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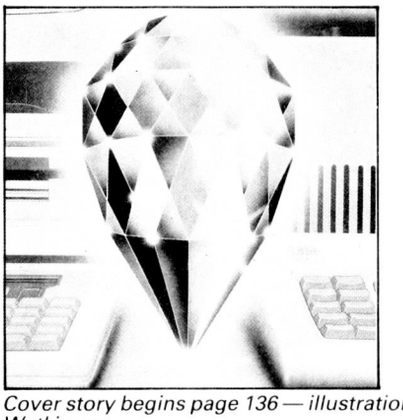
CONTENTS



Vol 8 No 2 February 1985

Cover story begins page 136 — illustration by Mark Watkinson

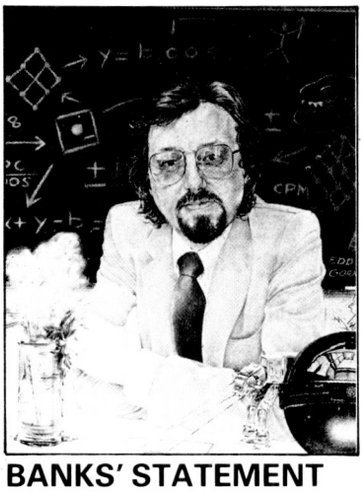
REGULARS

NEWSPRINT 108
Guy Kewney takes a break from playing Elite to bring you all the inside stories.

YANKEE DOODLES 124
Manufacturers are measuring up American laps and taking knee sizes — David Ahl puts portable machines into perspective.

ORIENT EXPRESS 126
Our Tokyo correspondent tracks down the new Japanese micros.

LETTERS 131
Messages of anger, frustration — and even some praise. Plus a helping of Bludners to put the record straight.



BANKS' STATEMENT 134
Down in the Biology Lab something is stirring — Martin Banks takes a peek.

SCREENPLAY 200
Tony Hetherington dons his Hercules Poirot disguise to solve Murder by the Dozen — but that was just the start of his troubles.

BIBLIOFILE 204
David Taylor makes friends with some robots as he reviews the latest books.

TJ'S WORKSHOP 206
Hints and tips for making the most of your machine.

SUBSET 212
Not to be missed by masters of machine code.

COMPUTER ANSWERS 214
Puzzle over your problems no longer — Simon Goodwin has the solutions.

NETWORKS 222
Peter Tootill's step-by-step guide to connecting your micro to an online system.

SUBSCRIPTIONS 224

LEISURE LINES 225

NUMBERS 225

MICRO CHESS 225

ACC NEWS 226

DIARY DATA 227

TRANSACTION FILE 227

WRITING FOR *PCW* 229

PROGRAM FILE 230
Nick Walker presents his pick of the programs.

BACK ISSUES 254

ADVERTISERS' INDEX 295

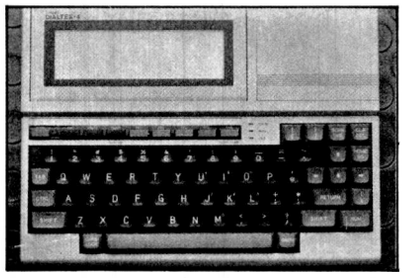
CHIPCHAT 296
Read all about it — Page 3 girl in Mac meeting, bingo playing at breakfast, and readers' revenge on Acorn copyright routines.

Founder Angelo Zgorelec **Editor** Graham Cunningham **Production Editor** Ginny Conran **Sub Editor** Lauraine Danker **Home Computing Editor** Tony Hetherington **Business Computing Editor** Peter Bright **Staff Writer** Nick Walker **Consultant Editors** David Tebbutt, Dick Pountain **Editorial Secretary** Tracy Dear **Group Art Director** Jim Dansie **Art Editor** Peter Green **Assistant Art Editor** Paul Ballard **Typesetters** Meadway Graphics 198 Victoria Road Romford Essex **Sales Director** John Cade **Publisher** Tony Harris **Publishing Assistant** David Mankin **Group Advertisement Manager** Peter Goldstein **Advertisement Manager** Bettina Williams **Assistant Advertisement Managers** Laura Cade, Claire Rowbottom **Sales Executives** Janette Pitt, Claire Barnes, Philip Benson, Mike Blackman, Julian Burns, Steve Corrick, Andrew Flint, Tony Keefe, Christian McCarthy, Sarah Musgrave, Tony O'Reilly **Advertisement Assistant** Julia Vale **Advertisement Production** Jeska Harrington **Production Assistant** Bev Grice

BENCHTESTS & REVIEWS

DIGITAL RESEARCH'S GEM 136
The battle of the icons begins — the GEM operating environment brings the features of Apple's Macintosh to Acorn, IBM, Apricot and Atari screens.

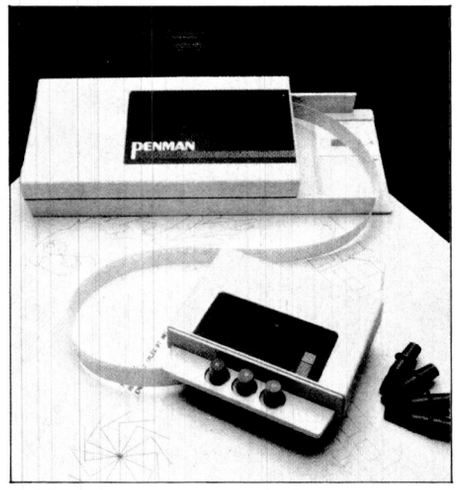
SHARP MZ-800 144
Top-end home machine or bottom-end business? Tony Hetherington puts Sharp's newest micro into perspective in an exclusive review of this Personal CP/M system.



DIALTEX-4 152
Looking for an inexpensive portable with built-in communications and word processing software? Peter Bright reviews the latest contender in the knee-top market.

MIND YOUR LANGUAGE! 158
There's a world of languages to explore beyond Basic. If it's structure you're after, try Pascal or its offspring Modula-2. If it's artificial intelligence that appeals, then try Lisp or Logo— while a preview of Mac Basic proves that the language can still come up with a few surprises.

WORDSTAR 2000 172
WordStar, the most revered (and feared) applications package ever, now has a friendly follow-up. Kathy Lang assesses the balance between power and ease of use in WordStar 2000.



PENMAN 176
As featured on *Tomorrow's World*, the Penman is a plotter, turtle and mouse rolled into one.

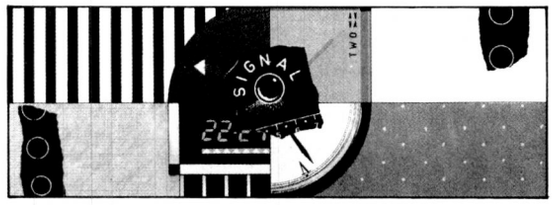
KNOWLEDGEMAN 188
Integrated packages can present problems — Knowledgeman takes a 'looser' approach while retaining sufficient integration to allow easy movement from one function to another. Kathy Lang puts it through its paces.

FEATURES

PICK A NUMBER 178
Mike Liardet simplifies Basic programming with some algorithms for handling random numbers and arithmetic functions.



TWO INTO THREE WILL GO! 184
Making the most of dBaseII — and moving up to dBaseIII — courtesy of Kathy Lang.



IS ANYBODY THERE? 192
Different methods of data transmission explored by Martyn Croft.

LIVING IN THE REAL WORLD 196
Interactive video is beginning to put promise into practice. Mary Sargent looks at the technology involved in simulating real and imaginary situations.

TEACH YOURSELF C 216
Les Hampson explains how to construct functions and useful programs by taking advantage of the C language's power and flexibility.

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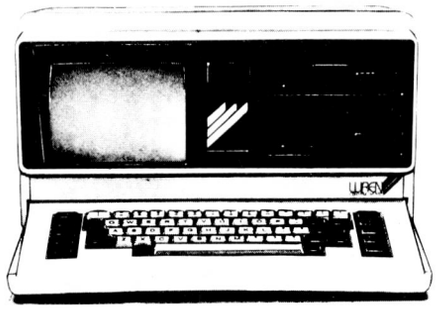

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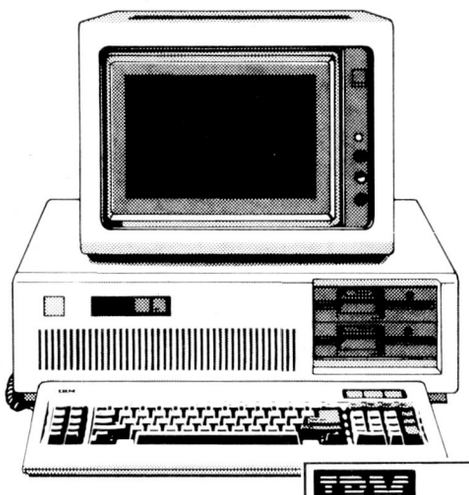

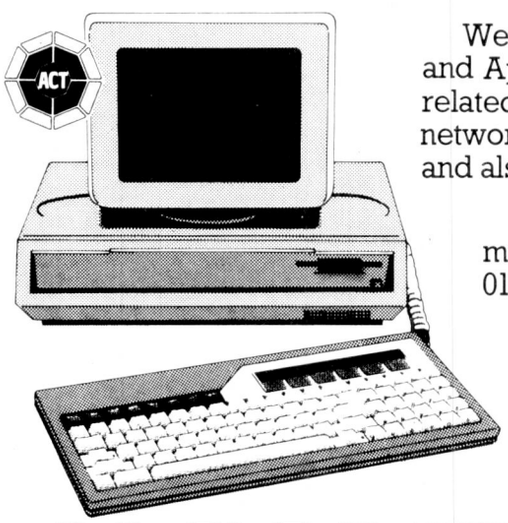

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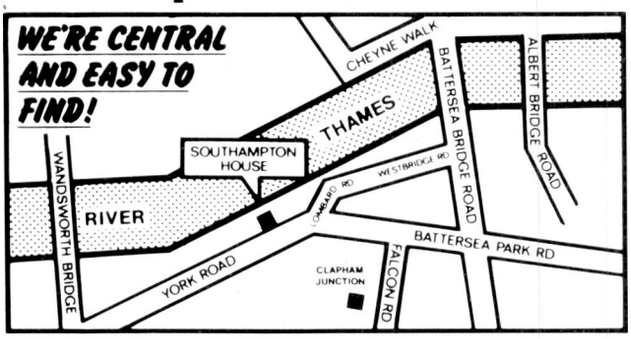

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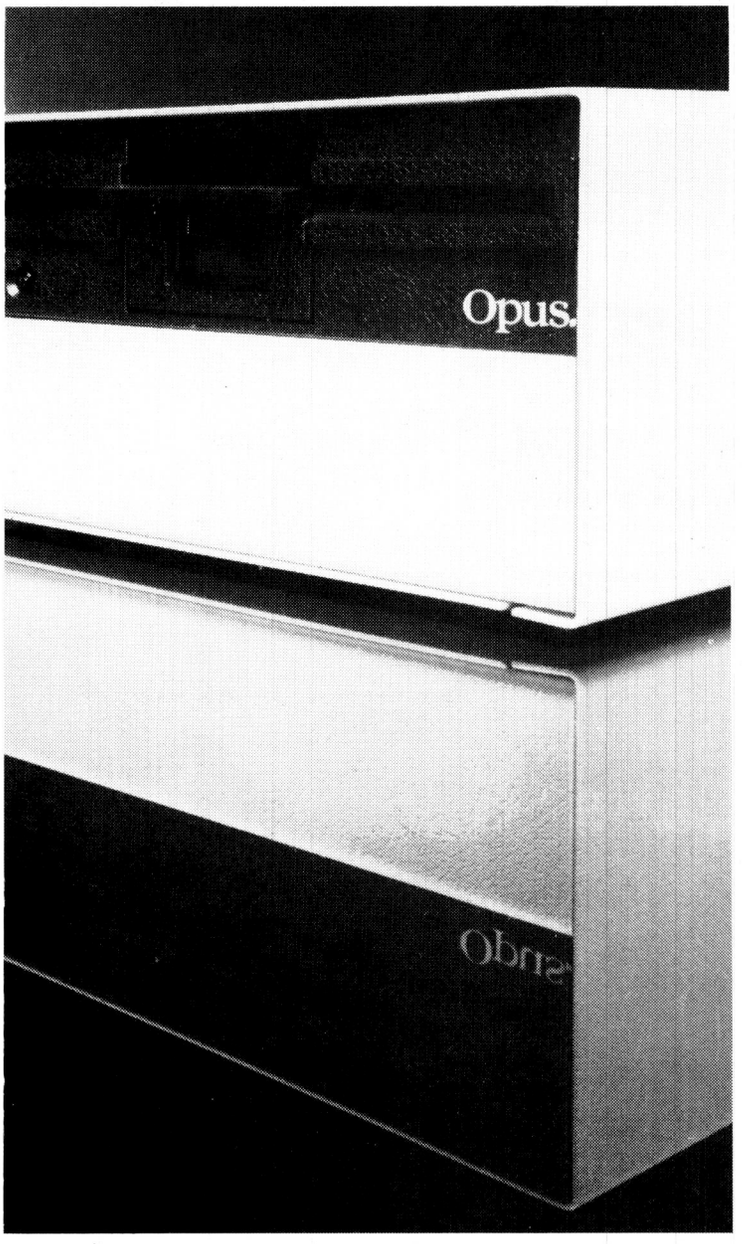

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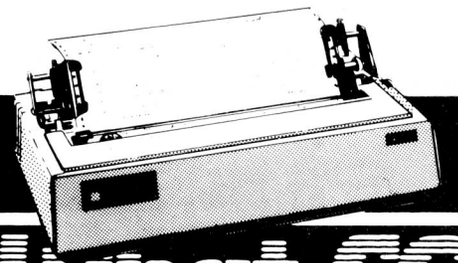

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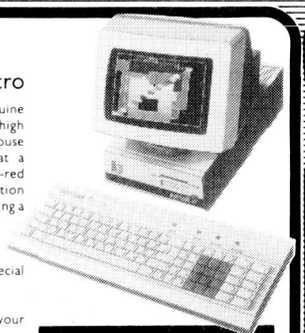

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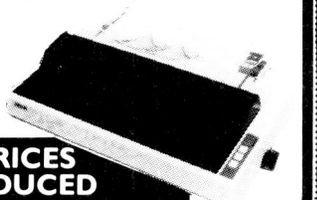

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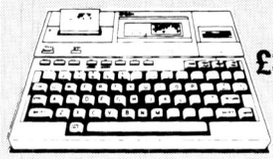

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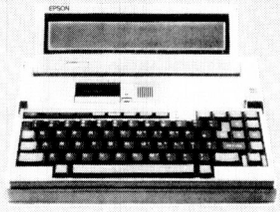

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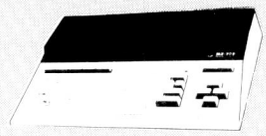

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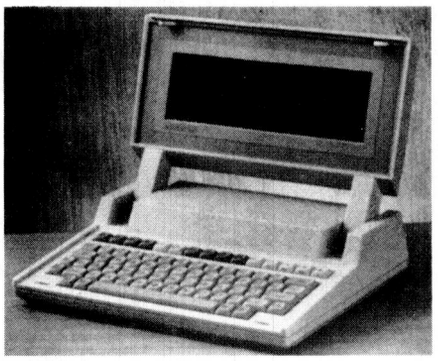

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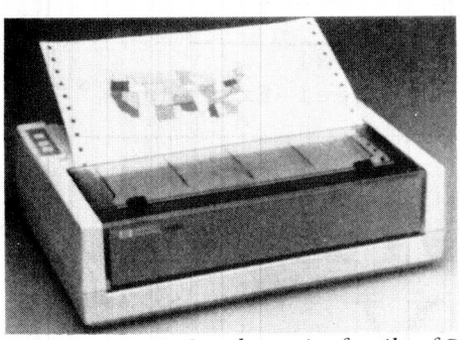

ThinkJet

The ThinkJet printer weighs only 6½lb, and it takes up a bit more room than your telephone. So, it can work right on your desk. ThinkJet personal computer printer is surprisingly quiet while printing 150 high quality dot-matrix characters per second for text or graphics.

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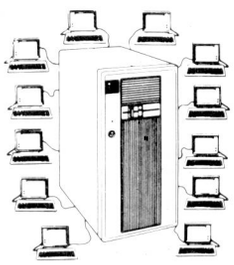

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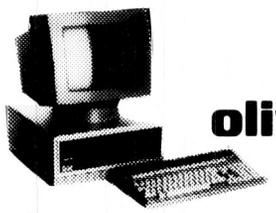

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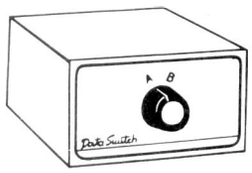

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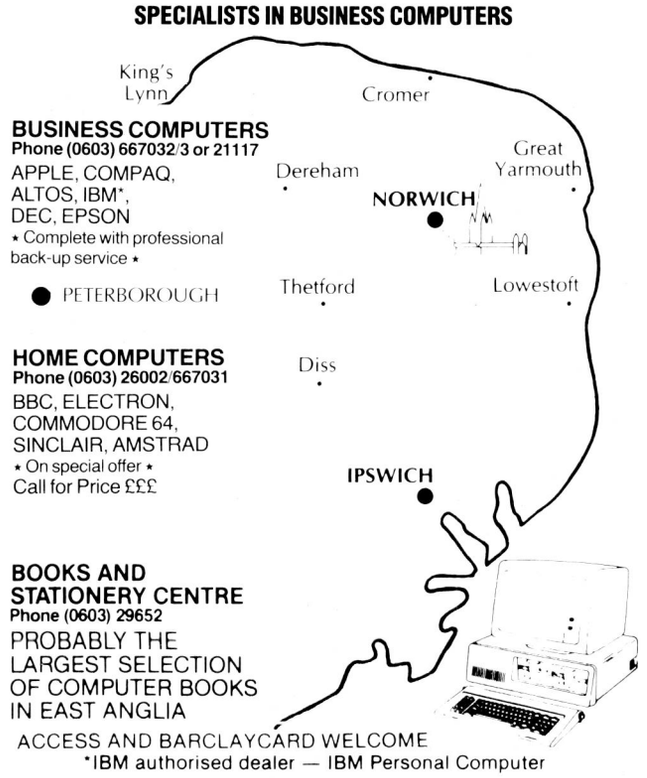

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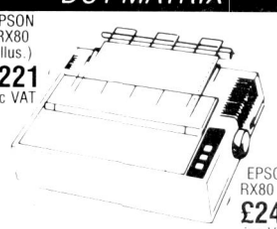

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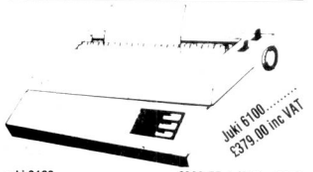

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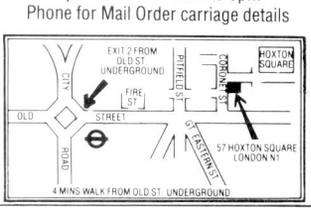

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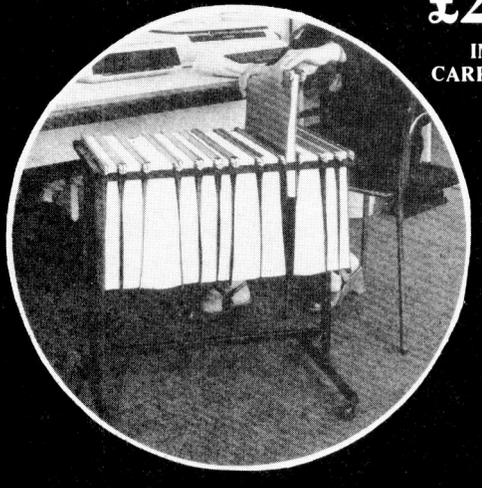

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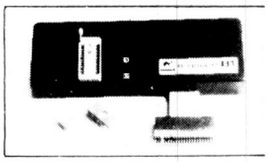

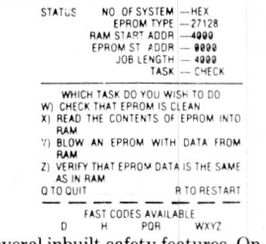

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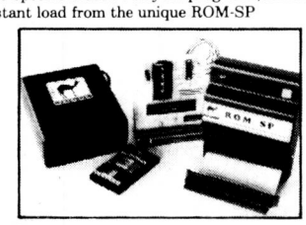

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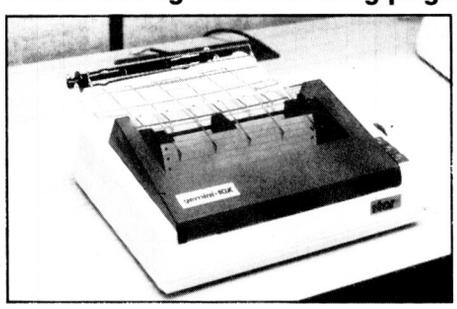

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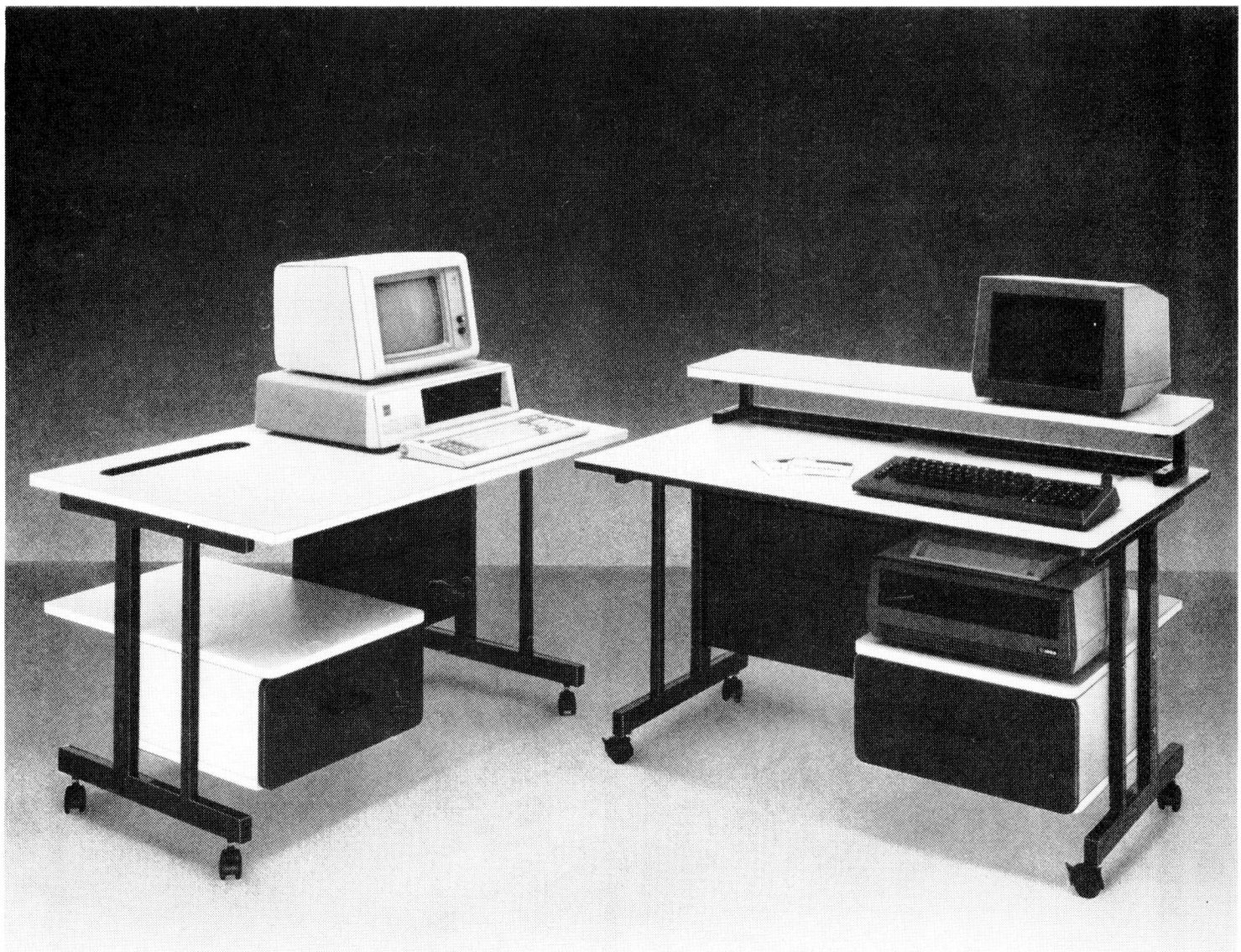

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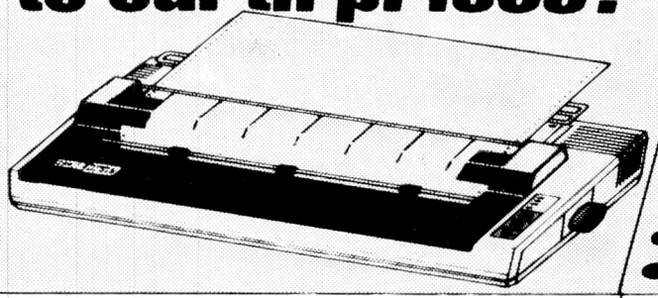

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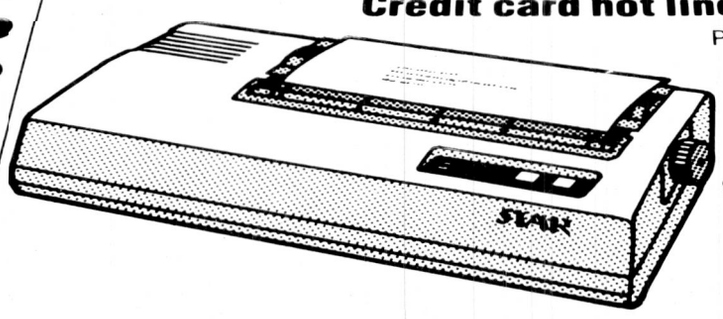

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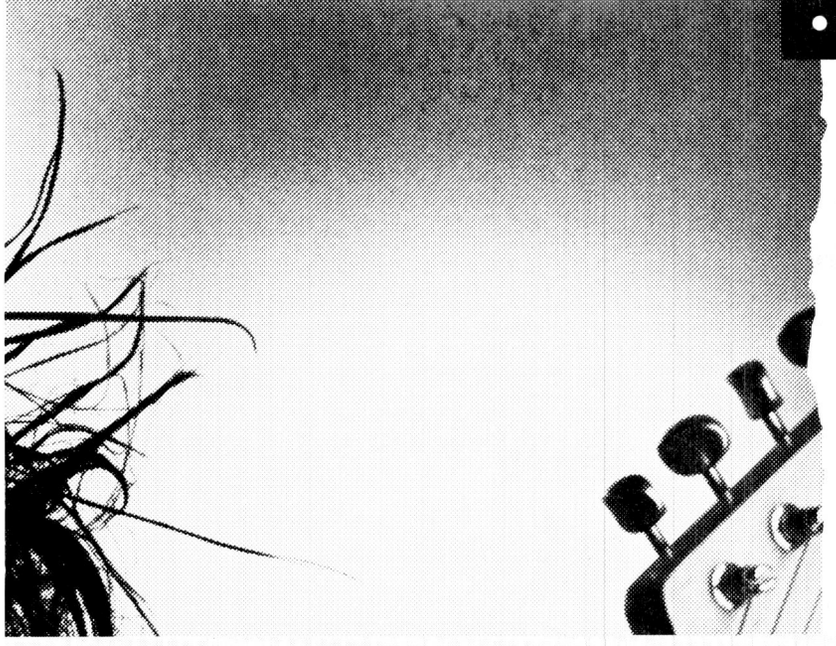
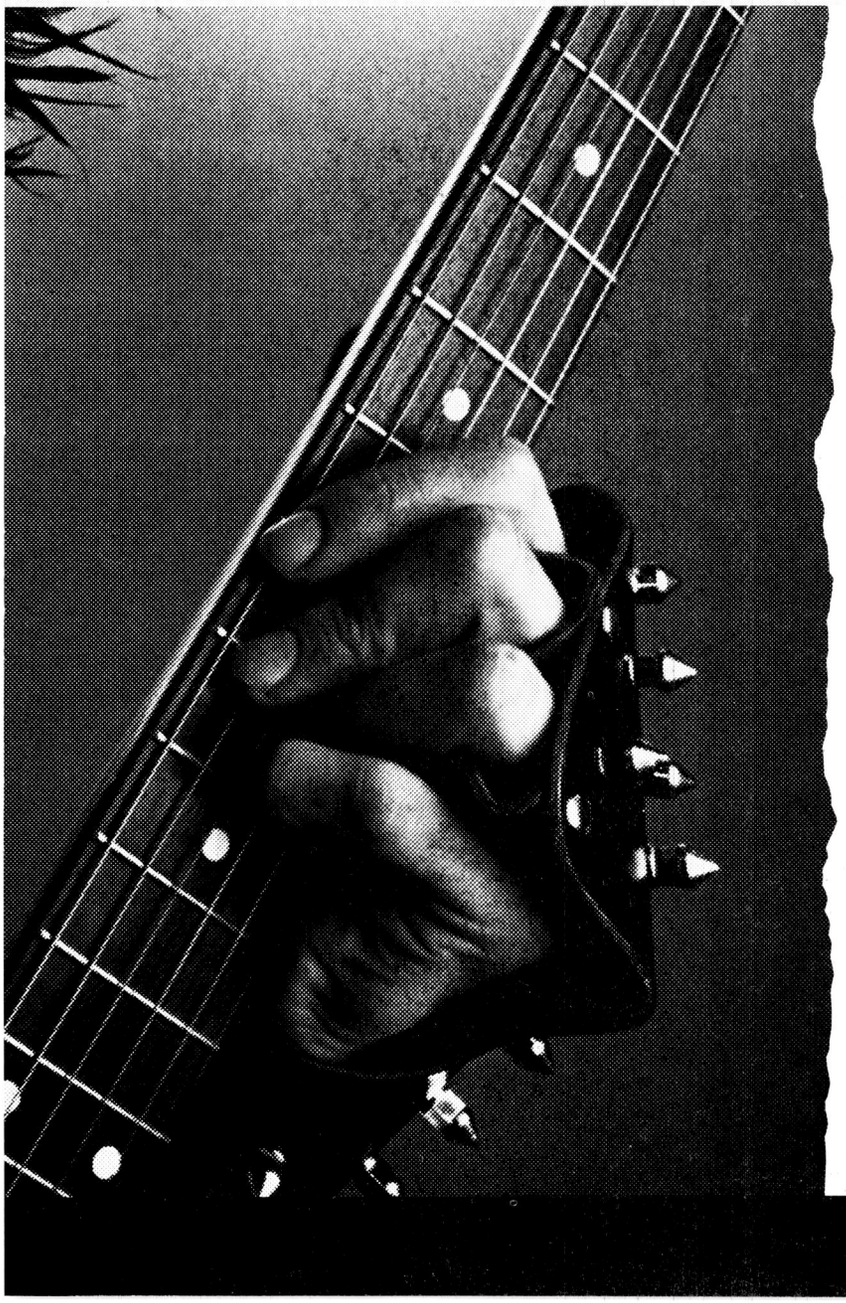


One finger and half a brain are all you need to make music on the new Music System.



You're looking at a composer.

It's hard to believe, I know. But with the aid of The Music System program, he has just written a whole 'song' completely by himself.

Clever boy.

"Toxteth Dawn" is the name of the 'song'.

It's a love song.

Without any knowledge of music he bought the music system program, went home, booted it up on his dad's BBC B and started to create.

He used the synthesiser part of the program to make a few noises. Added a pinch of an old song from the Song and Sound Library.

Laid down some percussion. And put a hint of bassoon and strings over the top.

And hey presto.

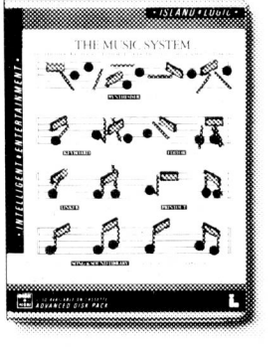
The musical answer to zits. "Toxteth Dawn."

Because his dad's computer had a printer as well, the program even printed out the composition in full musical-manuscript form.

So he could show it to the rest of the band. And they could say. 'WOSSAT?'

Isn't it time you became a composer too?

The brand new Music System from Island Logic.



DISK PACK £24.95 INC VAT. CASSETTE 1 (SYNTHESISER, KEYBOARD, SONG AND SOUND LIBRARY) £12.95 INC VAT. CASSETTE 2 (EDITOR, PRINT-OUT, SONG AND SOUND LIBRARY) £12.95 INC VAT. PLEASE ADD £1.25 P & P PER ORDER AND SEND A CHEQUE/PO, ACCESS OR VISA CARD NO. WITH ORDER TO: SYSTEM, 12 COLLEGIATE CRES., SHEFFIELD S10 2BA. (CREDIT CARD HOTLINE 0742 682321).

THIS PROGRAM IS RECORDED ON THE HIGHEST POSSIBLE QUALITY DISKS, AS SUPPLIED BY MEMOREX

BYTE SHOP News

INTRODUCING BYTE SHOP TRAINING COURSES

As part of our plans to offer the very finest all-round service to business microcomputer users, we're pleased to be able to announce the introduction during 1985 of a series of Byte Shop Training Courses. These vary in complexity from 'Understanding Computers – A Jargon Breakdown' to Programmers Courses on Pascal and Cobol. Initially the courses will operate in London, Birmingham, Glasgow and Bristol. If you would like details 'phone Ian James on 0480 218812.

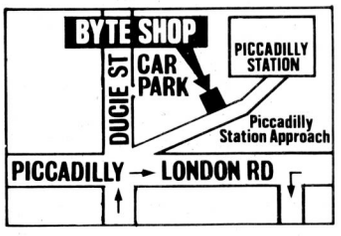
Getting the right computer

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.

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.

WHERE TO FIND US: MANCHESTER



Train commuters to Manchester will be well aware of the location of the Byteshop Manchester already, but for those not in that category, our store can be found on the Approach to Piccadilly Station. The Byteshop has been in Manchester for the past seven years and Manager Robin Pimlott has gathered around him a highly experienced team of DP Professionals. They will be pleased to arrange a demonstration from the wide range of micros in stock. Give them a call on 061-236 4737.

LARGE MEASURES... AUTOMATICALLY

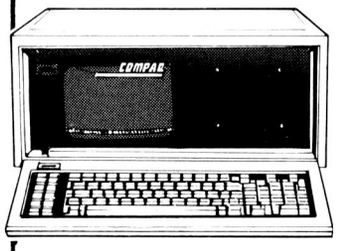


William Grant and Sons Distillers are perhaps best known for their world renowned malt whisky, Glenfiddich. Always looking for ways to improve efficiency, Grant's contacted Jon Browne at Byte Shop Glasgow and subsequently acquired an IBM PC based system running special software written by Jon himself. The primary task of the system is to link with a flow meter which measures the amount of whisky drawn into casks from the storage vats. The information gained is used to produce updated stock levels, reports and invoices as well as the three part documentation required by HM Customs and both Grant's local and head offices. The installation has been a great success and the process which used to take three days with a measuring jug etc now takes ten minutes!

THE BYTE SHOP. THE FIR TURN TO FOR MI

COMPAQ

STANDARD & PLUS



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 disk drives, high resolution screen and tough carry case **2195.00**
'Plus' models as above but with single 360Kb floppy and 10Mb hard disk drives **3945.00**

ALL PRICES EX. VAT

DESKPRO

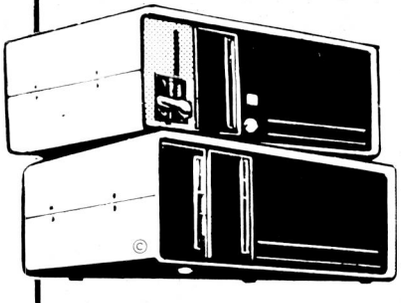
Four new PC/XT compatible models from Compaq fully complementing the now established 'Standard' and 'Plus' models. By incorporating the high-speed 8086 microprocessor, Deskpros can offer 2-3 times faster processing speeds than standard PCs while running virtually all PC/XT software without modification.



The Deskpro models start with an entry level system ideal for first-time computer users and progress to the top of the line Model 4 which has claims to being the most powerful high performance personal computer on the market. Lower level models are capable of being upgraded should the need arise.
Common to all models are dual-mode monitor, full keyboard and PC/XT compatible expansion slots.

Model 1; 128Kb RAM: single 360Kb disk drive **2195.00**
Model 2; 256Kb RAM; dual 360Kb disk drives **2595.00**
Model 3; 256Kb RAM; single 360Kb & 10Mb fixed disk drive **3995.00**
Model 4; 640Kb RAM; single 360Kb, 10Mb fixed disk drive plus an internal 10Mb fixed disk drive back-up .. **5595.00**

COMART COMMUNICATOR



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 15 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

£1800 per user

Communicator CP520MP including 5 display terminals, cables 6 × processors and 6 × 64Kb memory **9095.00**

£2119 per user

Communicator CP1525M with M-BOS operating system, including 5 display terminals, dot matrix printer and cables **10595.00**

NEW COMMUNICATOR CP2000 SERIES

Featuring the new 'powerhouse' Intel 286/287 processors, the three models in the CP2000 series have at least double the speed and processing capacity of most conventional multi-user systems. The big performance and excellent value of the CP2000, means that it can comfortably support up to 12 users for as little as £2995. Importantly, the CP2000 series runs two industry standard operating systems, BOS and the latest version of the concurrent CP/M, allowing you to switch from up to four programmes simultaneously without clearing the screen.

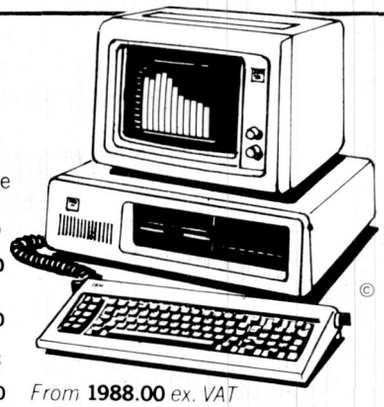
IBM/PC

The IBM PC/XT'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 mainframe.

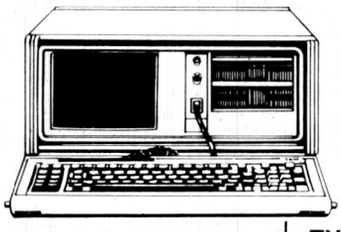
IBM PC; dual 320Kb disk drives; 64Kb RAM; UK keyboard and screen **1988.00**

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 **3432.00**



From **1988.00** *ex. VAT*



IBM PORTABLE PC

Offers the features of PC computing in a self-contained portable package weighing only 30lb (13.6kg). Specification includes 256Kb RAM expandable to 512Kb, dual floppy disk drives, 9" amber screen and smart system carrying bag **2254.00**

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..... **1,954.00**

Expansion Unit 2 – 10 Mb hard disk unit for PC/XT..... **1,581.00**

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**

Orchid PC Net Starter Kit – local area network allowing file and disk sharing plus optional electronic mail from **1000.00**

PC Net Cards – to link additional terr..inals to network from..... **460.00**

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**

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 **4399.00**

Accounting System
IBM PC XT; Sales, Purchase and Nominal Ledgers. Invoicing and Payroll; dot matrix printer..... **4999.00**

ALL PRICES EX. VAT

SYSTEM SPOTLIGHT



IBM PC AT

If you are doubtful whether a standard PC will have the processing speed or memory to keep up with your future developments then the AT is the obvious choice. The AT's 'formidable' spec. includes 256Kb standard RAM (512Kb enhanced version), 1.2Mb disk drive (plus 20Mb enhanced), new DOS 3.0 operating system expandability, monitor and new enhanced keyboard with 10' coiled cable, separate numeric key pad for easier and error-free data entry.

Basic ..... from **3374.00**
Enhanced ..... from **4703.00**

ST NAME BUSINESSMEN CROCOMPUTERS.

