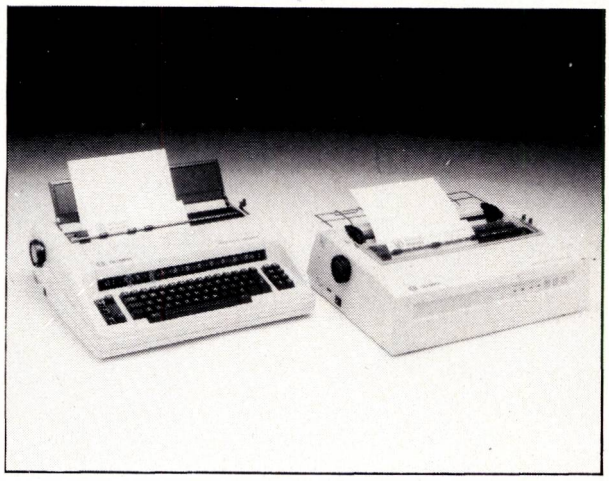

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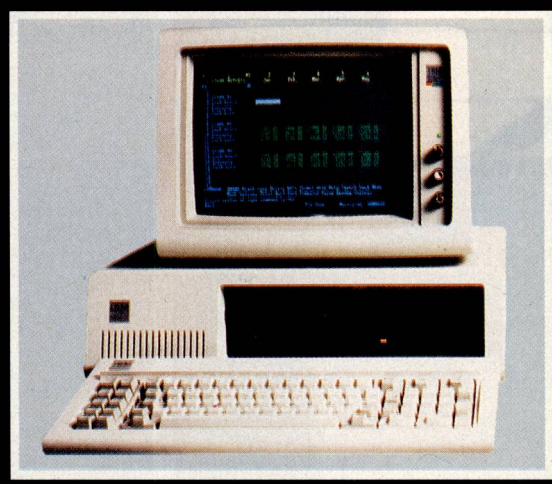

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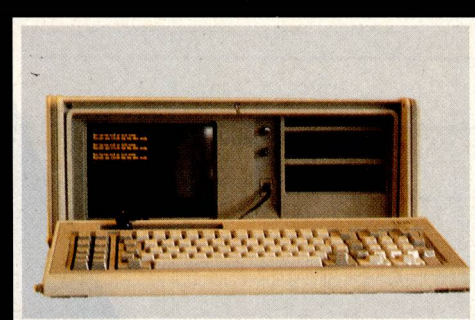

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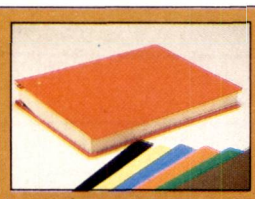

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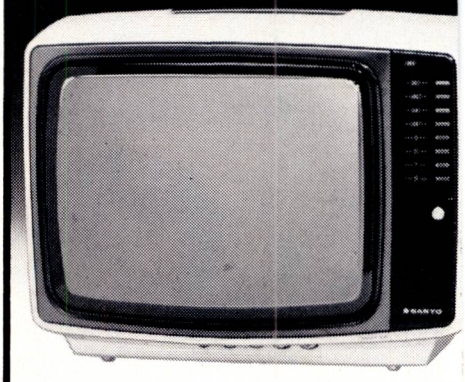

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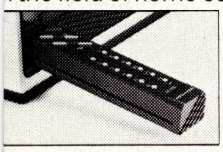

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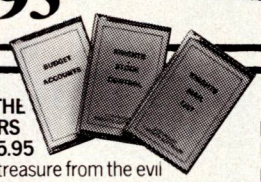

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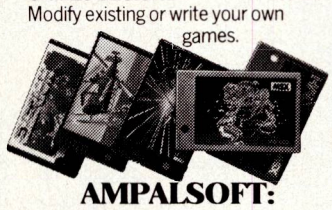

AMPALSOFT:

The **"CHESHIRE CAT EDUCATIONAL SERIES"** of programs will be made available to MSX users.

ABOVE ARE ONLY A FEW OF THE MANY PROGRAMS AVAILABLE FOR YOUR MSX BY MAIL ORDER OR FROM YOUR LOCAL STOCKIST.

SOFTWARE



TOSHIBA

SOFTWARE STARTER PACK As a special introduction to your MSX computing, Toshiba offer a pack of 5 exciting computer games for **ONLY £30**

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AXIS
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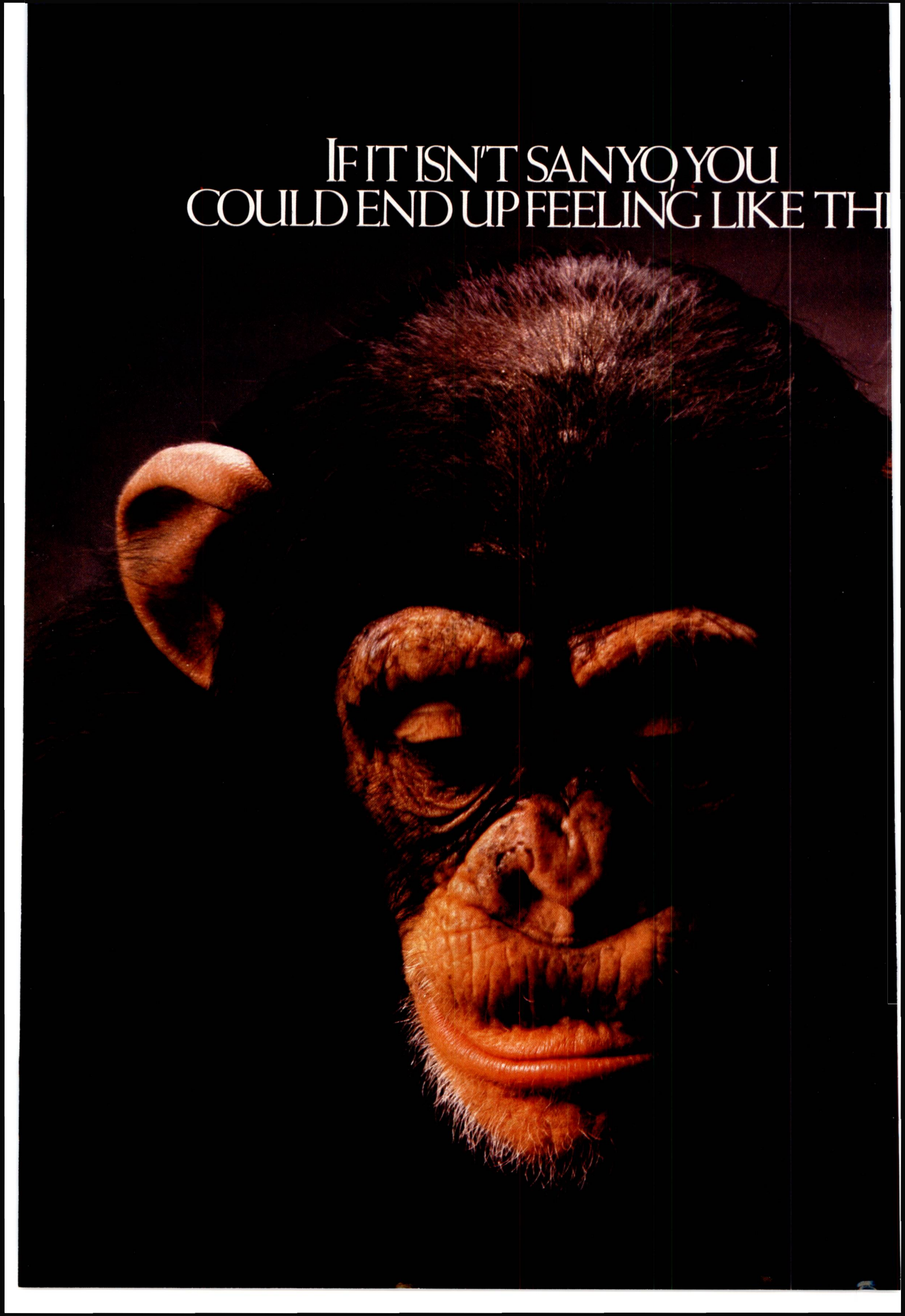
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COULD END UP FEELING LIKE THI





Strange, some people don't know an awful lot about Sanyo computers.

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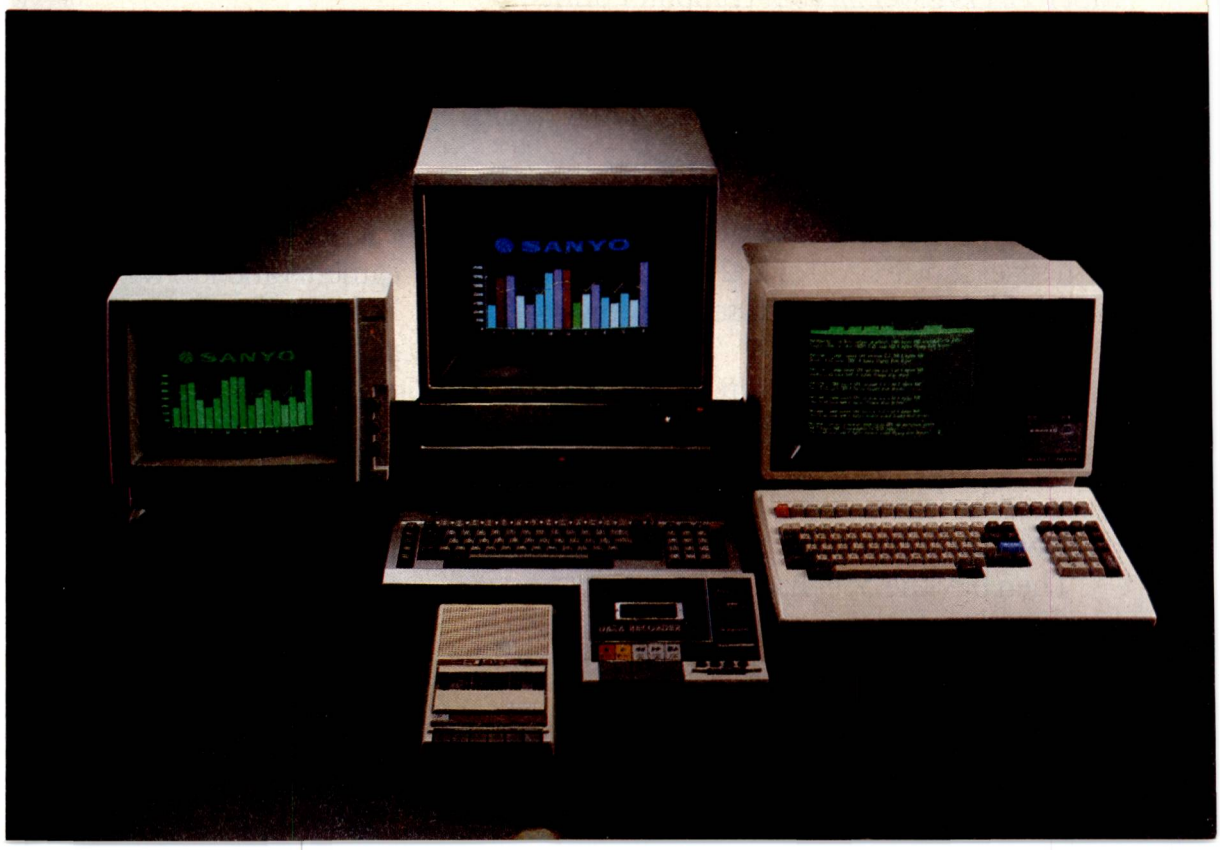
COMPUTERS SHOWN: MBC550, AND MBC4050, BOTH WITH 128KB RAM (EXPANDABLE TO 256KB/384KB).