At a glance Computer Checklist

	IBM AT	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. **Open Access** – Exciting new integrated business package rivalling Lotus 1-2-3 with WP, Database, comms and 3-D graphics..... **450.00**
8. **Multi-Mate** – New standard in fast, easy to use, function key driven wordprocessing for the IBM PC **330.00**
9. **SuperCalc 2** – Sophisticated, easy to use financial spreadsheet for in depth analysis, modelling and forecasting **195.00**
10. **Framework** – Integrated package featuring word processing, spreadsheet, graphics, data management **495.00**
11. **Friday** – Personal file management package for the novice with quick custom reporting..... **195.00**
12. **dBASE III** – Powerful easy to use database with enhanced reporting facilities and ability to print mailing labels from files..... **495.00**
13. **Cardbox Plus** – Simple to use selective data retrieval tool with extraction and sort facilities..... **330.00**
14. **Level II Cobol** – Mainframe level II compiler, well suited for new applications development: tools and utilities available..... **965.00**
15. **GraphStat** – Up and coming statistics and colour graphics package for the IBM PC..... **195.00**
16. **CBASIC** – Widely used commercial programming language for business applications development, interpreter also available **125.00** (CP/M86.271.00)
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. **Presentation Master** – Provides all you need to turn your PC/XT into a graphics/slide production unit **1495.00**
20. **Pascal MT +** – Comprehensive integrated language for developing production quality software..... **269.00** (CP/M86.462.00)

ALL PRICES EX. VAT

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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BYTE SHOP HEAD OFFICE
Grove House, Great North Road,
Little Paxton, Cambs. PE19 4EL.
Tel: 0480 218812

KJ A Kode International plc Company

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For the BBC Microcomputer

Software

PASCAL-T
Pascal-T is a 16k Eprom program capable of compiling source PASCAL into a compact and very fast threaded-interpretative code. Full Editor and disk support are included, together with a comprehensive manual which contains many program examples.
Price £59.00

XCAL
A computer-aided learning system in a 16k Eprom and support disk. The emphasis here is that no programming skills are required in the construction of the learning sessions or their playback, as the whole package is completely screen driven. Facilities include: Text Pages, Graphics and Histograms. **Price £65.00**

FORTH
A choice of configurations as follows:
8k Eprom + Disk containing assembler and program examples. **Price £34.72**
16k Eprom containing assembler and utilities. **Price £49.00**
Disk-based Forth for the BBC 6502 2nd Processor. **Price £29.00**
All the above are Econet II compatible and utilise DFS compatible files to hold Forth screens. Supplied with 200+ page manual.

ELECTRON FORTH
An 8k Eprom for the Acorn Electron, complete with comprehensive manual. **Price £30.00**

LOGO-FORTH
A 16K Eprom program introducing this very powerful but friendly turtle-graphics language. Users also have access to the support Forth nucleus. Supplied with comprehensive manual. **Price £59.00**

M/UTS
Powerful machine-code monitor with disk utilities on 8k Eprom. **Price £19.95**

Business Software

A suite of three programs as follows:
Sales Ledger
Purchase Ledger
Invoicing & Stock Accounting
All include comprehensive documentation. **Price each £90.00**

Software for the CMS 6809 2nd processor

FLEX with Assembler and Editor. **Price £85.00**
FLEX FORTH includes Editor and Assembler together with over 100K of utilities and example programs. **Price £50.00**
PL9 Compiler — very advanced native-code compiler, similar in syntax to Pascal. **Price £98.00**
'C' Compiler. **Price £170.00**
LUCIDATA PASCAL. **Price £105.00**

Hardware

'BSECURE' Security cabinet for the BBC Microcomputer. All steel construction, colour matched to BBC Machine. Features a lockable compartment with integral drawer mechanism in which the machine is situated. Above this is a separate compartment which will accept a 19" Eurocard Rack or other equipment.
External dimensions are:
Width: 20"
Height: 13"
Depth: 17"
Available in the following formats:
Cabinet only. **Price £60.00**
Cabinet + 19" Rack, PSU and 7 card Backplane. **Price £198.00**
6809 2nd Processor with Tube Interface and linking software. **Price £274.00**
Eurocard version of above fitted card front. **Price £289.00**
Connecting Cables for above cards:
Short. **Price £15.00**
Long. **Price £20.00**

GRAPHICS CARD
A 64k high resolution graphics card for use with the 6809 2nd processor. **Price £299.00**
6502 Low cost controller card.
6809 Low cost controller card. **Price £119.00**
ROM Programmer card. **Price £130.00**

Other cards available — Please enquire

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BBC Model B (Free Recorder + Games)	£389
Electron	Call
Memotech 512 (Free rec)	£275
Memotech 500 (Free rec)	£199
Advance 86b	Call
Sinclair QL	Call
Sanyo 550	£640 + VAT
Sanyo 555	£799 + VAT
Einstein	POA
Amstrad	Call
Amstrad colour	Call

MONITORS

JVC Medium Colour	£199
JVC High	£249
Microvitec Medium (QL)	£275
Microvitec Medium (BBC)	£299
Ferguson MC101 (TV-Mon)	Call

PRINTERS

Shinwa CP80 CTI	£234
Epson RX80 FT	£289
Cosmos CP80	£214
Juki 6100	£388
Cannon 1080	Call
Brother HR15	£442
Olivetti JP101	£155
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Z80 2nd Processor	£349
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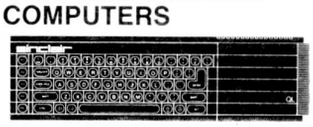
ORIC AND SINCLAIR COMPUTERS



Oric 1 computer 48K £85 (£82) £92. Oric Atmos computer 48K £171 (£158) £168. Oric colour printer £134 (£123) £140. Sinclair flat screen TV £113 (£105) £115. Sinclair Spectrum Plus Computer £182 (£176) £187. Sinclair QL computer £406 (£385) £410. Sinclair Spectrum 48K £131 (£131) £143. Microdrive £51 (£50) £60. RS232 interface 1 £51 (£50) £60. Special offer:— Microdrive + Interface 1 + 4 cartridges £102 (£100) £120. Blank microdrive cartridges £5-50 (£6) £7. Standard floppy disc interface for Spectrum £102 (£92) £112. (See Cumana disc section for suitable disc drives). Fuller FDS keyboard for Spectrum £52 (£52) £62. Fuller master unit £56 (£56) £62. Interface 2 £20-45 (£20) £24. 32K memory upgrade kit for 16K Spectrum (issue 2 and 3 only) £31 (£28) £30. Spectrum Centronics printer interface £51 (£47) £52. ZX printer has been replaced by the Alphacom 32 £71 (£69) £82. 5 printer rolls (state whether Sinclair or Alphacom) £13 (£16) £21. ZX81 computer £45 (£44) £54. 16K ram packs for ZX81 £28 (£25) £30.

COMMODORE COMPUTERS

Commodore C16 Starter Pack £145 (£142) £162. Commodore Plus 4 £305 (£281) £301. Commodore 64 £222 (£215) £235. Convertor to alow most ordinary mono cassette recorders to be used with the Vic 20 and the Commodore 64 £9-78 (£9) £11. Bargain package:— cassette convertor + compatible cassette recorder £37 (£38) £44. Commodore cassette recorder £43 (£44) £50. Printer interfaces for Vic 20 and the Commodore 64:— Centronics £45 (£41) £46. RS232 £45 (£41) £46. Disc drive £233 (£209) £234. 1520 printer plotter £165 (£149) £159. MPS801 Printer £235 (£220) £245. Light pen £29 (£29) £33.

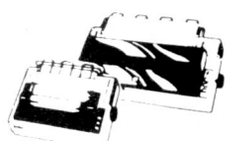
ACORN COMPUTERS

Electron £173 (£179) £199. BBC Model B £404 (£357) £387. Kenda double density disk interface system £149 (£131) £141. See below for suitable disc drives.

CUMANA DISC DRIVES

To suit disc interfaces of Sinclair Spectrum, BBC B and Videogenie. Single:— 40 track single sided £176 (£158) £178. 40tr double sided £218 (£195) £215. 80tr ss £207 (£186) £206. 80tr ds £234 (£209) £229. Dual:— 40tr ss £299 (£280) £320. 40tr ds £395 (£353) £393. 80tr ss £372 (£334) £374. 80tr ds £437 (£390) £430.

PRINTERS



Oki Microline 80 £138 (£135) £165. Brother HR5 £162 (£146) £170. Shinwa CTI CP80 £225 (£218) £248. Canon PW1080A £332 (£299) £329. Epson RX80 £277 (£251) £282. Epson RX80F/T £314 (£286) £316. Epson FX80 £399 (£358) £388. Combined matrix printers and electric typewriters:— Brother EP22 £173 (£166) £186. Brother EP44 £258 (£235) £260. MCP40 Oric Colour printer/plotter £134 (£123) £140. Interfaces to run the above printers from Vic and the Commodore 64 £45 (£41) £46. We can supply interfaces to run the above printers from Sharp computers £58 (£52) £55.

UK101, SUPERBOARD AND VIDEOGENIE

We still support these Computers. Write for our list.

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We offer a world-wide repair service. Write for a quotation.

SWANLEY ELECTRONICS

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Tel: SWANLEY (0322) 64851. Official orders welcome. UK prices are shown first and include post and VAT. The second price in brackets is for export customers in Europe and includes insured airmail postage. The third price is for export customers outside Europe (including Australia etc) and includes insured airmail postage.

THE BUSINESS WORLD IS SPLIT BETWEEN THOSE WHO HAVE COMPUTER SYSTEMS - AND THOSE WHO ALSO UNDERSTAND THEM

Introducing Byte Shop Training Centres

Pretty soon there will be only one kind of business.

The business whose staff fully understands its computer systems.

Those businesses who fail in this respect will, simply, not be in business.

That is why – as an urgent priority – The Byte Shop is providing computer training from our Business Centres in London, Bristol, Glasgow and Birmingham.*

And they're the best – in keeping with our tradition ever since we opened the UK's very first specialist microcomputer centres.

The courses are structured and modular so students can start at the level that suits them whether they just wish to understand the basics or are DP professionals.

And since our courses are approved by the Manpower Services Commission, your company may well qualify for a grant.

Send off the coupon for our brochure containing full course details and booking forms. Do it now and help yourself to our rather generous introductory offer.

TITLE	CODE	DURATION
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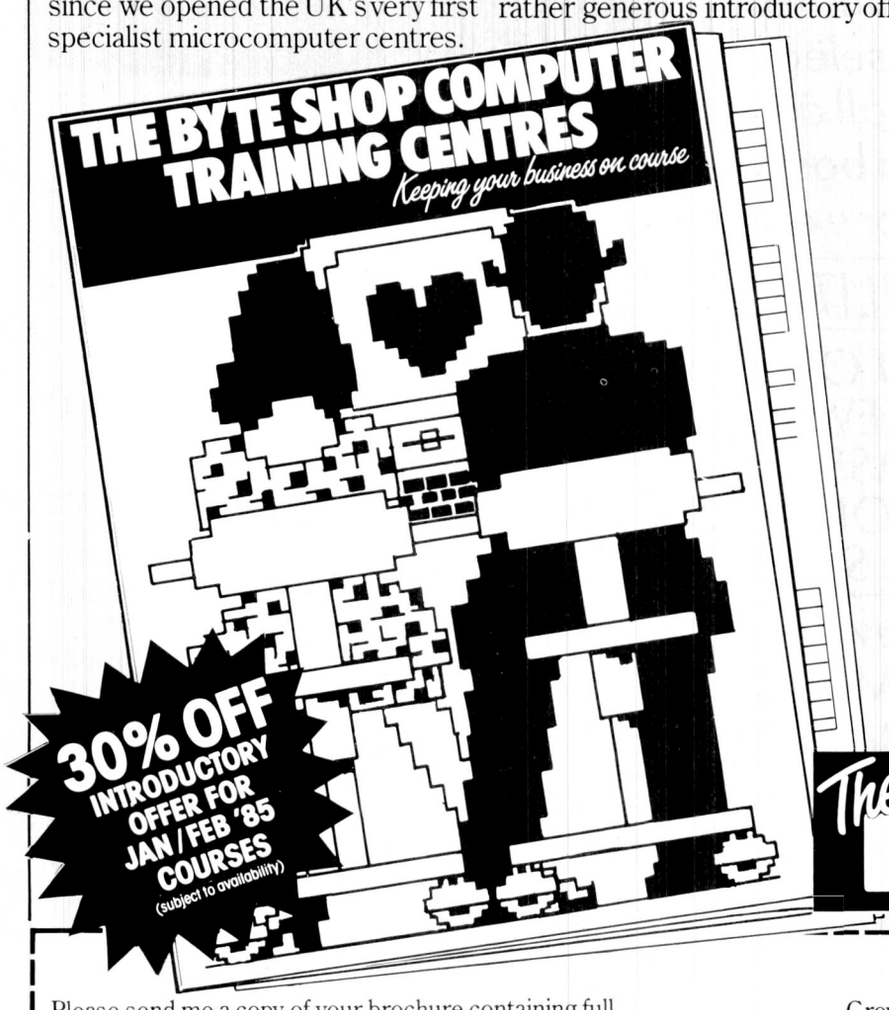

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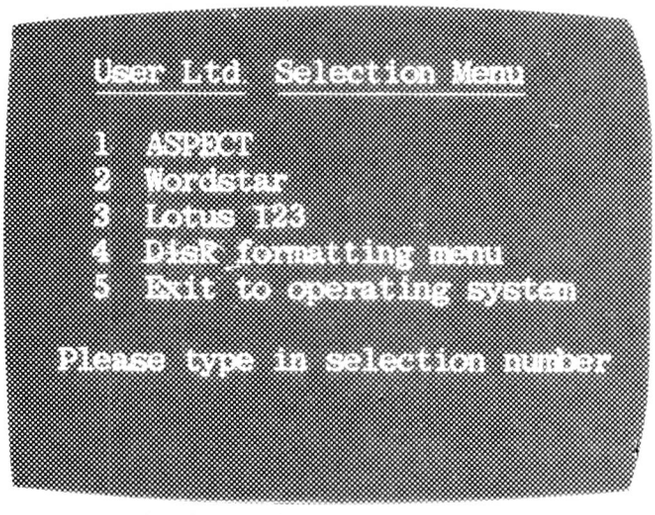

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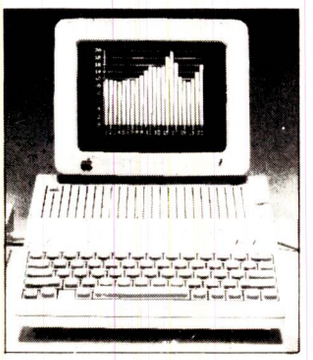

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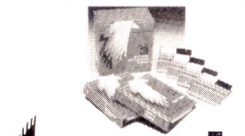

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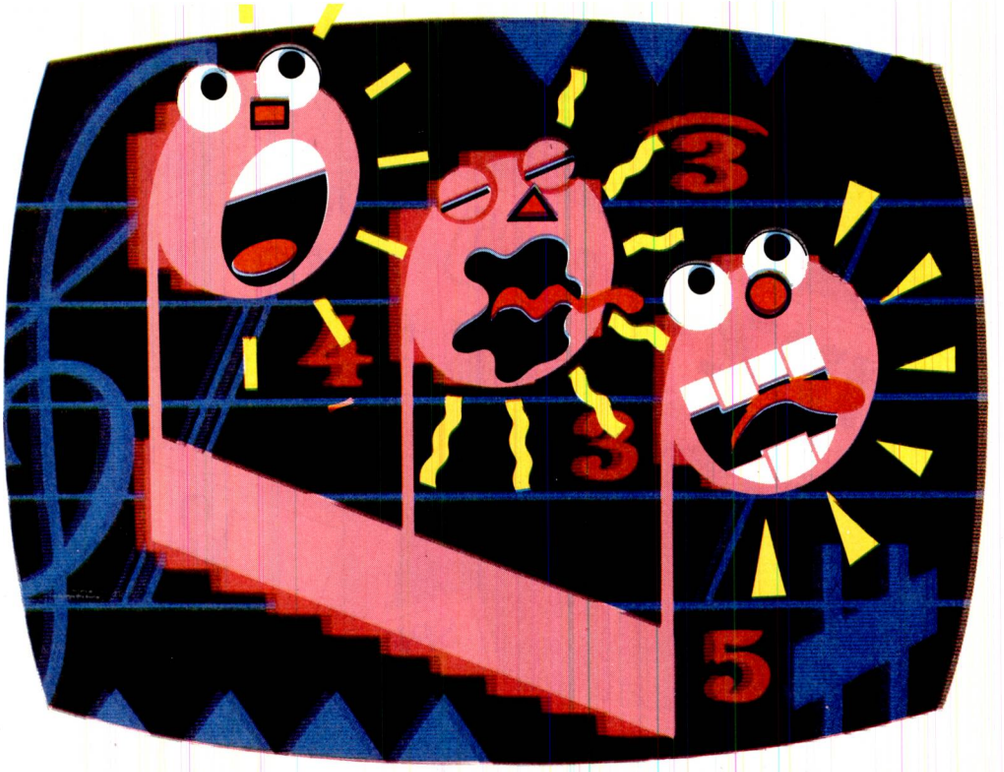

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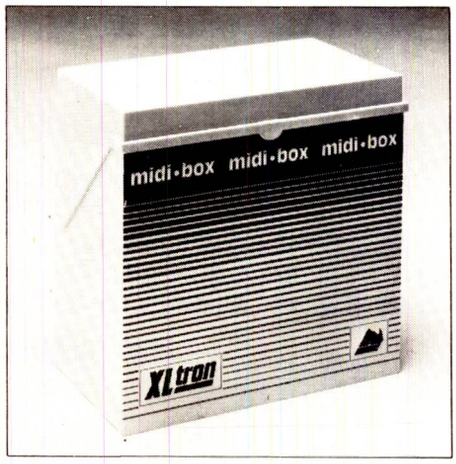

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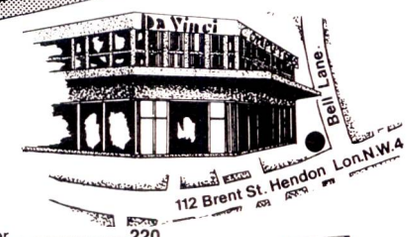

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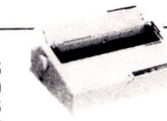

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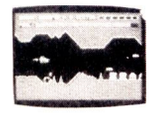



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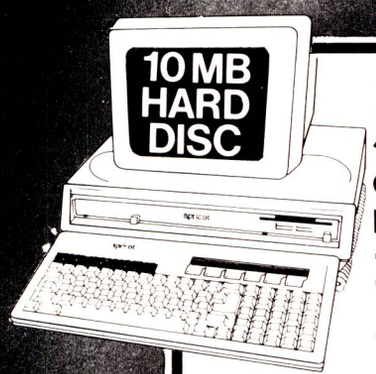

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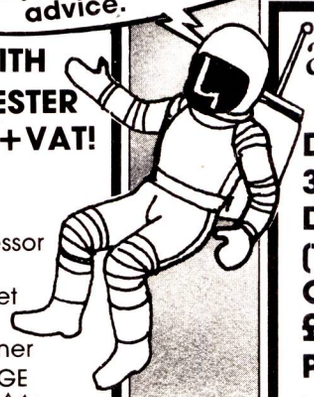

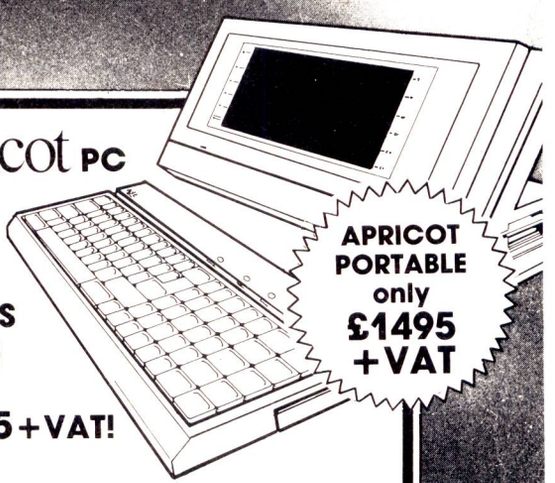

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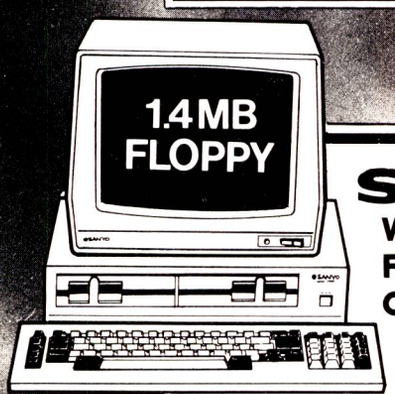

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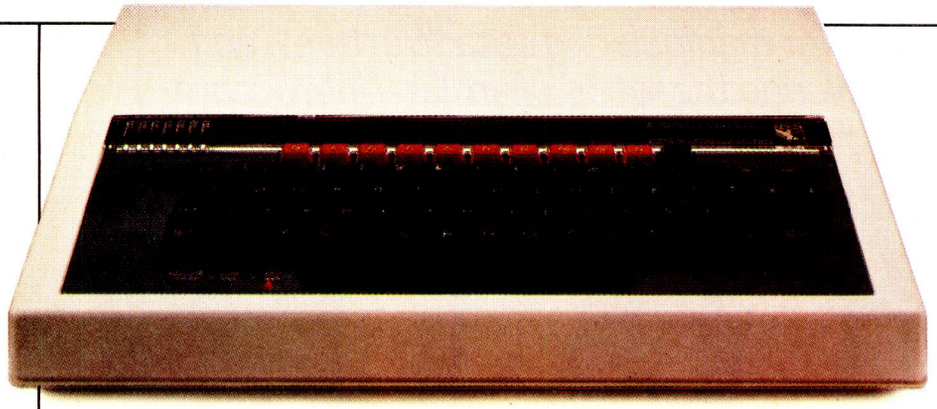
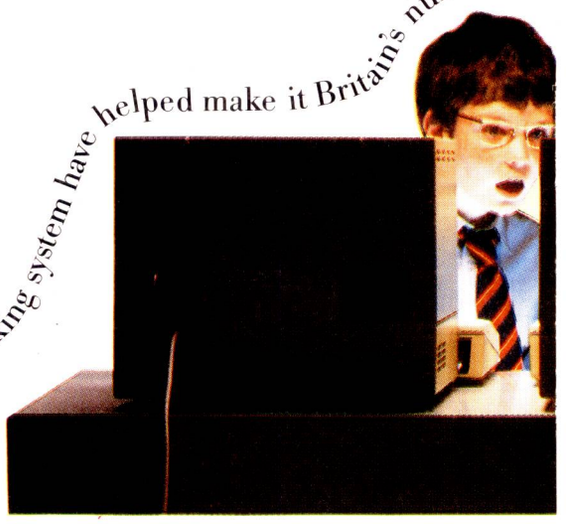
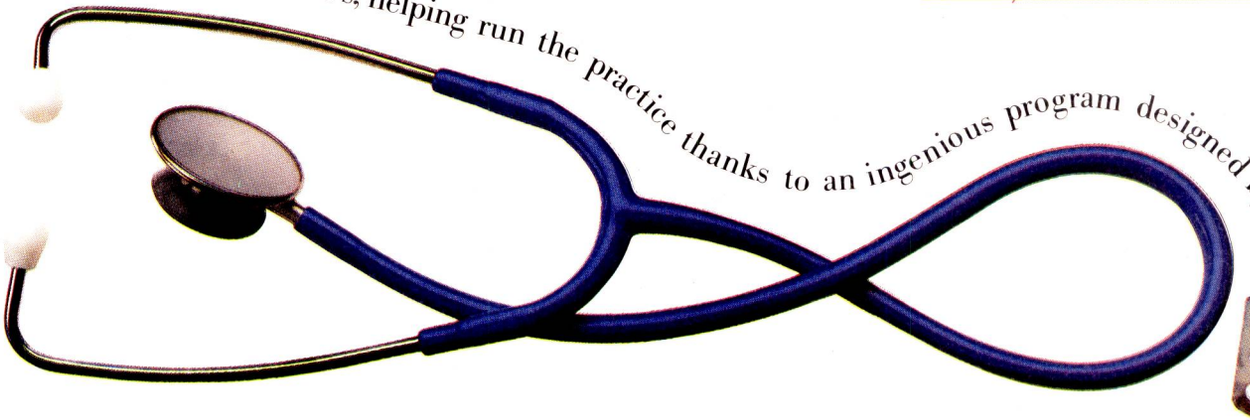


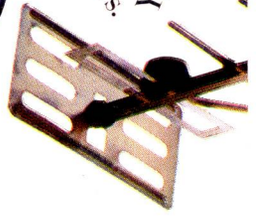
It stretches into schools where BBC Basic and the Econet networking system have helped make it Britain's number on



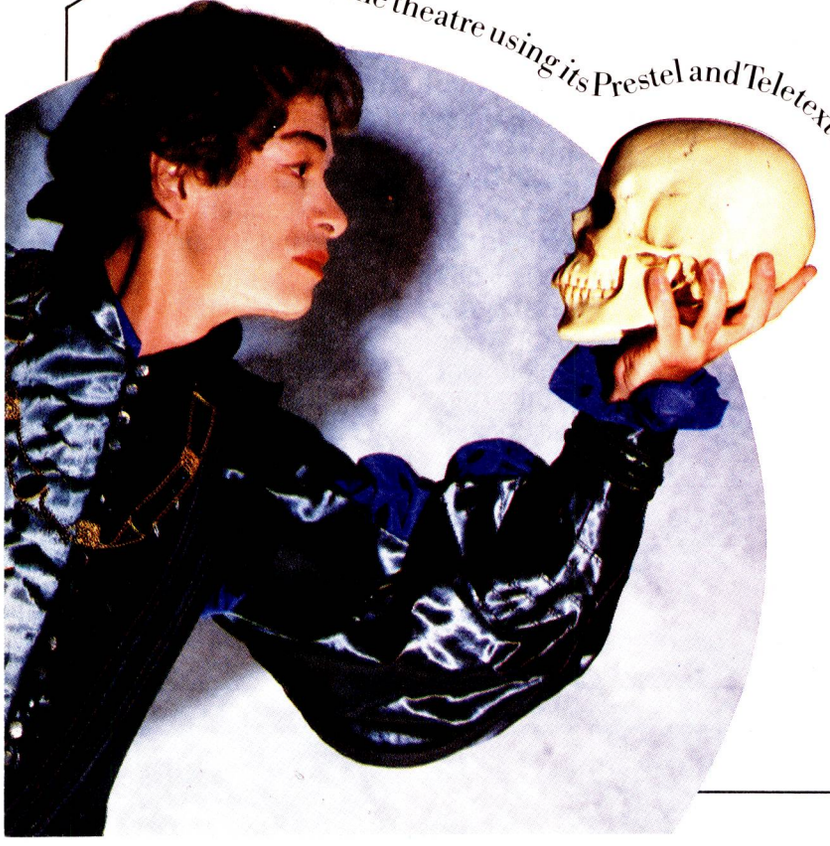
It's down at the doctor's, helping run the practice thanks to an ingenious program designed by two GPs.

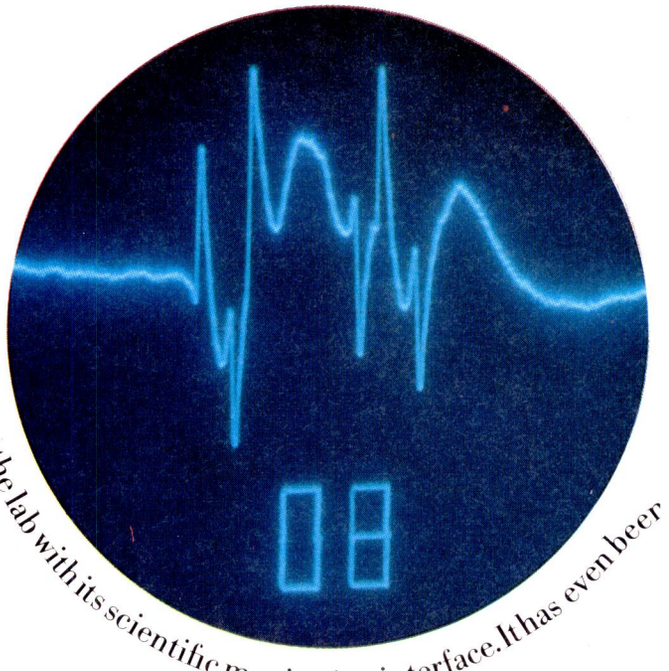


You'll catch it

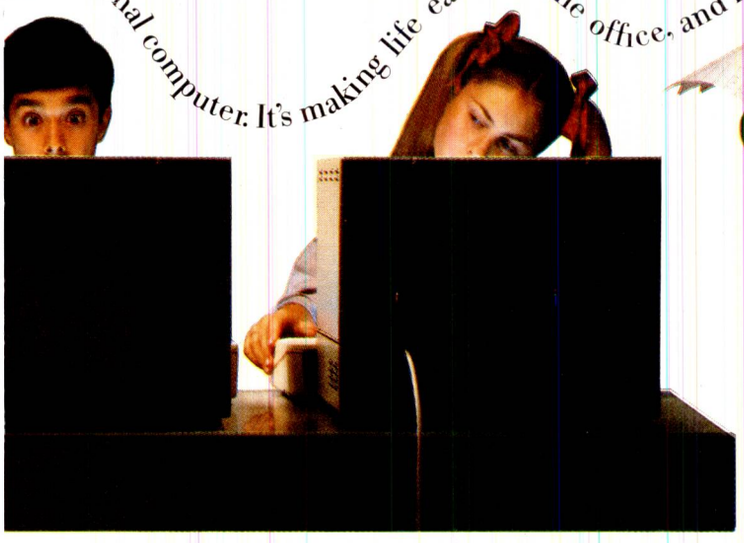


It can take you to the theatre using its Prestel and Teletext adaptors. While helping out at the lab with its scientific monitoring interface. It has even beer



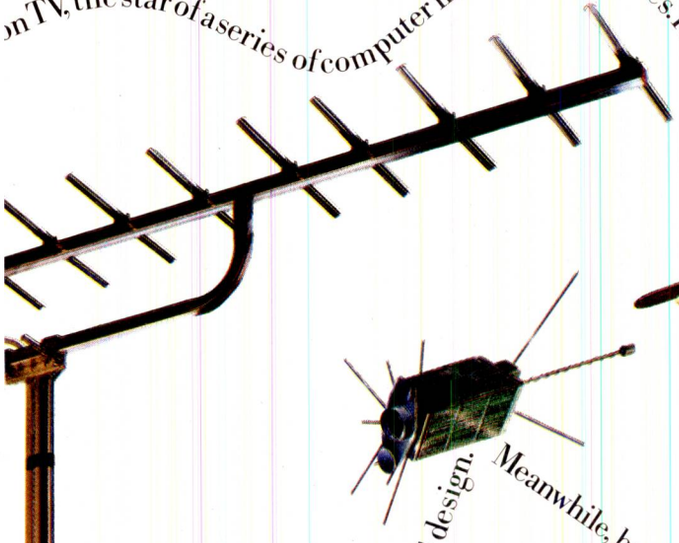


educational computer. It's making life easier in the office, and has grown into the country's top micro for small businessmen.



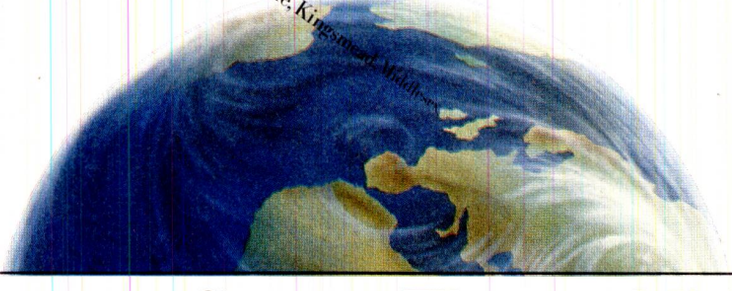


on TV, the star of a series of computer literacy programmes. Its colour graphics and new Bitstik make it welcome in design studios.





working in space, tracking a satellite it also helped design. Meanwhile, back on Earth at 49 Acacia Avenue, Kingsmead, Middlesex...



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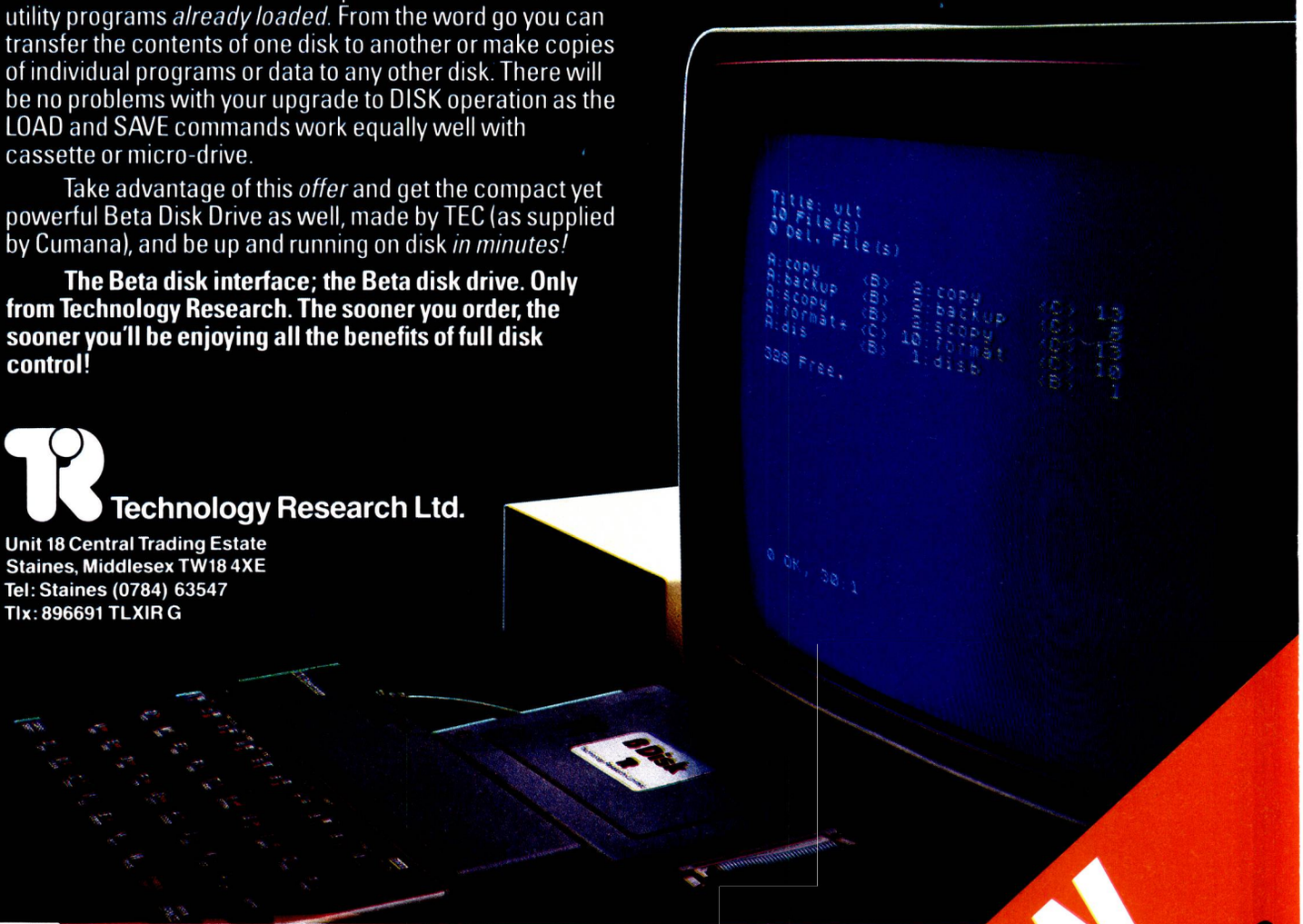

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Also included in **MicroCache** is a printer buffer. This enables printing to apparently occur immediately by 'printing to RAM'. Actual output to the printer occurs in background mode without delaying the user. The RAM used by the disk cache is dynamically shared with the printer buffer; whichever is causing you most delay automatically gets the most RAM. This is a much more cost-effective way of saving time than purchasing expensive add-on printer buffer boxes.

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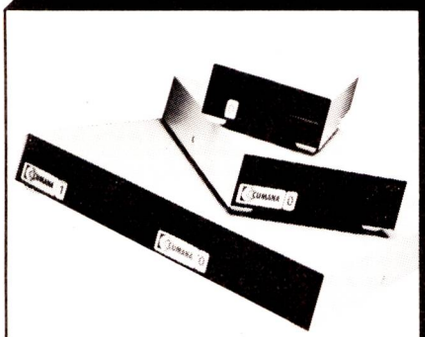

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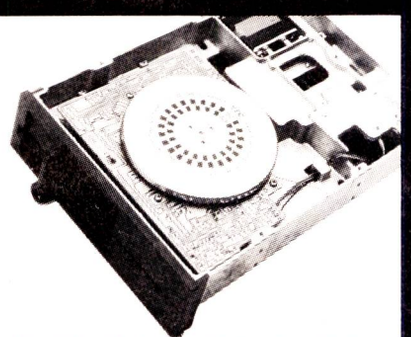

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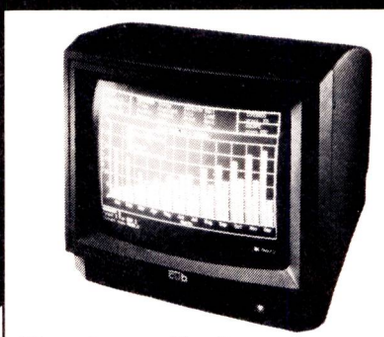

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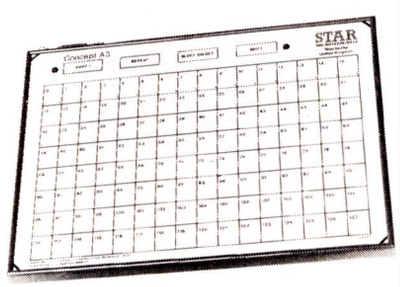

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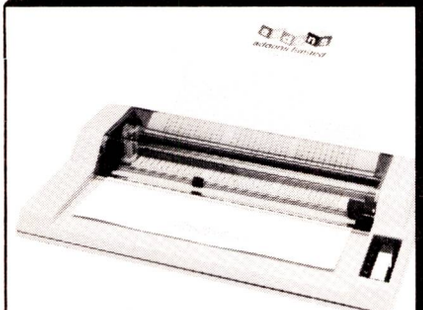

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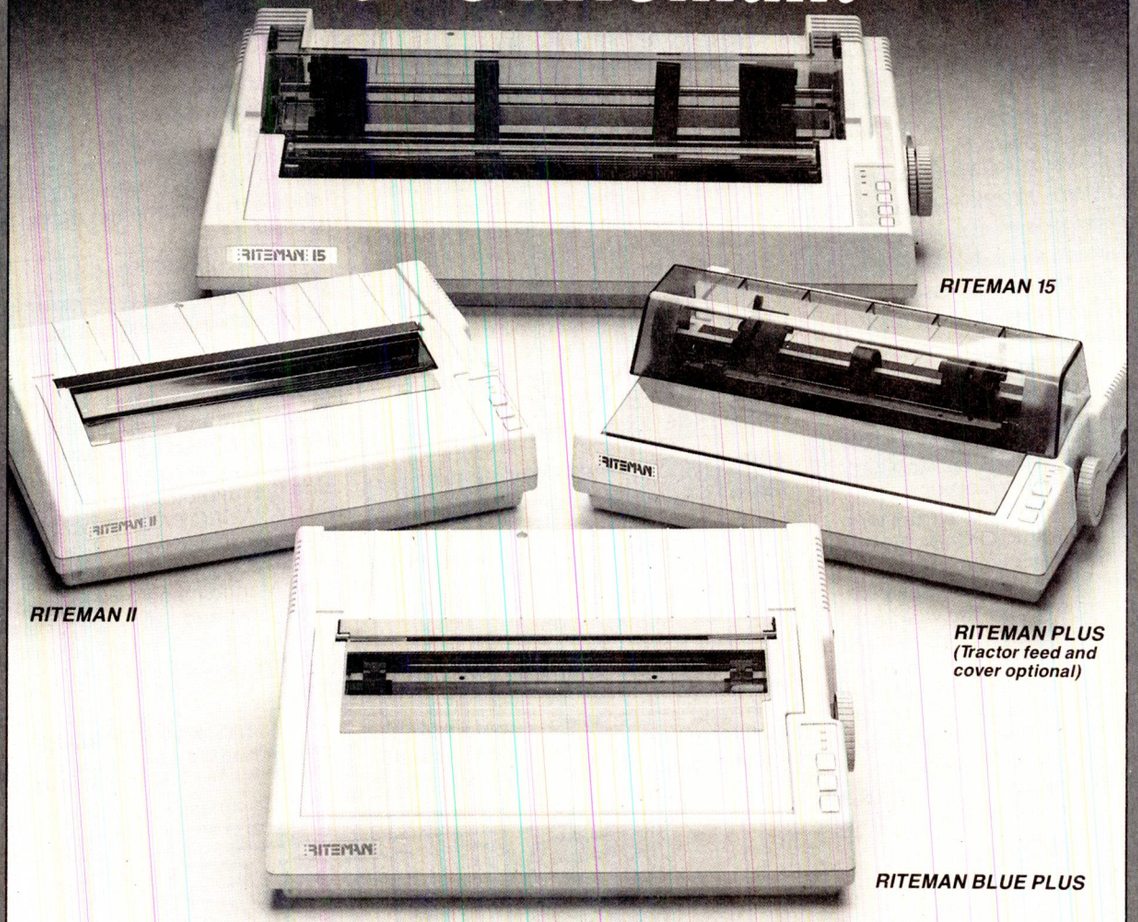

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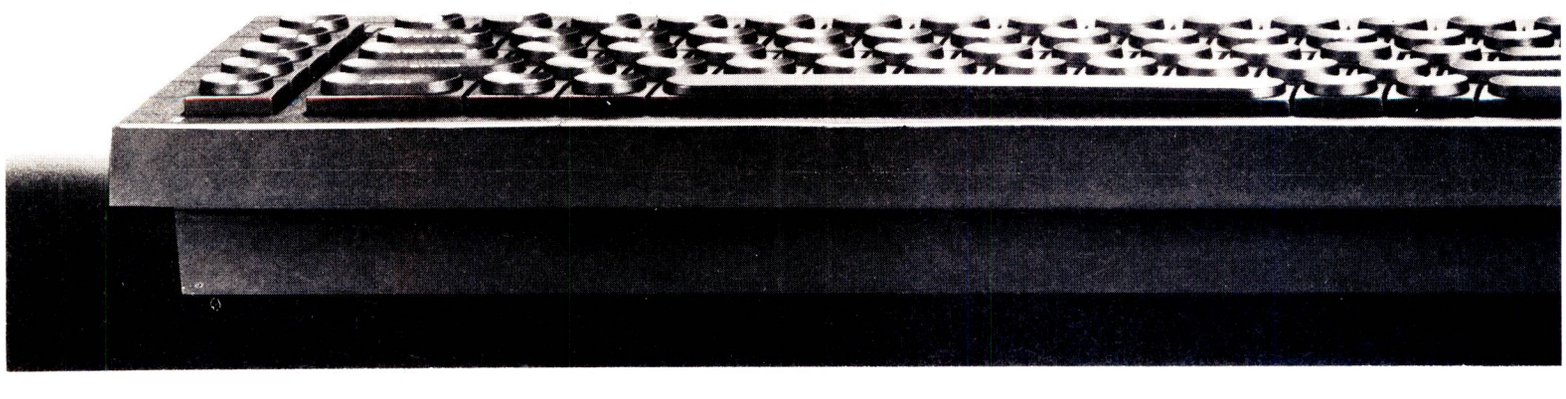

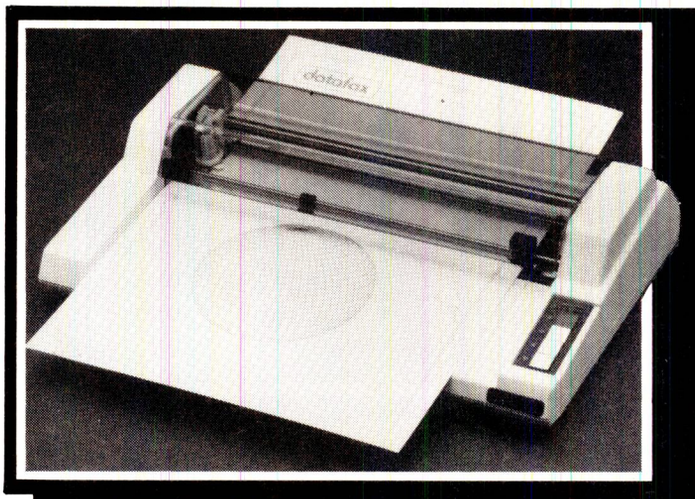

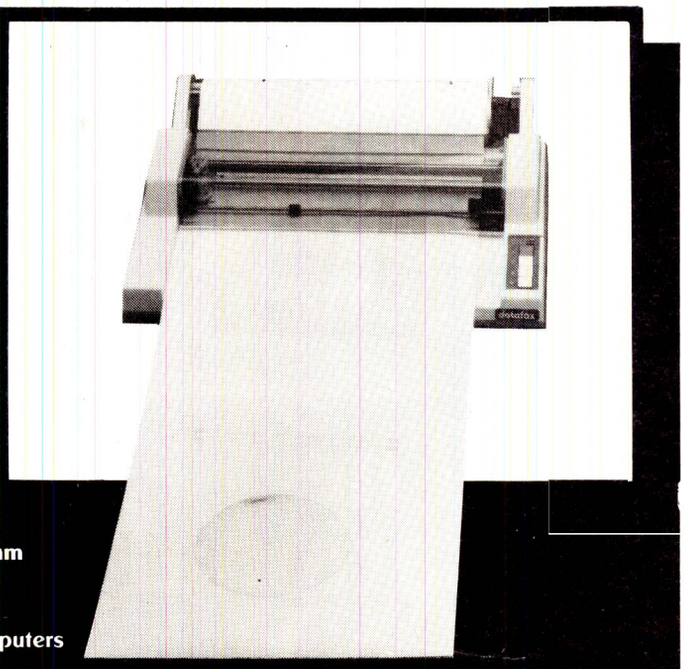

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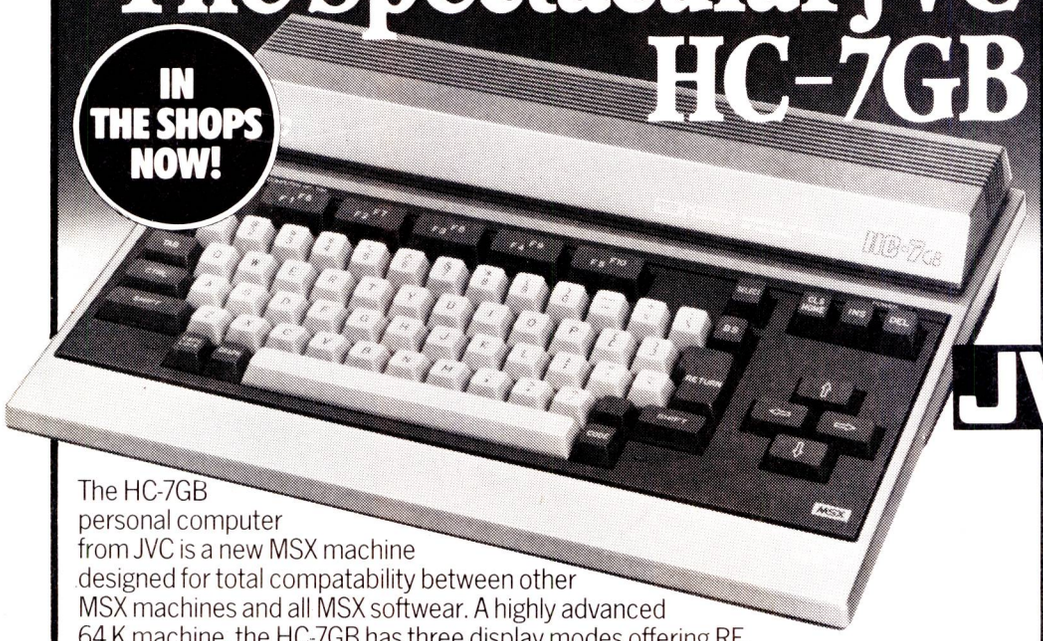

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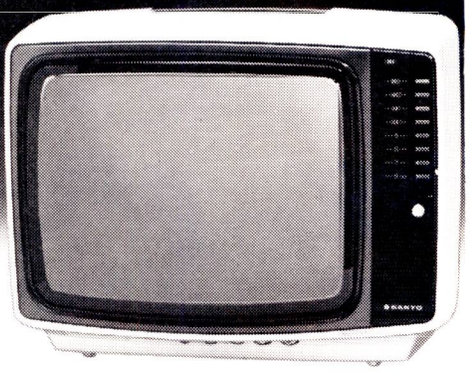

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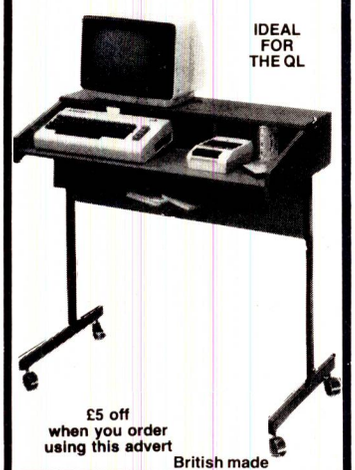

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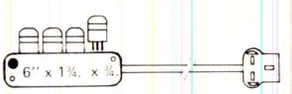

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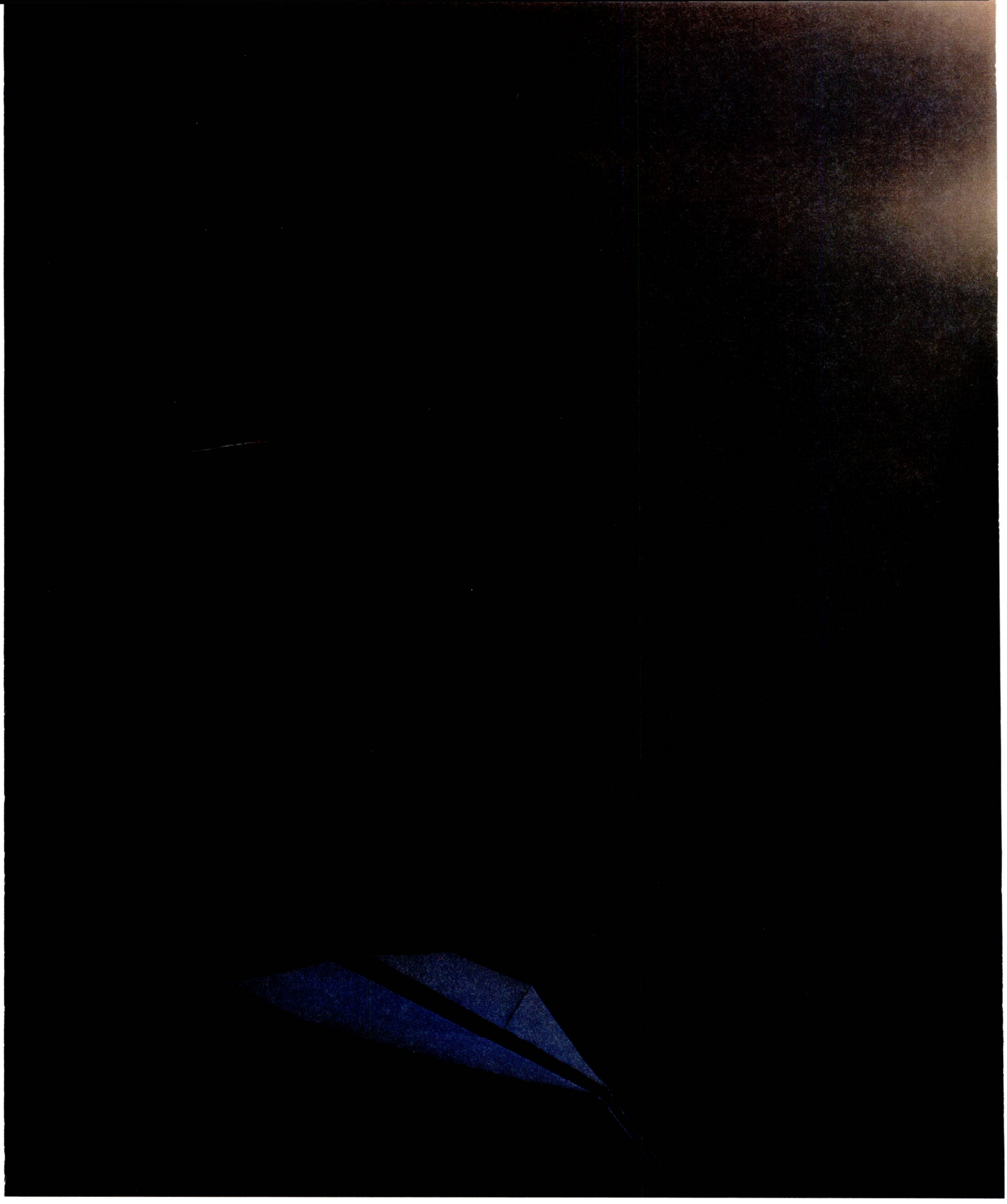

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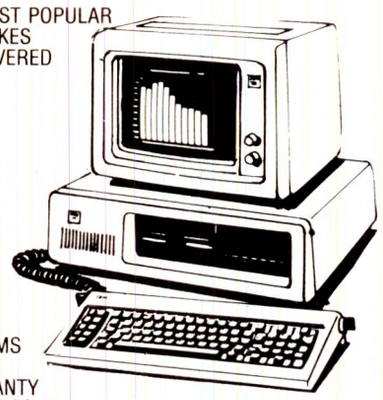

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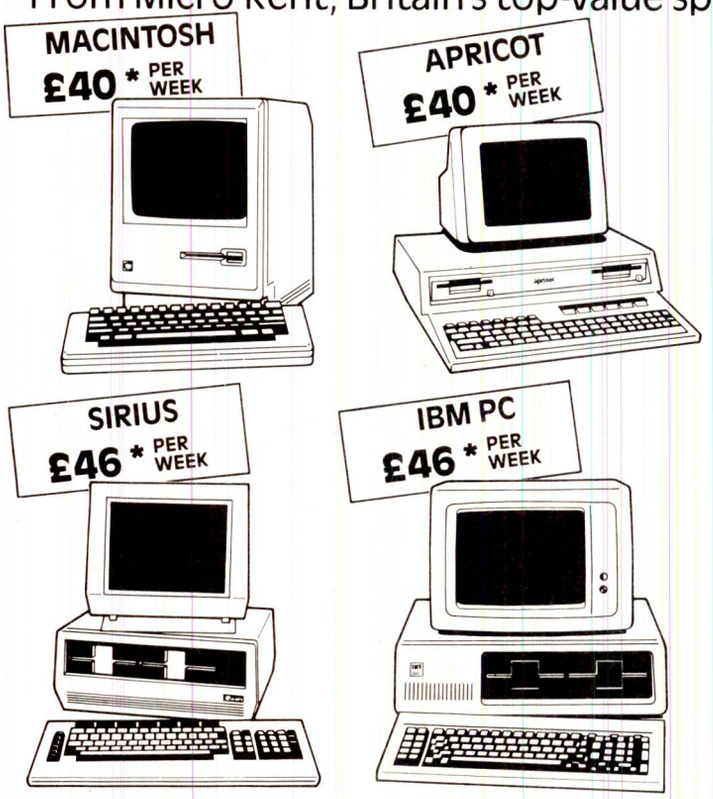

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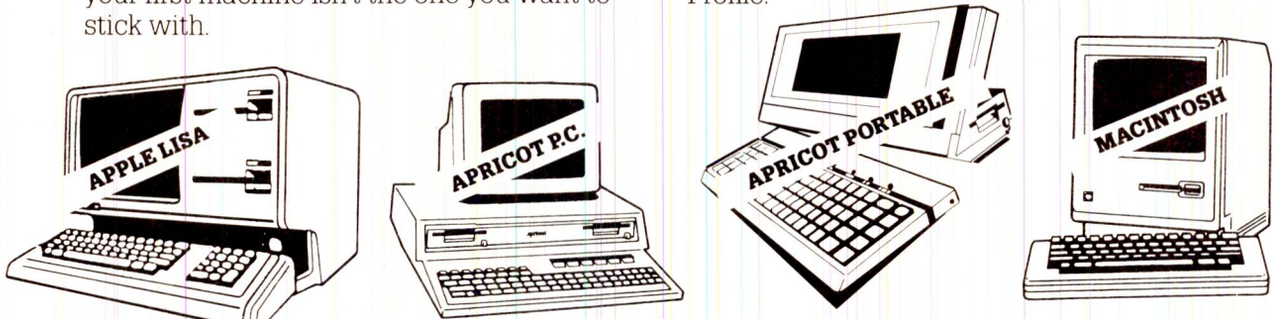

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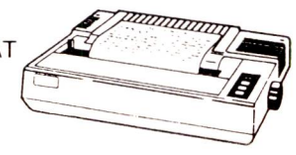

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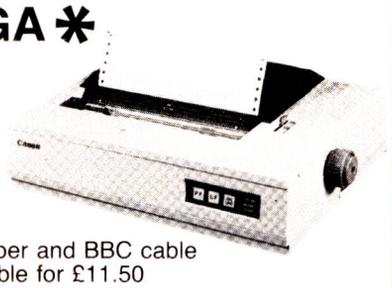

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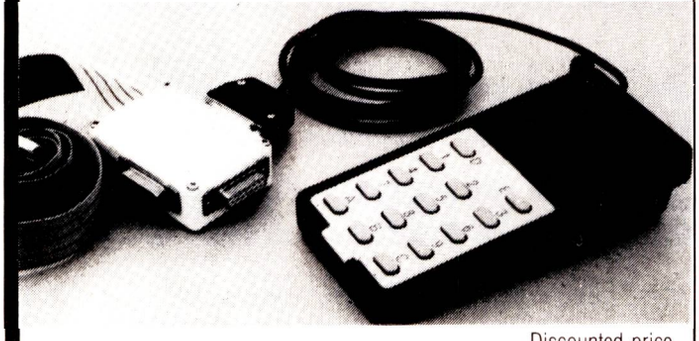

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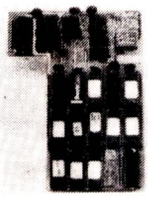

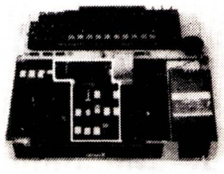

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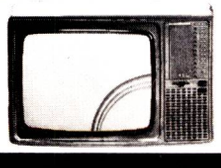

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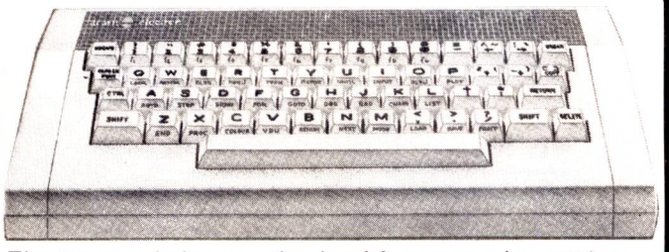

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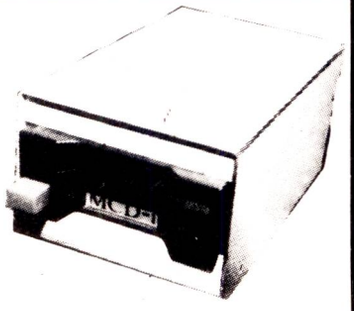

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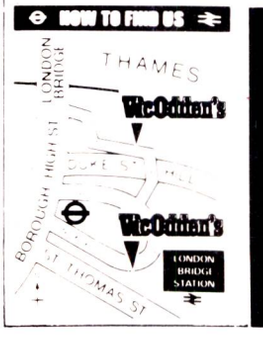

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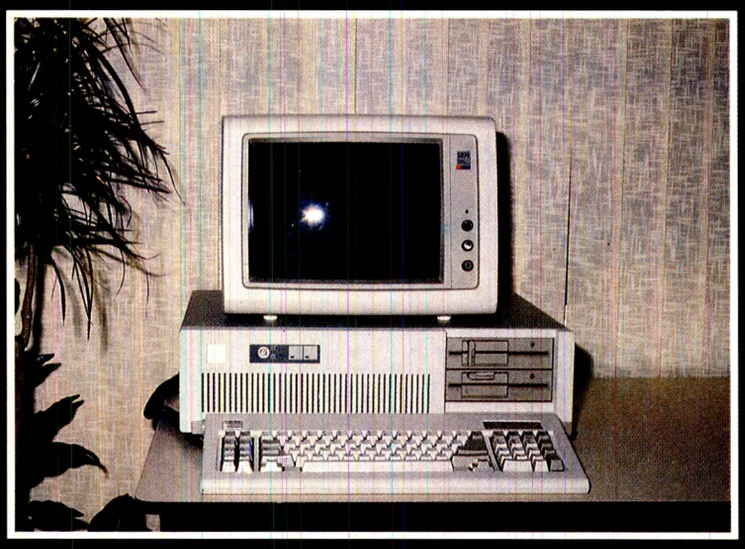

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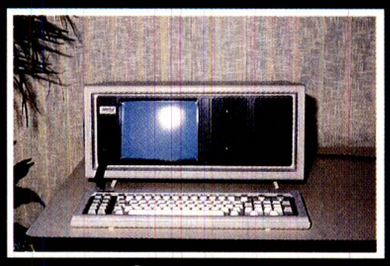

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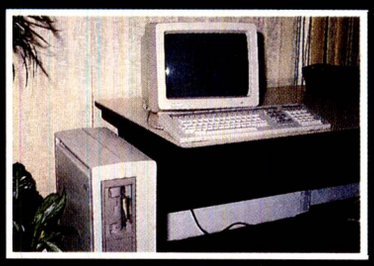

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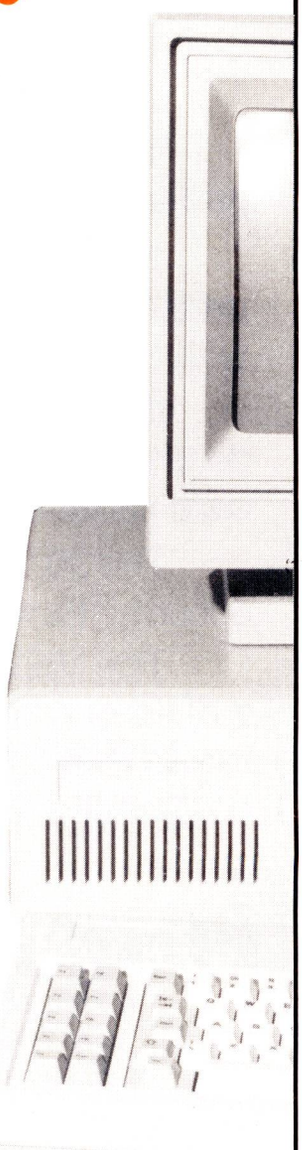

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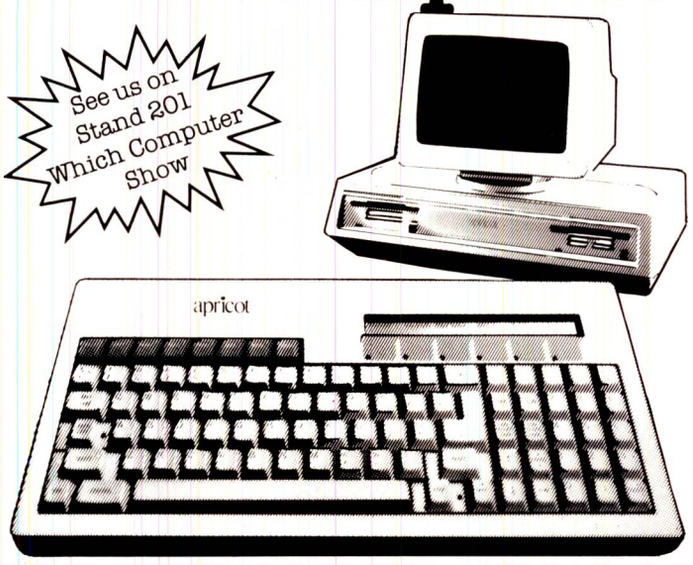

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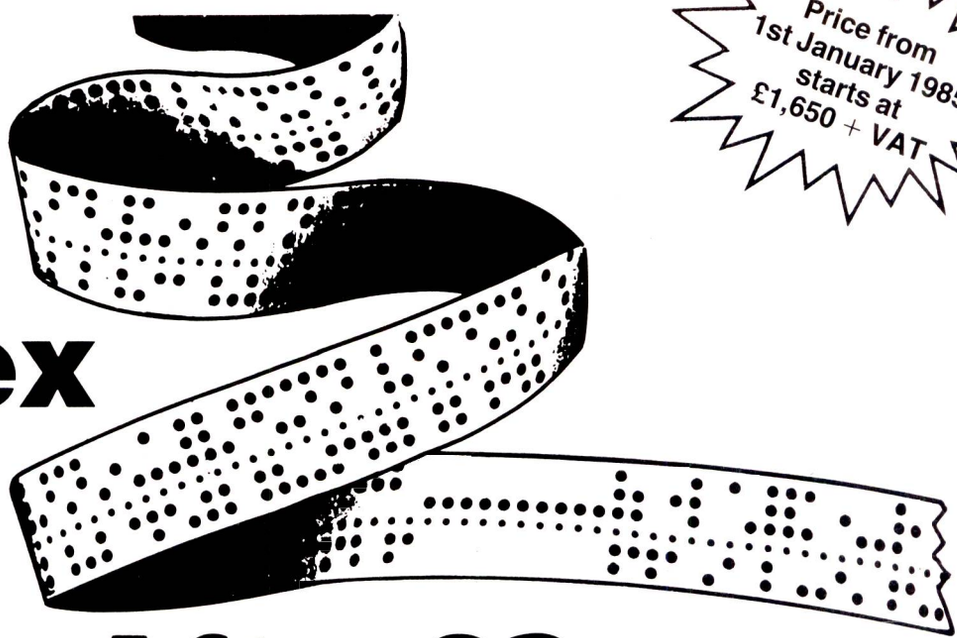

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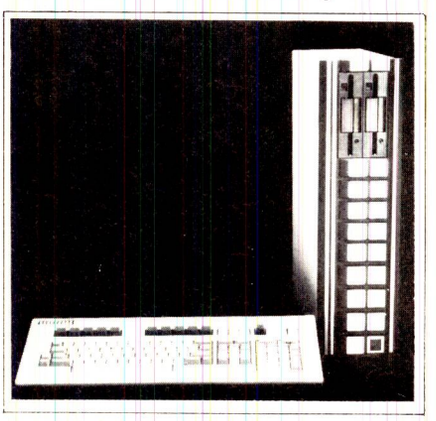

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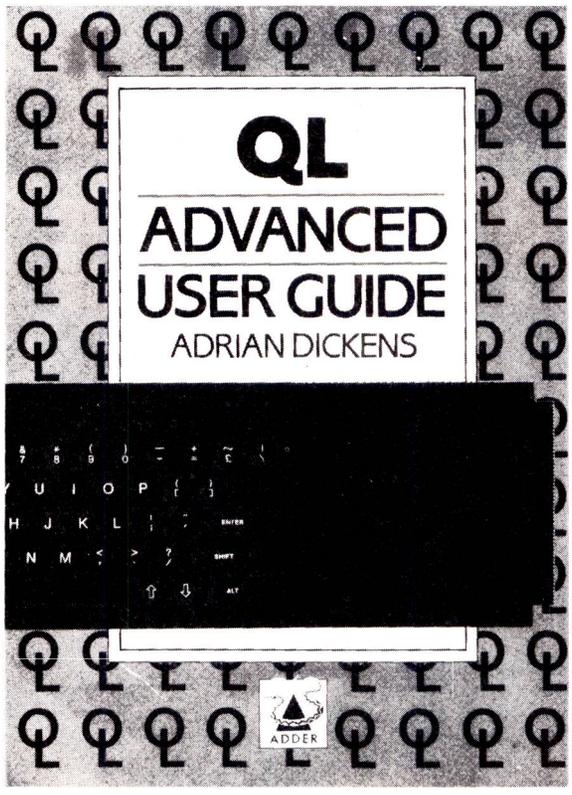

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AMX ART

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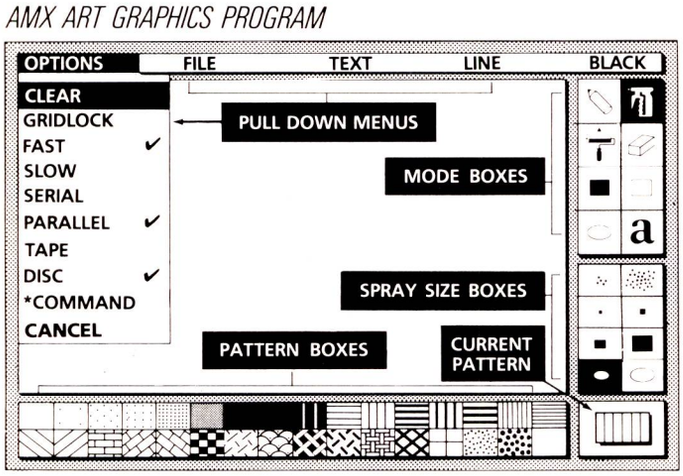
AMX ART GRAPHICS PROGRAM



The AMX ROM – contains fast machine code routines for creating on screen windows, icons, and pointers and enables to MOUSE buttons to be programmed for use with commerial software such as Wordwise and VIEW.

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A MANUAL describes how to operate the MOUSE and the ROM routines which are available in both basic and machine code programs.

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AMX ART includes full use of on screen menu boxes, icons, and pull down menus so that beginners find it very easy to learn and gain confidence in the use of the B.B.C. Micro.

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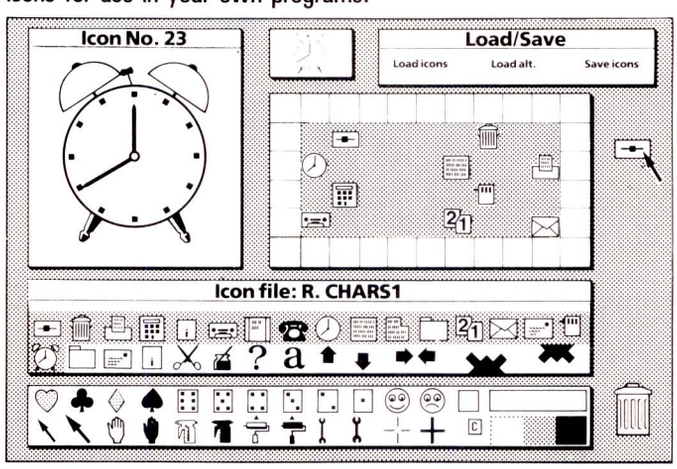


ICON DESIGN PROGRAM

TECHNICAL REQUIREMENTS

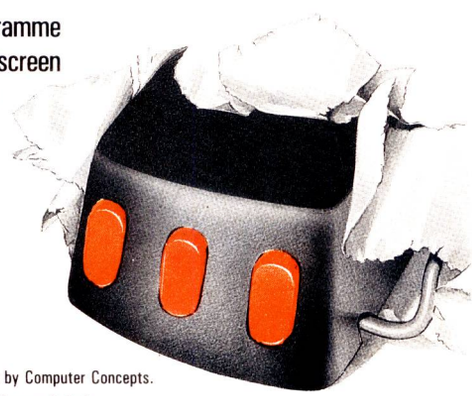
The AMX MOUSE can be used with any B.B.C. Model B computer fitted with the Operation System 1.2 and is compatible with the second processor and disc or tape filing systems.



The AMX MOUSE is adjustable for sensitivity via software control and three buttons can be programmed to simulate 24 different key codes.

The AMX MOUSE may be disabled by a simple software command and will then not interfere with normal operation of the computer.

The AMX ART programme enables users to print out screen displays using any Epsom compatible dot-matrix printer. Owners of non-standard printers may use their own screen dump routines.



'Wordwise' is a wordprocessing program by Computer Concepts.
'View' is a word processing program by Acornsoft Ltd.

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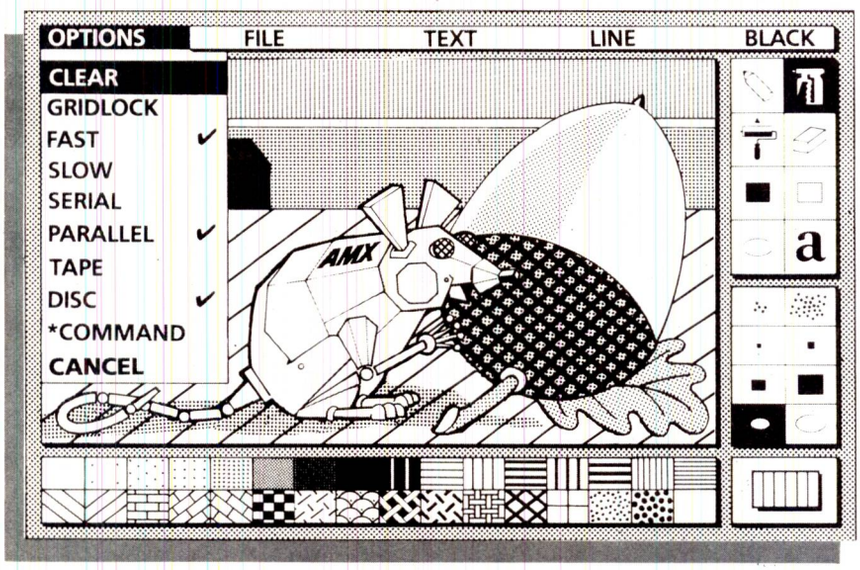

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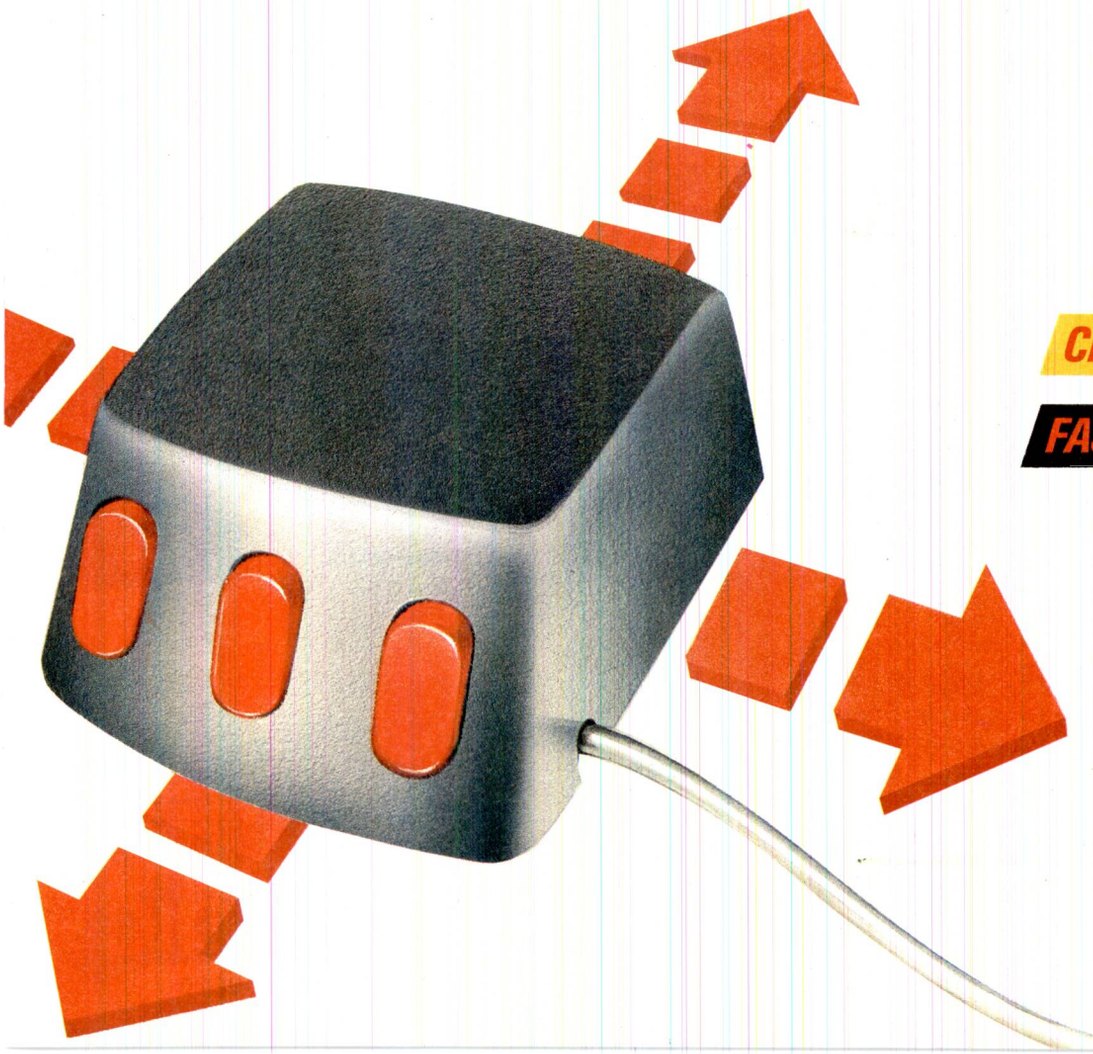

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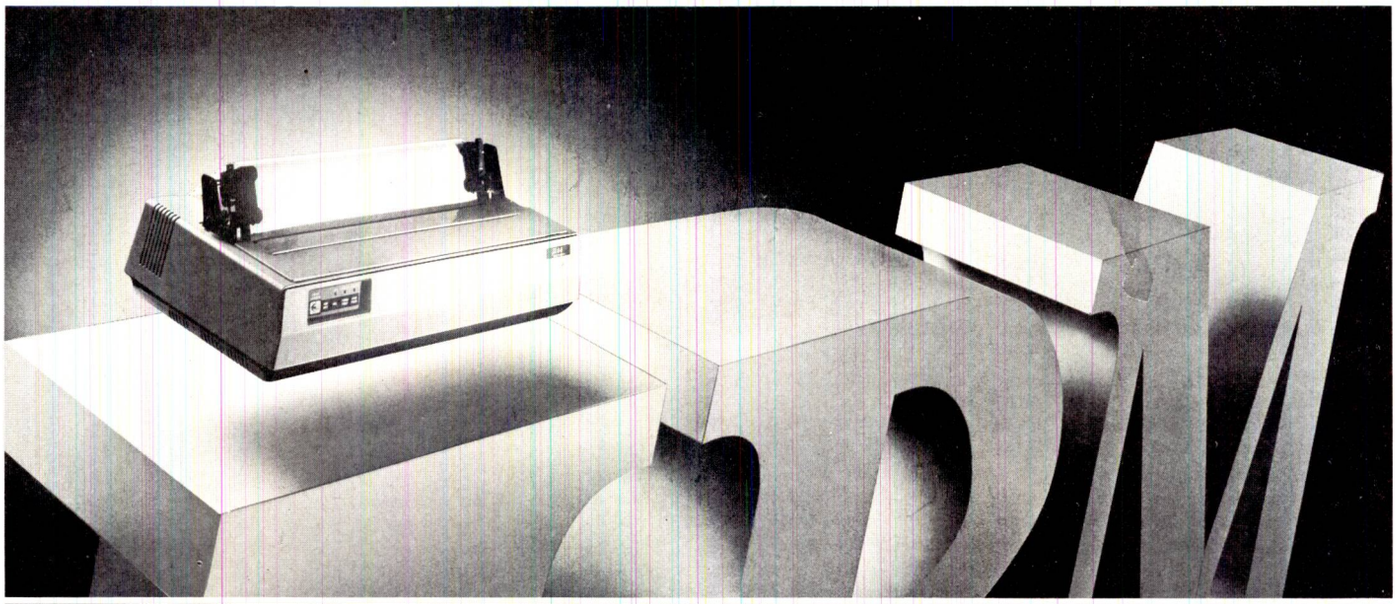