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for the BBC Micro.

Designed for the small to medium sized business user, where speed and efficiency are vital, Gemini Integrated programs are suitable for sole traders, partnerships, or limited companies. All require a BBC B 32K microcomputer, and an 80 column printer. A double disk drive with an Acorn compatible DFS is required for integrated accounting purposes. A single disk drive may be sufficient where modules are used independently, although this is not recommended for the Sales Ledger and Invoicing module. The manuals indicate the system capacities for various disk drive combinations.

Why Integrated Accounting?

Because it will retrieve information stored in one program for use by another, and store data in one program which has been generated by another.

Why Gemini?

Because our business software for the BBC Micro is based upon the solid foundation of experience. Not only are three of our Directors Chartered Accountants, but we have also successfully written business software for the BBC Micro since it was first launched.

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A program providing full control over every aspect of stockholding operations.

Inventory Master File holding details of part number, selling and cost price, sales and product code, current stock, location of stock, allocated items, re-order level, quantity on order, current period activity and supplier code.

Maximum 980 part numbers on 40 track disk and 1980 on 80 track disk per stock file.

NO SECOND PROCESSOR REQUIRED!

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Produces invoices and statements for customers and enables a tight control over credit procedures to be maintained by producing aged debtor reports.

Automatic updating of sales ledger. Can hold up to 135 customers on 40 track disk system and up to 610 customers on 80 track disk system per Sales Ledger file.

Comprehensive analysis of invoices over unlimited, user definable sales codes.

Price £99.95 per Module VAT inclusive

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Provides a full range of controls over the different aspects of Payroll Accounting including tax and other deductions.

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Maximum 50/98 employees on 40 track single/dual disk system and 140/198 employees on 80 track single/dual system per Payroll file.

NOMINAL LEDGER

This is the central module of the Integrated Accounting system and may also be used independently as a Cash Book or interfaced with the Sales and Purchase Ledgers and Payroll programs.

143 Nominal accounts all of which are user definable.

Full cash Book facilities.

Print out of full Trading and Profit and Loss Account and Balance Sheet together with notes to the accounts.

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Used independently or interfaced with the Gemini Nominal Ledger, the program maintains a complete file for each supplier, records amounts outstanding at any time, helps to determine which invoices are payable, and payment dates for the claiming of discounts.

Comprehensive analysis of invoices over unlimited, user definable expense headings.

Maximum number of suppliers on 40 track disk system of 135 and maximum of 610 suppliers on 80 track disk system per Purchase Ledger file.

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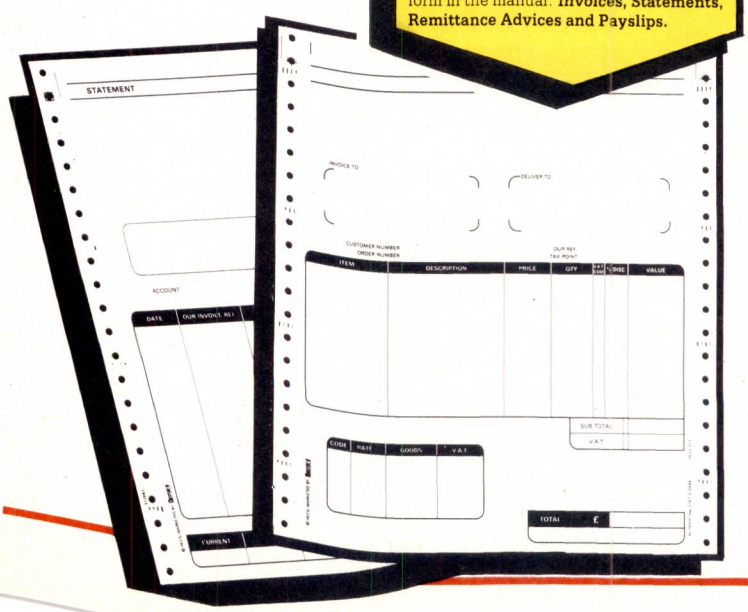
The following Gemini two-part pre-printed continuous stationery forms are available by completing the order form in the manual: **Invoices, Statements, Remittance Advices and Payslips.**



Available from:

Most good software dealers... or phone Gemini for immediate despatch quoting your Access, Visa or American Express card number. Telephone (0395) 265165/265832. Alternatively make your cheque or Postal Order payable to Gemini Marketing Ltd., and send to Gemini Marketing Ltd., 18a Littleham Road, Exmouth, Devon EX8 2QG.

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PCW

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To order, just clip the coupon below. Personal callers welcome.

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Disco Technology Limited, Lex House, 3/6 Alfred Place, London WC1, England. Telephone 01-631 0255,



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____(qty) storage box(es) filled with 25 d/sided disks at £47.15 each.
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Prices include VAT and P + P. I enclose cheque for _____
or debit my Access card no. _____
Name _____ Signature _____
Address _____
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Postcode _____ Telephone _____

To: Disco Technology Ltd, Lex House, 3/6 Alfred Place, London WC1.

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BBC Micro Computer System OFFICIAL DEALER

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BBC Model B Special offer	£320 (a)
BBC Model B + Econet	£389 (a)
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DFS Kit	£95 (c)
Econet Kit	£45 (c)
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Z80 2nd Processor	£265 (a)
6502 2nd Processor	£175 (b)
Teletext Adaptor	£190 (b)
IEEE Interface	£282 (b)
Prestel Adaptor	£99 (b)
RH Light pen	£39.50 (c)

BBC FIRMWARE:

1.2 Operating System Rom	£7.50 (d)
BASIC II ROM	£22.50 (d)
VIEW Word Processor Rom	£48 (c)
WordWise Word Processor Rom	£34 (d)
BCPL ROM/Disc	£86 (c)

UTILITY ROMS:

Disc Doctor/Gremlin Debug ROM	£28 ea (d)
EXMON/TOOLKIT ROM	£20 ea (d)
Printmaster (FX80)/Graphics ROM	£28 ea (d)
ULTRACALC spreadsheet ROM	£69 ea (c)

COMMUNICATION ROMS:

Termi Emulator	£28 (d)
Communicator	£59 (d)
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For detailed specification on any of the BBC Firmware/Peripherals listed here or information on our complete range please write to us.

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These drives, fitted with high quality slim line Japanese mechanisms are supplied in attractive cases with BBC matching colour and come complete with data and power leads, manual and formatting disc. The 40/80T switching is supplied as standard on TEAC 80T drives. Single drives are supplied with or without power supply. All dual drives are supplied with integral switch mode power supply. TEAC & MITSUBISHI drives are compatible for both single and double density operation. These drives can also be used with any other micro with a Shuggart A400 interface.

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1 × 400K TS55F (40/80T) TEAC	£198 (b)
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BROTHER: HR15 **£350** (a); EP44 **£199** (a):
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EPSON Paper Roll Holder **£17** (b); FX80 Tractor Attach. **£37** (b); RX/FX80 Dust Cover **£4.50** (d).
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GRADUATE The card to convert your BBC into an IBM PC. To be available early September. Send for details.

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Microvitec 1451 14" RGB Med Res	£295.00a
Microvitec 1441 14" RGB Hi Res	£339.00a
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KAGA Vision III 12" RGB Super Hi Res	£358.00a
KAGA 12" Green Hi Res	£106.00a
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The original speech synthesis for the BBC: still the best. Attractively packaged self contained speech synthesiser with built in speaker and AUX socket. Allows creation of any English word with ease and economical memory usage. Simply plug into the user port, simple software means no need for ROMs. Supplied with software instructions and demo/development programs
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for the BBC

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(Speed Block Type)

	St. Pin	Recep-tacles	Edge Conn.
10 way	90p	85p	120p
20 way	145p	125p	195p
26 way	175p	150p	240p
34 way	200p	160p	320p
40 way	220p	190p	340p
50 way	235p	200p	390p

JUMPER LEADS

24" Ribbon Cable with Headers

	14pin	16pin	24pin	40pin
Single End	145p	165p	240p	380p
Double End	210p	230p	345p	540p

Ribbon Cable with Sockets

	20 pin	26 pin	34 pin	40 pin
1 end	160p	200p	280p	300p
2 ends	290p	370p	480p	525p

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(Grey/meter)

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16 way	60p
20 way	85p
26 way	120p
34 way	160p
40 way	180p
50 way	200p
64 way	280p

D CONNECTORS

MALE	No. of Ways			
Solder	80p	105p	160p	250p
Angled	150p	210p	250p	365p
FEMALE				
Solder	105p	160p	200p	355p
Angled	165p	215p	290p	440p
Hoods	90p	85p	90p	100p

IDC 15 way Plug 340p Socket 400p
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14 pin 375p 16 pin 400p
40 pin £10.30

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(25 way D)

24" Single end Male	£5
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DIP HEADERS

	Solder Type	IDC Type
14 pin	40p	120p
16 pin	50p	140p
24 pin	100p	200p
40 pin	200p	225p

EUROCONNECTORS

DIN 41617	PLUG	SKT
21 way	160p	165p
31 way	170p	170p

DIN 41612		
2 x 32 way St Pin	230p	275p
2 x 32 way Ang Pin	275p	320p
3 x 32 way St Pin	260p	300p
3 x 32 way Ang Pin	375p	400p
1 DC Skt A + B	275p	
A + C	350p	

For 2 x 32 way please specify spacing (A + B, A + C)

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	0.1"	0.156"
2 x 6 way (Commodore)	—	300p
2 x 10 way (Commodore)	150p	—
2 x 12 way (Vic 20)	—	350p
2 x 18 way	—	140p
2 x 23 way (ZX81)	175p	220p
2 x 25 way	225p	220p
2 x 28 way (Spectrum)	200p	—
2 x 36 way	250p	—
1 x 43 way	260p	—
2 x 22 way	190p	—
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6802	300p
6809	650p
6809E	£12
68B09	£12
68B09E	£16
68000-L8	£48
8035	£12
8039	£12
8080A	450p
8085A	£18
8086	£22
8088	£22
8748	£45
TMS 1601	£12
TMS9980	£12
TMS9995	£12
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Z80	300p
Z80A	400p
Z80B	750p

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6522	400p
6532	650p
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68B21	250p
6854	850p
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6875	750p
8205	225p
8212	£11
8216	300p
8224	300p
8250	£18
8251A	£18
8255AC-5	£19
8256	£25
8279	£11
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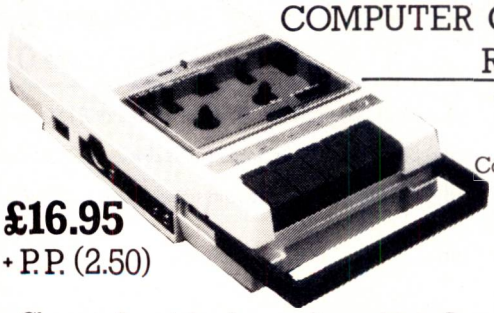

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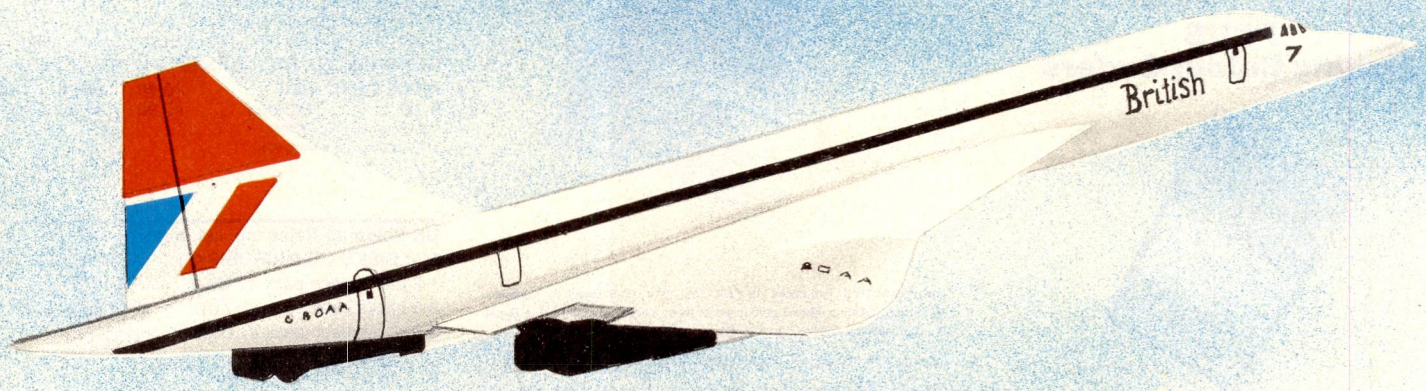



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DISKING NEWS

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We were buying some equipment the other day, and were having it checked out through the lunch hour as the engineer concerned knew we were in a hurry. Needing assistance he gave a lady colleague another unit to test. She happily complied, and was busy when a sloppy looking male individual entered the room. This very cocky young man had been wandering around the factory most of the morning, doing nothing apart from embarrassing us all with filthy jokes in very bad taste. He now confronted the lady and told her that under NO circumstances should she be there after 1 o'clock and that her lunch hour was NOT for working. She was too embarrassed to argue, and walked out to keep him quiet, leaving the unit under test. Just another customer's unit. Just another customer. Just the hand that fed him. "Another pint John?"

As promised last month, the NEW Microdisk SEE 10 has arrived, and is FREE with every pack of ten MEMOREX 6100 Microdisks, or Maxell CF2 microdisks. It is also available separately at £2.50 EXC VAT. The fabulous NEW MEMOREX cleaning kits, have also arrived and at these prices give you NO excuses not to own one. We still ship the world's best diskettes faster than anybody, we always enclose a VAT invoice and current price list. If we can't ship within four working hours (YES HOURS) we'll ship a more expensive alternative equivalent at OUR Expense!

FREE with EVERY ten-pack of diskettes from DISKING. SEE 10 LIBRARY BOX



Also available individually for £2.50 exc VAT either for 5¼" (SEE 10) or any 3"/3½" microdisks (SEE 10-3)

PLUS
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A multicoloured pack of ten fibre tipped pens for colour coding your diskette labels available individually at 49p per pack of ten exc VAT.

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DISKING Means Business

Diskette Storage

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Part. No	Description	Price
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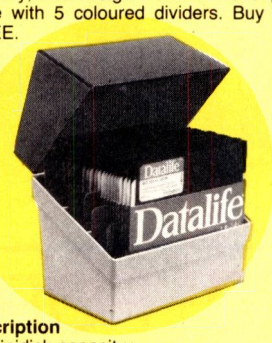

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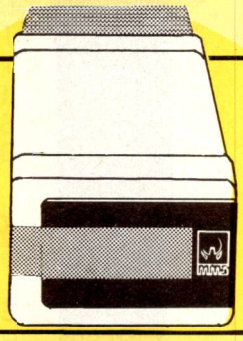

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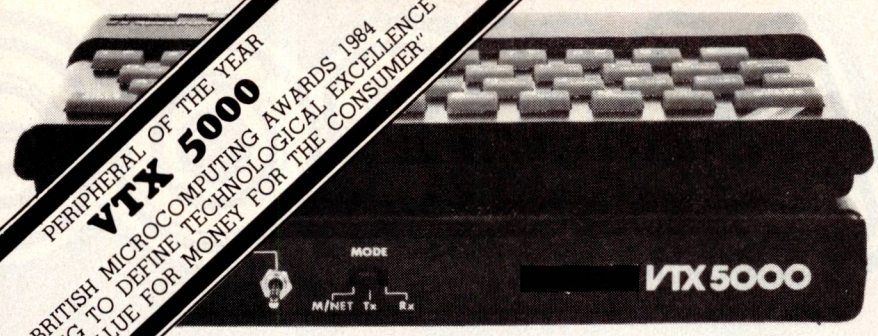

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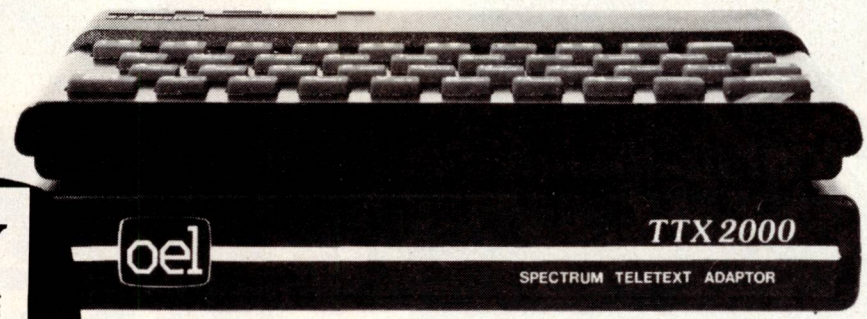

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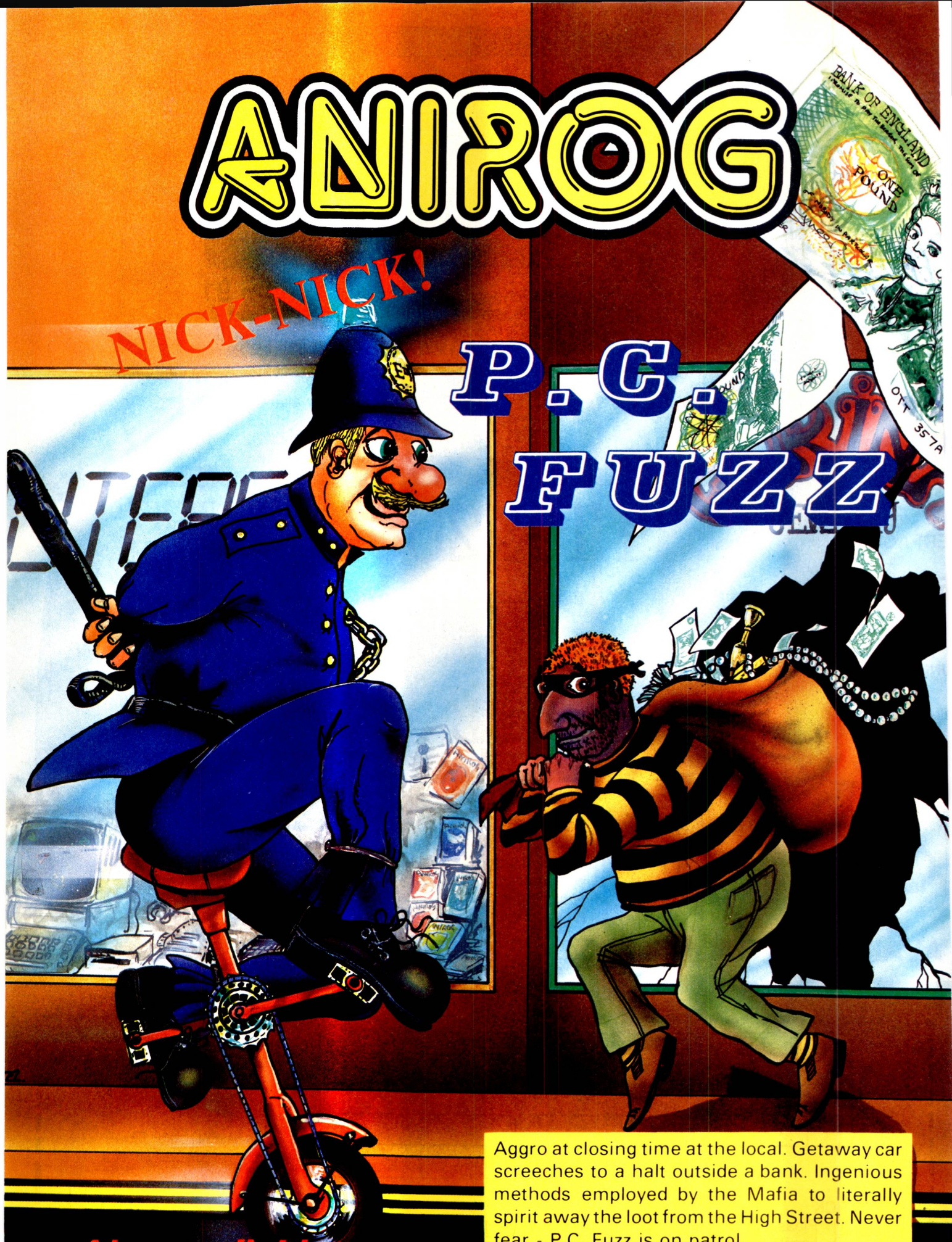

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CONTROL 'C' database generator leads the field in business software. It puts you in total control of your system. In only a few hours without expertise or experience you can create professional programs, tailored to your needs.
CONTROL 'C' produces files and reports with real time updates; letter and label formats and bar-charts with full colour graphics. All these are totally integrated and can be altered with ease as your needs change. An equivalent suite of programs designed by an expert programmer would take weeks to produce and cost you £1000s.
CONTROL 'C' is flexible, easy to use and very fast.