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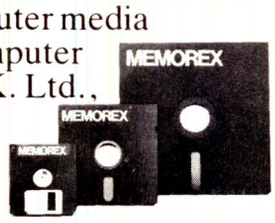

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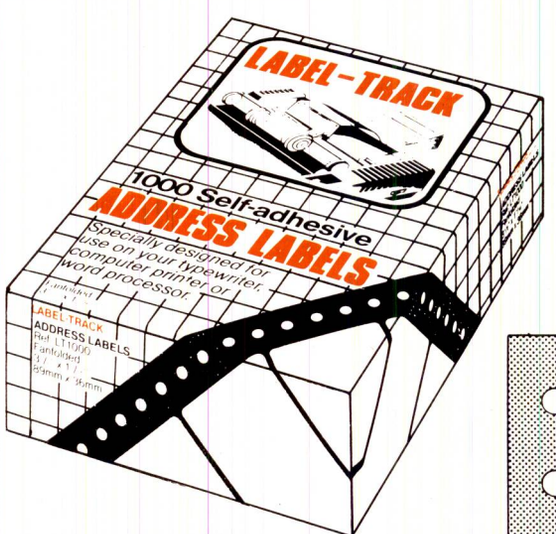

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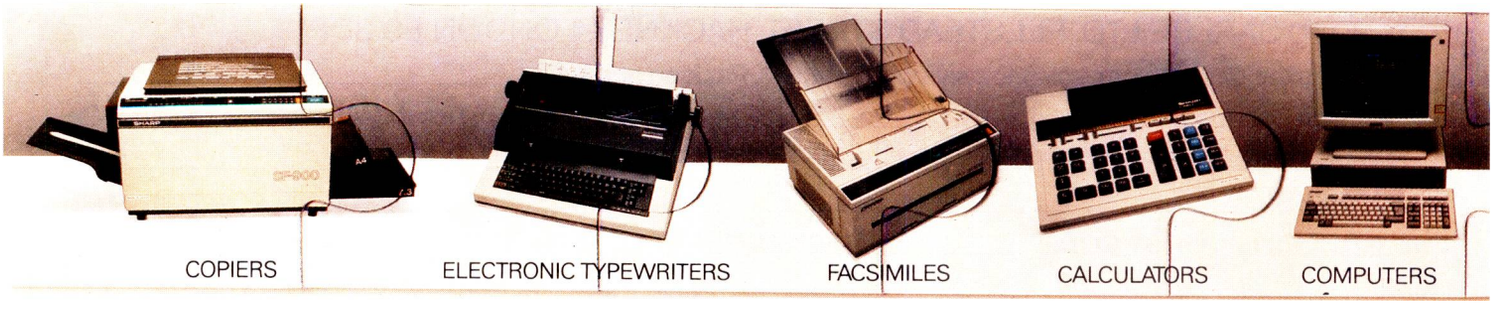

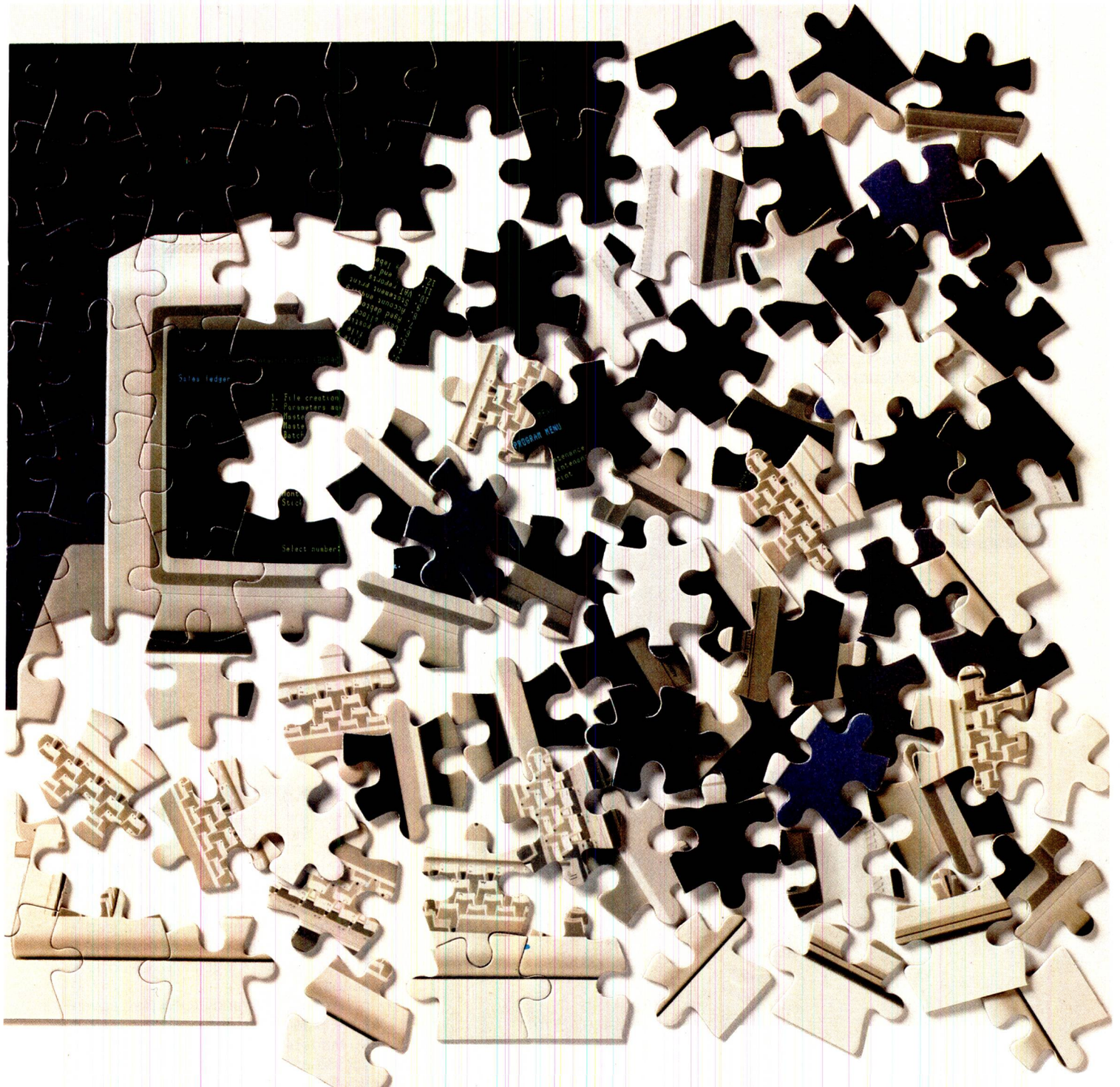

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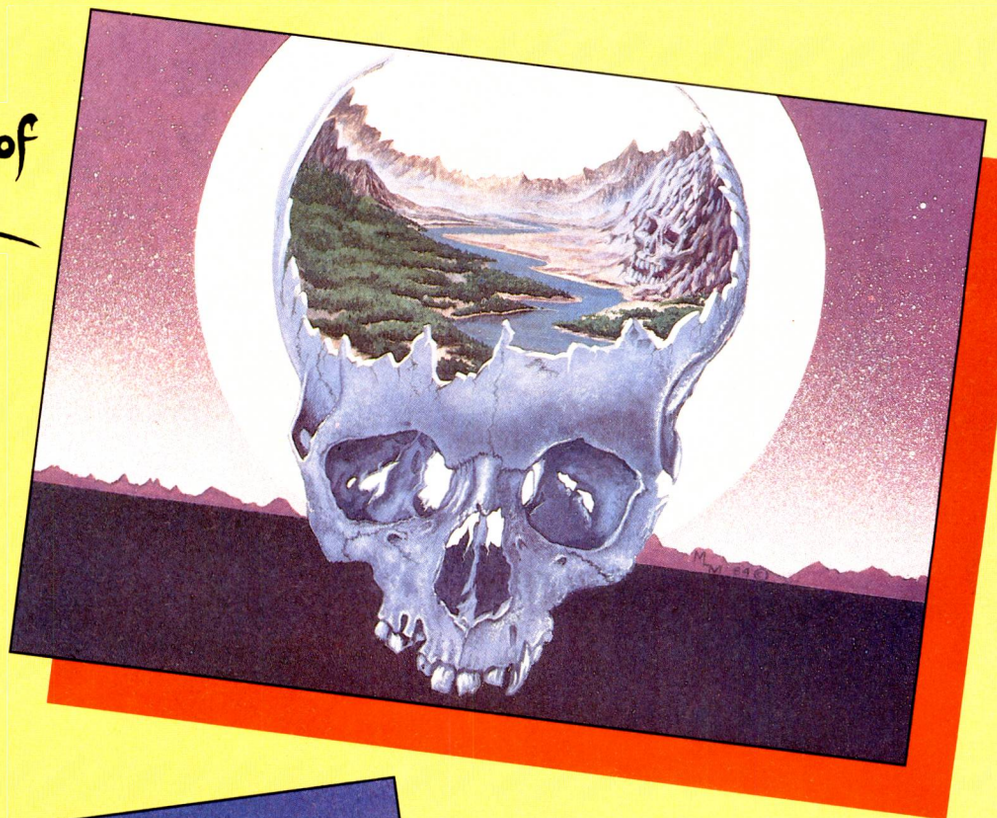

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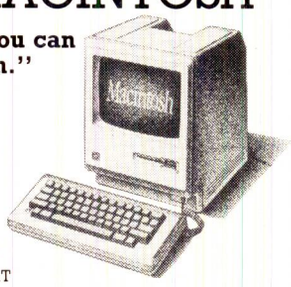

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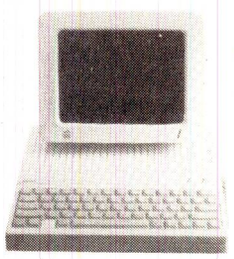

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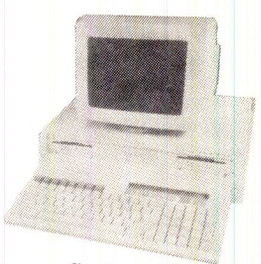

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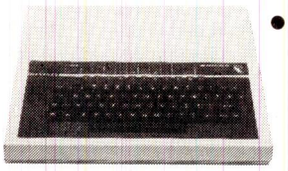

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NEWSPRINT



Controversy makes the news this month: Compunet considers the BBC and Spectrum markets; Elite becomes a way of life; and PCW on TV? Guy Kewney reports

Intelligent guess

It now looks very likely that Compunet will extend itself into the BBC and Sinclair Spectrum markets, and no longer be an exclusive Commodore preserve.

This is still not certain (or wasn't at press time) and the reason for my 'intelligent guess' goes like this. There are close on £1 million worth — maybe more — Prestel-style modems crammed into the warehouses of Prism Microproducts, the Spectrum distribution company. They were originally part of a deal with Prestel and Micronet.

It isn't any closely-held secret that Prism is retrenching, and would very much like to have those modems converted into money. However, relations with Micronet and Prestel have soured, rather, and Prestel just won't wear the idea of having a rival to the Micronet club (which it has invested a lot of money in) set up its own system.

So, in order to get the modems out into the homes of Britain, Prism came up with an idea which may turn out to be more promising than the original idea of just selling them at a profit.

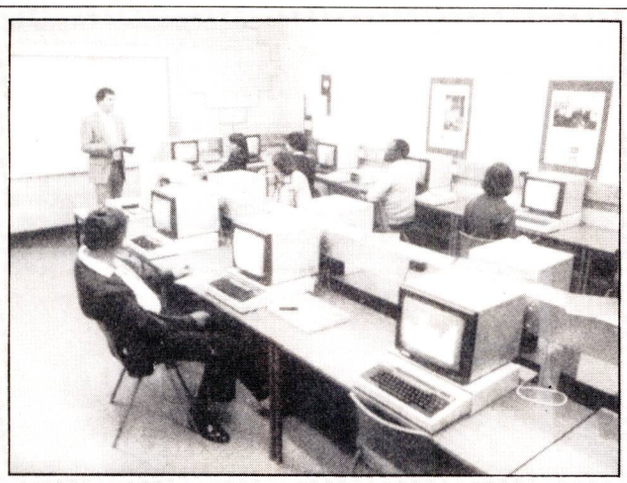
The idea is to offer a central computer system on which publishing ventures can be launched. Publishing, however, with a difference, according to consultant Robin Wilkinson, who is putting together the plan for Prism. His theory is that publishing on a network can be a much more convivial effort, where the 'readers' are actually the contributors, and where they can share ideas and opinions among themselves. He is known to be talking to several network management companies about the possibility of launching such a system.

Prism has just relinquished the last of its profitable titles to EMAP — a publishing house which very cleverly got an option to any computer magazines launched by ECC, the publishing part. But although ECC is now closed down, the feeling persists inside Prism that it knows how to launch special interest, enthusiast publications, and that an electronic network would be a pretty neat way of doing this.

It will have to move. With Unicom just hitting the market with a £50 modem that dials and (if you program it) redials, my guess is that the market will pay the £50-£60 asking price for the Prism modems, plus the network, only for another nine months or so.

Intriguingly, Prism is also planning to put the QL onto a network. But from vibrations I pick up in the network community, there are people inside Compunet who don't want to get involved with that micro. And so if (as I guess) Compunet does turn out to be the one to set up a network for Prism, then it will probably require some other outfit to step forward and volunteer to carry the QL.

However, I'm not expecting a QL network in the first six months of 1985. The thinking inside Prism is that there have to be 35,000 users before a network is viable, and that sounds about right. And what gossip I do hear in the trade about the QL doesn't suggest that there are long queues of eager dealers, waiting anxiously for short-supply QL boxes to pass on to crazed would-be buyers.



A bridge is different from a gateway, in network terms, because a bridge links two nets in such a way that they effectively become one net. A gateway, on the other hand, makes the second net appear to be just one device on the first (and vice versa).

Acorn has now announced a bridge for Econet, and it's a cheap net for the BBC Micro. The Econet Bridge allows several BBC micro networks to be interlinked.

The picture shows the test installation at Manchester Polytechnic, where the system has had a six months field trial, and where the three networks involved have, apparently, worked a lot better than any did separately.

Come the revolution . . .

You can pour cold water on any happy ideas you had of getting a 16-bit BBC Micro early this year. What is on the way is a thing called 'Issue 10' — a new circuit to go inside the current BBC Micro.

Despite the fact that it's a pretty open secret inside Acorn, executives there sternly refuse to confirm (or even to call back and deny) the rumours now circulating. But Issue 10 doesn't look to be very much different from the old BBC Micro, except in disk handling, from the way a user would look at it.

Essentially, the new board is cheaper to build. Exactly how much cheaper isn't going to be clear, because one of Acorn's first priorities is to start giving the retail stores who sell it a bit more profit margin. But engineers who have seen the version which goes into the ABC box say that it isn't startling in its economy of design, and is one reason they expect the ABC to be over-priced.

So, there are more custom logic chips replacing large numbers of standard logic chips (TTL); and there's a more sophisticated disk operating system, not necessarily compatible with everything that has gone before, and one or two other nice features.

What the machine really needs, however, is something to put it as far ahead of the competition, in 1985, as the original Proton design was ahead of everything when the BBC adopted it.

Well, stop and think for a moment.

This month, Atari, now under Jack Tramiel, will produce its £300 (or thereabouts) Macintosh-alike, using a 68000 chip and Digital Research's GEM software. By half-way through the year, Tramiel has said he'll have a 32-bit machine for under £1000 with the same GEM interface.

That's the same GEM interface which makes the ABC look so nice, and on which Acorn is expected to put a £3500 price tag. And even the news that the operating system will be called TOS ('Tramiel Operating System?!') has failed to convince me that this Super-Mac is just a dream. It can be done.

Commodore is known to be working along very similar lines, with a low-cost IBM-alike and a series of other planned announcements. It's expecting a rough ride from Atari with no holds barred — word came in, first week in December, of a shareholders meeting in New York where they took voting rights away from any shares which were held in more than 10 per cent blocks. Tramiel, needless to say, still has a large block of Commodore shares.

At press time, rumours were just warming up about Acorn's plans to pull out of the States — but if they prove untrue, that'll be more surprising than if the US adventure *is* finished.

With all best wishes to Acorn as a leading UK micro supplier, I almost do hope the American effort is dead because that may help convince the Cherry Hinton

firm that the BBC Micro is not forever.

And it does have to think ahead, and design something truly revolutionary.

Elite addiction

I'm a terribly disappointed combateer. Heroically, I've been taking my Cobra Mk III trading ship into the toughest, meanest, baddest and plain politically destabilisedest star systems I could find, and getting wiped out as often as not, in my search for glory in the 'game' Elite. Game? It's a way of life!

And now, I find (outrage) you don't get any extra points for heroism! You get to be elite simply on the strength of having so many thousand explosions onscreen! And it doesn't matter who you kill, or what you hit. Destroy an innocent, helpless trader, running terrified for the space station, and he will spill his cargo into space. Don't pick it up! — shoot it. The police won't care about your piracy, unless you pick up some of the cargo and it turns out to be contraband.

Ah, well; at least my rating of 'deadly' is genuine. Watford Electronics is said to have a chip which automatically makes you elite. Other players have found system fiddles. And some have even been able to get to high levels by shooting asteroids (which don't shoot back, of course) which we disk-based players don't get. The programmers took them out for a test, and forgot to put them back again.

All this illustrates, I hope, just what a cult the game has become, and why people were so fascinated to see an (illegal) copy of a new version from Acornsoft, designed to run on the second processor, the 6502, at a London show recently.

The new version still doesn't give you more points for kills made in the Anarchy or Feudal systems. It doesn't time your reactions, and give you more points if you wipe out the attackers quickly. But it is in colour, and it does have a gloriously animated introduction, with the credits rolling away in Star Wars style . . .

Wait, my friends tell me, for Elite II, now in final preparation.



Do I detect signs of a thaw? Previously, relations between Mike Sterland, of Personal Computers Ltd, and Apple were a little icy. Sterland, one of the original two exclusive agents for Apple, had almost stopped dealing in Apple II micros, and concentrated on IBM and Compaq.

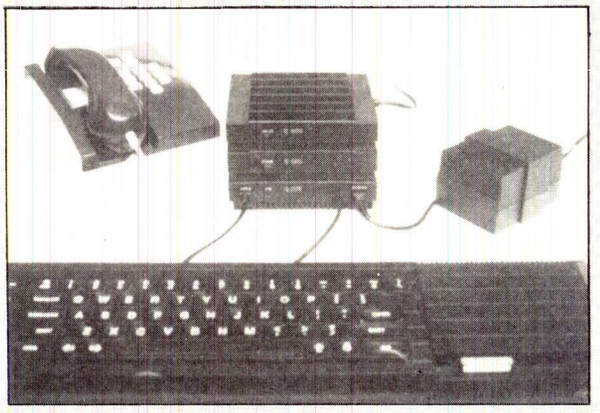
Now, lo and behold, here is Mike Sterland himself, standing in front of his new Macintosh Centre, where he sells only Macs.

He still sells IBMs, and so on, in his other shop just around the corner. But I'm delighted to see that he has stopped seeing Apple as the blundering incompetent that (I'm sure he didn't really) believed it had become, and has started doing good business again.

And the tall, leather-jacketed guy standing next to Sterland? Oh, well, it's Douglas Adams, author of the* Hitch-Hiker's Guide to the Galaxy, *and, mostly, harmless. Sterland asked him to open the shop. I'm a little miffed about that. Mike once asked me to judge a competition at his shop, and nobody took my picture and put it in* PCW. *Why should this enormous Oxford globe-trotter get all the glory?

A sad addendum to this cheerful little story is the fact that the other exclusive pioneer distributor of Apple, Keen Computers, has now gone out of business. At press time, the receiver had abandoned all hope of selling it off because so many staff had left for rival companies.

The company had picked up the Corvus local net franchise, so people were a bit suprised that it managed to go bust. According to friends who were thinking of buying it for the IBM franchise, however, Keen never managed to sell at the right price to make a profit.



Missing the opportunity of a lifetime, OE Ltd has failed to call its communications modules for the QL 'the QT', and has named it QCOM instead.

The software comes built-in to the controller box, QCON, which switches data in and out, emulates DEC VT100 terminals, and provides a serial interface into which you plug your modem. Then there's the modem itself, QMOD, which doesn't work at 300 baud, but at 1200/75 or 1200 half-duplex. And finally, there's the dialling unit and auto-answer unit, QCALL. Altogether: as near as dammit £200. Details are available from OEL on (0768) 66748.

Rising from the ashes

Much to the disbelief of everyone, the new Osborne Computer Corporation really does seem to be making a comeback.

Worse still (for those of us who thought it impossible) its new machine, the Vixen (in the States) or the Express (in the UK) or the Turbo (you can't call anything Vic or Vixen in Germany, because the V is pronounced F) is already sold out on its first three months' production.

The little half-size Osborne failed to impress me when I was shown a pre-production model. One of my main objections was the retention of the original Osborne's worst vice, the 'dead' keyboard. This has been fixed, and you can type ahead of the computer, up to 256 characters. Furthermore, the speed of the machine has been vastly increased, and so has its compatibilty with the old model. And best of all, Drive C Corporation has offered to buy $2m worth of the Vixen, in which it will install its own design of RAM disk/print buffer/hard disk interface.

The Drive C interface is the single most important peripheral for the ordinary CP/M machine. On a program like WordStar, for £600 on top of the cost of an ordinary Osborne, the Drive C extension provides 400k of memory, out of which all your overlay files run. There is absolutely zero delay on any operation, compared with two to 10 seconds on most WordStar processes.

Coupled with the way the Drive C device uses any spare memory as a print buffer, the result is literally the fastest WordStar computer I've ever laid eyes on.

But all this doesn't explain why existing Osborne users, who could just buy the Drive C interface anyway, are clamouring to buy the new Vixen/Express. A spokesman for the company suggested it was just 'part of the incredible Osborne fanaticism' among owners which has led the user groups to back up the rebirth of the company. I have to buy that explanation, because there isn't another obvious one that I can put my mind to.

Security leak

Having the name Prince Philip available to start a story always makes it a natural for Britain's breakfast newspapers, so when hackers started adjusting Prestel mailboxes last month it was inevitable that the *Daily Mail* (and TV news) would get hold of it.

The result, of course, was chaos for regular users, as Prestel bosses overreacted to a fairly standard breach of security.

People with access codes found they didn't work. People who were authorised

to use areas of Prestel memory found that hackers had broken in and, as a result, they, the official users, couldn't break in to their own areas.

It all comes of the failure of Authority, in high parts of Government, to accept that microcomputers really are computers. Other symptoms of this determined blindness are the recent attempts by the security services to block a method of protecting computer tapes, developed by an inventor who hoped to stop schoolkid piracy. It obviously never occurred to these so-called boffins that something which a private micro user could develop in his spare time shouldn't be more sophisticated than something they had developed, and that the failure was theirs. Instead of developing a more sophisticated method, they tried to suppress the privately developed system.

What is really exciting, according to my hacker friends, is that the system proved vulnerable to their unaided attempts to crack it within two weeks.

So with Prestel. Actually, Prestel is one of the most secure systems of its type, simply because of the nature of the hardware which Telecom uses to run it. It's possible to get access to somebody else's data by using their code, and it's possible to get people inside Prestel to provide the code, but it isn't easy to get the Prestel computer to reveal those codes without that kind of help.

On other private viewdata systems, however, the more flexible operating systems used make security breaches a certainty. A friend of mine assures me that to the best of his knowledge, there's no way to prevent users of an RXS-based system on a DEC minicomputer from pre-extending a new file, to include other areas such as the area where all the password codes are kept. On a DEC system changes are possible to the actual operating system, for a skilled systems programmer. On the Prestel minis, the operating system is hard-wired into the hardware.

Tops for networks

At last, networks are starting to appear which acknowledge the need most of us have to talk to makes of micros other than our own. Top of the list is an American announcement of a Total Operating System independent (TOPS) network, which they describe as 'transcendental' because it actually does reconcile total incompatibilities.

Or, more correctly, it will.

The company, Centram Systems West, an independent computer company in Berkeley, California, is now looking for licensees for TOPS, and expects to have versions that will reconcile PC-DOS and MS-DOS with Machintosh DOS by March 85. After that, the company hopes to have support for old CP/M (8-bit) computers, and Unix 'and other operating systems' by the summer.

The announcement wouldn't be worth taking seriously unless it were both a hardware and a software solution — and it is. The hardware provides a high speed link between machines operating at up to 0./8 megabits per second, using a telephone cable with four wires.

The software part, however, is the new and interesting bit — it provides a standardised network environment with network operating system calls.

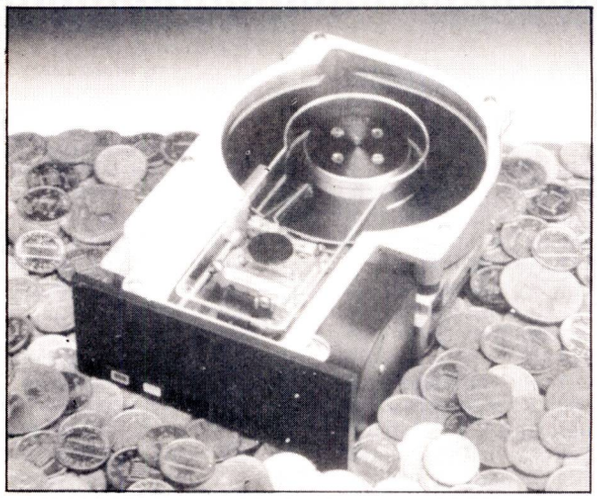
Some other systems (quite a few) allow users of dissimilar machines to use the same central disk. There's usually a limit to this, and in any case, the normal method (dividing the hard disk up into 'partitions') doesn't allow two computers such as the Mac and the IBM PC to access the same partition and work on related files simultaneously. TOPS, however, aims to do this:

A TOPS user may treat a remote file, created under any operating system, exactly as if it were resident on the internal disk drive. A Mac can look at the directory of a remote IBM disk and see it in the Macintosh format of icons on a desktop.

What it can't do, however, is make specialised files — for example, WordStar files or Cardbox files — accessible to a computer which can't run the program. A WordStar file will appear to be gibberish to a Macintosh. A MacPaint document (drawing) will not make any sense to an IBM. And until somebody writes an application to interpret the data, no amount of networking can get round the problem.

However, what TOPS will do is give access to other peripherals on the network. And where machines do run the same program (albeit under a different operating system) they'll be able to swap spreadsheet data, text, and database information.

What we won't know until Centram gets a UK agent is price. Box add-ons for the IBM family and other card-slot machines, and add-on units for other micros, will be available, it says, but no price



Naked winchester disks don't often get exposed in this column. The reason for revealing the Newbury Penny is that you just might see some in American micros soon.

The company launched it in the US on the same day as in Britain, and that's why the coins in the photograph include English as well as American pennies (cents) — and, intriguingly, Americans were impressed with the price. Penny offer 50Mbytes on a 3in drive, and the company is very hopeful of business arising directly out of the weak pound sterling against the dollar. The American-based rivals are suddenly priced to the high end of the market, executives told me smugly.

Oddly enough, I was more impressed with the new NDR 8935 (ah, they don't write numbers like that any more) printer — it has 18 needles, so it can print letter quality at a blistering 90 characters per second, or draft quality at 200 characters per second. Since there was no price at the launch, I couldn't get too worked up about that — what impressed me was the silence. As matrix printers go, it's like a ghost.



Kempston has dived into the BBC market with its joysticks, hoping that people will have heard of its good reputation in the Sinclair Spectrum world. Unfortunately, not everybody with a BBC Micro will want one because these have switches, not rheostats. But if your software will look at four micro switches, 'allowing movement in a total of eight directions', then you pay £17 and away you go.



Choosing a printer is a lot easier than choosing a computer.

THERE are dozens of quality printers from which to choose. With quality price tags of around £250.

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In the speed stakes, the M-1009 is certainly no slouch, being fully capable of up to 50 characters per second.

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Being an impact printer, the M-1009 will print on virtually any paper, including letter headings, invoices and standard office stationery.

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In its price range, the M-1009 has a great deal more character than many printers.

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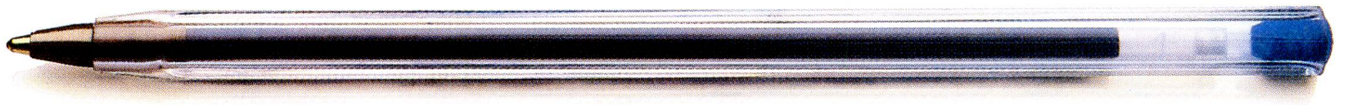

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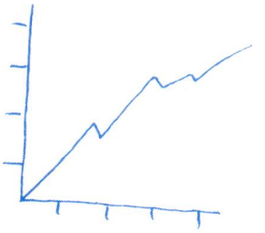

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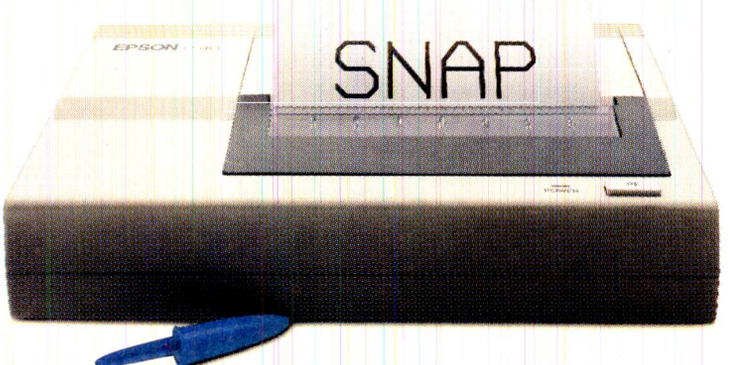
Dear Me,

Even writes letters!



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No less than 96 ASCII plus international type and graphic characters are standard.

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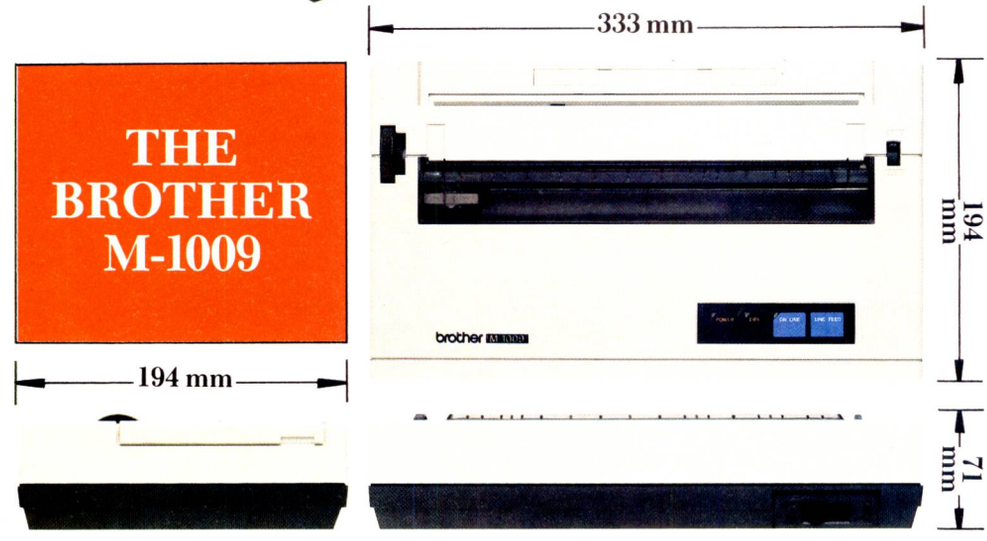
THE BROTHER M-1009



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information was available at press time. Details are available on (415) 644 8244 and 8245.

Following in footsteps

After the fantastic Filevision, databases for the Macintosh are coming thick and fast.

Unfortunately, the one I like best is Infocom's new Cornerstone and that's not moving from the IBM family for ages, but in the meantime there are some encouraging alternatives.

Filevision itself we have all heard about. But from Stoneware, originator of DB Master, there is now something called a Mac version. It's actually nothing like DB Master: it's (as Apple chairman Steve Jobs promised) something which incorporates so many new Mac features as to be unrecognisable as the same product.

Essential advantages which I like include the ability to hold your files on as many floppy disks as you like — up to about 32, that is. The designer doesn't actually recommend that you try sorting a whole 32-floppy file into alphabetical order, but if you normally keep it on a hard disk and you have a copy spread over 32 floppies, you'll still be able to get the mailing list printed.

And it seemed easy to use, barring one drawback — the ability to edit a request for data would be nice. Reports, as database people call them, require thought, and usually some trial and error is substituted for much of the thought. But on this version (I am assured it will change) you can't see what your request was, so you have trouble changing it.

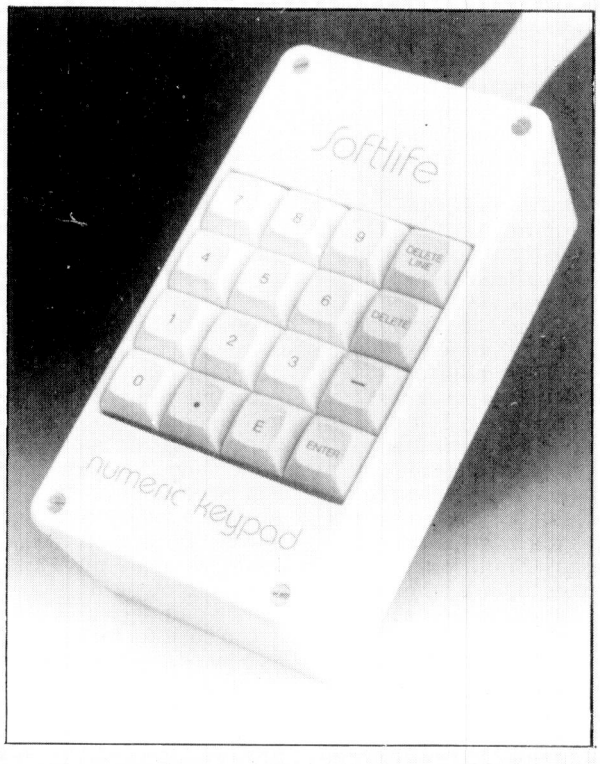
From Eqtron, a Canadian company, there is MacBase, designed by somebody with a name that I went to some trouble to check: Pierre Vella-Zarb. Claims for this one are not checked, but the claim that I liked was: 'Unlike other database programs, MacBase is not report-oriented. All calculated and reporting fields appear right on the screen.'

That one is not yet available, but the company is on (416) 361 5002.



One of the first dealers of the MAD-1 turns out to be not just a shop, but a rental outfit.

The rental company is a newly formed concern, Select Computing, and it will be offering the machine on both rental or purchase. This struck me as unusual enough to suggest running the silly picture of Alan Mawdsley and John Blair signing the dealership agreement. John Blair is from importer MBS Microtex, and if only his publicity agency had told me which one was him, I could pass the information on to you. Mawdsley is on Slough (0753) 44878, and I think he's on the left. But it's just a guess.



For users of BBC Micros who are tired of hunting for the numbers along the top row, this Softlife numeric keypad could help with the accounting. I wish people who built these things would go to the trifling trouble of adding all those things that you normally need the SHIFT key for — the multiplication sign, for example, or the ones which are never where you expect them — the minus sign, for instance — but they never do. This one costs £59, and includes software, built in, to interface to most Acorn-approved operating system calls.

Details on Cambridge (0223) 62117.

Serious software

Serious software, at last, for the Sinclair QL — the programming language, APL, has been launched by Micro APL.

This specially adapted version, says the company, dispenses with the usual APL programming symbols, where single signs, looking like half-Greek, half-gibberish, act as keywords. The idea of this system is to simplify the language for beginners.

MicroAPL says this is the very first time that this 'simple, yet powerful programming language, traditionally offered only on mainframes and large powerful supermicros, is available to the mass market.'

Actually it isn't the very first time, because I saw a version on the ZX81 three years ago. But nobody bought it.

Details on (01) 622 0395.

FAST ballot

A law on software copying now stands a fighting chance of being passed as a Private Members' Bill, now that William Powell (sixth in the lottery for a non-party bill) has named the FAST bill as his choice to get enacted.

For no very obvious reason, Parliament calls this lottery a 'ballot'. It works like this: everybody puts their name into a hat, and some are picked to go first, and others to go last, with their own favourite law. Then the first half-dozen or so are furiously surrounded by urgent lobbyists with urgent legislation. They pick something which is non-controversial (so it stands a chance of being passed by the House) in the hope that they will be remembered as the promulgator of a great Act — the 'Powell Act' may pass into computing history.

It's a shocking way of organising the nation's law-making. However, for the Federation Against Software Theft, it's one step nearer a solution to organised crime raids on software.

Unless, of course, they've left a big ruddy loophole in the Bill.

The hard sell

Just supposing that you'd got tired of seeing Chris Serle talking about computers on the BBC (inbetween being an auctioneer and a racing driver in *The Deep End*) — why, then you'd miss out on the joy of buying a £20 videotape called Easy Microcomputing, where he tells you about Sinclair, Future Computers, Prestel, Micropro, Comshare, BOS, and Brother.

These are seven of the eight companies who have 'sponsored' the tape which takes you through four main sections — 'The Basic', on to 'Why Computerise', then 'How to Select', and finally 'Specific Applications'.

There's also a sponsor called Braid, and presumably

they use Braid equipment to deal with the computer industry, too. But it's hard to shake off the feeling that this is sales promotion you're paying for. If I ever get to see the tape and find out otherwise, I'll be sure to let you know.

Dead serious

You could argue that if there's an applications program to handle cemetery accounting, then there must be lots of others to run under the same system — which is why Pick Systems is promoting its launch of the Pick operating system on the IBM XT by announcing its graveyard system.

Pick is often seen as a serious rival to Unix, simply because it is business-oriented rather than programmer-oriented, but up until now it hasn't been available on a stand-alone personal micro.

More convincing, however, than all the talk, is the list of Pick Hits, a directory of applications for Pick which the company has launched. The list has over 500 entries, and contains the names, addresses and phone numbers of over 150 companies developing various applications for Pick.

Dick Pick, the originator of Pick (he designed it for use by army personnel who were 'very inept' at computer use) took time out to bash Unix when he announced the IBM version. Pick pointed out at his Comdex press conference in Las Vegas that 'in the case of Unix, there are no less than 25 commercially available versions, in addition to scores of Unix lookalikes.

'While all these versions are similar in theory, software that runs on one version will not easily run on any other. The modifications required to run the application can be costly and time-consuming, taking two people a minimum of six months to port software from one Unix system to another.'

Further information direct from California: the number is (714) 261 7425.

Speed freaks

Jarogate has 'accepted a challenge thrown out by TDI of Bristol that the Pinnacle is the fastest micro in the world' by running some Benchmarks on its own Sprite business micro.

The Sprite hasn't got its share of mention in this column, perhaps because it was just another machine based on the chip Intel supplies for the IBM AT, the 80286.

Now, however, the directors have achieved fame by the simple expedient of running a Benchmark. The way they cooked the Benchmark was to include disk work — something which I'd regard as quite fair, because disks slow most programs down. But all Benchmarks are written to prove the speed of the computer which does them best, so don't get too excited about the news that the Jarogate Sprite took 25 minutes to run a program which took 36 minutes on the Pinnacle.

The additional information that the Rair Supermicro took 33 minutes (faster than the Pinnacle) is just thrown in for laughs, and the news that the ICL PC took a dreary 62.5 minutes is thrown in out of cruelty.