IT IS QUICK TO LEARN A person with no knowledge of programming can produce his first screen and file with full editing facility and together with a selective printed report from that file in under 2 hours. (Our guinea pig took 1 hour 25 minutes). The second file, screen and report will take under ½ hour (our guinea pig took 27 minutes). It is very logical in its approach, there are full prompts at every step. It is not necessary to learn any new concepts or any additional programming commands. The tutorial and manual are easy to follow, taking you step by step through the procedures. You will have total mastery of CONTROL 'C' within a few hours.

IT IS FAST TO USE The completed suite of programmes are simple for the operator to understand. Each routine can be selected from a menu with full prompts at every stage, one 30 minute session can teach a new operator how to run the system. Users can then input new records, amend records (with automatic updating of calculated fields) or delete records very rapidly and save the data in a fraction of a second. They can edit letters and print out general reports, individual letters to customers, labels or selective reports of all records meeting chosen criteria. And then create bar charts of any combination from the information on file. And the speed at which it fufills this function is comparable, if not better than the typical speed of large supermicros or mini computers running under BASIC.

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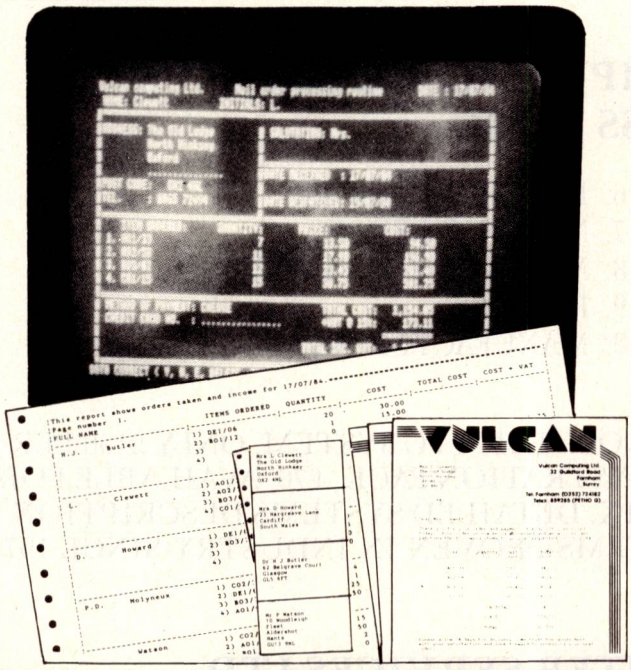

An Experienced Programmer
will appreciate how the generator will save days or even weeks in producing a system - creating all the files and file maintenance routines together with the printouts required in a fraction of the time previously needed. It will eliminate the need for complex testing and will result in a standardised package with a very professional appearance which would sell at a substantial price. (One of our programmers built a suite of programmes for a client using the generator and charged £800 for it. It took him less than 1 day to produce!).

A Beginner to Programming
will now be able to tackle complex programming tasks himself. Whereas, previously a set of programs necessary to build and maintain a set of records on a file and print selected reports using BASIC might have taken several weeks hard work and then STILL have had bugs in it, the generator will be able to complete this task in an hour or two. Now the beginner can be certain that programming will be fast and completely reliable. When he decides to computerise more procedures he will be able to build onto his existing database system.

FEATURES OF CONTROL 'C'

★ A full screen and file generator with 'screen based' definitions - the next generation from the standard 'menu driven' databases. It is very easy to add to, delete from or change a generated screen.
★ Record size is only limited by size of memory, typically in excess of 3000 bytes.
★ Files can be easily restructured, enlarged or shrunk without corruption of existing data.
★ Number of records per file is only limited by size of disc storage.
★ Each file can contain as many key fields as you like; you can sort in any combination of fields for creating new files, printing reports, letters, labels, screens or bar charts.
★ A full report generator with letter writing, complex Mail Merge and word processing facilities. Label printing
★ File definition listings with full data dictionary on all fields in all files. Enables the programmer to access the data easily when building additional routines.
★ Can use colour, sound and graphics where available on the computer. Full set up routine to configure your database to any printer.
★ Select drive for programs and for data; read disc directory, copy, delete, rename a file all within the generator.
★ Can implement all function keys where available into generated programs.
★ Very fast in use - on most computers a screen with 40 prompts saves and clears in under 1 second.
★ Creates files compatible with commonly used packages such as Wordstar, Multiplan and Supercalc.
★ Instantaneous update on screen of all figures simulating spread sheet programs.
★ Full error recovery feature implemented so programs will not crash when used by operator.
★ Simple screen editing of all files by end users.
★ Multi user access capability if used with a Network System.
★ Routine to design your own multi level menus to create complete system packages - also full password protection.

HOW TO ORDER

CONTROL 'C' comes to you on floppy disc together with tutorial instructions and a comprehensive manual. The BBC version costs £69.95 inc P & P; the version for all other computers is £99.95 inc P & P. When ordering please state type of machine and disc drive. Send your cheque for the complete system which includes file creation, bar graphics, report, label and letter generator to:

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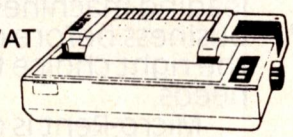

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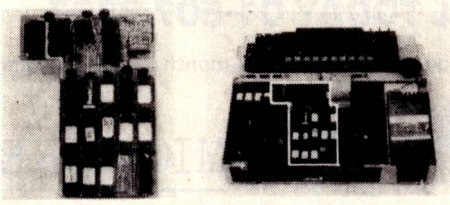

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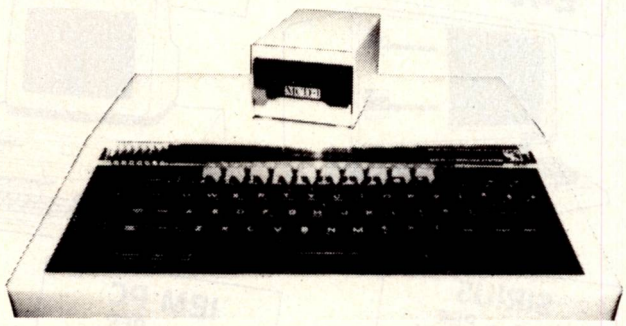

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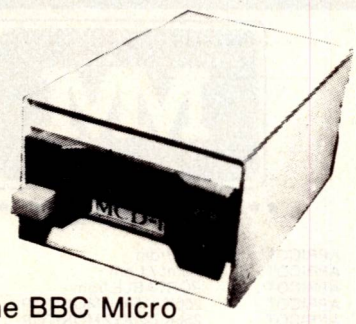

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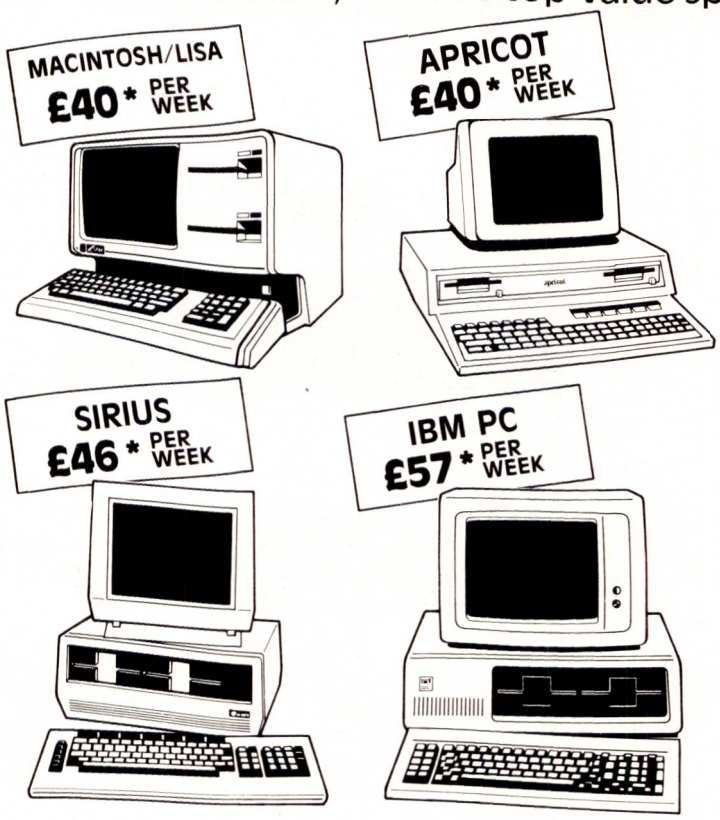

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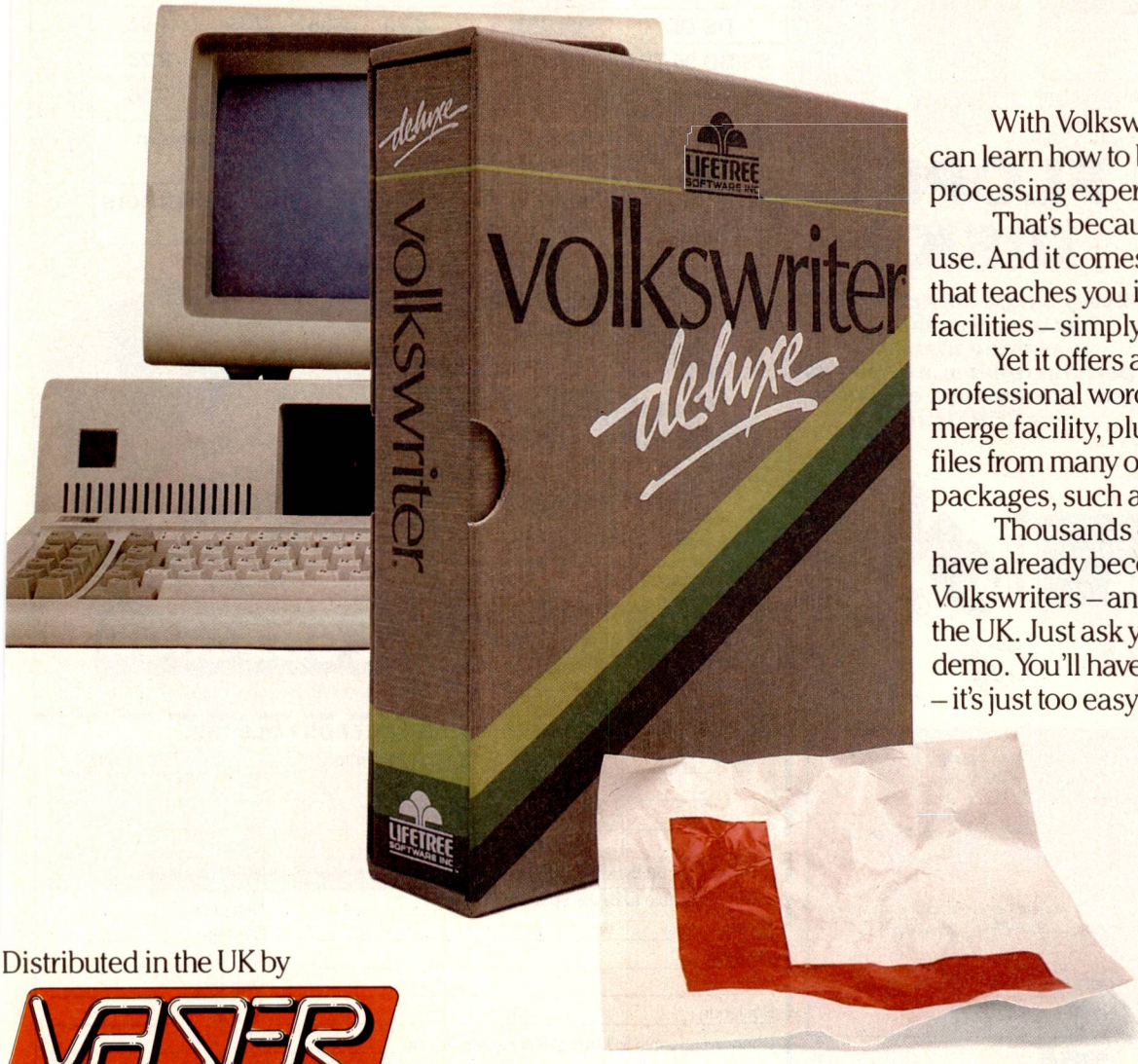

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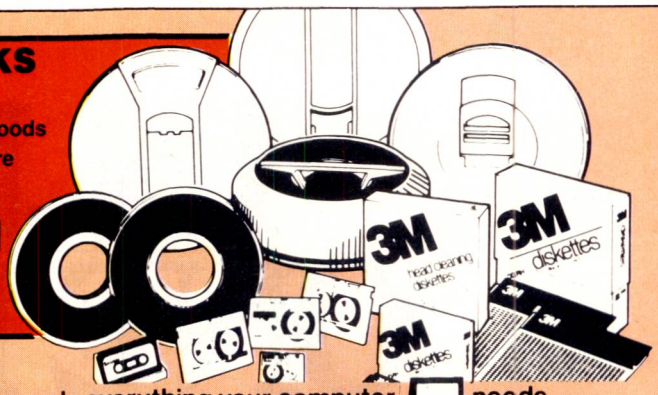

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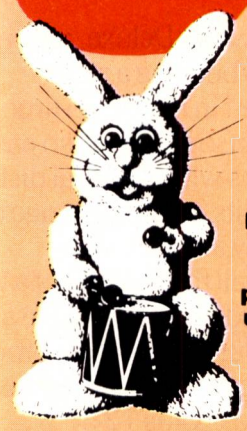

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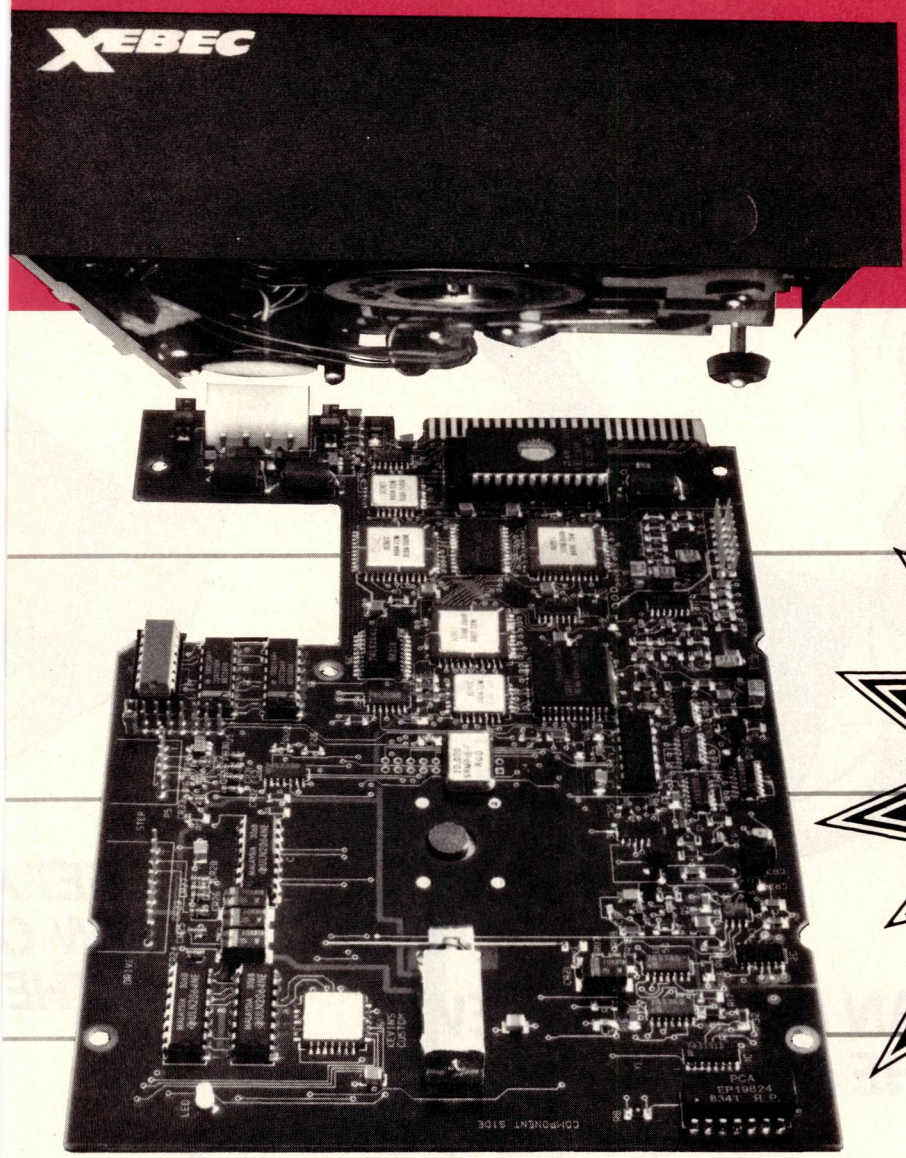

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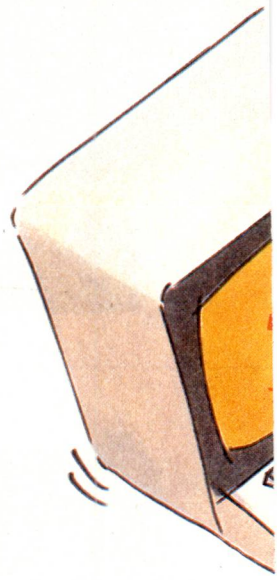

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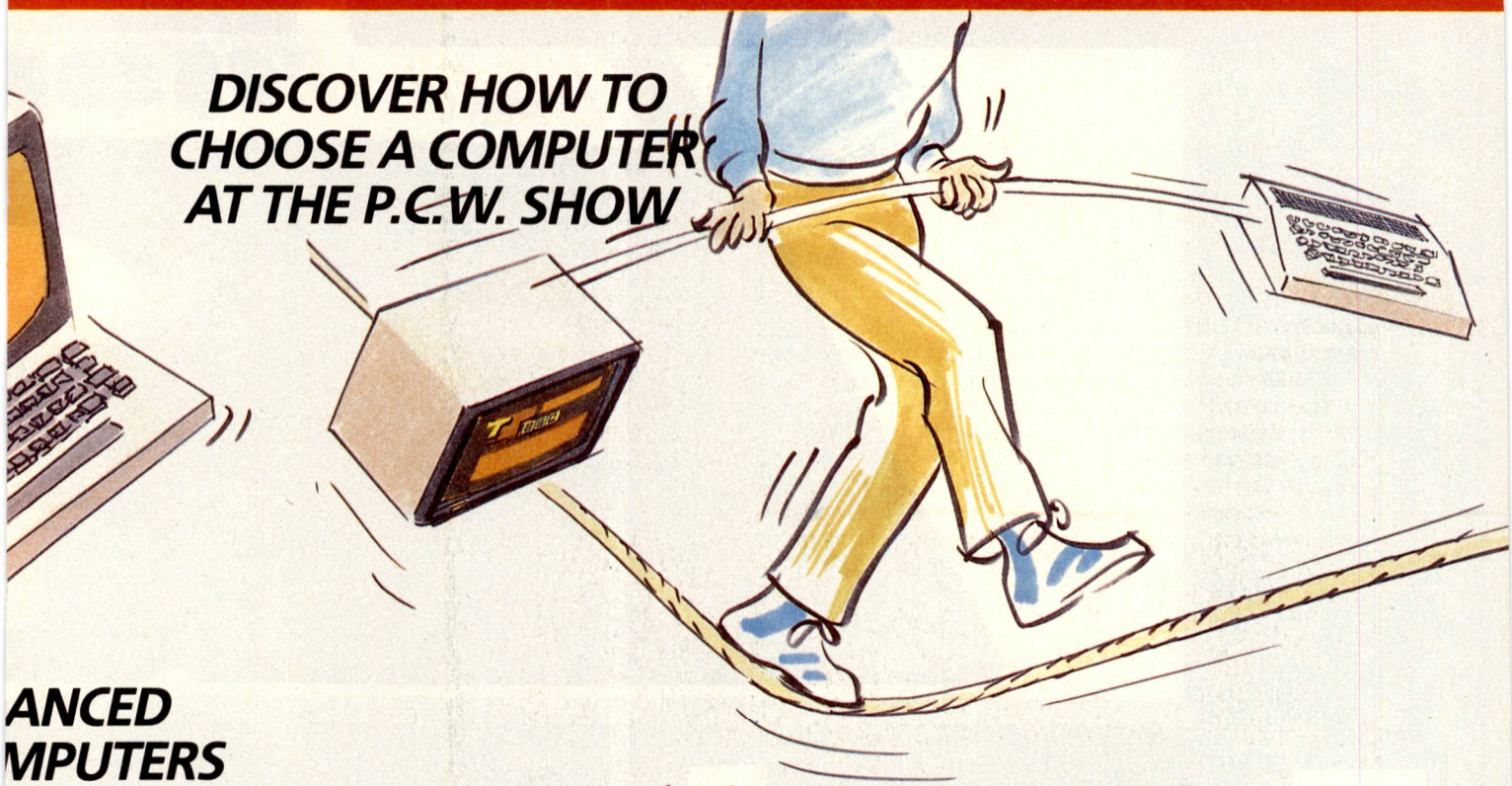