Keeping calm

I'm not at all convinced that I ought to get too excited about the arrival of Victor in the UK. The company builds the Sirius micro which ACT has just abandoned, and while the new management, based in Windsor, is at pains to suggest that this is just because ACT is favouring the Apricot, there is some evidence to suggest that the machine is not really a technology leader any more.

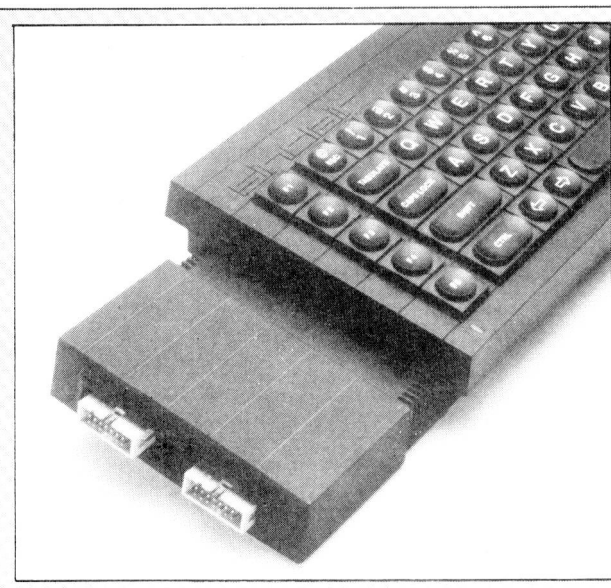
For example, I haven't been able to get MS-DOS 2.0 for the thing, and software like Lotus is conspicuously not generally available either.

Undeterred, the company is launching a UK subsidiary, and hopes to be launching its portable Vicki version (which just failed some crucial American radio interference and electrical safety tests) soon, two years after I first saw a prototype in Amsterdam.

The basis for the optimism, as near as I can gather, is the factor which I thought really damned the old Sirius — a board to turn it into an IBM PC.

This add-in board costs around £1000, or will when it's available. Added to the cost of a Sirius/Victor, it makes it almost twice the price of an ordinary IBM, which is why I wasn't excited about it when it was previewed in Atlanta last May.

However, to Victor setting up over here, it represents a way of making £1000 a time, selling to existing users of the



The quick way to get software for that QL you bought, in the first flush of enthusiasm, is (apparently) to buy another micro.

This serious suggestion comes from PCML, which has produced a CP/M add-on for £200. It's a Z80 chip with 64k of memory, two input and output ports, a parallel printer interface (which has 64k of memory into which printer data can be fed for later printing), and a tracker ball interface.

When the company gets round to launching disks, I'll be really impressed. Details, meanwhile from the new subsidiary company, QL+ Ltd, where John Fuller or Derek Batey will answer calls on (0372) 67282.



This, as you may have suspected, is just another version of the Husky, this time 'ideally suited to expert system applications' because this is the version with 352k of usable RAM.

The suggestion, as you can tell from the picture, is that a doctor could use it by the bedside to run through a question and answer session with the expert system until coming up with a diagnosis.

What I'm afraid of are the number of people who are going to write unspeakable captions in the top left hand corner of the photo.

Details on Coventry (0203) 668181.

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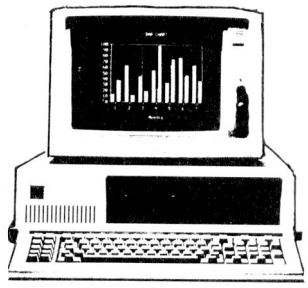

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7 **APRICOT Xi.** Superfast and super powerful 10Mb version of the Apricot. Full hard disk computing at exceptional value. With the Xi, Morse are **giving away the Brother HR1** daisywheel printer and free word-processor and spreadsheet, etc. **saving £525.** In matt black: **£2990**

8 **APRICOT PC.** Compact, powerful, friendly, British. This hugely popular system now has Lotus 1-2-3, Symphony and many other programs available. The two versions with 315K or 720K disks are both supplied with **FREE £390 PRINTER** etc. 12" display available. PC's from **£1790**

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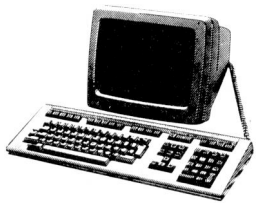

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DEC RAINBOW 100, 132 column display, dual 400K disks. It was £2295, at Morse now only **£1350**
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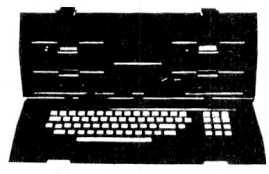

OSBORNE EVENT

Morse have purchased a large amount of new, used and ex-demo Osbornes. All are boxed, complete with manuals, software and 30 day warranty. Software: SuperCalc, WordStar with MailMerge, CP/M, C- & M-Basics.
80 column display, double density disks, blue casing: **£650**
52 col d.density, blue case: **£450**
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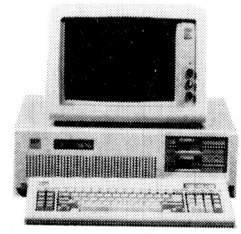
We also have DataStar, SuperSort, cables etc. These bargains will be snapped up, so call in today!



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Sirius. 'Your system won't run Lotus 1-2-3? Never mind — for just another grand, you can have . . .' and so on.

And, I have to admit, there are enough Sirius users around to make a useful market.

Bargains galore!

Atari has announced a price reduction from £180 to £130 on its 800XL micro. The news will bring cries of rage and pain to those who paid several hundred pounds for the machine, but fortunately, in this country there weren't many who did that.

What could be entertaining, however, will be the reaction of those who paid £130 when Atari drops the price again in January. At that point it is expected to hit £99, according to people who were eavesdropping on a conversation between Jack Tramiel and his UK manager.

At £130, the machine must be regarded as the bargain of the season, whatever the price may do later (see the picture story).



According to Atari chairman Jack Tramiel, you could own a full-blown 32-bit micro for around £800 by June/July this year; this is the top of four ranges announced by Tramiel on a brief visit to London. The other three ranges are 8-bit machines, 16-bit machines and the existing video game consoles.

Apart from his vicious price-cutting, the first signs of Tramiel's regime were expected at CES in the States. Four machines will make up the 8-bit range, a repackaged 800XL, a 128k version of the XL, a portable with 256k and a machine with high-quality sound output. These machines are based on the original 6502 400/800 architecture and should be software-compatible.

In April his 16-bit range will be launched at the Hanover Fair, and as speculated these will be 68000-based machines. Tramiel, with his usual modesty, has named the operating system TOS (Tramiel Operating System), although the system was actually developed in cooperation with Digital Research. Above this will sit DR's GEM system giving a Mac-like filing system, mouse control, icons, and so on. Finally, eventually there will be 32-bit workstation machines based on the National Semiconductor 32032 processor. Tramiel sees these machines, which will include bundled-in software, as bringing CAD/CAM to the masses.

This all sounds very nice, but the question is: 'Will he do it?' Apart from the $75million that Tramiel personally put into the venture, he needs another $150million. He confidently predicts that Atari will have made a profit out of the last quarter of 1984 and hopes that this will persuade the banks to put up the cash.

To make a profit out of such low prices, Atari intends to build fully-automated assembly plants in both the States and Europe which will produce machines cheaper than their current Far Eastern plants (see 'Bargains galore!')

Expensive information

Owners of IBM and compatible micros spend an average of $1315 on software in the first year, according to a market study by Frost and Sullivan. Apparently, Americans spend something like $729 on software to come with the machine, and the other $586 worth is bought over the next 12 months.

The news, for software writers, is good. Frost and Sullivan director Joseph Savino predicts on the basis of his studies that the amount will actually rise in future. 'In 1986,' Savino says, 'sales in the first year after purchase alone will surpass the initial software sales.'

Probably, you have to have good news for people when you hope to take $1550 off them for a copy of the report. Included in the price is a review of existing software categories and products, a discussion of 10 market leaders, and profiles of 96 other products, plus advice to vendors.

The advice can't be what costs the money. Suggestions apparently include the warning that 'Documentation is important, because many personal computer users refuse to buy a product until they're convinced that they know what it's supposed to do.'

Many; but not, I gather, all.

The S1 lives!

Until a Swedish company took over European marketing, little had happened to S1, a new operating system designed to distract the world from both Unix and PC-DOS, since it was given to the world by Multi Solutions two years ago.

Quite probably, that will continue — little will happen. People have written very enthusiastically about the concepts behind the software, and it apparently has great virtues compared with both Unix and Pick.

But even the news that Entronix AB of Sweden will market the S1 as the standard operating system on its line of VME bus computers (based on the Motorola 68000) fails to conjure up the sound, in my imagination, of hordes of eager programmers stampeding for their coding sheets.

Just for those who feel that absolutely anything that intends to rival Unix is worth a boost, then you can get details from Multi Solutions in New Jersey on (609) 896 4100.

Too good to be true?

The Unicom modem I mentioned last month covers both European and American standards, answers the phone and returns calls from other computers, and works at standard 300, standard Prestel and 1200 half-duplex communication rates. It sounds like a lot more than the £60 asked by Unicom. It also remembers a long list of telephone numbers, associated with names.

And that price includes VAT and postage.

Naturally, many people have expressed scepticism about the product. At a London show where the machine was meant to be available, the word that 'they're going to be available in three days' time' was greeted with rank disbelief by hopeful buyers, and with fear by those who had sent in their money.

But, as far as I have been able to establish, the firm is real, the modem works, and the £24 ROM with software was pretty well debugged.

There is a snag, however, and that is approval. The technical/sales blurb says 'all major components are BT approved', which is not at all the same thing as saying that it's legal to use it on the phone network.

History has shown that this doesn't necessarily deter people from buying — and, presumably using — a non-approved modem, as the Minor Miracles proved. (I should remind you here that the Minor Miracles is now approved.) But it's a consideration of some weight.

The other snag is that, although the company says it will auto-redial, it will only do that if you write a bit of code first. Strictly speaking, it's illegal for a UK modem to automatically redial a number

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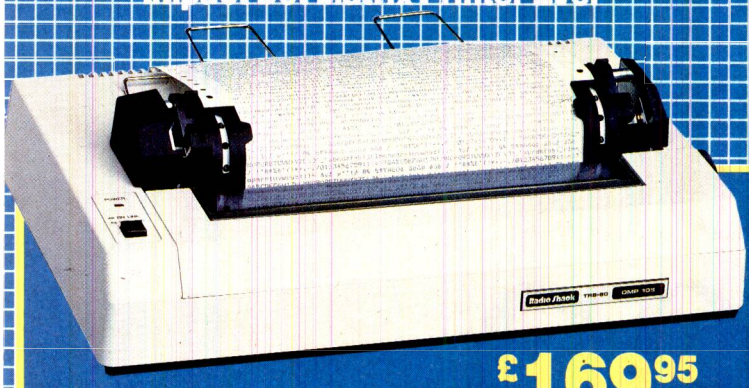

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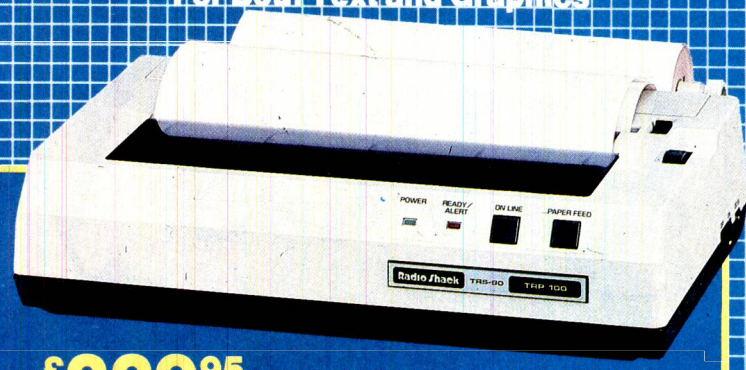

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- Prints 180 cps
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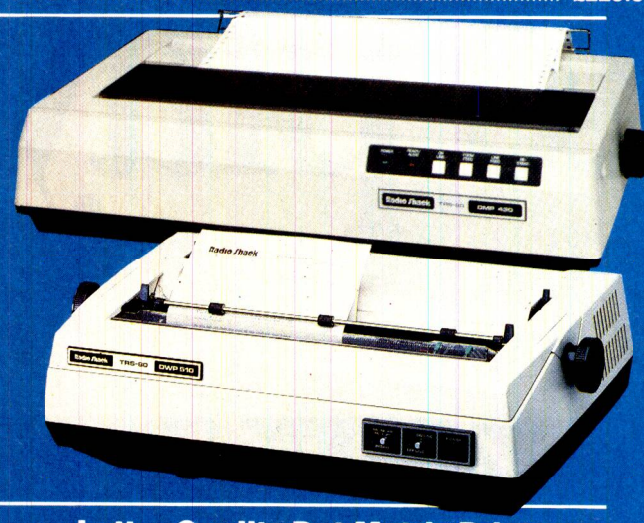



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PCW 12

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Free software worth over £100 is the name of the game.

Along with your new CPC 464 (colour monitor or green screen VDU) you'll receive a software starter pack of 12 (yes, twelve) cassettes absolutely free.

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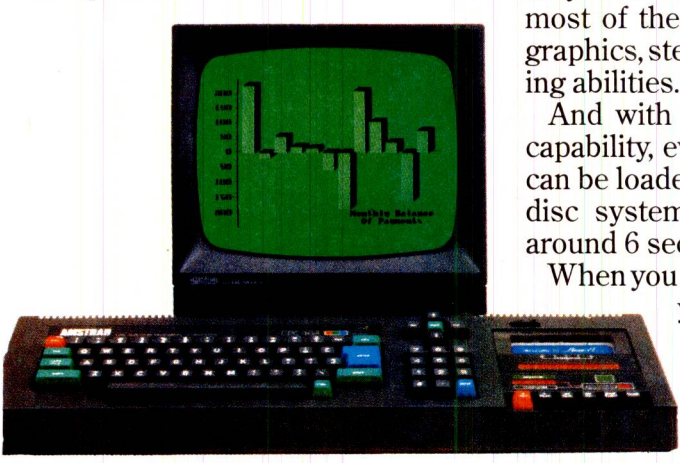
That's *one* good reason for making Amstrad's CPC 464 your new home computer.



CPC 464 green screen VDU (GT64)

Here are the others.

The CPC 464 comes complete with its own colour monitor or green screen VDU and built-in cassette data recorder. (Optional disc drives are now available with CP/M* and DR. LOGO* supplied as standard.)

It has a typewriter-style keyboard and numeric keypad. 64K of RAM, 32K of ROM and a very fast extended BASIC with real time features.

And it costs a great deal less than the price of a comparable system.

The CPC 464 can handle the trickiest computer games (if you can), revision for exams, cataloguing and budgeting.

And it comes complete and ready-to-go.

Amsoft. A ton of software.

Yes. Now there are over 100 titles from Amsoft and independent publishers. And the list is still growing.

Arcade games, educational programs and business applications – they're all designed to make the most of the CPC 464's impressive graphics, stereo sound and processing abilities.

And with Amstrad's *speedloading* capability, even complex programs can be loaded quickly. The optional disc system will load a game in around 6 seconds.

When you feel the need to upgrade your Amstrad system to disc drive, just send your favourite Amsoft cassettes to us and we'll send you back the same Amsoft programs on Amsoft disc for just £4.95 per cassette, the price of a blank disc.

Join in the fun.

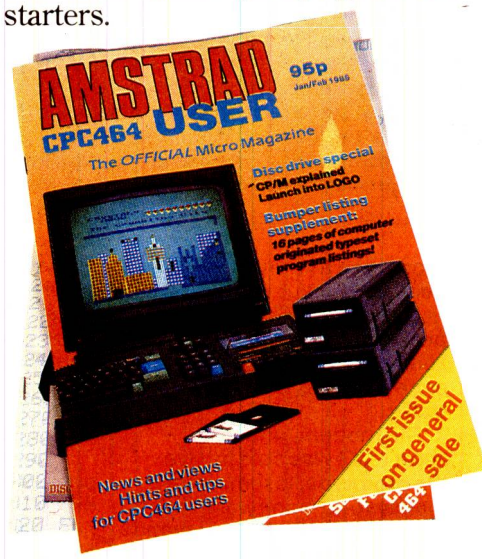
Our CPC 464 User Club is a must for all owners.

As a member, you'll be the first to know about the additions to the range. Hardware and software.

We'll provide you with your own privilege card and send you free, a year's subscription to the Amstrad User magazine packed with programs, features and information.

You can enter competitions for valuable prizes and keep up with all the latest Amstrad developments.

And with the free software pack, we think that's pretty good for starters.



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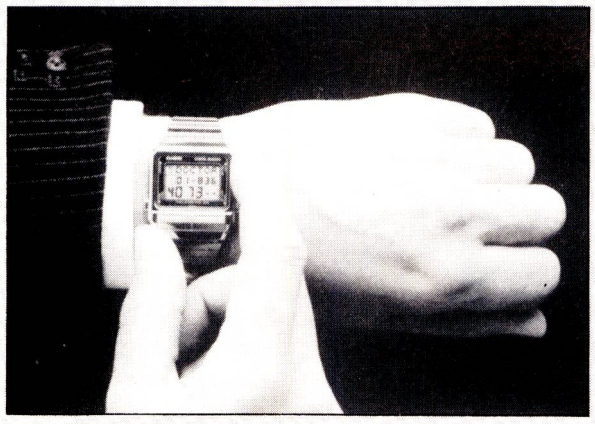
PCW 6



If the doctor's phone number on this watch display is anything to go by, Casio must think the UK is inhabited by hypochondriacs. The Databank 500 digital watch can store up to 50 sets of six letters and 12 figures. Ideal if you've got a lot of doctors, or need to store other useful information — the company suggests such things as bank account codes, train schedules and birthdays.

more than five times an hour, because the out-dated phone network which Telecom has been feather-bedded into keeping for so long couldn't cope with that kind of dialling traffic.

The modem, under the short test I was able to give the prototype, is remarkable mainly for the software which accompanies it. As a modem, it's so dumb that nobody would be able to make it send any degree of sense without the full specification of the chip (built by AMD, Advanced Micro Devices) that does all the coding and decoding of sounds.

However, the other side of the coin is that it becomes very much an extension of the BBC Micro, rather than a peripheral, once the Unicom Zromm (Unicom's ROM) is plugged in.

What I liked most about it was the ability to set it into 'host' mode — this was weird. I dialled the BBC from my Osborne and began typing in commands as if I had the BBC on my lap. It ran BBC Basic down the phone line, even responding correctly to a transmitted break code. I could have used View, the built-in word processor, or any other tube-proof program. (Naturally, to go with this feature, there's the option of a system password which prevents stray hackers, like the folks who wrote this program, from crashing into your files and deleting your data.)

The feature which will appeal to most telecommunications people, however, is the download and upload routine. This takes any binary file and dumps it into the system in ASCII, representing hexadecimal numbers with two letters. On retrieval it automatically reconstitutes the original binary pattern.

The result is that it becomes possible to use a BBC Basic disk to store a full WordStar file, or to use Telecom Gold for the same purpose. Normally, an attempt to do this would either garble the file completely, or lose all the special text attributes such as automatic paragraph justification.

For people wanting to run a bulletin board, it has the nice little extra of automatically adjusting the baud rate of the incoming call. It will accept 300/300 full duplex, Prestel standard or reverse Prestel standard, all inside a second of the call being put through.

Since the modem's intelligence is in the computer, any competent programmer can treat it as a native function, just like other operating system commands. Many of the Zromm functions, for example, generate Basic errors as interrupts, so that an 'ON ERROR GOTO' statement can pick up line disconnect or incoming call events.

It's easy to tell what its designers do with the small hours of the morning — they play MUD, the multi-user dungeon that comes live, at midnight, from Essex University.

The way you can spot this is the Chat facility.

When a normal terminal program is running, it shows onscreen what you type, as you type it (echoed from the receiving computer), and also what the receiving computer is sending. It can't separate them, so an attempt to type 'Hello' while somebody else is saying 'What' ends up as 'Hewihiaot'. On the multi-user dungeon, when typing in a command across a wizard's general announcement, gibberish results.

Unicom Zromm splits the screen, so that your words appear at the bottom and the system's words appear at the top. This is also useful in the Chat facility of bulletin boards like Telecom Gold and The Source.

The only thing I'm not certain about at this stage is parity. It was originally designed as a way of eliminating errors, making sure that the system always had an odd or even number of bits per character. And I quite accept the designer's statement that it isn't useful, since a no-parity system will work with most public networks. But if somebody else is generating parity, it can mess up the system until you persuade them to stop. And if their system can't stop (or they don't know how to make it), then there's nothing the Unicom owner can do about it.

A nice final touch, among many that show the scars that the designers have acquired working with the BBC Micro, is the *HOPPIT command. It tells the BBC Micro that the Zromm isn't there, thus eliminating the bugs that conflicting system calls can so easily generate. After *HOPPIT (to which the Zromm responds with a petulant 'bibi, snif'), even the BREAK key will not reveal the presence of the chip in the sideways slots.

The real test will be the Commodore 64 version. Can these people really show the same familiarity with the errors and omissions of that clumsy machine as they do with the BBC and, as I suspect they will, with the Amstrad? Watch this space.

At the launch, the Unicom was just for BBC Micro owners. However, versions are promised for Amstrad, Commodore, Sinclair, the IBM PC and the Electron.

Details and orders on (01) 482 1711.

Red herring

Don't be depressed by the news that Psion's Xchange suite of integrated packages is the built-in program on the ICL One Per Desk. You've met the word processing part, Quill, inside the Sinclair QL, where it's been described as 'awful' and 'slower than anything except Microsoft Word on a Macintosh.' But on other machines, a rather better version is available.

The One Per Desk is, in essence, a QL with the software loaded in permanent memory. But the software has been rewritten by ICL, and initial reports suggest that it's a hefty improvement.

Psion has also released improved versions of Xchange in the last few weeks for MS-DOS machines, including the Apricot, which are noticeably better than the impression given by the QL, and a version for Macintosh is due out in a few months.

The One Per Desk itself is another triumph of ICL over logic. It's a computer into which you can't load programs — you have to plug them in.

A lot of people have been very nice about this intelligent telephone, and in truth it does have enough functions to sell to corporations who can afford it. But it isn't a microcomputer, and if it's a success, then the micro business will be proved to have been a red herring.

Pause for thought

Amid several announcements of people starting to sell the Zenith PC (an IBM-alike micro) in this country, the one which may give rival ACT greatest pause for thought will be Microworld, the major ACT distributor in Scotland.

The Zenith is very much more visible in its native American market that it is here, but has the reputation of being very close to the IBM and reasonably priced. Now it is building up a network of dealers — still nothing like as comprehensive as ACT has — but nonetheless, something of a rivalry. The attraction to these people is, apparently, the fact that the company has been around. Indeed, in its original incarnation as Heathkit, supplier of homebuild audio circuits, it's an established firm.

Zenith is available on (0425) 29451, and Microworld is on (031) 557 2087. London dealer Drake Computer Systems, on (01) 734 9681, will also be

running one-day courses, for around £95 each, on various software packages like Lotus 1-2-3 and Framework.

The whole truth

Competing with IBM is a bit like having a picnic on the rim of a volcano — you know which side the bread is buttered, but your bread and butter keeps getting moved in a panic. So far, ACT has managed to keep itself just one jump ahead — and we can hope that the deal it has tied up for Apricot distribution in the States manages to pull off the trick again.

The problem facing ACT is simple: the IBM PC is, at last, dominating the business micro market here, as well as in the US. Figures available to IBM's own dealers (on a quasi-confidential basis) suggest that IBM now has 27% of the UK micro market. More worringly, they show ACT getting 7%. And although the figures were compiled for IBM itself and therefore may be taken sceptically by some, it's clear that IBM believes them because IBM is boasting about it to some of its dealers.

The question is: is it true?

If it is true (or, more importantly, if the trade and the City believe it's true) then there still isn't any urgent need to panic about ACT.

Firstly, the market is growing, fast. Not as fast, perhaps, as it was growing last year, but still very fast, and the percentage growth figure conceals the very large absolute growth — the extra number of machines sold this year. Even if ACT's share of this new market is only a quarter of IBM's, ACT might still be selling enough to live on.

Also, there are two markets — the small business market and the corporate market. They are very different, and IBM's main strength is not in small businesses.

Secondly, ACT has, finally, managed to set up a deal in the States. It raised $20 million in a few days on the private venture market here, and has launched Apricot Inc in the US. That company is selling through a network of independent representatives which used to carry the Apple range to retail stores. John Sculley, head of Apple, fired the reps back in summer, and they have just signed up for seven years to carry Apricot exclusively.

As Roger Foster observed, making the announcement in Las Vegas, the company only has to achieve one per cent of the US micro market to be able to put 30,000 machines into American users' hands this year. And that figure would keep the company's Glenrothes factory busy and quite profitable while it sorts out its other problems.

The problem, as dealers report it to me, is simple — lack of software.

The trouble with refusing to give in to blackmail is that you usually have to live without whatever you were being blackmailed over. Roger Foster refused, a year ago, to be blackmailed into paying over the odds (he thought) for an early version of Lotus 1-2-3 for the Apricot range. The result is that the product is only now available, and its follow-up, Symphony, is still 'on the way'. At the time I thought this was more foolhardy than brave, and I still don't feel that time has proved me wrong.

However, there is a market in which the availability of Lotus 1-2-3 doesn't matter a damn, and that is the accountancy market.

Small businesses buy micros for accounting work, not for the sort of spreadsheet manipulation of internal budgets which keep office employees so blissfully happy for hours on end. Talk to dealers who sell to corporate buyers and you'll find the IBM picture faithfully repeated — or even overstated. One central London dealer selling mainly to corporate buyers, in bulk, tells me that he sells one Apricot for ten IBMs, of all models.

Talk to country retailers, however, who supply small businesses with accounting software, and a totally different picture emerges — they sell three times as many Apricots as IBMs. And selling software, they sell three or four times as much for the Apricot as for the IBM. None of these people will stand up and speak in public, of course, because 'we're in bed with both of them, rather,' as one supplier put it.

Which is bigger? Accounting for small businesses, or spreadsheets for the big corporations? Because, as one software publisher put it: 'Who inside ICI has heard of ACT? And which small business manager knows of IBM except as a typewriter supplier?'.

However, a supplier of non-accounting and non-spreadsheet software, Caxton, might get a rather less biased picture, one way or the other. Caxton's products sell roughly four times as much as the IBM as for the Apricot, and it believes that the figures quoted by IBM, for total sales, may be right.

If all that is true, then several conclusions are possible. First, IBM is much bigger than ACT. Second, the accounting market is a quarter of the size of the corporate market.

Or third, IBM is starting to gain recognition from the small business owners of Britain as a supplier of retail micros.

I think that's what's happening, myself.

Nothing doing

Only a lunatic or a gambler — or a journalist desperate for stories — would go to Las Vegas at any time. For a journalist to justify the trip, there has to be some pretty good stuff.

Normally the Comdex computer show can be counted on for that good stuff — but not this time. In fact, nobody had much to show for their past year's work except those who had been working on Macintosh software, mainly because innovation has slowed down in the shadow of IBM.

There were 1200-odd stands in half a dozen exhibition centres in the town. My guess would be that there were 10 people per stand, but let's be generous and suppose that each exhibiting firm had other people behind the scenes, and they averaged 30 staff per stand.

By that reckoning there would be just short of 40,000 people wearing green exhibitors' badges. All the other people one met should have been wearing white or yellow badges, because that's how they were coded.

Absolutely, no way, were they in the majority.

On the final two days of the show, Saturday and Sunday, the halls were empty, and even the organisers admitted that 'this weekend opening isn't going to work,' although they thought they might try it again next year.

On the first three days, my own estimate, backed up by a straw poll of people working on busy stands, would suggest that the exhibitors still slightly outnumbered the guests and visitors. In short, there were at most 60,000 people there, and it's time the organisers admitted that they've got caught on their own initial hype. When it was first launched, they exaggerated the figure. The next year it went up, so they had to increase the exaggeration. And so it went on.

It isn't really worthwhile. After all, even if (as all the taxi drivers agreed) numbers were down on the previous year, it's still an enormously important show.

From the point of view of the British taxpayer, eager to see our information technology industry exporting healthily (!), the two highlights of the show were Whitechapel Computer Works and ACT — in that order. Missing this year were Rair, Enterprise, FTS and Future Computers. Of course, also missing were a hundred other manufacturers who don't have the vision, courage, or optimism (and who can blame them) to take the first steps to export, even to the extent of buying a spot on the Export IT area held by the BOTB.

Really, there isn't much excuse for that. People who just want a quiet life shouldn't set up a business. If you have set up a business and you can't be bothered to go to a show as crucial as Comdex, you aren't serious, and you don't deserve to stay in business more than five years. And that, in most cases, is what I can see happening to the backbone of today's UK micro business. END

PCW screentest

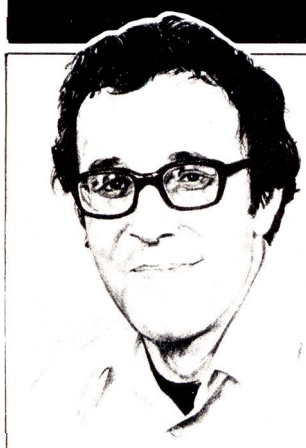
PCW ***is taking a hand in the new Channel 4 TV series,* 4 Computer Buffs.** ***One of our Benchtesters, David Tebbutt, is putting various machines through their paces while we'll be providing full details on two construction projects developed for the show.***

The first programme in the series will be broadcast on Monday 11 February from 5.30 to 6pm in the evening. Educational material on Prestel is one of the first topics, along with news of a bulletin board service, first sight of a ZX81-based buggy (called the Trundle), and an introduction to lightpen software transmission — actual transmission will come later in the series.

The first TV Benchtests, featuring the BBC, Amstrad and QL, are being lined up for the 18 February programme.

And the morning after each show there will be machine-specific audio software transmissions, between 10 and 10.30am and then repeated between 11 and 11.30am.

YANKEE DOODLES



Competition is hotting up in the microcomputer stakes. David Ahl presents his findings of who'll be doing what during 1985.

A bit on the small side

Lap-top, knee-top, notebook portable, whatever you want to call it, many US manufacturers are betting their future on the small micro.

Texas Instruments was humiliated with its 99/4A home computer, its portable CC-40 went nowhere, and even its TI Pro was less than enthusiastically received. But its new Pro-Lite seems to be off to an explosive start. The machine is functionally similar to its big brother, the TI Pro, with a 16-bit CPU, 256k of memory, a full 25-line by 80-character LCD screen and a full-stroke keyboard. It differs only in the size of the disk drive — 3.5in on the Pro-Lite — but the Pro-Lite can be connected to an MS-DOS desktop machine for up or downloading of programs and data. Curiously, the machine doesn't come with a battery pack — TI's research revealed that most people don't want true portability but a 'carry around-ability'. Hence, the battery pack is an optional extra. The price is a heady $2995.

Another upper-end entry is the Datavue 25. Like the TI, it has a 25-line by 80-character screen, a 16-bit CPU, and 256k of memory. It has a 5¼in floppy disk drive built into the side of the system unit and a detachable keyboard which communicates via an infra-red beam like the IBM PC Jr. Like the Pro-Lite, the Datavue is said to be IBM compatible. Base price is around $2000.

Three machines from Japanese makers are also fighting for a share in this market — the Sord IS-11C, the NEC 8401 and the Epson PX-8. The PX-8 (Geneva) is already on sale in Europe, but the others are still new. To me, the 8401 looks like a winner. It has a 16-line by 80-character fold-up screen, 64k of RAM, a 300-baud modem, integrated software (WordStar, Calc, Filer, and Telecom), the CP/M operating system, optional memory cartridges and a 3½in disk drive. The price is just under $1000.

The Sord IS-11C has a large 25-line by 80-character LCD screen, a built-in modem and microcassette drive, integrated software, 80k of RAM, and much more — all for $1500. The machine will initially be aimed at OEMs, a smart move in the light of Sord's lack of marketing prowess in the States.

No optical illusion

Information Storage of Colorado Springs has announced a 5¼in, 100 Mbyte, write-once optical disk drive. The drive has a two and half million bits per second transfer rate, an average access time of 200 milliseconds, a recording density of 11,500 bits per inch, and a track density of 14,000 tracks per inch.

The drive will use a 13cm optical platter, which is ½in smaller than standard audio compact disks. The media is supplied by Hitachi/Maxell and Sumitomo Chemical. The Sumitomo disks have not previously been seen in the US and are seen as a new move into that market.

Evaluation units for OEMs are priced at $3000. However, company president, Steve Popovich, expects prices to drop to $500 by 1986. Popovich expects the drive will satisfy 'a real need for archival and audit trail data.'

Occupational hazard

With retail stores drying up for all but a handful of microcomputer software companies, specifically makers of the best sellers (for example, Lotus, Ashton-Tate and Software Publishing), makers are analysing the situation as they search out new markets.

The main findings? After implementing word processing, a spreadsheet, and perhaps a database, people don't know what to do with their computers. The answer? Vertical applications.

Studies show that five key occupational groups will account for over half the PC sales in the next three years: engineering and related professions, corporate executives and consultants, small business managers, health care professionals and technicians and, finally, accountants. Currently, there is relatively little software to support these fields directly, so they would appear to be the best niches for smaller software companies to chase. In the future, there won't be much of a market for a new spreadsheet, but a heating efficiency program for a consulting engineer — well, that's a different story.

All that jazz

The long-rumoured Lotus product for the Apple has finally been formally announced. In keeping with musical names for its products, Lotus has called the $595 integrated software package, Jazz.

Jazz requires a fat Mac (512k of memory) with an external disk drive. While the majority of Macs sold so far do not have this much memory, they can be upgraded for $1000 or so. Furthermore, since many buyers will want Jazz, Apple will probably sell mostly fat Macs (at a somewhat higher margin) in the future.

Lotus officials emphasised that Jazz is not a copy of Symphony — criticised by so many as being overly complex — but that it incorporates features only available on the Mac, which makes it easier to use than Symphony.

Break it if you can

Elite Software Systems of Albany, NY, has come up with Encomp, a software encryption system which renders a disk unreadable without the right password. To back up that claim, the company is offering $10,000 to anyone who can break the system using a personal computer. Entries will not be accepted from mini or mainframe users. The company sent out 6000 entry forms but so far has received only three replies — all of them incorrect.

Random bits

Personal Peripherals, maker of Super Sketch graphics tablets and Super Stik joysticks (for the Commodore and Atari computers), has acquired TG products, makers of joysticks, paddles, and related products for Apple and IBM machines . . . Most observers have felt that DEC has come off a decided second best to IBM in the personal computer market. Ken Olsen, president of DEC, admits that the company has failed in the retail market but says: 'We've sold more than we expected in the market we planned the machine for' (smart terminals to the firm's larger computers). Nevertheless, the firm has just cut the prices of Rainbow systems by about 20 per cent. This was 'to remain competitive,' according to product manager Barry Folsom, and does not signal a renewed effort to get back into the retail market . . . In the frantic closing days of congress before the presidential election, coverage of crime-control legislation was significantly curtailed from that originally proposed. The bill that was passed defines only two computer-related crimes: breaking into a computer system and receiving classified data with an intent to injure the US, and trespassing into a government-owned computer to modify, use, or destroy data. Private businesses aren't at all pleased since home hackers still have a free reign . . . Softra, Inc is installing point-of-sale terminals in retail computer stores which make and dispense disks of applications software in about one minute. Retailers like it because it saves inventory stocking costs and the manufacturer likes it because he gets immediate feedback on sales . . . First Byte has introduced SmoothTalker, a speech synthesis package for the Macintosh which reads text directly from the screen without any extra hardware. END

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ORIENT EXPRESS



Conservation hits the industry and there are lots of new machines and peripherals on the Japanese scene, as Shinichiro Kakizawa reports.

What's new?

Lots of new micros have been announced in Japan recently, and some may already be available in the UK.

There's IBM Japan's PC twin JX series, now in the shops and selling well. And the market leader, NEC, with more than 50 per cent of the Japanese micro field, has launched a series of new 16-bit models in its PC-9800 range.

This includes the PC-9801/F3 with a 10Mbyte hard disk drive as standard, and the PC-9801/F3 which features 256k main memory and two 1Mbyte 5¼in floppy disk units as standard options.

These NEC announcements are obviously intended as a counter-punch to the IBM JX machines. The company has also announced several improved versions of its lower-end, 8-bit PC-6000 series. The new models are the PC-6001 Mark 1 SR and PC-6001 SR, and both units offer more RAM space and choice of peripherals than the older models. Incidentally, NEC offers no MSX machines.

Canon has released a new 16-bit workstation/micro, the AS300. It's the most powerful model within Canon's 16-bit range, and can be used as a Japanese/English word processor, a micro and terminal, and Canon's own integrated software, Super Canon Eleven, is available to supplement it. The IBM 3270 protocol is also supported by Super Canon Eleven. The basic system costs £1733; Super Canon Eleven costs £330.

Sony has launched two new MSX machines for home/games users. The model HB-101 is for beginners, and the HB-701 is aimed at more advanced users who want to control their video and stereo equipment.

The HB-101 is the successor to Sony's first MSX machine which was launched in December 1983. The major improvements are its more user-friendly appearance, and the inclusion of packaged software which offers a personal schedule management program, a simple memo writer, and a database-type program for storing addresses and telephone numbers. The basic model has 16k RAM expandable to 64k, and costs £156.

The more powerful model, the HB-701, has a 'superimpose' feature which places pictures, and a series of characters generated by the micro, onto video film. Built-in graphics software enables the user to construct colourful images. An additional capability is that existing equipment can be attached through Sony's optional interface unit.

The basic HB-701 model, without the 3½in disk unit, costs £330, and is evidence of Sony's continuing strategy of combining micros with audio/video equipment.

Sharp has announced a new model of its popular X1 personal computer TV. The X1-Turbo has upward compatibility with the older X1 TV, and improvements include: 640 × 400 dot full colour mode; a paint feature 30-40 times faster than the older model; a superimpose option; automatic switching from low resolution to high resolution on the TV; and a 1000-character display on the same screen.

The basic model, which includes a processor/keyboard and a colour display unit, costs £1250.

Sharp has also launched another new portable computer, the PC-2500. A plotter/printer which operates with four colours on 114mm paper is included, and the LCD screen displays 150 × 32 dots. Using the RAM card, the maximum main memory size available to the user has expanded to 21k. The PC-2500 costs £283 here in Japan.

Hitachi has announced a new MSX machine, the MB-H2. Its most attractive feature is the inclusion of a stereo cassette deck, with which automatic selection and playback can be programmed. A simple digitiser tablet can also be attached so that input of graphics is easier.

Hitachi intends to sell the machine to the educational market, as it can be used for entertainment: for example, producing children's picture book-type sequences. The ability to play good stereo music plus easy-to-handle graphics software has made the MB-112 an ideal machine for such applications.

Some peripherals have been launched, too.

Pioneer has announced an MSX Extended Processor, the ER101, which will enable any MSX machine to connect with laser/video disk players. The ER101 can be linked to MSX machines with a capacity of over 32k. In addition, a new game, Laser Game, will be available soon from Pioneer. The ER101 costs £170.

Century Planning Ltd, a Tokyo-based company specialising in unique peripheral equipment for micros, is selling a bar code reader together with paper software for MSX micros.

Current MSX programs either take the form of ROM cartridges, floppy disks or cassette tapes, but Century's paper software comes in bar code form.

To run a program, you have to buy the bar code reader and a book of paper software, and input the program by scanning the book using the bar code reader.

The cost of the bar code paper software is just a fifth of a ROM cartridge and a third of a cassette tape. The reader costs £98, but once bought, you can enjoy the cheap paper software indefinitely — sounds reasonable! A book containing five to 10 bar code sheets costs £8.

Waste not, want not

Cheap, continuous computer stationery made of recycled paper is now available in Japan. A large department store chain and a waste paper collection/recycling firm have jointly developed a 'natural resource conservation' computer paper.