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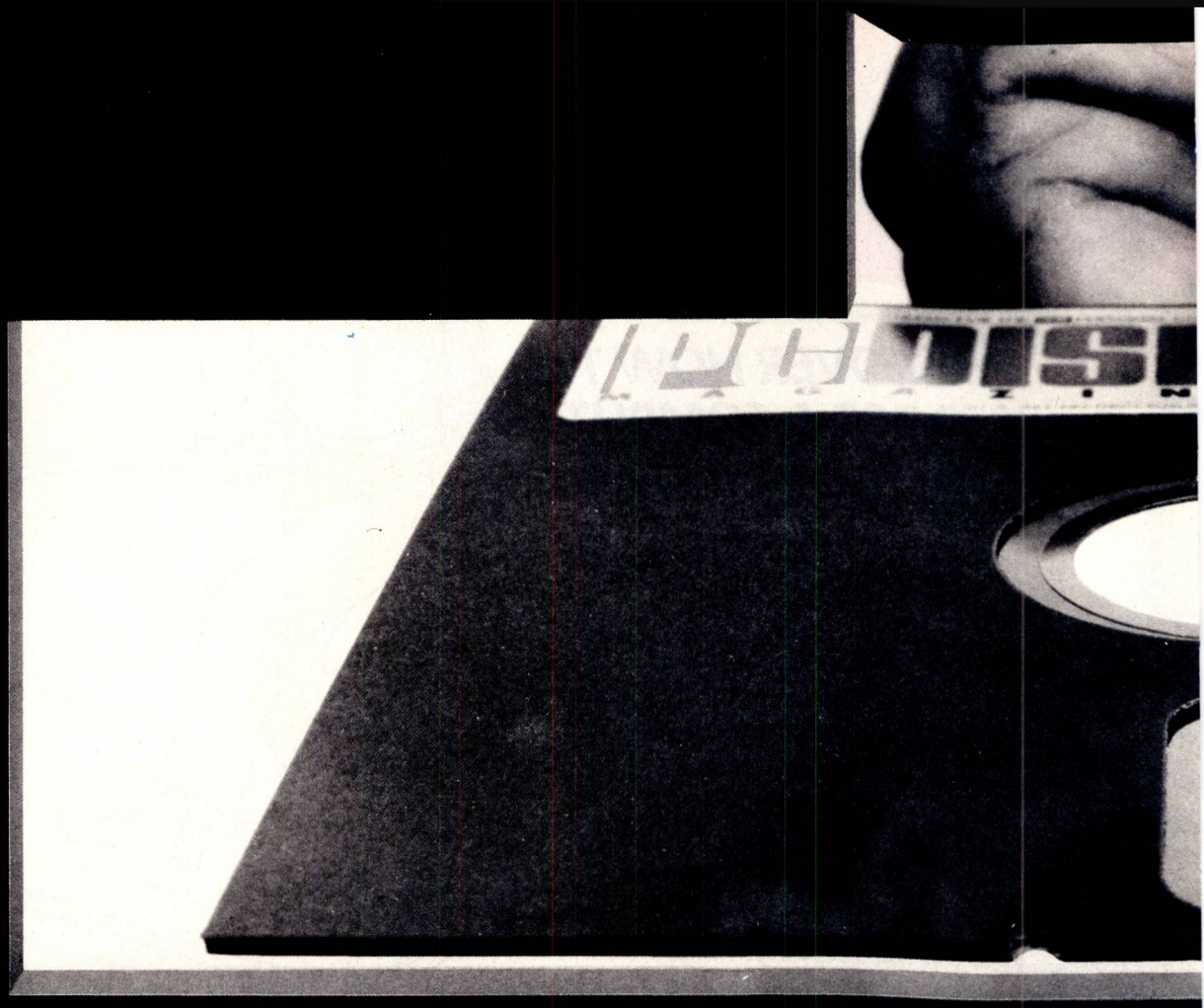

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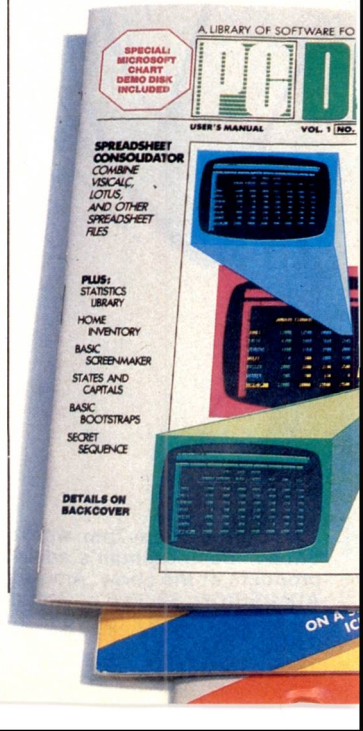

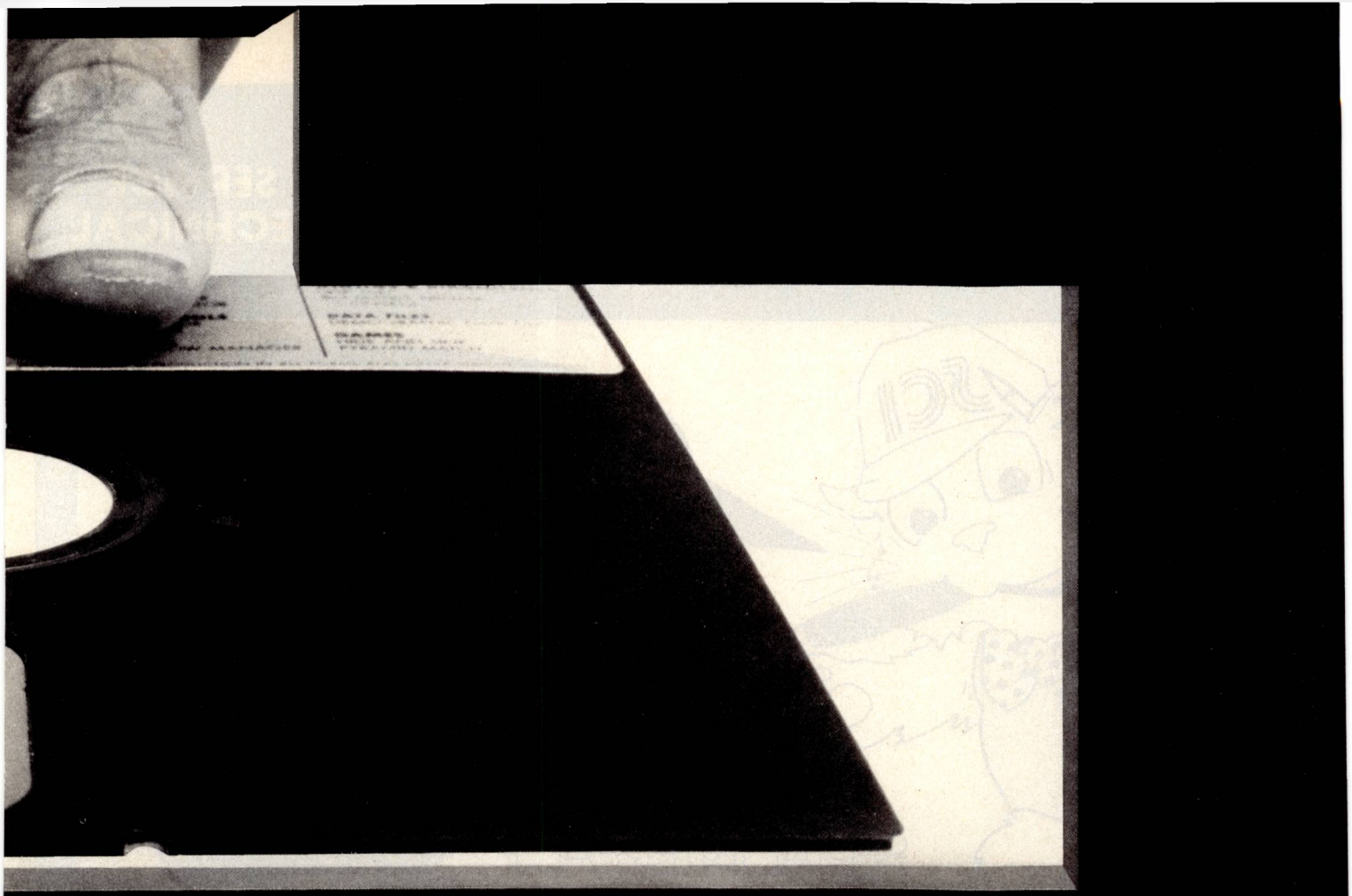

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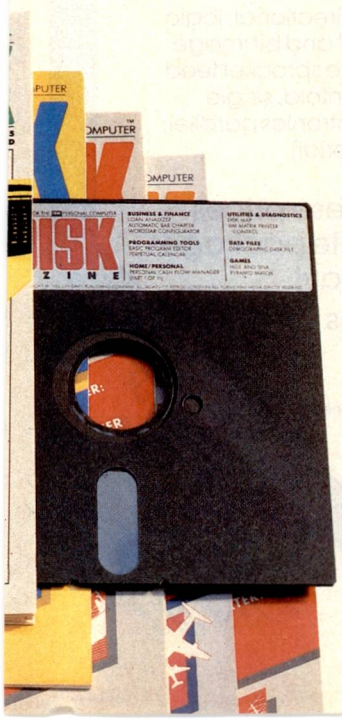

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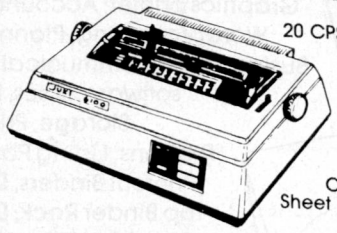

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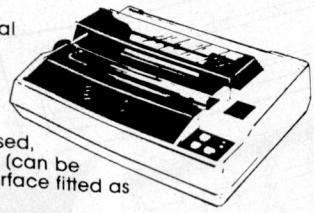

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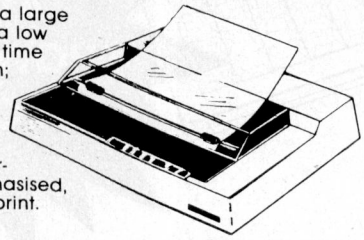

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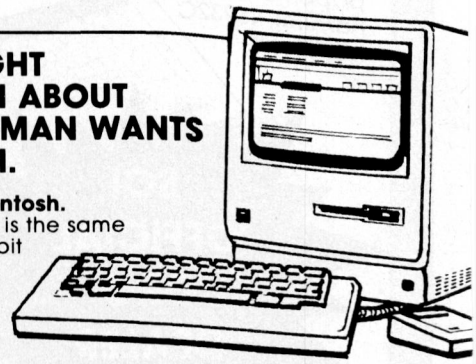

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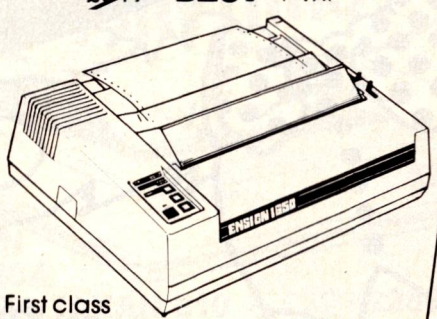

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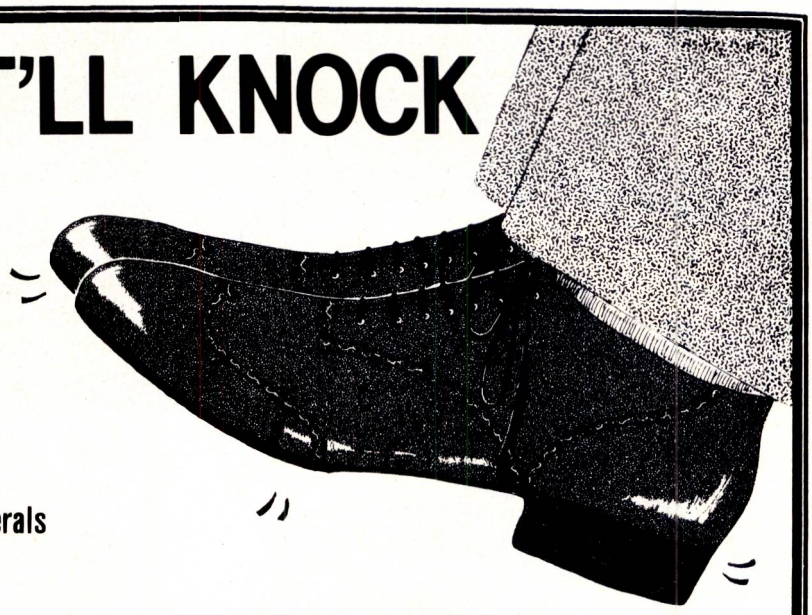

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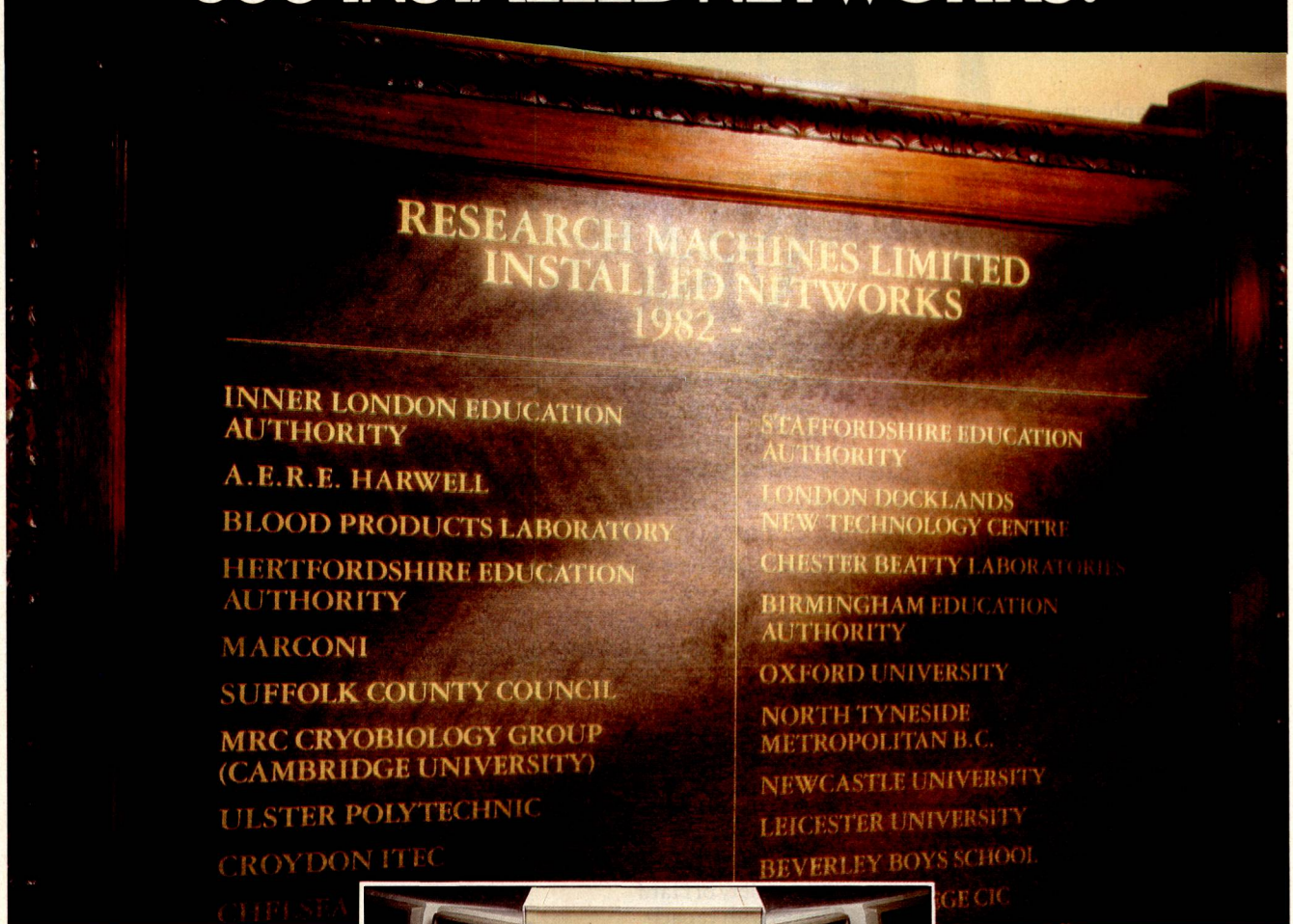

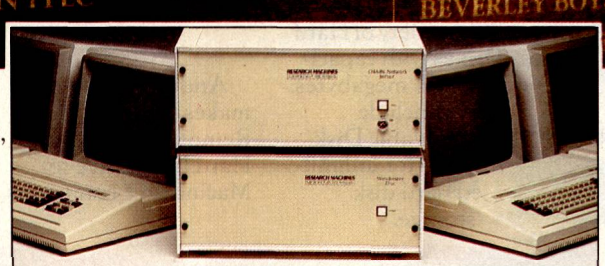

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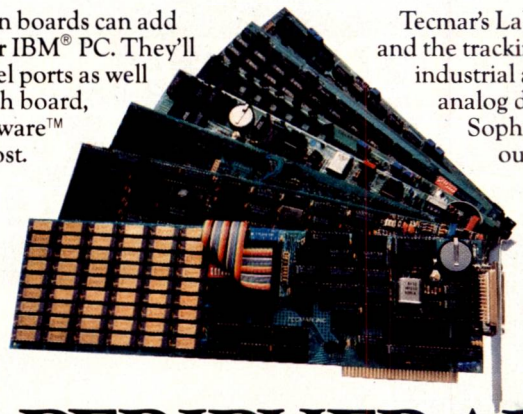

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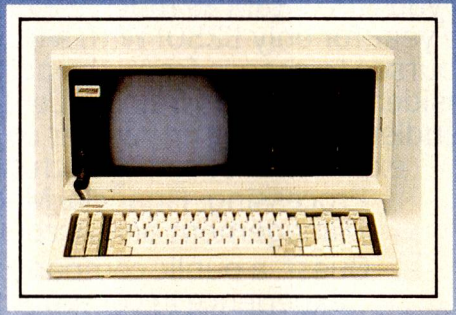

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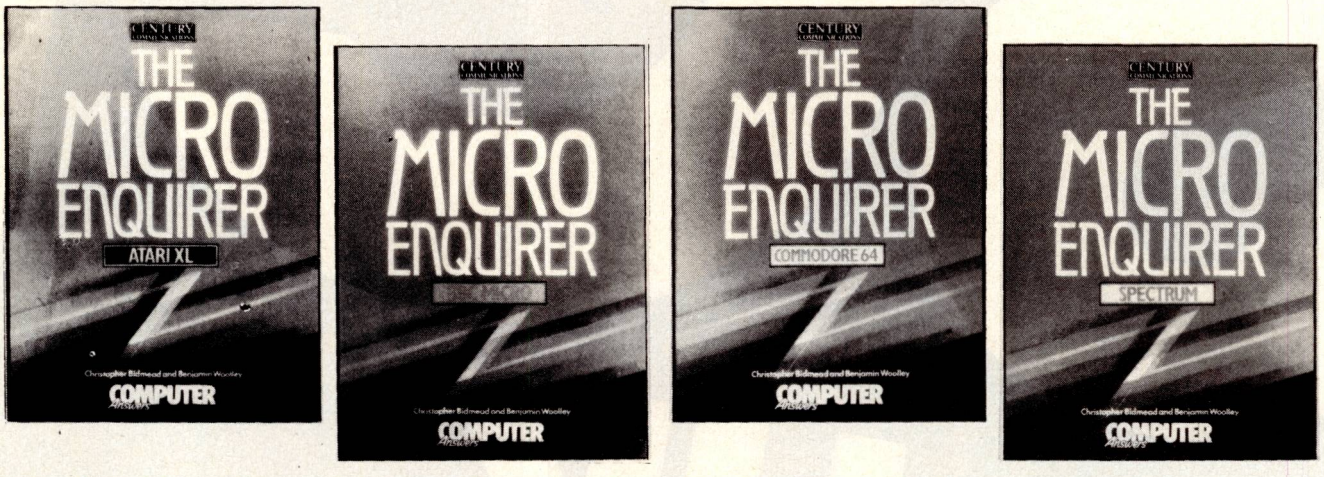

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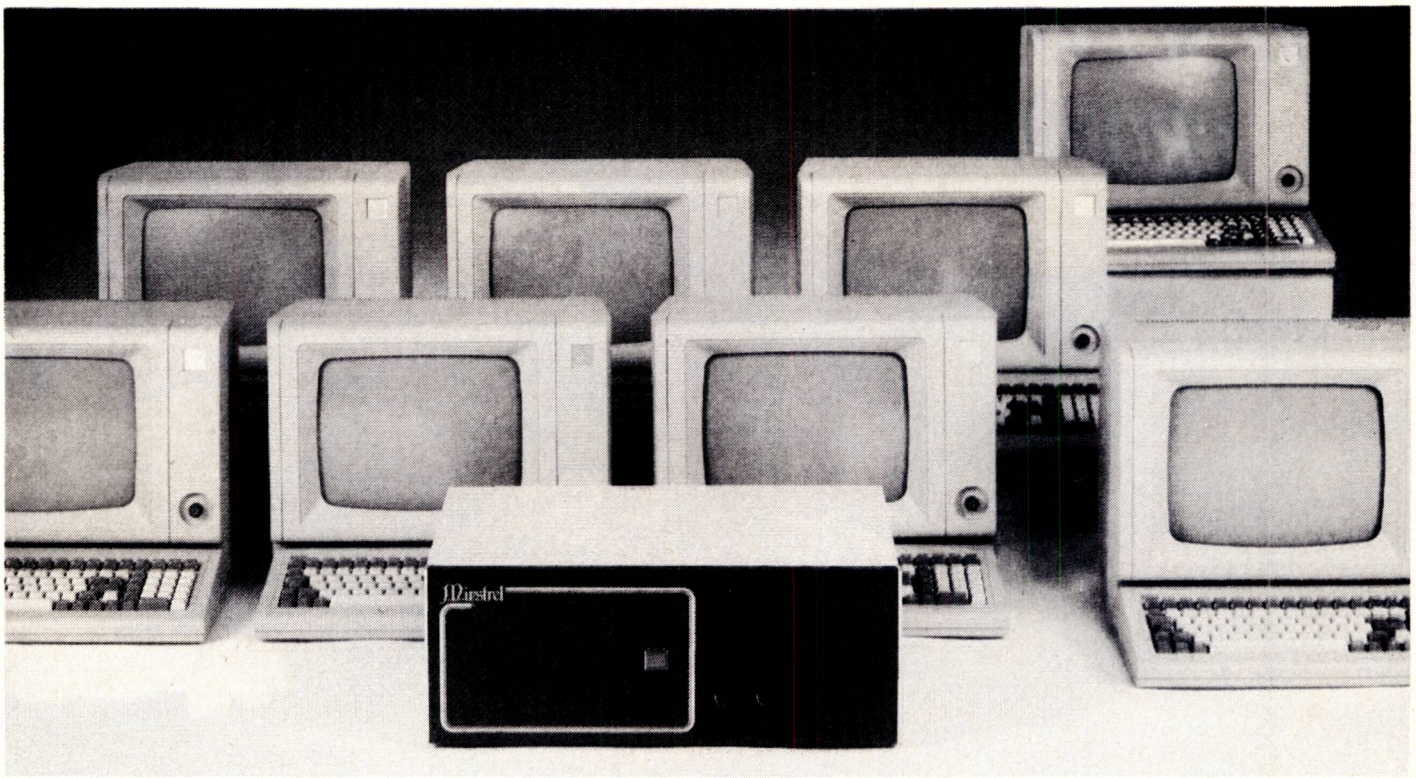