There's nothing wrong with the appearance of the recycled product, which is somewhat similar to cheap writing paper with its 'rough book' surface. But compared with ordinary computer paper, it looks a little shabby.

However, it costs 40 per cent less than ordinary paper at £4 per 500 sheets.

For non-recycled paper, the same number of sheets would cost more than £7.

Let your machine do the walking

There is now available, free of charge, an automatic dialling machine which stores up to 3200 different telephone numbers.

Too good to be true? Yes and no. You can certainly have the machine for nothing. The catch is that you can't choose the telephone numbers to be stored. In fact, all 3200 numbers are already programmed in when you buy the machine, which is basically an electronic telephone directory.

The cost of the machine/directory will be paid by the maximum 3200 sponsors whose numbers are stored in the ROM.

The free automatic telephone directory is available from Great Japan Computer Systems of Tokyo.

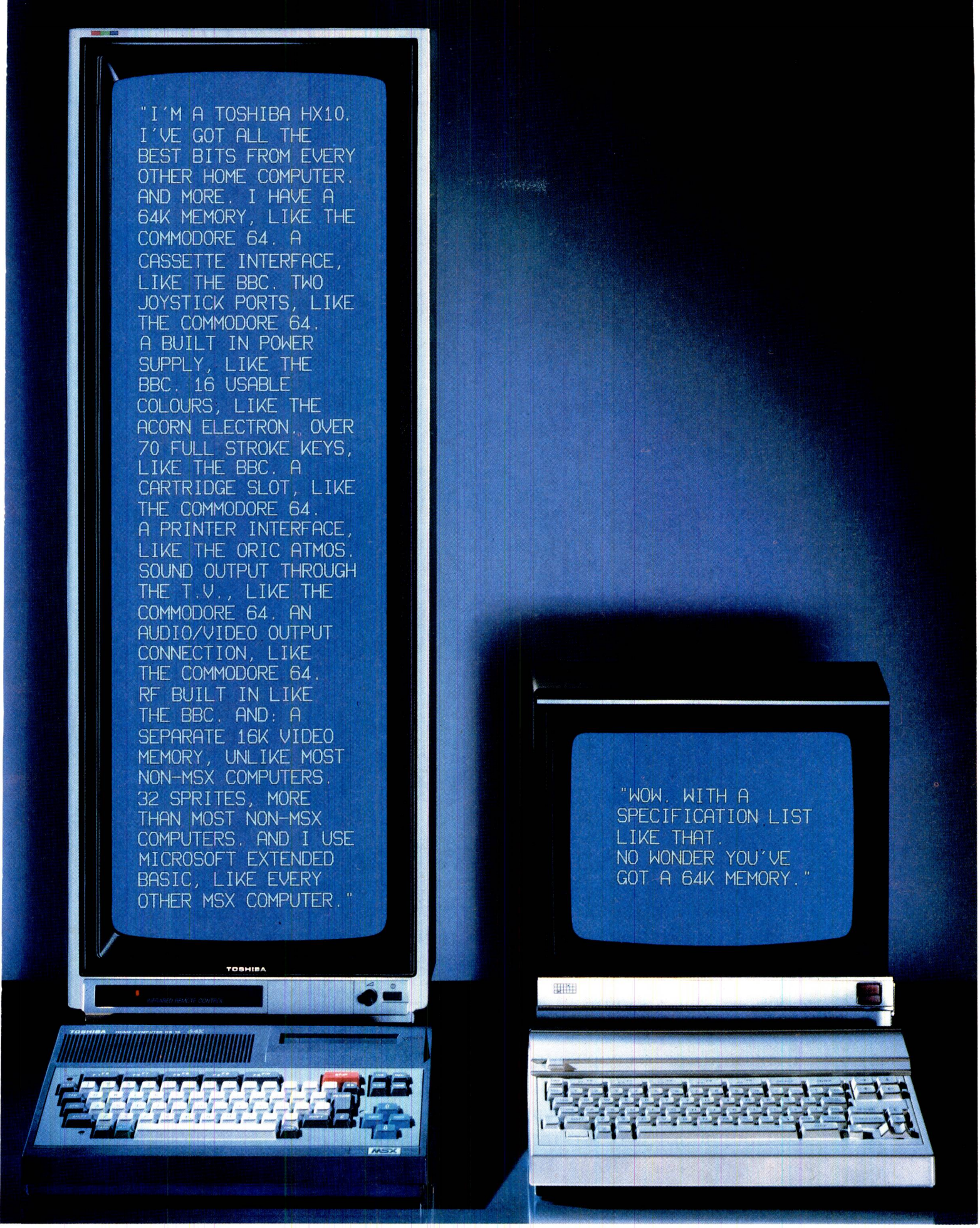
Taking the initiative

What can you do with heaped stocks of dead games software — whether ROM, cassette tapes or diskettes? It's a major worry for thousands of High Street micro storekeepers in Britain. Users find it hard to obtain the right software, and shops regularly run out of stock.

The same problem exists in Japan, with the popular games, rather than the expensive business software, being the hardest hit.

As a solution, Japan now has three networks operating to provide 'telesoftware'.

Under the telesoftware service the average cost of a copied program will be £3-£5 if you take your empty MSX ROM cartridge to the shop. It's an exciting idea for Japanese users, as it means greater choice, lower prices and an end to the dreaded: 'We'll order it for you'. END



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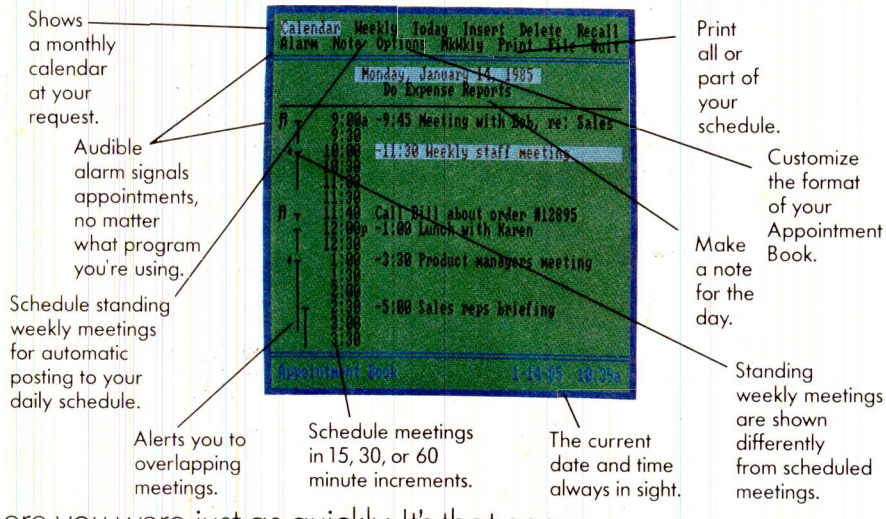

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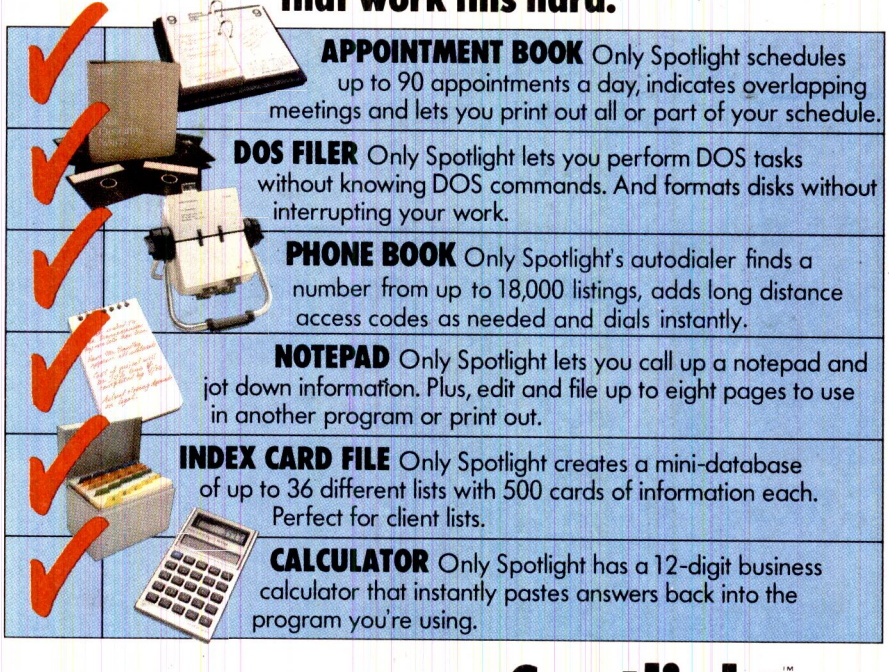

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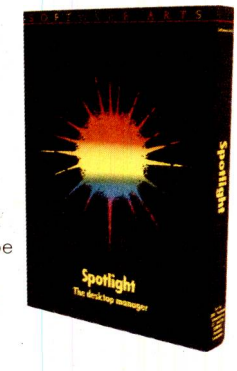

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LETTERS



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Bad timings

I have an aversion to Benchmarks.

If we compare two machines via Benchmarks constructed with two high-level language compilers, we are comparing two compilers, not two machines. Claiming that a third objective party selected the Benchmarks or the compilers, or that they were picked at random, changes nothing in my eyes. I don't see objectivity or randomness as relevant. We're judging the effectiveness of a computing machine, not performing political or statistical hocus-pocus.

The quality of an algorithm or its programming can be more decisive in the results of the Benchmark measurements than the machine differences. The function of Benchmark results versus algorithm or program quality is not smooth, both because a small but clever improvement in quality can have a drastic effect on performance, and because the idea that quality can be metricised is nonsense in the first place.

I would seriously consider the results of a comparison of two machines carried out as follows. Two teams, each of hot-shot hardware and software designers, are assigned one to each machine. They are given an amount of money to spend, not necessarily equal. For different classes of applications (number crunching, data processing, control, and so on) they are to design systems. There may be other constraints placed on the teams depending on machine characteristics. Performance results are compared. Such a test would have greater validity than the childish make-believe that's currently prevalent.

The popular Benchmark tests are selected for the lowest common denominator of the machines that are being compared. Thus, binary numbers are limited to 16-bit precision (which is quite unrealistic in scientific or military weapons applications). Now *all* the Intel machines are limited to 16-bit arithmetic (in hardware), but the VAX is *at least* a 32-bit machine! To select Benchmarks that are limited to the 16-bit 'toys' and then draw conclusions about comparative performance is self-delusion, at best.

Perhaps the source of my aversion to Benchmarks is this: their illusory purpose is to tell me what a machine can do. What I want to know is, what can I do with a machine?

Dave Loev, Israel

Who's pulling the strings?

I was recently invited to assist the guest speaker at a meeting of the Technology for Business (TFB) User Group. Being a former employee of TFB, and now a competitor, I advised the speaker to notify the User Group of my previous connection and present position in order to avoid any potential embarrassment. This was done, and I was confirmed as welcome. Furthermore, one of my colleagues attended the planning session together with the guest speaker and a User Group representative.

When I arrived at the convention, words in hand, I was recognised by one of TFB's staff, who immediately phoned his managing director. What followed was bizarre.

The managing director of TFB rushed through the traffic to the venue and told the delegates, via a message on the back of one of his visiting cards, that he was in the hotel foyer and that he objected to my presence. Next, a ballot paper was passed around the delegates during the guest speaker's address asking them to vote as to whether or not I should be allowed to speak.

When the guest speaker reached the point where he invited me to take the floor, the chairman interrupted the proceedings and convened a private meeting of the committee members present, together with TFB's managing director.

Upon their return I was allowed to deliver an edited version of my speech. However, when I tried to make a general recommendation about operating systems, namely that their characteristics should be considered very carefully by would-be users, I was told I was 'out of order'!

Then, on completing my brief talk, I was asked to leave.

Perhaps the fact that I have an intimate knowledge of TFB products through my prior association, and that I am now involved in marketing competitive systems, was good reason for TFB to be nervous about my presence. Perhaps the company could not believe that I would pitch my talk at a 'general' level. Perhaps it was simply being 'protective' towards its users. If, however, a user group is unaware of alternatives, trends, future options, and so on, how can it enjoy a constructive dialogue with its supplier, aimed at improvement and the solidifying of relationships?

If a user group is not allowed an open mind, it is simply inviting its supplier to pull its strings.

Ron Goodman, sales director, Wasp Software, Croydon

Calling all Rochester Forth enthusiasts

As chairman of the fifth international Rochester Forth Conference, I would like to place a call for papers in *Personal Computer World*.

The conference will be held from 12-15 June 1985 at the University or Rochester, New York, and sponsored by the Institute for Applied Forth Research Inc. The focus of the conference will be software engineering and software management.

There's a call for papers on the following topics:

* Software Engineering, and Software Management Practices
* Forth Applications, including, but not limited to: real-time, business, medical, space-based, laboratory and personal systems; and Forth microchip applications.
* Forth Technology, including finite state machines, metacompilers, Forth implementations, control structures and hybrid hardware/software systems.

Please submit a 200-word abstract by 30 March 1985. Papers must be received by 30 April 1985 and are limited to a maximum of four single-spaced, camera-ready pages. Longer papers may be presented at the conference, but should be submitted to the *Journal of Forth Application and Research*.

Abstracts and papers should be sent to the conference chairman: Lawrence P Forsley, Laboratory for Laser Energetics, 250 East River Road, Rochester, New York 14623. For more information, call or write to Ms Maria Gress, Institute for Applied Forth Research, 70 Elmwood Avenue, Rochester, NY 14611, USA. Tel: (716) 235 0168.

Lawrence Forsley, conference chairman, Rochester Forth Conference

In the minority

I seem to be the only person at school who uses their computer for doing useful and serious work. I am an avid reader of your excellent magazine and hurry to buy it every month, but my friends say: 'It's rubbish! There are only a few games reviews', and so on. I'm the only one who doesn't rush out to purchase the latest 'Video Blast'em', or something similar. No-one believes I don't play games on my micro, and I have become alienated from most of my trigger-fingered friends.

Don't people of my generation see that computers are wonderful things, capable of more than 'Shoot the alien'? They *can* do so much more.

After buying my first computer (a Dragon), I bought a game; I was bored with it five minutes after loading it. That was the one and only game I ever bought. After progressing to an Electron I saw even less reason to purchase games software, as

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Softerm PC lets you access information services, bulletin boards, electronic mail systems, and even your company's computer. It has all the features you need, including keyboard macros, built-in phone book for automatic dialing, and simultaneous capture to print or disk. Softerm's extensive file transfer capabilities include automatic execution using command files, support for popular protocols like XMODEM, and our own Softrans™ protocol which includes an adaptable source program for your host computer.

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Softerm PC supports concurrent operation of up to 4 communications ports and 3 printer ports through background processing queues. Now you can operate your system to its full potential by simultaneously using your available ports for printing or communications functions. Real-time scheduling eliminates unnecessary pauses and gives maximum throughput for smooth, efficient operation.

Complete emulation of 24 terminals.

Softerm PC is not limited to basic TTY terminal emulation. It includes *exact* emulations of 24 popular terminals and provides all keyboard and display functions. Also, both conversational and block modes are supported. If Softerm PC is not completely compatible with your application, return it for a full refund.

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ADDS Viewpoint	IBM 3101 Model 20
Data General D200	Lear Siegler ADM-3A
Datapoint 3601	Lear Siegler ADM-5
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LETTERS

the Electron's Basic negates the need for any other software.

The vast majority of younger computer users will probably disagree, but I feel that the need for games is minimal if the user is willing to devote a bit of grey matter to his computer and not use it as a souped-up Atari console.
L Krancioch (13), Chelmsford, Essex

European Tandy

With reference to the solution suggested in 'Computer Answers', November *PCW*, for Spanish and other European accented characters, Tandy offers a system that would be suitable for occasional use as it lacks the ability to (easily) redefine the keyboard.

The Model 4 with Superscript and a Tandy dot-matrix printer can print on paper any of the characters needed for any European language. On the screen, however, there will only be a code (for example, I see ©8 where I want a pound sign in the text). The number of user-definable characters that you can enter at the Model 4 keyboard in this way is limited to 20, but help is at hand in the Model 100. This can generate any of the extended Tandy character set of graphics and accented characters (coded from 32 up to 255) onscreen, but only by using two-key or three-key entry. For example, hitting the 'GRAPH' and 8 keys together gives the £ sign onscreen, which will also appear on the Model 4's screen when uploaded (after a simple offset has been applied to compensate for the difference of 20 hex in the two machines' codes).

If there exists a word processing program that uses the DOS keyboard and printer drivers of one of the improved DOSes, like LDOS, on the Tandy Model 3 or 4, there would be little difficulty or expense in filtering the keyboard or the printer the way one wants — Dvorak, EBCDIC . . . Does anyone know of such a program?

Just to exercise your printer, here are a few of the possibilities: é â § c ù Ü ñ ¿ o © ˜ Ä Ü Ö ß.
JA Negus, Vallon Pont d'Arc, France

First-class printer

Having read much in the computer press about the poor after-sales service given to purchasers of computers and peripherals, you can imagine how I felt when my Quen-Data DWP 1120 daisy-wheel printer developed a fault shortly after purchase.

To add to my problems, I then discovered that the firm which had sold it to me was already in the hands of the receiver! With fear in my heart I approached the importers in Milton Keynes.

Far from being made to feel somehow obscurely in the wrong, however, I received such excellent customer service from Quen-Data (which had a replacement printer on its way to me within 24 hours and free of charge) that I felt honour-bound to set the record straight. It may be that there are a few sharks in this business, but I have nothing but praise for the few firms with whom I have had direct dealings. The after-sales service Quen-Data gives is all that it ought to be.

My school has two Juki 6100 printers in daily use — printers costing considerably more than the DWP 1120, even at discount prices. I can see little to choose between their output and that of the Quen-Data, which is harnessed via a Kempston E interface to a 48k Spectrum with microdrive. I find this set-up perfectly adequate for my needs as a secondary school teacher with letters, book reviews and children's reports to write (Tasword Two) and class records to keep (Masterfile), to say nothing of the occasional game to play for relaxation!

It's a source of some amusement to me to realise that my humble kit (valued in total — computer, printer, TV, microdrive, interfaces and software — at not much more than the price of a QL) is capable of producing an end product that will stand comparison with the output of systems costing many times the price. No matter how humble the technology that provides its input, it's ultimately on the quality of the printed output that the job is likely to be judged. In this respect, the Quen-Data leaves little to be desired.
J Brown, Cirencester, Gloucestershire

Understanding

In 'Communications', November PCW, a certain Dr Jowett claims that Psion's Quill word processor is slow because it's written in C. He then goes on to make some remarks about text handling. Apart from the fact that he's wrong, he shows how badly he has misunderstood C.

C has no intrinsic 'string' data type unlike, say, Basic. Its text strings are nothing more than arrays of characters. In practice this is no problem, because a set of string-handling functions is easily written, or comes ready-made with the compiler.

However, the C definition does include the requirement that compilers terminate quoted text strings with a zero-value character. For example, 'cat' becomes 'c', 'a', 't',0.

The zero terminator allows strings of arbitrary length to be handled simply wherever it isn't necessary to know the length immediately. But there's nothing in C to prevent Basic-style length values, or some other system, being used elsewhere. It's up to the programmer to decide which method suits the coding problem best.

In fact, C is a good language for writing word processors. Please don't blame it for Quill's sluggishness.
Andrew Stephenson, High Wycombe, Bucks

The right connection

Guy Kewney is less well-informed than usual when he says (December 1984): 'You need to dial up each time you want to load' software downloaded from Compunet, thereby incurring phone and connect charges.

No, you do not, Guy. The modem needs to be plugged into the computer if the software is protected, but there's no need to be logged on. And unprotected software, like our 70+ free educational programs, will run without a modem being attached.

So, the point of our software protection routine is *not* to increase British Telecom's profits, but to ensure that top publishers like Thorn-Emi, Oxford Computing Systems, Anirog, Bubble-bus, Lothlorien and Llamasoft can feel secure in offering their best and newest software to Compunet subscribers.
Jane Firbank, editor, Compunet, London W1

Simple Quickie

It surprises me how very few people can, off the cuff, answer the *PCW* November 'Leisure Lines' Quickie. Yet the answer gives much easy-to-remember, and to use, formulae for converting °C to °F or *vice versa*:

°C = (°F + 40)×5/9 + 40

or

°F = (°C + 40)×9/5 + 40

That is, either way, the first step is: add 40; last step is: subtract 40. To overcome any difficulty as to which ratio to use in step two, all you need to remember is that °C values are smaller than °F (except below −40).
J Gutkowski, Cranbrook, Kent

END

BLUDNERS

There was an error in the instructions printed with the program 'Commodore 64 Defkeys', Program File, November 1984. To define a function key the command is !n=text, not n=text as printed. Similarly, within a Basic program the command is REM !n=text.

Any readers who measure their own system's performance should get in touch with us — we're keen to see who comes out ahead.

In the same issue we discussed some Benchmarks for measuring disk performance and invited readers to send an sae for the programs. We've been sending out the DISKMARK listing but not including the CHAINPGM, which is shown below.

```
0 GOTO 10
1 SAVE "CHAINPGM", A : STOP
10 REM
11 PRINT"CHAIN PROGRAM LOADED — RETURNING TO
MAIN PROGRAM"
100 CHAIN "DISKMARK", 160,ALL
```

END



BANKS' STATEMENT

New horizons

Will a new disk operating system from IBM sound the death knell for CP/M, MS-DOS et al*? Martin Banks plumbs the question's murky depths.*

She sat, as all good research microbiologists do, with one eye permanently fixed to the blunt end of a microscope. The sharp end was stuffed firmly into a very murky pond and she was trying hard to see the way forward.

After much tuning of her light source, she found something. 'It's growing fast at one end, which is what Professor Egast predicted, but it's not dying at the other. What's more, there seem to be some odd nodular growths all the way along it, especially at the growing end, and the whole thing seems to be under attack from a different species, a blue species of some kind,' she said. Had she discovered something? Would the blue species eat the other, and why was nothing behaving entirely as Professor Egast had predicted?

Our biologist was looking at the wondrous workings of the species Discus Operatum Systematis, DOS for short, a strange being that has a growing and profound effect on an increasing number of people. In particular she was studying the growth patterns of the sub-genus of this species, Personilium Computicus, which was not behaving in the way that the famed Professor Egast — the man who discovered the genus PC, as it is called — had predicted. In addition, it was now apparently under attack from a strange and as yet unidentifiable protagonist, which the microbiologist could only describe, temporarily at least, as a 'large blue blob'.

Professor Egast had discovered that Personilium Computicus Discus Operatum Systematis (known in microbiology circles as PC-DOS) was extending in a linear fashion from the long-discovered genus of the DOS species, Computatum Programmanium Microsqutum (CP/M). This genus was well known to have an internal structure based around eight chromosome clusters, normally referred to as bits. Its behaviour patterns were well known, although occasionally unpredictable. It was a slow mover, but usually managed to get there eventually.

Professor Egast noticed in 1981 that there was a genetic mutation at one end of the genus CP/M. This was at first thought to be a major genetic development, for it was discovered that its structure was now based around 16 chromosome clusters. The professor postulated that the PC-DOS end of the genus would continue to grow away from CP/M in a linear fashion, and that the original CP/M host would wither and die.

The arrival of MSX from the Far East is, researchers suggest, one reason for CP/M not withering and dying as had been predicted. CP/M is actually gaining sustenance from its apparent rival, mainly because of its established place and its wide range of single cell and multiple cell parasites. These have been essential elements in the survival of CP/M, and it's noted that MSX lacks similar parasites to any great degree.

Researchers have also discovered that Professor Egast's linear growth prediction is not completely accurate. A fundamental part of this prediction is that there will be little or no nodular growth from specific cells within the genus. The professor claimed that such growths, essentially clusters of minor cells all interconnected to a central 'controller' cell, would be separate entities, away from the mainstream. He even defined their inward-looking multi-cellular linking to the controller cell as Xenophobic Interdependent Extremities, or Xenix for short. For a time it looked as though he was right, for there was a mutual exclusivity about PC-DOS and MS-DOS single cells, and Xenix clusters.

Now the picture is changing. Another sub-genus, long assumed to have no relevance to the main thrust of genetic development, is allowing these single cells and cellular clusters to exist together. This is the simultaneous hyperactivated multi-cell genus with task multiplicity, normally referred to as the Concurrent variant of DOS. Researchers are still not sure exactly how significant this discovery is, although the team leader, Dr Kildare, feels that the genetic possibilities which stem from mixing both single-cell and multi-cell organisms will lead to a more balanced entity being developed in the long term.

Researchers are intrigued by the discovery that the Concurrent variant of the genus has developed the capability of forming itself into wonderful shapes of a graphical nature. These can be manipulated by the researchers with ease, and the entities and cells then seem to react as though communicated with. It is being suggested that these cells may possess far greater powers of communication than was previously thought possible, although it's expected to be some time before anyone discovers how to make use of this capability effectively. Professor Egast is confidently predicting that a similar discovery will be made for the MS-DOS genus by the middle of the year, and that it will be much more comprehensive in its capabilities.

But what is intriguing researchers most, however, is the appearance in the murky pond of this new species. So far it has been very hard to identify and researchers are being extremely cautious; they are unwilling to speculate on future discoveries in this area. It does appear, however, that what the microbiologist referred to earlier as a 'large blue blob' could indeed be a genus within the species Discus Operatum Systematis.

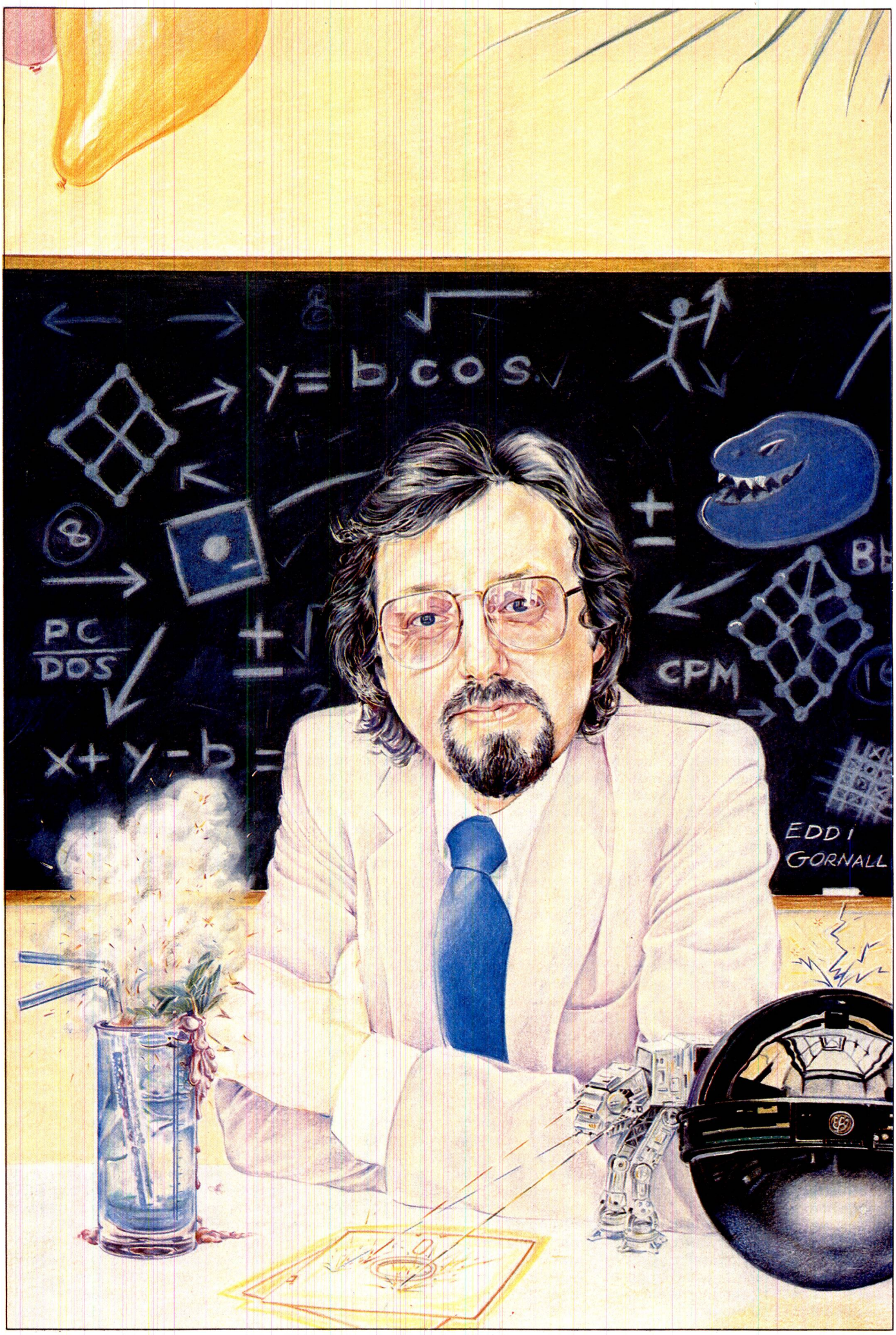
So far, all that has been seen with any degree of certainty is a poorly defined outline of one aspect of the genus. As one researcher put it: 'All we have seen so far is the top view, and even then we don't really know what that looks like.' There is considerable concern among researchers, however, that this 'top view' may be a precursor to something much more significant, something which has been seen in other species in the computer family, in particular the computer gargantuum species.

There, Indiscriminatum Brutalisio Machismium, as the large blue blob is actually known, has all but killed off the other species. Only a few genetic anomalies remain. The researchers are trying desperately to identify the top view to see if it's from the IBM family (most are sure of this in their hearts), and whether there are any other species from the same family that can be expected.

It's possible that the entire nature of the Discus Operatum Systematis species will be altered, if not destroyed, should the IBM genus gain a strong foothold. Experience of the genus says it will, and that the long-term effects could be significant.

The murky pond may never be the same again. END

Illustration by Eddi Gornall


y=b,cos.
PC
DOS
CPM
x+y-b=
EDDI
GORNALL



SCREENTEST

Digital Research's GEM

GEM will obviously invite comparison with Apple's Mac, but its main advantage is not just user-friendliness but its ability to be ported across a wide range of machines. Peter Bright investigates.

Digital Research (DR) isn't a company whose name is synonymous with user-friendliness: this is the company which gave us BDOS ERROR ON A. But things look set to change with the introduction of its super friendly package known as GEM.

GEM is an acronym for Graphics Environment Manager and for once the name actually fits the product. It will run on most popular micros and gives them the friendliness of a Macintosh or a Lisa while still retaining the ability to run popular applications software.

So does an Apricot F1 + GEM=a colour Macintosh? Read on.

History

Before I describe GEM itself, it might be a good idea to look at the history of Digital Research in terms of system software.

Back in the old days (at least 18 months ago), before IBM came onto the micro scene and 8-bit machines still ruled the roost, CP/M was by far the most popular general purpose micro operating system. Its major advantage, from an applications programmer's point of view, was that using CP/M routines rather than going directly to the hardware, they could be fairly sure that their programs would run on a wide range of machines.

This was a major factor in the growth of popular micro software. Products like WordStar and dBaseII could not have reached such a wide range of users if it hadn't been for the standardisation that CP/M brought.

The advent of 16-bit machines with high resolution screens made porting software from machine to machine much more difficult. The major problem is usually the screen: the classic case being the IBM PC where programmers have been forced to write directly to the hardware if they want to do anything fancy with the screen. As soon as you start writing directly to the hardware, you make it more difficult to port the software onto other machines.

To circumvent this problem, DR brought out a product called GSX. This is a set of graphics-handler routines which sit next to the operating system effectively extending the system software's coverage to take care of high-res graphics. The result is that writing a program with calls to GSX instead of your own screen driver, it's easy to make your program work on any machine supporting GSX. Since about 75 OEMs, including the likes of ACT, have taken GSX, this is a major incentive to write for the system.

Architecture

GEM is very much an extension of DR's attempt to keep applications programs as distant as possible from the hardware of any particular machine.

The total GEM system encompasses the operating system and GSX in order to provide the applications programmer with a total environment in which to operate. The vast majority of the code is written in 'C' with only minimal amounts of machine-specific machine code. It's also very modular, so the hardware specific drivers can be easily accessed and altered.

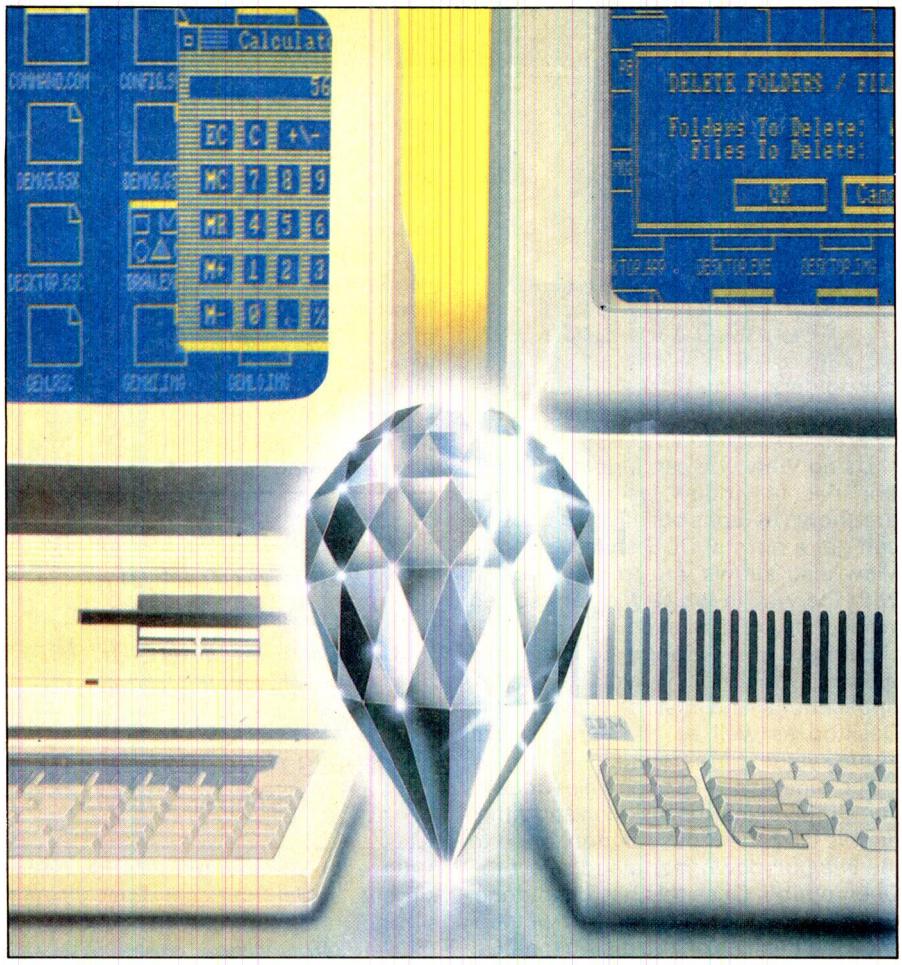
The result is that GEM is much less dependent on the hardware/processor/operating system combination than most other systems. DR is initially offering GEM on Intel processor-based systems running under Concurrent CP/M or PC/MS-DOS. This makes it accessible to the majority of business OEMs.

Firm customers at the moment include ACT for its Apricot range, Acorn for its ABC 300 business machine and ICL for a 'hush hush' new business machine. In addition Atari has announced that it will be taking GEM for its new ultra-cheap/high spec business machine. Finally, and predictably, DR itself has implemented GEM on the IBM PC. (Prices of the relevant implementations haven't been finalised yet.)

Although GEM is currently only available on the 8088/8086/80186/80286 family, it won't be long before it's on 68000s and 32016/32s. As it's largely written in 'C' you *only* need a good 'C' compiler and a little ingenuity to get it running on the processor of your choice.

As far as operating systems are concerned, the picture is also very flexible: I would expect to see GEM running on other operating systems in the immediate future.

An obvious candidate is Unix, where GEM could go a long way to converting what has always been a supremely unfriendly system into a usable business operating system. Given DR's



current activity on the Unix front, this wouldn't be at all surprising.

Look at Figs 1 and 2 and you'll see that GEM isn't just one program; rather it's a collection of bits and pieces which form a total picture.

To get GEM running you'll need: one operating system, one copy of GSX Version 2 tailored for your hardware, one GSX extension kit from GEM Services and one copy of the GEM Desktop applications program. While you're at it, you might as well pick up the bundled icon editor, GEM Draw and GEM Wordchart utilities which are thrown in free.

If you intend to write programs to run under the GEM environment, then you'll probably need the GEM Programmer's Toolkit. This consists of a wide range of compilers and utilities which allow you to take advantage of GEM's built-in routines. (DR is at pains to point out that it regards GEM as an 'open system' and is offering generous licencing deals to persuade applications houses to take GEM and tinker around with it.)

The two most interesting parts of the GEM system are the GEM Services system software and the GEM Desktop applications program.

GEM Services: an extension to the GSX system. If you're planning to use icons and mice, you'll need to be able to do pixel operations to get smooth movement out of the mouse cursor and the pictures, which spend most of their life being dragged around the screen. GSX in its basic form doesn't provide for this, but GEM Services does. It also operates in much the same way as the ROM routines in Apple's Mac — that is, it provides applications programmers with routines to make life easier when dealing with scaling, mice, icons and all the rest.

Again, a look at Figs 1 and 2 reveals that the operating system, GSX and GEM Services bind together to form the programmer interface, but they do not provide the user interface directly. This is provided by the GEM Desktop program.

GEM Desktop: when you look at the pictures of the GEM system, what you are in fact looking at is the Desktop program; the rest is a bit like an iceberg — it's there, but you can't see it. The Desktop program allows you to load and run other programs, copy disks, and do all the normal housekeeping chores which would normally be done by typing commands directly to the operating system.

As far as the system software is concerned, Desktop is just like any other applications program, it just happens to be the one which is loaded first. If another application is loaded from the Desktop, then the Desktop is thrown out and the application is loaded and run in the normal way. As soon as the applications program has finished, the Desktop is reloaded. This makes it an example of what you can do using the system software. It also means that if you don't like it, you can throw it away and write your own.

By the time you read this, GEM should be almost ready for public release. As I write, it's still in a pre-production state, so the version I looked at may vary slightly from the final production model.

I used GEM on two machines: an ACT Apricot F1 and a Compaq portable IBM PC clone. The Apricot F1 is about the minimum specification on which GEM will run. It has an 8086 processor, MS-DOS, 256k of RAM, a single disk drive and a colour screen. The GEM system software uses up 128k of RAM and the Desktop takes an additional 70k. Don't forget that the Desktop is switched out when you run an application, so it doesn't take memory away from the application.

The upshot of all this is that 256k of RAM is the minimum you can have and still have a fighting chance of running decent applications programs.

It was very interesting to note the difference between GEM running on the Apricot F1 and the Compaq. As GEM is adaptable in terms of hardware, what is basically the same program can look slightly different on different machines. If you have a high-res display (say, you have a Herculese card on your IBM), then GEM will be high resolution; if you have colour, GEM will be colourful.

It was also interesting to note the difference between GEM running in colour on the Apricot F1 and in black and white on the Compaq. At the time of writing ACT hadn't finished writing the colour drivers for GEM on the F1. As a result the colour scheme shown in the pictures probably isn't the same as F1 owners will see in the final version. (I chose yellow and blue because I thought they looked pretty.)

The first thing that struck me was that the display on the Compaq was much faster than the Apricot F1's. Cursor movement was smoother, and window movement and scaling were both faster and smoother. Both the Compaq and the Apricot F1 are similar in terms of pure hardware speed, but whereas the Compaq only has to update a monochrome display, the Apricot F1 has to update a three-plane colour display. This obviously takes longer. Colour costs speed.

Having said that, overall I found GEM very fast indeed. Even on the Compaq, the speed of drawing was comparable with Apple's Mac. This is fast indeed if you consider that the Compaq uses a slow old 8088 whereas the Mac uses a 68000.

Booting up GEM is an interesting experience.