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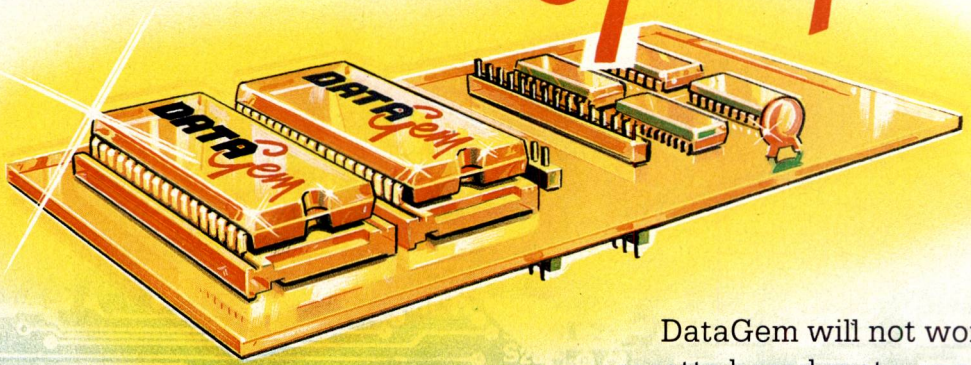

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CHIP CHAT

Lightweight: buyers of keyboard cases for the Spectrum have hit on a pleasant wheeze. Once you've taken out the machine's innards and put them in a new keyboard case, take back your empty Spectrum and demand a refund because it doesn't work. The highly skilled computer sales people, so computer-literate that basics such as weight pass them by, have been known to fall for it.

Come in number nine: ACT's promotional material for the new Apricot Portable praises the machine's voice recognition and hi-res flat screen. However, it forgets to mention an additional feature only revealed in the photograph: two rows of identical number keys. Numbers 7,8 and 9 are the ones that get a double billing while 1,2 and 3 never made it.



Apricot Portable: the keyboard with a difference (see 'Come in number nine')

Bright move: British Telecom celebrated its information networking strategy, headed 'Britain should be at the forefront', by proposing a joint venture with that well-known 'British' company IBM.

ChipChat needs no reassuring about IBM's contribution to the British economy—after all, you have to invest in order to make even more money. But when called for news of the company's latest US launch, IBM UK said it was still in the dark. It's a shame that they had no money to feed the electricity meter—wonder where it could all have gone?

Truth is stranger than . . .: Martin Banks may be pondering chips for breakfast in this issue—but, as ever, Sinclair has already beaten everybody else to the crunch. Courtesy of Kellogs, 100 Spectrums are being offered as prizes on the back of cornflake packets. Breakfast being neither Martin Banks' not ChipChat's favourite time of the day, we won't be competing for the prizes.

Keep it clean: impregnated wipes may not be the catchiest of phrases, although ChipChat is sure that they have their uses. In fact Robinsons of Chesterfield has written to assure us that they do—not just for computer hardware, but for wiping babies (no part of the anatomy specified) and cows as well (specifically, their udders).

Nostalgia: *Sinclair QL User* (as opposed to *QL User*, that other well-known mass circulation magazine) is so full of innovative ideas that it looks exactly like *PCW* used to.

A similarly enterprising advertising policy is being pursued, with the result that the magazine has a one-page ad promoting scientology. And very interesting reading the ad makes too. For example, did you know that 'a science of the mind is a goal which has engrossed thousands of generations of Man . . . and down in the arsenal is an atom bomb, its hopeful nose full-armed in ignorance of it'? And would you have guessed that such phrases might form part of an 'all-embracing statement of great propensity'? You wouldn't? Shame on you.

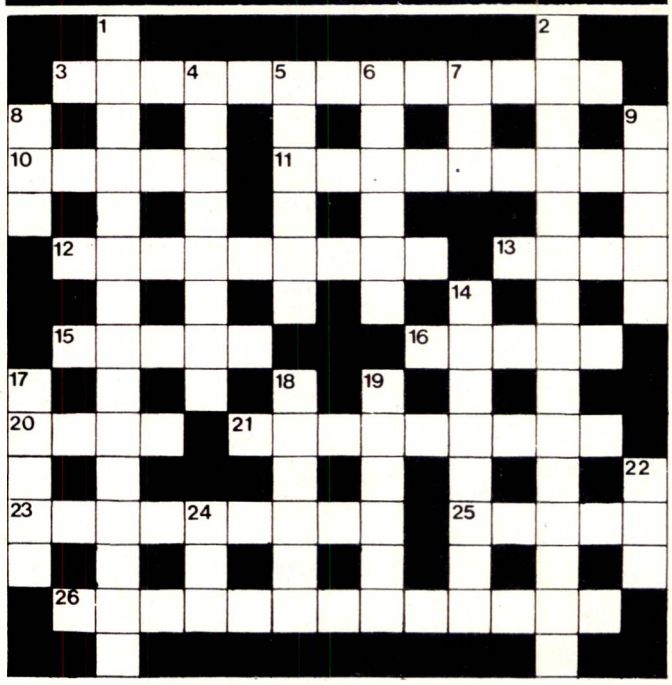
On your bike: one part of the Imagine empire which has escaped publicity so far is its sponsorship of motor-bike rider Malcolm Lucas. Undeterred by the shambles elsewhere in the firm, Malcolm managed to finish the Formula 1 race at Silverstone—unfortunately he came in 22nd, or fourth from last, although 37 riders started the race.

Mac-mouth: 'I am my own consumer' is the proud, if confusing, declaration from David Hancock, Apple's new UK leader. What he consumes, he says, are 'personal power tools' which 'can expand the ability to realise individual potential.' ChipChat thinks what he's getting at is that he enjoys using the Macintosh. But to return to Hancock's own words, these tools are of benefit to 'the new breed of achievers that this country is looking for.' ChipChat hopes that this new breed pays a bit more attention to the English language.

Band-wagon: the Stranglers, billed as 'the bad boys of rock', must be the oldest boys in the music business. Now they've added adventure games to their repertoire, in the form of Aural Quest. For all you pop-pickers, it forms part of their Aural Sculpture album, due to be released on 5 November.

END

PRIZE CROSSWORD



CLUES ACROSS

3 Reason for aligning text to the margin (13)
10 Note in nonchalant language (5)
11 Liveliness of moving graphics (9)
12 Safeguarded against writing (9)
13 Vulgar numerical system (4)
15 Quiet among buzzers, but electronic noises nevertheless (5)
16 Standard to improve system when up (5)
20 Recall from memory the sound of a little dog (4)
21 Peripheral paper perforator (4,5)
23 Do a plot in designing tape marker (4,5)
25 Records on the printer (5)
26 Count Figaro in plot to deceive the system (13)

CLUES DOWN

1 Van der Graaf's numerical output device? (6,9)
2 Rational choice (7,8)
4 Printing apparatus—sort of television, we hear (8)
5 Cross-channel location (6)
6 Misdemeanours could be perfect when wiped (6)
7 ASCII 84, we drink (3)
8 Behave like Sirius (3)
9 Let in a sort of chip (5)
14 Row about the parameter, perhaps (8)
17 Machine whose significance is of some gravity? (5)
18 Note gap in organisation of process for transfer to backing store (6)
19 Religious order or magnetic band? (6)
22 0+0=0: 0+1=0: 1+0=0: 1+1=1 (3)
24 Initialise pulse repetition frequency (3)

Cut out or photocopy your entry and submit it to *PCW* by 19 October. You could win £10!

Send your entries to: *PCW*, Prize Crossword, 62 Oxford Street, London W1A 2HG

Name_____

Address_____

August winner: B Seaton, Wirral, Merseyside

August solutions:

SOLUTIONS ACROSS

8 Screendump 9 Flag 10 Modems 11 Crash 13 Photon 14 Resident 15 Scrolls 17 Connect 20 Filename 22 Steady 24 Scale 25 Thrice 27 Goto 28 Screenplay

SOLUTIONS DOWN

1 PCW 2 Resort 3 Internal 4 Cursors 5 Spaces 6 Off and on 7 Machine code 12 The Chip Shop 16 Operator 18 Onscreen 19 Restore 21 Averse 23 Escape 26 RAM

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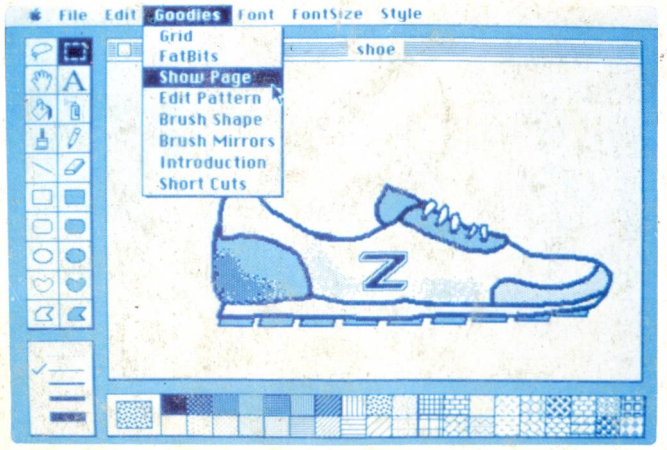

Imagine: you select tasks, or edit text and data, by moving a 'mouse' on your desk to move a pointer on the screen.

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