Before you can achieve anything, the machine has to load the operating system, GSX, GEM Services and GEM Desktop. This can take quite a while on a floppy system. The first thing you see is a little sign onscreen saying 'welcome to GEM' and displaying the DR banner. To get any further you have to use the mouse to select a little 'OK' box.

Illustration by Mark Watkinson



SCREENTEST

The system then goes off and loads the rest of GEM and suddenly ex-MacIntosh and Lisa users have an overwhelming sense of *déjà vu:* the Desktop program's display is very similar to the Mac/Lisa's. Most of the screen is displayed in shaded grey to represent a desktop. Along the top of the screen is a menu bar and down the left-hand side of the screen are icons which represent floppy disks, hard disks (if you have them), and the ubiquitous 'trashcan'.

The menu bar contains pull-down menus labelled 'Desk', 'File', 'View' and 'Options' which are selected by using the mouse to move the cursor over the word. As soon as you do this the menu shoots down and stays there until something else is selected. This makes it very easy to accidentally select an unwanted pull-down menu. This became increasingly annoying. Apple's Mac requests that you press the mouse button to select a pull-down menu — a much better idea.

The Desk menu contains a number of accessories for the desktop. On the review system it was possible to select

'GEM is very much an extension of DR's attempt to keep applications programs as distant as possible from the hardware of any particular machine.'

and display a calculator and a clock on the screen. However, Desktop does have options which allow you to install new accessories into the Desk menu, so the Puzzle on the Mac could yet find its way onto GEM.

File allows you to open an icon, get information about an icon (this is deceptively useful — see below), create new folders, format disks, drive printers and finally quit GEM to get back to the operating system.

Using View you can juggle information in a file window. Usually disk files are shown as icons but, if you wish, you can get a normal DOS style directory. View also allows you to play around with the way in which files are sorted when they are displayed

Options is a strange collection of utilities which allow you to install applications and disk drives into the Desktop as well as allow you to set some system parameters.

File windows — To open a file window, you simply select the disk icon and either double click the mouse button, or go to the File pull-down menu and select the Open option. Once this has been done, Desktop opens up a full screen window showing the files on the disk in the DOS root directory.

The file window uses icons to represent the files on the disk. On the pre-production version the icons hadn't been finalised, but there are basically three types:
application: a square icon with a dark top edge;
document: represented as a piece of paper with the edge folded over; and
folder: which is simply a folder.

The contents of the different icons are self-explanatory; the application icon contains executable files and the document icon contains everything else. Folder is a representation for a DOS sub-directory and can contain a whole new set of files. To run an applications program, simply select the icon for that application and either select Open from the File pull-down menu, or double click the mouse button.

The file window can be manipulated in a number of ways: you can shrink it or expand it by selecting the little overlaid window symbol in the bottom right-hand corner of the window and then moving the mouse. The size of the window is governed by the mouse's movements. To move it around the screen, take the cursor to the top edge of the window, select it and then drag it wherever you want. If you want to

'DR is initially offering GEM on Intel processor-based systems running under Concurrent CP/M or PC/MS-DOS. This makes it accessible to . . . business OEMs.'

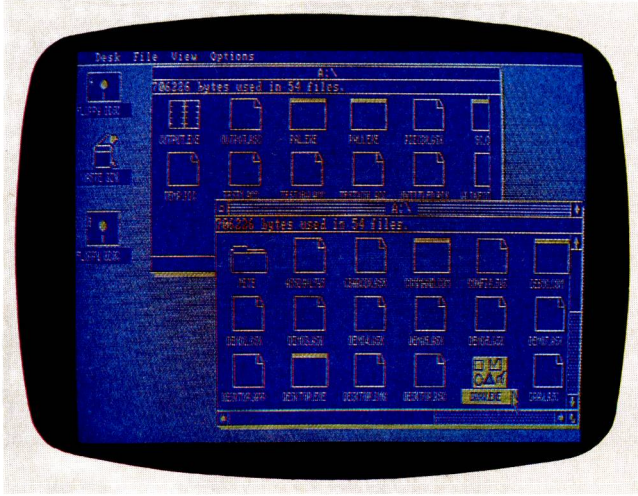
restore the window to full screen size, simply select the diamond-shaped symbol in the top right-hand corner of the window.

It's often necessary to have more than one file window open at the same time. If you do this, Desktop allows windows to be displayed however you like: for example, overlaid, overlapped, on side by side.

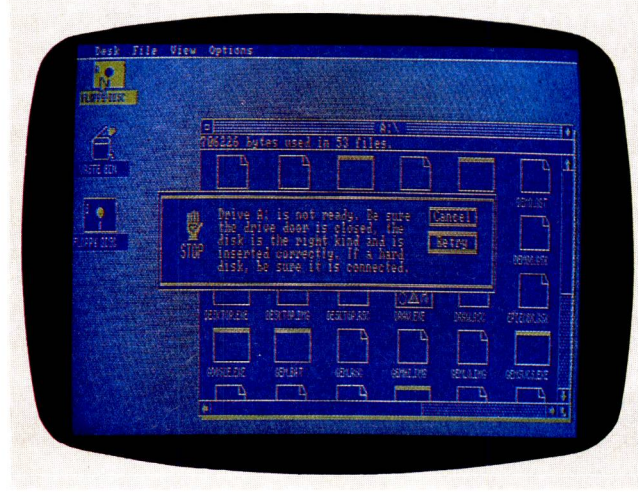
Finally, 'Scroll Bars' run along the bottom and up the right-hand side of the file window. These can be used to pan around within the window if all the files won't fit.

Housekeeping — the Desktop program allows you to do all the normal file manipulation and housekeeping operations in a way that is easy to understand and in most cases extremely logical.

Copying files — the file copying functions within the Desktop bear a close



Windows can be overlapped as shown here



A dialogue box provides a warning

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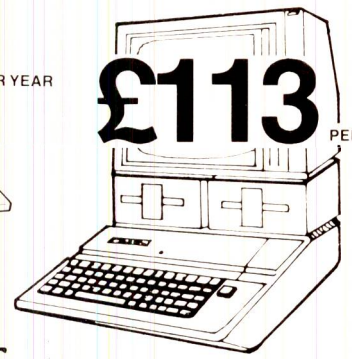

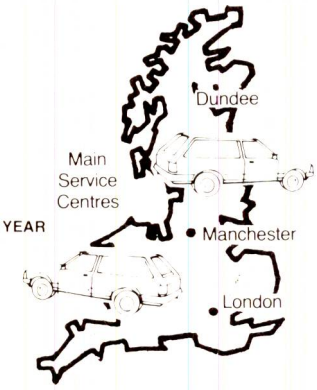

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resemblance to those in Mac's Finder. To copy a file you simply select the icon of the file you want to copy and then just drag the icon to where you want it to go. For example, say you want to copy a file from drive A to drive B. First you open the file window from drive A. Next you shrink and drag the window so that you can see the disk icons and the bin. To copy the file you select the icon of the file you want and drag it to the disk B icon. The Desktop will then ask you to confirm that you want to copy the file and then go ahead.

If you want to delete a file, the procedure is similar, except instead of dragging the file icon to the picture of the disk, drag it to the bin.

If you want to copy more than one file, all you have to do is draw an extended box around the icons of the files you want to copy. The Desktop program will then highlight all the selected icons and you can drag them to the required positions.

The whole operation is not only quick and simple to execute, but very logical: if you want to get rid of a file, drag it to the bin!

Folders — you don't have to use folders, but they are necessary to prevent the screen from looking untidy. A folder is GEM's representation of a DOS subdirectory and is a very useful tool for grouping similar files.

A new folder is created by selecting the 'New folder' option from the File pull-down menu. Once you have created your folder, you can copy files into it from the root file window. You can either do this by dragging the files to your new folder icon, or you can open up the root file window and the folder file window, place them side by side on the screen and drag the files from one window to the other.

Although folders are very useful, I can foresee some problems. The first is that copying files into a folder leaves you with two copies of the same file—one in the root and one in your new folder. This means you have to copy the files to the folder and then delete them from the root. Apart from the fact that this isn't exactly logical, you could easily run out of disk space during the copy procedure if, say, you're copying multiple files. This happened to me and the only way around it was to copy one file, delete it, copy the next, delete it, and so on. This soon gets very tiresome.

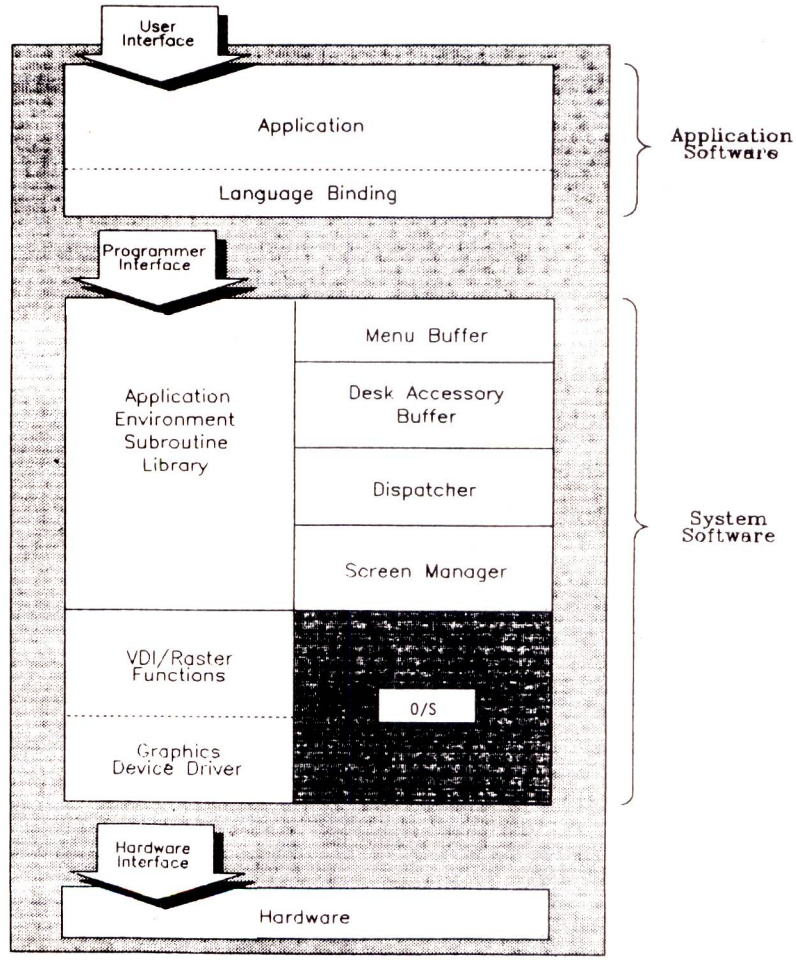
When you get the system, you might well decide that you want to put all the system files in their own folders. This would lead to another problem. When you copy the system files to a folder, you are effectively copying them to a subdirectory. The next time you boot the system, it will look for the GEM system files in the root and won't be able to find them. To get round this patch an AUTOEXEC file to switch to the correct subdirectory before calling the system files — although patching AUTOEXEC files isn't what GEM is supposed to be about.

Here it would be very easy to point out that Apple's Mac doesn't have either of these problems. But while comparisons with the Mac are bound to spring to mind, remember that it doesn't matter how good GEM is, it still has to work with unfriendly hardware and DOS, and in this respect it's limited by both. It's a measure of the quality of GEM that you forget that DOS is lurking somewhere underneath.

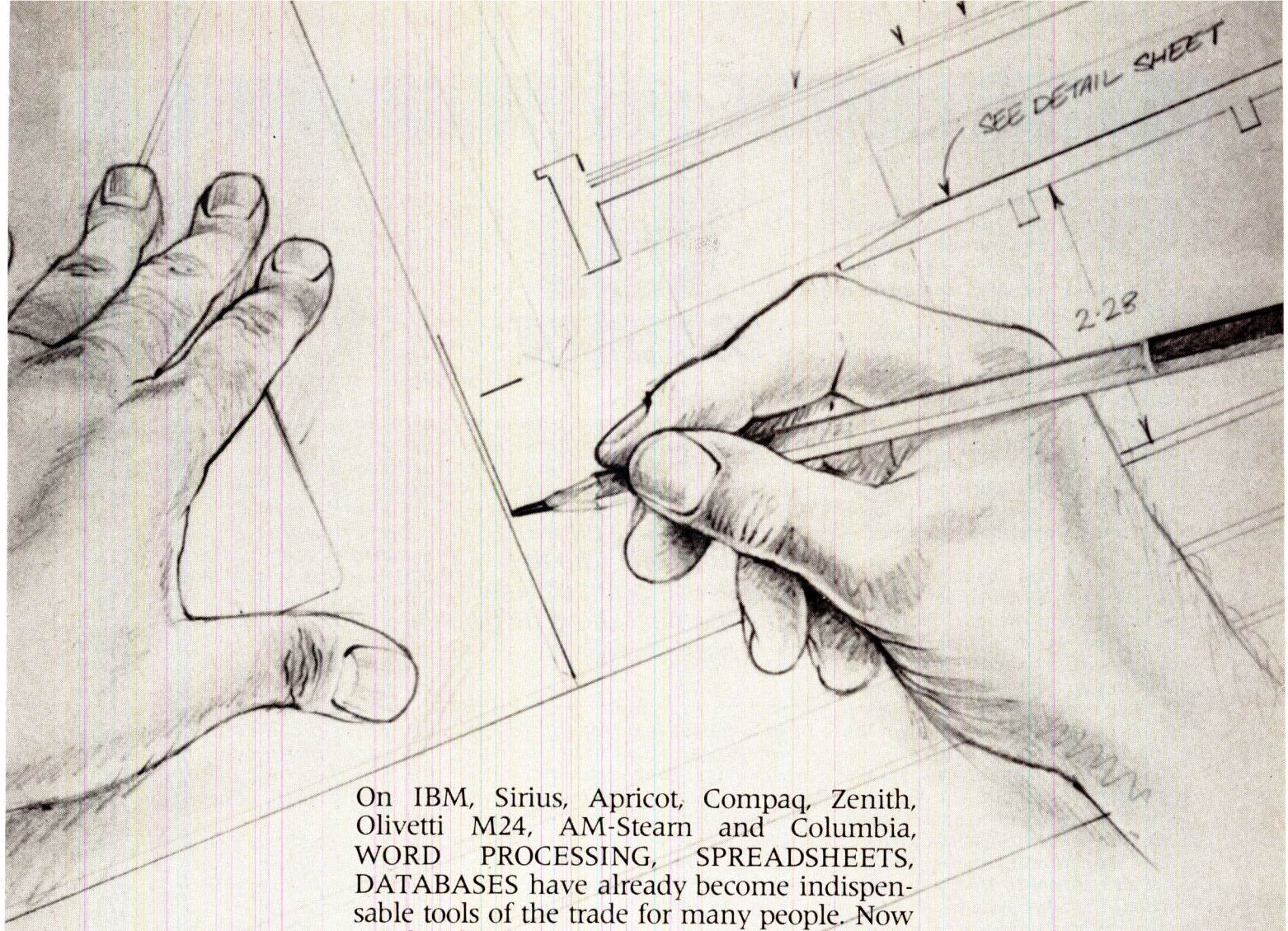
The only slightly unfriendly aspect of GEM which I found (that wasn't forced on it by hardware or operating system constraints) was in renaming a file. I spent about twenty minutes with a couple of DR engineers trying to work out how to rename a file. In the end they had to resort to reading the manual — the first and last time that the manual was needed. It turned out that to rename a file you have to select the icon associated with the file and then select 'Show Info' from the File pull-down menu. The usual function of Show Info is to give useful information about files and disks. However, it does also display the filename along with a cursor which you can use to edit the filename — I don't know why the rename function was hidden here.

Error messages: GEM makes good use of dialogue boxes to inform users of errors and warn them if they are about to do something stupid. One of the screenshots gives an example of a dialogue box. In this case the disk was taken out of the drive and a disk read was attempted. A box is displayed showing a picture of a hand with a STOP legend and a message saying "Drive A: is not ready. Be sure the drive door is closed, that the disk is the right kind, and is inserted correctly. If it's a hard disk, be sure it's connected." This is a vast improvement over DR's traditional offering — 'BDOS ERROR ON A'! (remember!).

Additional programs: In addition to the main Desktop manager program, the



A block diagram showing how GEM software is subdivided



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production version of GEM will also be supplied with a painting program, a word processor and an icon editor for designing your own icons. Because of the pre-production nature of the review system, only the paint program was supplied, so I am unable to comment on the other two packages.

The painting package is to be known as GEM Draw. The review version bares a superficial resemblance to MacPaint. However, this resemblance ends under closer scrutiny.

GEM Draw is selected from the Desktop in exactly the same way as any other applications package: simply select the GEM Draw icon and give it a double click or select Open from the File menu.

Once Draw has loaded, you are presented with a screen set out in a standard window manner. The screen can only look at part of the picture, so scroll bars are provided to allow you to pan around and look at the whole scene. The menu bar runs along the top of the screen and a toolbox runs down the left-hand side of the screen.

The toolbox on the review system contained 10 symbols. The first is a picture of a hand pushing a square; this allows you to move objects around the screen. The second is another hand, but this didn't appear to have any useful function. The other symbols allow you to draw squares and oblongs, rounded squares, circles and ellipses, filled polygons, straight lines and curves. In addition there are facilities for freehand drawing and text entry.

Options available from the menu bar allow you to execute all sorts of fancy tricks to create pretty pictures. You can store pictures on disk and then call them up and combine them to form a new picture. You can zoom in on the picture, add detail and then zoom out again. Finally — providing your hardware can support it — you can use any one of 16 colours and 16 fill patterns to brighten up your work of art.

'Digital Research deserves to do well with GEM. From the end user's point of view it's the best thing this side of a Mac.'

Conclusion

I liked GEM a great deal. It obviously invites comparison with Apple's Mac, but I believe a comparison on a feature for feature basis is misleading. The Mac is a custom-designed hardware/software package with the sole aim of making life as easy as possible for the user, so it will always win on that basis.

But user-friendliness is only one of GEM's aims: it also sets out to provide the applications programmer with an interface which will hold good across a wide range of hardware.

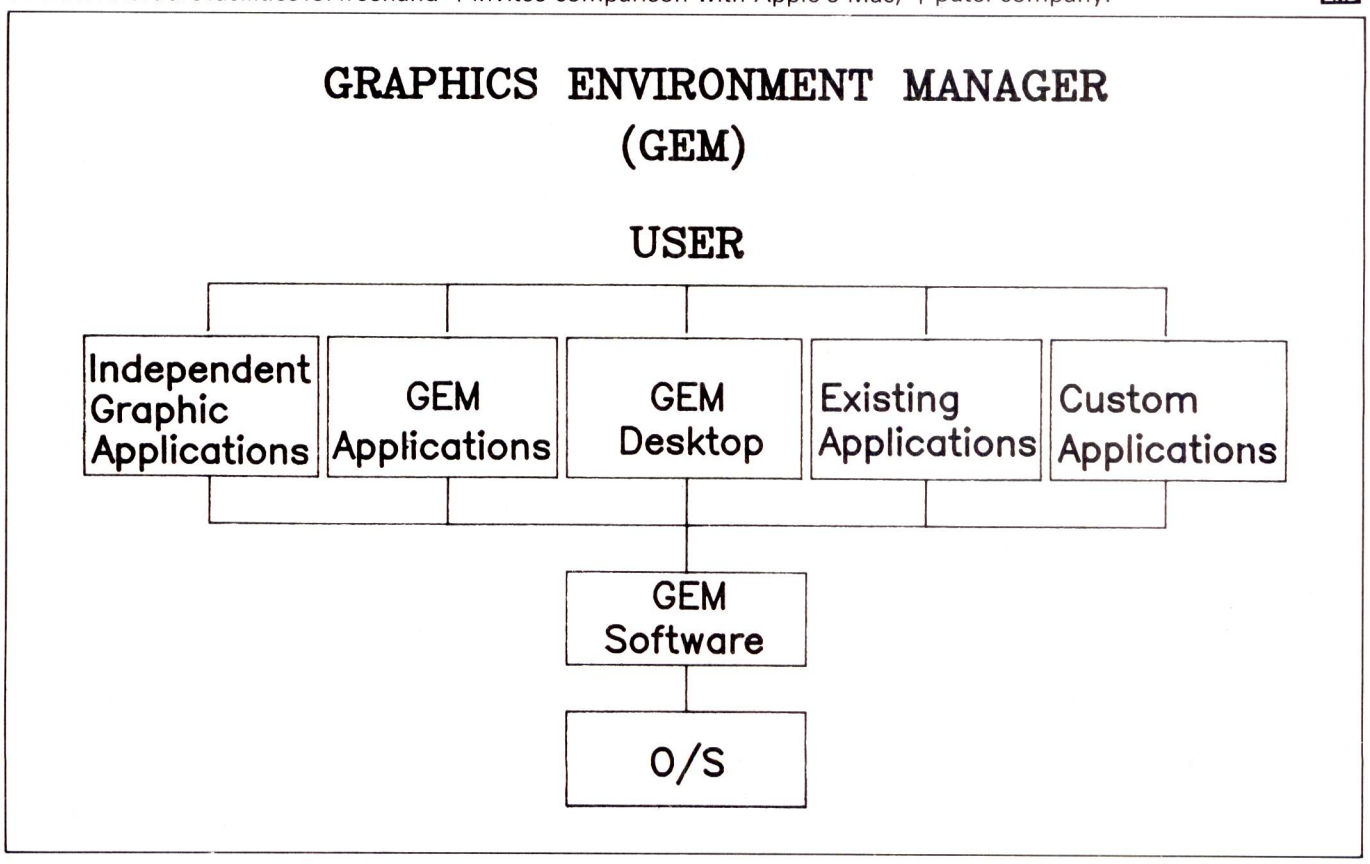
I believe it succeeds in both its objectives. I found it extremely easy to use and was very impressed with the way in which it disguises the unfriendly hardware and operating systems lurking under the surface.

On the software compatibility front, a standard is badly needed. Obviously IBM provides a standard for 16-bit software, but it is very constraining and dangerous in that software houses are dependent upon the whim of 'big blue'.

Other software houses have tried to invent standards. VisiOn hasn't done anything and Microsoft's Windows is still in the pipeline. It looks like IBM will try to do something with Top View, but this hasn't been released in the UK yet.

Digital Research deserves to do well with GEM.

From the end user's point of view it's the best thing this side of a Mac. In addition it offers software houses and OEMs access to an open system capable of embracing advanced technology without the risks involved in dealing with the world's largest computer company. END



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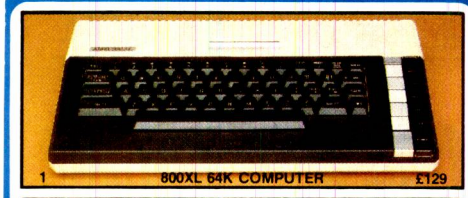
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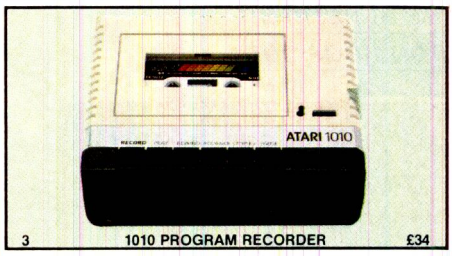

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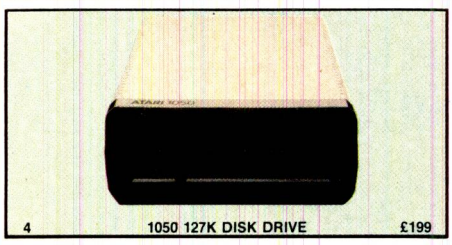
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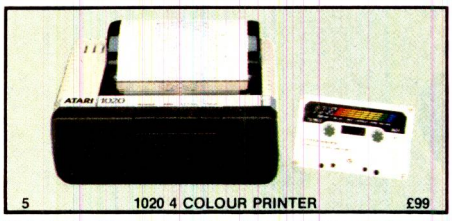

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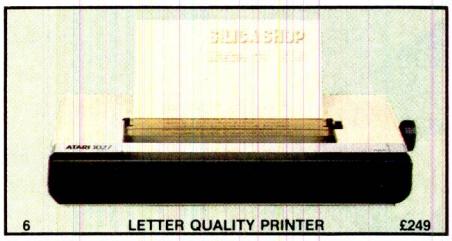
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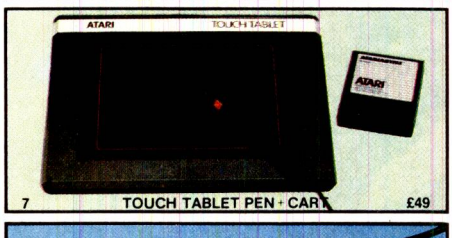

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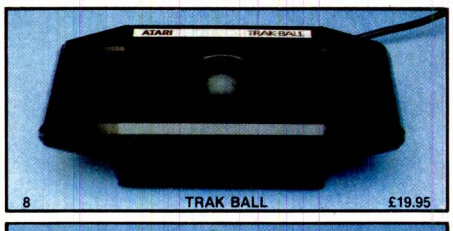

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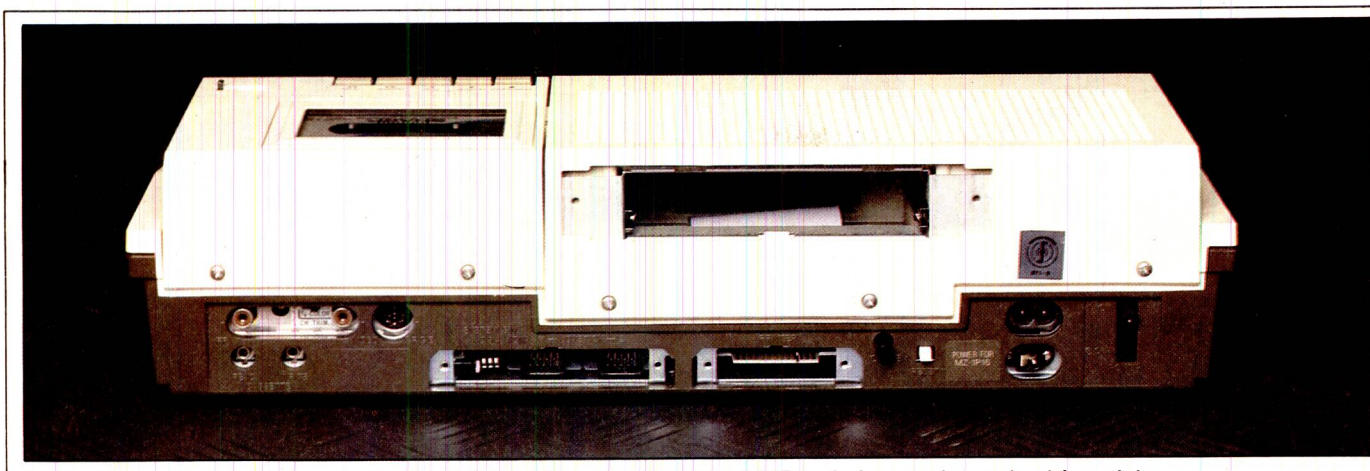
Sharp MZ-800

Sharp's successor to the MZ-700, the MZ-800, has been launched into the sub-£1000 business market where it's hoped that its major feature, Personal CP/M, will ensure its success. But will it be more at home in the serious home user's environment? Tony Hetherington finds out.





Unscrewing three panels reveals the disk interface slots, external DIP switches and standard joystick ports

To date, Sharp computers have occupied two distinct areas of the computer market — home and business. Sharp's home micros have appealed to the enthusiasts, and the company has since followed the old but still-used MZ-80 series with the MZ-700.

The MZ-800 is a derivative of the 700 but offers high-resolution graphics, built-in cassette unit and three sound channels.

The MZ-800 is targetted as a business micro to supplement the company's range of business machines that, while applauded for design and construction, are criticised for not being IBM-compatible or sufficiently innovative to stand alone.

The MZ-800 is intended to dispel these criticisms, for not only is it data-compatible with the IBM PC, it's also the first machine to offer the user-friendly delights of Personal CP/M.

Hardware

The MZ-800 has a mains lead that would be more at home with a cassette recorder, an RGS lead, a manual, and a cassette containing the Basic and some demo programs. The machine can be used with a normal television but no lead is supplied for this purpose.

The review machine was supplemented by a Sharp MZ-IF02 5¼in disk drive and a MZ-1DO5 colour display monitor, which is the required hardware to run Personal CP/M.

The MZ-800 is housed in a cream and brown plastic unit, and has a rather angular appearance which isn't alleviated by the built-in cassette player and expansion unit that give the machine an uncomfortably high profile. These are secured in place by a number of screws and form an integral part of the machine. I stress this point because if you remove them, the case becomes identical in size and shape to that of its predecessor, the MZ-700, which *PCW* Benchtested a year ago.

The MZ-800 also has an identical 69-key keyboard which features a standard qwerty layout, five function keys and a cluster of cursor control keys. The INSERT and DELETE keys are positioned above the cursor cluster and are a little too far from the other keys; they switch the qwerty keys between their normal alphanumeric mode and graphics mode. Each key has two graphics symbols that can be printed from the key; these symbols are shown on the 700's keyboard but are omitted from the 800. Instead, a pack of stick-on labels are supplied with the unit.

There's no CAPS LOCK key, but there are two SHIFT keys which curiously swap upper case letters to lower case. This is the opposite of the normal set-up and can be reversed by pressing CTRL-E. All the alphanumeric keys have auto-repeat and are nicely spaced with a good, positive feel.

The integral cassette player is perched on the top right-hand side of the unit and houses the basic cassette controls, including a tape counter. Unfortunately, its lofty position means that the user has to peer over the top of the machine to read it.

Video outputs for RGB, composite and TV are grouped together on the back of the unit together with external cassette controls. Also along the back panel are the ON/OFF switch, power-in socket, power-out socket to drive the Sharp colour plotter, volume control and reset switch. The reset switch is uncomfortably near to the volume control, but since the switch needs a good push this shouldn't cause too many problems. Taking a screwdriver to three panels reveals the expansion slots for a disk interface, a printer connector, a group of four DIP switches and two standard joystick ports. The



The side view shows the machine's large footprint, protruding disk interface and ungainly appearance

joysticks ports are a surprise: to date Sharp has stuck to its own design, but more surprises are to be found in the DIP switches. At a flip of one of these switches the 800 becomes a 700 and can run most 700 software, the exception being joystick-controlled games. The other switches are set to reverse the polarity of the external cassette ports or the type of printer to be used, which can be either Sharp or Centronics, and replace the more conventional switches that were located on the 700's PCB.

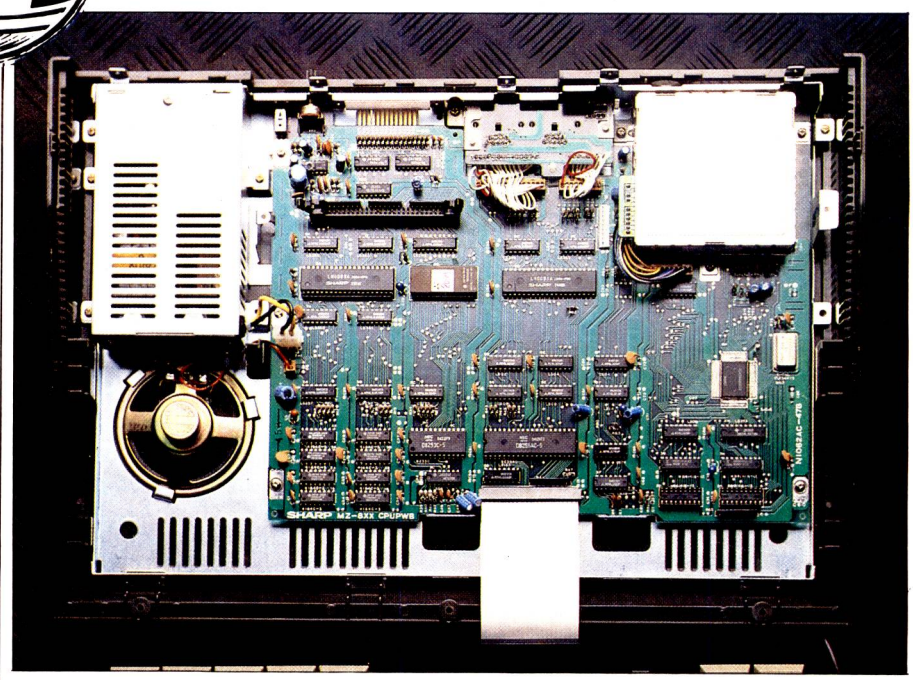
Getting inside the 800 requires a determined effort. You unscrew three screws underneath the keyboard, then remove a further five screws to get at the cassette unit and expansion box, both of which must be disconnected from the PCB. This reveals two more screws, and you can finally remove the case top by prising it apart with a screwdriver or similar implement.

Inside the case is an extremely neat circuit board, with the only connecting wires there for the joystick ports. There are a mixture of chips which are mainly from Sharp, Mitsubishi, NEC and Texas Instruments.

The 800 is driven by a Z80A processor running at 3.5MHz, and is supported by a TI 76489 programmable sound generator which gives the 800 its sound capability of three channels over eight octaves.

The 800 also features a custom-built video chip that has pins extending from all four sides and is a derivative of the one found in the 700, but is now improved and offers the user true high-resolution graphics. This chip is supported by 16k of video RAM, and a further optional 16k VRAM can be added into the two empty chip holders at the front of the circuit board. There's 64k of user RAM and a 16k ROM containing the system monitor. To the left of the PCB is an internal power supply and a hefty eight-ohm, one-watt speaker with a volume control.

Unscrewing the panel on the expansion unit reveals a slot with guidelines, along which slides the disk interface that terminates in an RS232 interface. This is the existing 700 disk interface which, unfortunately, extends out of the back of the machine by about 1½ins. Sharp tells me that there will eventually be a screw, or metal cover, to protect the vulnerable circuits.



The video chip has pins extending from all four sides

The RS232 interface is connected via a cable to the disk drives; these are existing Sharp drives and consist of two 320k 5¼in disk drives. They are of vertical design, have a turnlock door mechanism, and stand neatly alongside the colour monitor. This is the currently-available MZ-1DO5 colour monitor which has a display resolution of 25 lines by 80 characters. Unfortunately it only supports eight colours, which is a shame since the 800 has sixteen. However, the extra eight colours are merely lighter versions of the other eight, so the monitor makes no distinction between them. For example, grey looks the same as black, as does light yellow and dark yellow. The monitor has a built-in RGB cable (its only interface) which only just reaches the 800's socket.

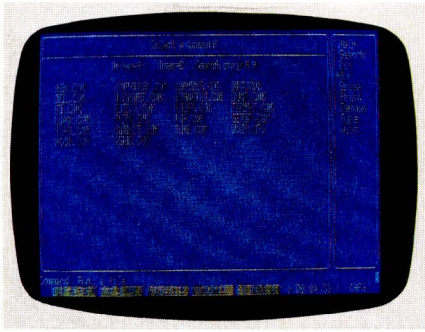
Additional hardware intended for the 800 includes a RAM file card and a quick disk drive. The RAM file plugs into the expansion slot below the disk interface and has 64k of memory onboard that can be accessed as if it were a disk. Any files or data on the RAM file will be lost when the machine is switched off, so it will have to be backed up to either tape or disk. Consequently, access times to the RAM file are dramatically faster than to disk.

The quick disk is described as a 'sequential disk unit' and replaces the cassette drive. It takes 2½in 64k disks, which are the disk alternative to cassette tape and can only be used for sequential files. They have a speed advantage of an average access time of about eight seconds.

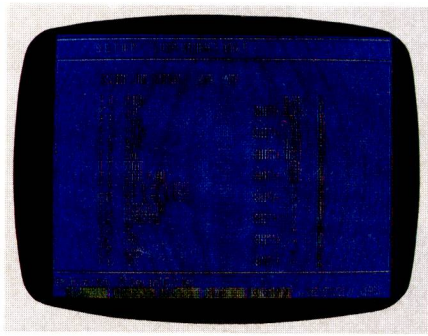
System software

When the MZ-800 is switched on, you're welcomed by a list of available options. You can use the machine's monitor, load a language in from cassette, or, if the disk interface is present, load a program from disk. If a disk is ready in the drive, it will overrule the option and the disk will load automatically. This is the MZ-800's main claim to fame, as it's the first computer to offer Personal CP/M (PCP/M).

When PCP/M has booted it provides the facility to autorun a program; this is



PCP/M's friendly face

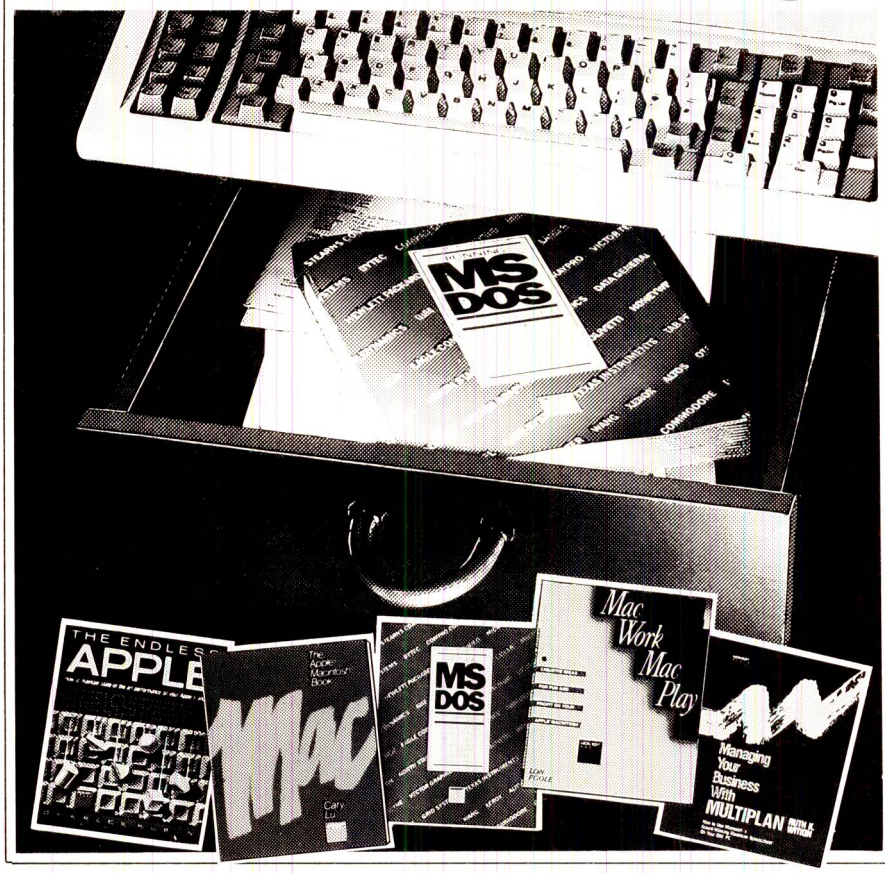


32 definable function keys



The Diskedit utility

Some people in business have an unfair Advantage.



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initially set up to run the VCCP (Visual Central Command Processor), which is a front end to PCP/M and is a very friendly system guide.

It's ironic that the 800 is aimed at the small businessman or serious home user, because while these users will appreciate PCP/M's features, they won't fully understand the differences between this system and its anti-social predecessors.

The VCCP basically consists of three screen windows and a number of predefined function keys which work together to allow easy selection of the required progam or utility. The screen is divided into a main, or file, window which measures 20 lines by 69 characters, a command window which runs alongside the file window and is 10 characters wide, and a three-line information area.

The command area holds a list of commands that can be selected with the cursor keys and submitted by pressing CR (carriage return key). These commands are file management commands and include utilities such as Erase, Rename and Print a file, as well as Run a program and a Help function.

When you select a function, cursor control appears in the file window where you select, from the directory list, the file you wish to use. (A brief description of these functions is given in the information area.) Displaying the Help text reveals a summary of these instructions, plus the information that further commands can be added by the user to the command window by editing the VCCP.CFG file which is present on the disk.

Underneath the brief command descriptions in the information area are the current settings of the function keys. Through a clever organisation of these keys, 16 functions are squeezed onto five keys. This is possible because the fifth key is always set to 'next' and logically displays the next four available functions.

These keys are predefined as useful functions, such as DIR and PIP commands are set to transfer all files from drive A to drive B, and *vice versa*.

To the right of the function key display is a clock which is set to zero when the machine is switched on, but can be reset with the TIME command.

The PCP/M disk contains the usual collection of utilities including Format, a disk and system copy program as well as the file transfer program, PIP.

It also contains some interesting additions, including a powerful disk editing utility called Diskedit. This allows the user to examine and alter any file, block or sector of a disk and immediately alter it. Obviously, it would be unwise to edit the system disk before you have copied it.

Diskdef allows you to change the format of drive B so that PCP/M can read and write data which is compatible with other Sharp formats, as well as the IBM PC.

This means that someone who works with an IBM at work will be able to continue his work on an 800 at home.

Users can customise their PCP/M system with the Setup utility. For example, they can change colours from the initial cyan on black to any combination, like magenta on green.

The auto-execute facility which automatically runs VCCP can be altered to run any command or program.

'The machine (the MZ-800) will appeal to that growing group of users who have an IBM PC at work and require a system at home for serious work.'

Selecting the option that redefines the function keys reveals that you can also define the action of the blank, TAB, INST, DEL and cursor keys, with or without the SHIFT key, which gives a total of 32 definable key combinations.

Other available definable options include specification of main and auxiliary input and output devices which may be the console, keyboard, disk drive or RS232 interface, the printer mode, either MZ-code or ASCII, and the word length, parity and stop bit parameters for data transfer via the RS232.

The review copy of PCP/M was a pre-release evaluation version which, although it performed all the above, flatly refused to run any programs or utilities from the VCCP. Sharp is aware of this problem and is confident that it will be overcome before the machine is released.

VCCP and all the above features have been added by Sharp, and have transformed PCP/M into an extremely easy and friendly system to use.

The traditional version of MBasic supplied with PCP/M is just one of five Basic interpreters available for the 800. The others are a disk Basic, quick disk Basic and a cassette supplied with the standard machine which contains S-Basic, as on the 700, and MZ-800 Basic.

MZ-800 Basic takes over four and a half minutes to load and leaves less than 22k of the machine's 64k RAM available to the user. This is a longer load time which leaves less memory than the S-Basic, but users will soon realise why.

The main difference is the introduction of true high-resolution graphics that can be drawn with a resolution of 640 × 200 pixels in four colours. This, however, requires the additional VRAM chips, so most users will have to be content with 320 × 200 pixels and only a choice of four of the sixteen colours. A colour is assigned to one of the colour palettes with the PAL command, and it's these palettes, numbered 0 to 3, that are used in the graphics statements. They are: SET and RESET for each of the pixels; LINE, to draw lines between points; BOX, to draw a box and, if required, to fill it in; CIRCLE, to draw circles and arcs; and PAINT, to fill in figures in any colour. By far the most powerful command is SYMBOL, which draws a user-defined graphics character in any colour anywhere onscreen. It also contains parameters which, when set, can magnify the character horizontally and/or vertically up to 255 times the original. The resulting pattern can be rotated through any right-angle. This is all accomplished in a single command — some compensation for the lack of sprites.

Music commands are much the same as in S-Basic but there are now three channels to program simultaneously, which is accomplished by alternating the notes for the channels with the MUSIC command. When specifying a note, the user can control the note's tempo, duration and octave as well as specify silent periods.

MZ-800 Basic still lacks program structures such as Repeat-Until and While-Wend, but contains a non-standard concession to structured programming in the LABEL command. This should be used at the beginning of subroutines and has the form 100 LABEL "PCW"; it assigns the variable PCW the value of the line number, in this case 100. Consequently, the label can now be used in GOTO and GOSUB statements: for example, GOTO "PCW", which transfers program control to line 100. This is simple but effective, as it does help to make listings more readable.

S-Basic's file handling commands have been extended to allow the creation of sequential files on the RAM file and via the RS232 interface, as well as the cassette player. These commands include: WOPEN# and ROPEN#, to open a file for output and input respectively; PRINT#, to write to a file;

Benchmarks

B1	1.4
B2	3.4
B3	9.2
B4	8.2
B5	9.0
B6	17.6
B7	33.0
B8	82.1

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January issue.

and INPUT# to read it. Files held on the RAM file can be deleted, merged and chained. The quick disk Basic and disk Basic extend these commands for the respective devices.

Entering the BYE command takes you out of Basic and into the RAM monitor, and is used to examine, alter and locate the contents of RAM; you can return to Basic by entering R. This shouldn't be confused with the ROM monitor, which is available before Basic is loaded and is useful for writing machine language programs.

Applications software

Details of the availability of applications software for the MZ-800 were vague at review time, but what is clear is that software will be available from a number of sources.

The major source of software will be programs to run under PCP/M, which, according to Sharp, can be readily transported with little modification. The company is confident that the new machine will have ample software by its launch date in mid-January; such packages will include WordStar, dBasell and several spreadsheets.

An additional source of software is available at a flip of the DIP switch. Consequently, 800 users will be able to run the programs and languages already available for the 700, and I would imagine that the traditional Sharp software houses, such as Kuma, Sharpsoft and Solo Software, will supplement this range with programs that exploit the 800's additional features.

Documentation

Two preproduction manuals were available with the review model — a 'tentative' version of the *MZ-800 User Guide* and a photocopy of the *Personal CP/M manual.*

The *User Guide* began extremely well, with clear instructions on how to set up the machine, and directions on loading in the Basic and the demo program. This program is an excellent addition, and clearly illustrates the graphics and sound facilities.

Unfortunately, the *Guide* then assumes that after a section outlining the Basic commands, the user is ready for circuit and chip diagrams, and ROM calls.

Clearly something is missing, and the book industry will no doubt be willing to fill the gap.

The *PCP/M Manual* is the usual epic tome that we expect from Digital Research. It does try to teach the user how to use PCP/M, but this is a lengthy process involving the theory of how files are stored on disk and an explanation of the format and use of PCP/M's commands and utilities.

As Sharp has dramatically enhanced PCP/M, it has added a section to this manual explaining the additions. This is the section I suggest you read first, as it deals with the system's friendly aspects. Once you feel confident with VCCP, then you can delve into the *PCP/M Manual* and discover the complexities of CP/M commands.

Prices

At the time of writing final prices had not been fixed, but the basic MZ-800 is expected to cost around £250, which is the same price as the 700 at its launch a year ago.

About £200 more will secure the quick disk version, but the full PCP/M model incorporating twin 320k disk drives will be around £650. Add to this the cost of a monitor, £285.95, and the Sharp emerges as a contender in the under-£1000 business micro category.

Conclusion

Sharp is selling the MZ-800 as a business machine, and indeed it's to be distributed by the computer division rather than the home computer and calculator division. But this policy may prove harmful to the machine's credibility. The fact that it's the first Sharp computer to have standard joystick ports, a built-in cassette recorder, a Basic which supports high-resolution graphics and three-channel sound is consistent with a business image.

The review model was an ungainly partnership between the new MZ-800 and an existing Sharp monitor and disk drive; while functional, the system's to big to sit on a desk. The area occupied by a micro is referred to as its footprint, and the 800 has a print twice that of an IBM PC.

In addition, the disk interface coupled with the cable extends several inches out of the back of the micro, and can obstruct access to the monitor and disk drive. The solution is to move the keyboard further away, but this is restricted by the short RGB cable.

The MZ-800 is, however, the answer to Sharp's critics. Not only is it data-compatible with IBM, it features PCP/M. This is its ace-in-the-hole and will guarantee the machine some success, but that success is likely to be on the businessman's desk.

The machine will appeal to that growing group of users who have an IBM PC at work and require a system at home for serious work. It's in the 800's favour that these people will be able to work on their IBM data files, such as a WordStar document, as well as being a source of education and entertainment for them and their families.

Having said that, Sharp owners are an enthusiastic bunch and they won't allow Sharp's marketing policy to dissuade them from thinking that this is Sharp's best home machine to date. END

Technical specifications

Processor:	Z80A running at 3.5MHz
ROM:	16k (monitor)
RAM:	64k user RAM + 16k video RAM
Mass storage:	None as standard, optional twin 320k drives
Keyboard:	69-key qwerty keyboard including function and cursor keys
Size:	4in × 17¼in × 12in
Weight:	8lbs 8oz
I/O:	Expansion slot, printer port (non-standard)
DOS:	Personal CP/M
Bundled software:	None
Peripherals:	RAM file, quick disk drive, additional VRAM

In perspective

As a business micro the MZ-800 will have some stiff competition in the sub-£1000 category, including the Apricot F1. Here, its ungainly appearance and huge footprint will restrict its success. Its major asset is PCP/M which will rejuvenate the cause of CP/M in general, as it's recently been losing ground to MS-DOS. Another factor in its favour will be its data compatibility with the IBM PC, but it will be its size that will keep it in the home.

In its basic form, the launch price makes it a competitive choice for a home machine. It will enjoy its best success against, ironically, its predecessor, the MZ-700. These machines are similarly priced, although the 800 offers more features and the option to run 700 software. Curiously Sharp has no plans to reduce the price of the 700, perhaps in the blind belief that the 800 is a business machine.

I doubt that it will make any new inroads into the home market despite its added features. Although the sound capabilities equal those of the Commodore 64, its lack of sprites, and particularly its cassette-based Basic, will deter the games players and the first-time buyers.

Its best hope is as an upgraded home machine where it's in competition with machines such as the Memotech RS128 and the Advance 86. Here, the Sharp is not only cheaper but also offers a new, exciting operating system in PCP/M. Only in this market will its size be either tolerated or appreciated.



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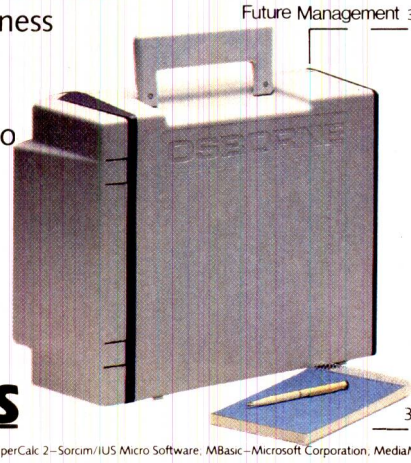

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Dialtex-4

Talbot Computers' Dialtex-4 offers portable communications and text processing in a small, battery-powered unit. Will it serve as a boon to users in the field? Peter Bright takes a look.

Over the past year the market for small battery-powered portable machines has taken off, but the leaders in terms of volume are probably still the first Kyocera machines which are marketed under the banners of Tandy, NEC and Olivetti. These machines offer basic communications and text processing facilities at a reasonable price.

The Dialtex-4 is supplied by Bournemouth-based Talbot Computers. It's aimed squarely at people who need portable communications and text processing facilities with more advanced features than those available on the Kyocera-type machines, but who don't want to pay too much extra.

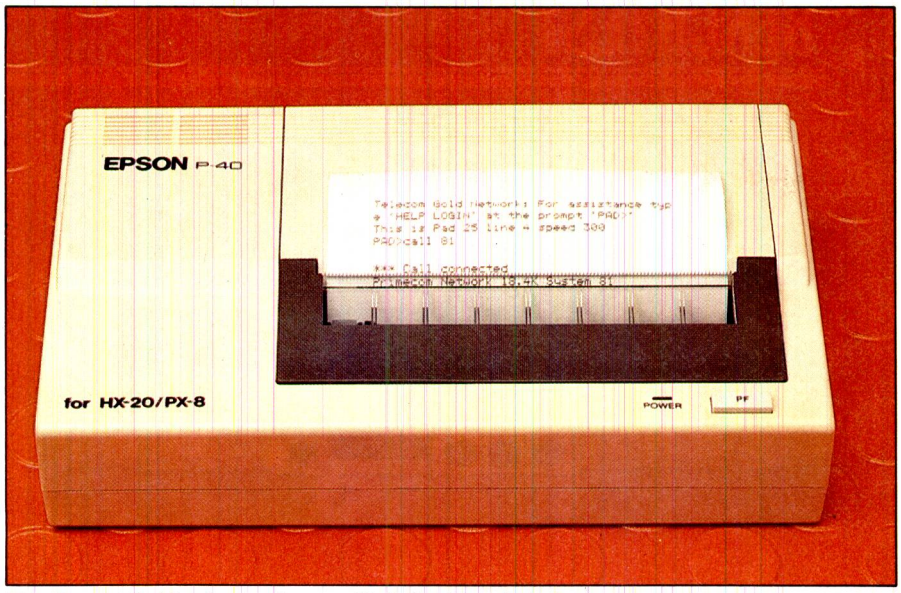
Hardware

The Dialtex-4 is certainly a very compact piece of kit: everything is enclosed in a case measuring just 34mm high by 297mm wide by 216mm deep.

At first sight it looks very like the Epson PX-8, which is hardly surprising. It works with Epson peripherals and the main PCB bore Epson's name, which also appeared on the maker's label at the back of the machine.

The whole unit is encased in extreme-





The Epson P-40 micro printer will fit inside a briefcase

ly high-quality, cream-coloured plastic casing to give a very solid, well-made look. Everywhere you look on the Dialtex-4 there's a slot, plug or hatch, so I'll start with the bottom and then work around the sides.

The bottom of the machine houses two covers, one switch and a catch arrangement. The smaller of the two covers hides the battery compartment. The unit can either work off four AA-sized dry cell batteries or from their rechargeable equivalents; the review machine was supplied with the rechargeable variety.

To save power, the system switches itself off after a preset time, which can be set by the user using the 'Config' program. When the batteries get low a warning appears on the screen, and the machine refuses to be switched on again. When you do find some power, it at least has the good grace to come back at the point where you left off.

The larger of the two covers hides two ROM sockets; these can be used to plug in ROM-based software so that there's no need to load the software from disk. Most ROMs from the Epson PX-8 will apparently fit, although the WordStar ROM I tried didn't work. The review system was supplied with a Basic ROM and the other slot was free. (It's intended that the Dialtex software will be supplied on ROM on the production versions.)

Next to the battery compartment is a switch marked 'Backup On/Off'; this allows you to switch on or off the battery backup for the RAM. Normally it would be left in the 'On' position.

The final object of interest on the underside of the unit is a complicated catch arrangement; this allows you to remove a module which takes up most of the area to the right of the screen. On the review system the module was empty, but a whole range of add-ons can be plugged in here to expand the unit. These include a microcassette mass storage device, ROM packs, RAM packs and a micro printer.

Talbot Computers are planning to put a direct connect modem into the module. This will save having to use an external modem or acoustic coupler, but don't expect it to happen quickly — we all know how long it takes to get modems approved by BT.

The left-hand side of the machine houses a cover which, when removed, reveals a 50-way system expansion bus connector for expanding the system.

At the back of the machine, we find even more buttons, holes and slots.

On either side of the back panel are two feet which can be flipped down to alter the unit's typing angle. In the centre of the panel are five connectors: first is a micro DIN plug which allows you to connect an external cassette recorder for mass storage. The next two are RS232 serial ports; these are again configured as micro DIN sockets rather than the more usual (but space-consuming) 25-way D plugs. Both the serial ports can be run at up to 38,400 bps, which is unusually fast for an RS232-type line as most micros are hard put to generate 19,200bps.



The Epson PX-10 portable disk drive is an impressive piece of kit

Next along the line is a 20-way connector which functions as a Centronics parallel printer port; this allows the unit to drive a wide range of popular printers. Finally, on the back, is the power input for running the unit and recharging the batteries if necessary.

Along the right-hand side of the unit are: an output to an external speaker; a bar code reader input; power on/off switch; viewing angle thumbwheel for the LCD; and the reset button. The reset button can only be reached with a pen or other long, thin implement, so there's no danger of accidentally switching the unit off.

I didn't make any serious attempt to get inside the unit. Although it looks possible, CMOS electronics are not fond of static and there would have been little point in opening it up.

The Dialtex-4's main processor is a CMOS Z80 running at a commendable 3.68MHz. This is supported by a CMOS 7508 4-bit slave processor which looks after the keyboard and handles power switching.

Nearly 4MHz is a respectable achievement for a CMOS Z80, and largely accounts for the comparatively speedy operation of the unit. It was certainly faster than many other small CMOS machines I have tried.

As standard the system is supplied with 64k of battery-backed CMOS RAM. If required, part of this can be set aside as a RAM disk. The 7508 slave processor also has its own 4k of dedicated RAM, while the standard ROM, which holds the operating system, has 32k. Up to two other 8-32k ROM capsules containing applications programs can be added onboard to bring the total to 96k.

The system can handle a wide range of optional mass storage devices — the most popular will probably be the microcassette unit which is handled by CP/M as a sequential disk drive. Other options include an external tape recorder and RAM disks.

The review machine was supplied with the Epson PF-10 portable disk drive. This is a compact battery-powered 3½in disk drive unit which connects to the main unit down one of the serial lines (which is why they were designed to go so fast).

The PF-10 really is a very impressive piece of kit. It's fairly light, very small and, above all, it works off its own internal rechargeable batteries so there's no need to go looking for a power supply.

The review system was supplied with an Epson P-40 micro printer; this is a very small thermal unit which also fits inside the briefcase. Again this connects to the main unit via one of the serial lines.

Like most portable machines, the keyboard on the Dialtex-4 is built into the rest of the machine. Where it differs from other portables is that the unit is available with two different keyboards.

Although the keyboard looks as if it's part of the whole unit, it's actually held

on by three screws and three lugs. If you remove the three screws, the whole keyboard unit lifts off. Electrical connection between the keyboard and the rest of the unit is achieved by 22 spring legs making contact directly with the main PCB, which proved to be a very neat and practical arrangement.

The main keyboard supplied with the machine is a fairly standard typewriter-style unit; the second is a heavy-duty membrane multi-purpose unit.

The membrane unit is designed more for data capture and in-the-field work rather than long-term typing. It has a separate numeric keypad area and is supplied with keyboard overlays so that it can be customised for specific applications.

The review machine was supplied with the typewriter-style keyboard; this features 72 keys all grouped fairly closely together to make them fit into the confined space available. Considering the lack of space, this keyboard is well designed and laid out. Although the keys aren't pitched, they are still easy to get at.

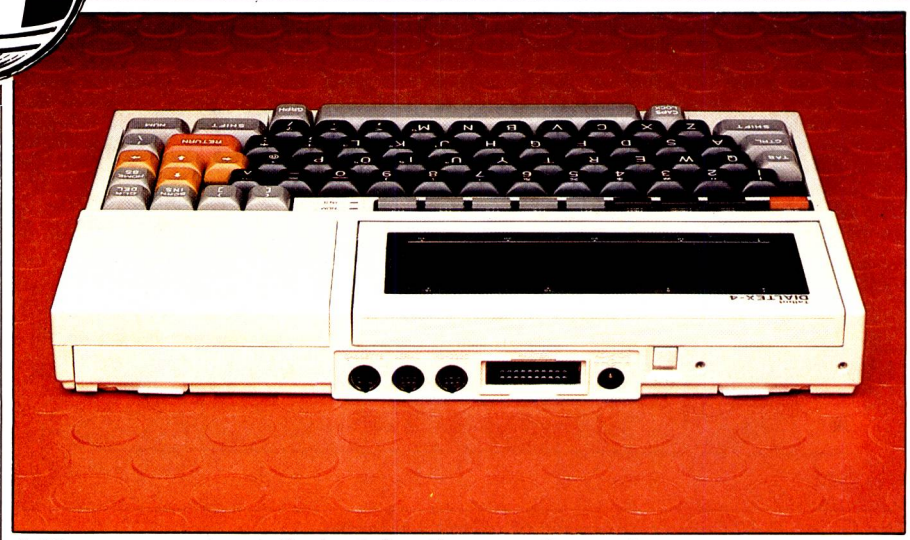
Rather than separating the different functions of the keyboard by spacing them out (there isn't any space), they are assigned different colours. The main qwerty typing area keys are dark brown, the RETURN key is bright red, the cursor keys are orange and all the other typing keys are light grey. This all looks very striking, although I feel the colour scheme is a little overdone.

In addition to the typing keys, there are nine special function keys. Five of these are set aside as programmable function keys which can be used from within an applications program, and the rest are labelled STOP, ESC(ape), PAUSE and HELP/SYSTEM. These keys are used to control the system and are discussed further in the software section.

Although there's no separate numeric keypad, the keyboard does consider calculator buffs by providing a 'Numeric' mode; this converts the M,J,K,L,U,I and P keys into a numeric section for entering numbers. Although this can be useful, it can also be very annoying if you engage it by mistake and type '250' instead of 'KIM'.

Overall, I liked the keyboard. The typing keys have a nice feel, the editing keys are thoughtfully arranged, and the whole thing worked well as a unit. A nice touch is that LEDs have been provided to indicate whether the CAPS LOCK, NUMERIC or INSERT key has been pressed — which overcomes any problems trying to work out what mode you're in.

The display on the Dialtex-4 is a 40-character by 8-line liquid crystal display (LCD). This is located in the top left-hand corner of the unit and can either be used flat or tilted up to allow better reflection of light. A thumbwheel on the far right-hand side of the unit can be used to adjust the contrast.



A 20-way connector on the back functions as a Centronics port

As with all other machines using LCD displays, the positioning of the unit is fairly critical in order to achieve good results. Having said that, this machine has one of the most easily readable displays I have come across. It may not be as big as some, but at least it's usable!

In fact the limitation on the size of the screen is not as great as it might at first seem, because it's possible to use the screen as a window onto a much larger 'virtual screen'. This virtual screen can be set to either 80 columns by 25 lines, or to 40 columns by 50 lines. You can easily pan around the virtual screen by using either the SHIFT or the CONTROL key along with the arrow keys. SHIFT/arrow will move you one line or character, and CONTROL/arrow will move you by a screenful.

The combination of this virtual screen capability and the CP/M operating system is very fortunate. Most CP/M programs expect to be able to use an 80 column by 25 line display — they could get quite upset if they found they only had 40 columns by 8 lines!

The screen goes a long way towards making up for its small size by its sheer usability. Lately I've had my fair share of large, unreadable LCDs: it makes a change to find one (albeit a small one) that I can read.

Benchmarks

BM1	2.3
BM2	6.0
BM3	14.3
BM4	14.1
BM5	16.7
BM6	30.7
BM7	47.8
BM8	63.5

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January issue.

My only criticism of the screen is the characters. Although they are reasonably large, they don't have true descenders: that is, the 'g's', 'j's', and so on don't hang down below the line. Although this isn't a major problem, it certainly looks odd.

System software

The Dialtex-4 is supplied complete with CP/M in ROM, which gives it theoretical access to a wide range of 8-bit disk software. The ROM version of CP/M looks and behaves in much the same way as good-old disk-based CP/M; if you've been brought up on the IBM PC, you don't know what you're missing.

The major difference is that most other CP/M systems have a 64k transient program area (TPA); this is the area of RAM which is available for applications programs. The maximum available on the Dialtex-4 is 55.5k and if you're using a RAM disk it's even less, but this is not as big a problem as it seems at first. Most applications on this machine will probably be stored in ROM; indeed it's possible that the Intext applications software described later is the only program you'll ever use.

When you first switch on the machine, you're taken into a menu system. This allows you to choose between the applications currently in the system by highlighting them with the cursor, and then to execute the application by hitting the RETURN key. If you don't like menus, you can get out by hitting the ESCape key which takes you back to the CP/M A> prompt.

If you hold down the CONTROL key while hitting the 'Help' function key, you're taken to another menu which allows you to play with the menu system, set an alarm, or set an application so that it auto-runs when you switch on the machine.

If you decide that you don't like the application selection menu, you can switch it off permanently from here: the alarm takes advantage of the Dialtex-

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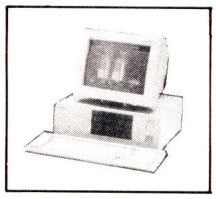

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4's built-in clock calendar chip. You can set the system to call you at a certain time and give you a message, and you can even set the system to switch itself on.

More ambitious users can use the Config program to set up the system to their own specifications. Using config you can set auto-power off, CP/M function keys, country, cursor type, date and time, disk drives, RAM disk, communications, screen mode and the printer port.

Auto-power off is the amount of time the system will allow itself to do nothing before it switches itself off to preserve power. Function keys allows you to assign CP/M commands to the programmable function keys; disk drives allows you to assign logical device names to the physical devices; and RAM disk allows you to set the size of the internal RAM disk.

The review system was supplied with the Basic ROM for Benchmarking purposes. This is much the same as the Epson PX-8 ROM Basic, which in turn is an enhanced version of Microsoft Basic-80.

Applications software

The Dialtex-4 is supplied with Talbot Computers' Intext text processing/communications software, which was specifically designed for journalists to write copy in the field and then send it quickly down the phone line to the office. It's equally applicable where text processing/comms facilities are needed in any field.

Intext is simple and straightforward to use. When the program is run, it presents a menu containing the following options: E(dit), C(ommunications), L(oad), P(rint), F(inish), N(ew), D(ialtext), S(ave), U(tilities) and R(ecover Text).

Edit takes you into a blank screen where you can type and edit your text. The ROM version will be able to handle 2500 to 3000 words before it runs out of space; because the review program was not in ROM, less space was available for text.

The editing functions are fairly basic, but certainly substantial enough to allow you to produce a rough copy in the field. Page formatting and printer codes can be embedded in the text, which enhances the printout.

Edit mode is ended by hitting the STOP key, at which point the system asks if you want to save the file. All documents are stored as standard CP/M ASCII files, although imbedded printer codes do use eight bits which might look odd if you try to TYPE the file.

Communications allows you to connect the Dialtex-4 to a modem or acoustic coupler and upload or download files to a remote system. I had no trouble logging on to Telecom Gold and the like, and the system certainly has potential. You can also echo everything that goes on to a printer in order to keep a record of your work.

Load loads a file into the editor. Print is a print processor which allows you to set margins, the number of copies to be printed, page length, and so on. Finish takes you back to the operating system, and New clears out the editor.

Dialtext is another communications option. It's a blocked transmission communications protocol which allows you to send files to another Talbot communications system. Since this system blocks the data it has the advantage of being more secure than the normal communications option, but it will only work with other Talbot systems.

Utilities allows you to get a file directory or to delete a file. The directory option contains the quaint message: 'Do not select a drive which is not connected.' Of course I did, and the program bombed out to the operating system. I hope this will be fixed on the final versions.

The final option is Recover Text — this is very useful. If you accidentally switch off the machine without saving your text, you can use this option to get it back. Very handy.

Intext is fun. I like the idea of the communications and the editor being together. The 40-column screen is a restriction but for short documents it's acceptable, and the same applies to the editor.

Documentation

The Dialtex-4 was supplied with three manuals: one for the system, one for the Basic and one for the Intext software. The first two were thick, book-bound A5 style, while the latter was a typeset 30-page booklet.

All three were adequate.

Prices

The Dialtex-4 with CP/M, utilities and the Intex program costs £649. This includes an optional module which can be either a micro printer, a microcassette unit or a 64k RAM capsule. Extra capsules cost around £130 each.

The specially designed carrying case will set you back £50, the disk drive costs £360 and the Epson P-40 printer weighs in at £95.

Conclusion

On the hardware side, I found a great deal to like about the Dialtex-4. It's very well made and offers that reassuring feel you find on the likes of Hewlett Packard kit rather than on £600 budget portables.

Although it doesn't break any new technological ground, it does have the overriding advantage of usability. The screen may be small, but at least you can read it.

On the software side, the Intext communications/text processing software is more than adequate for providing rough copy in the field.

If you need processing/comms ability in a cheap package, and you're prepared to talk to Talbot direct rather than explore your local High Street, then add this machine to your list.

Further details from Talbot Computers on (0202) 519282. END

Technical specifications

Processor:	CMOS Z80 main processor running at 3.68MHz, CMOS 7508 for keyboard and power sensing
ROM:	32k operating system, plus up to two other 32k applications ROMs
RAM:	64k
Mass storage:	Optional RAM disk, floppy disk, microcassette or external cassette recorder
Keyboard:	Either 72-key typewriter style, or specialised membrane customised keyboard
Size:	34mm × 297mm × 216mm
I/O:	Bar code reader, cassette, two × RS232, parallel printer, system bus
DOS:	ROM-based CP/M
Bundled software:	Intext text processing/comms software
Power:	Either external supply four AA-type dry cells, or rechargeable equivalents

In perspective

In terms of price, the machine is competing with the Kyocera machines — Tandy 100, NEC and Olivetti M10 — and it has the edge over these machines. It's better engineered, runs CP/M and, with the Intext software, offers more features than the Kyocera systems.

Although the comparison with the Kyocera machines is interesting, it's largely academic because the Dialtext-4 is aimed at vertical markets and is therefore not available in High Street shops. If you want one, you'll have to go direct to Talbot.



SCREENTEST

Mind your language!

There's a world of languages to explore beyond Basic. If it's structure you're after, try Pascal or its offspring Modula-2. If it's artificial intelligence that appeals, then try Lisp or Logo — while a preview of Mac Basic proves that language can still come up with a few suprises.



Adam Denning examines two Pascal compilers: Computer One's Pascal for the QL and Amsoft's for the Amstrad CPC 464.

How do you judge a Pascal compiler? By its speed of operation, efficiency of the runtime code or the capabilities of the language itself? Now that Computer One has released a compiler for the QL and Hisoft is following its Spectrum Pascal with an Amstrad version, it's interesting to see if a Z80 'old tech' machine can beat a 68000 beast at its own game.

COMPUTER ONE PASCAL

Computer One Pascal costs £39.95 and is supplied on microdrive cartridge with a manual which describes the system and the implementation of the language. The package includes a full screen editor and the language has been extended to take advantage of the QL's capabilities. Rather than compiling to pure 68000 machine code, this system translates the source into an interpretative code similar to p-Code or BCPL CINTCODE. A runtime interpreter then executes this code when the program is run.

The choice between a full compiler and one producing interpretative code is a difficult compromise. Full compilation needs a much larger system and the actual compilation process should be slower. It's also very much more difficult to write a full compiler for a new machine than it is to write one based around an interpretative system. This is because the code to which the Pascal source program is compiled can be written for an idealised machine, so it's easier to write a compiler; the only stage which takes any time to develop is the interpreter which is obviously machine-dependent. An interpretative code is almost certainly going to result in a more compact compiled product but it is inevitably going to lose out on execution speed. We'll discuss below whether an interpretative system running on a 68000 can compete against a fully compiled Z80 system.

Computer One Pascal is started in the normal auto-boot manner, but is interesting in that its first action is to reserve some resident procedure space and load a machine code extension to SuperBasic into it. This extension is a procedure called PASCAL and, once linked into the SuperBasic name list, is available as an immediate entry into Pascal by simply typing PASCAL and pressing ENTER.

This loads the command system which manifests itself as a menu with eight options, the first of which is 'Edit'. Edit runs the screen editor and is suitable for its intended purpose, although it suffers in comparision with other editors for the QL. There is only a basic command structure, such as search and replace, and, unless special symbols are used, lines cannot extend from one line to another. Nevertheless, it is capable of editing almost any sort of text file of quite reasonable length. If the editor was the first one of its kind that a QL owner would be likely to use, then that user would no doubt be quite satisfied, but there are numerous other products of this ilk which are far better in terms of facilities.

One interesting feature which depends on both the Computer One editor and the compiler, is the error-messaging system. Whenever a compiler error occurs it is put into an error file. When the original source is then edited to remove the errors, this error file is included, with each error message being reproduced at the right point in the program. The errors can then be easily corrected and the file re-saved. The errors are not saved with the source and are in a protected form inside the editor as they cannot be deleted.

The next menu option is 'Compile'. This prompts for the name of the file to be compiled, which must have an extension of _pas but can be on any drive. The system defaults automatically to drive two and assumes the extension, so compilation of a file called, say, mdv2_PCWProg_pas could be initiated simply by typing PCWProg in response to the prompt. The compiler takes some time to do its job, which is rather disturbing as compilation to interpretative code need not be this slow. Of course some of the delay is attributable to the relatively bad performance of the microdrives, but even so it seems certain that the system's compilation speed could be improved. The resultant object code is put into a file with the same name as the source but with a new extension of _qlp, which we are told means 'QL Pascal'!

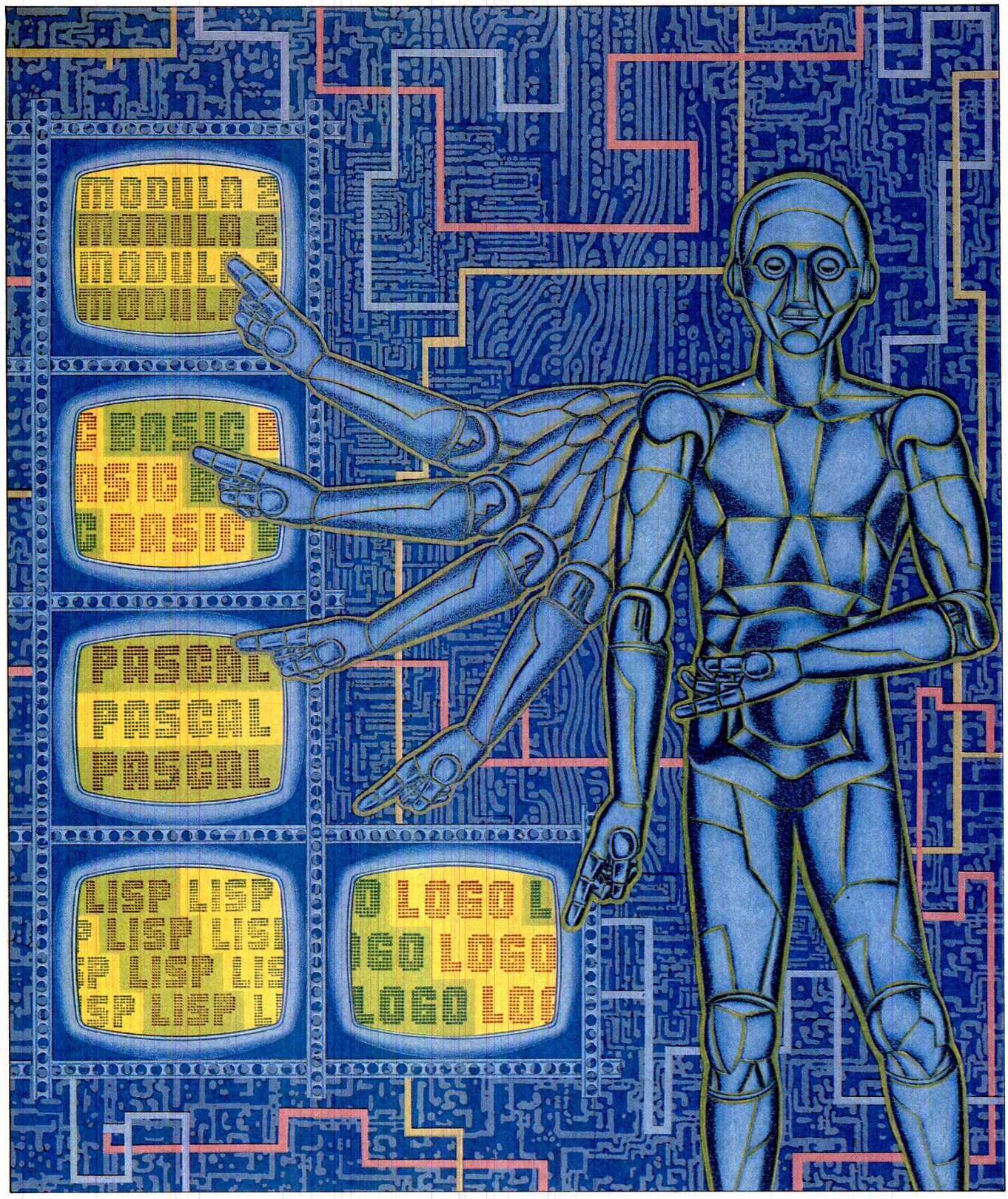


Illustration by Michael Kilraine

There are a number of compiler options which may be selected in the normal way, including switching the listing on or off, but there is no way to print or save the listing as it's produced. The default option is that no listing is produced, so only error messages are echoed to the screen. This seems as sensible as any other choice.

Perhaps the major failing point of this package is that it doesn't provide a really useful utility for two reasons. Firstly, it's not multi-tasking, so it's not possible to have another job running concurrently. Or if it is, no details are given as to how this may be done. More importantly the compiled code can only be run from the command menu. There is no option for producing standalone code despite the relative ease with which this could be done. It only needs an interpreter and a subset of the runtimes to be readily distributable. As it stands any programs developed with Computer One Pascal can only be used by the owners of the package, which rules out the possibility of commercial development of programs.

The product also suffers from a severe lack of standardisation, as programs developed using the more esoteric facilities available are very unlikely to be easily ported across to a more general Pascal compiler. In this respect it defeats its own object.

Of course any programs which *are* developed under Computer One Pascal will conform to the general syntax rules of Pascal, which are favoured by a great many programmers — so its use as an in-house (or in-home!) utility writing tool is still a possibility.

Pascal was originally designed as a teaching language which manifests itself in the strong typing and block



SCREENTEST

structure of the language. While it's not generally possible to interface to the operating system of the host machine as easily and closely as, say, C or BCPL, it is capable of allowing very complex programs to be written with relative ease. It is one of the most verbose of languages, though, so a programmer who is at the stage of deciding what language to use in writing a particular application should study those available with care. Computer One Pascal *is* capable of machine level interfacing via the numerous calls, PEEKs, POKEs and defined types representing the 68000 address and data registers, but Pascal isn't intended for that sort of thing.

AMSOFT PASCAL

Amsoft Pascal for the Amstrad CPC 464 is produced by Hisoft, which has developed similar products for other Z80 machines from the Spectrum to CP/M and MSX, including the first Spectrum C compiler. The Spectrum Pascal compiler is particularly notable for its almost standard syntax and the immense speed of both compilation and execution. The Amstrad version shares the same features as its older brother but it's considerably more expensive. And surprisingly slow.

The compiler comes on a cassette with two manuals: a reference text for the compiler and a basic tutorial to the language. The latter includes numerous examples and seems to fulfil its purpose quite well. On the reverse side of the cassette is a complete set of turtle graphics procedures, such as LEFT, FORWARD and TURN.

The compiler is loaded via a small Basic interface routine which allows the user to specify how much RAM the compiler will have available to it. By allocating less than is available it is possible to reserve space for the user machine code routines or whatever. As the choice of this value necessarily requires a deeper knowledge of the machine then would perhaps be expected, the setting can be defaulted by pressing ENTER. A further five minutes and the complete compiler is loaded and started.

It displays a Help menu showing the meanings of all the single letter commands available from the integral editor. This editor is a reasonable line editor which has a long pedigree, being seen on the Spectrum, various CP/M machines, the Sharp, NewBrain and MSX computers. It allows renumbering, line deletion, block moves, and global or selective search and replace. Although it's a line editor and therefore produces line numbers, these numbers are totally irrelevant to Pascal. Some people will never accept line editors, so a compromise has been made with the basic screen editing facilities of the Amstrad in order that the COPY key can be used in conjunction with the read and write cursors. This enables rather simpler, but less powerful, line alteration.

Once the program has been written it must obviously be compiled. Here the Hisoft product scores a distinct advantage over its QL counterpart. Compilation is *very* fast indeed, although it can be slowed down by having a listing, which obviously makes the compilation speed dependant on the Amstrad's notoriously slow screen-handling. A further feature here is the inclusion of other source files from tape during compilation, allowing for rudimentary library facilities. This obviously slows compilation down even further, but it is a useful facility. If a compilation listing is requested, then the machine addresses corresponding to each statement or block is produced in hex alongside the relevant line, giving it the appearance of an upmarket assembler listing. These addresses are useful for debugging, as runtime errors are reported in terms of address.

The usual compiler options such as printer listing, array bound checking, and so on, are all available and the final compilation of a program would normally switch off all unnecesary checks in order to make the code run faster. The object code produced by the compiler can be saved to tape along with the relevant runtimes, allowing programs to stand alone. This is a major scoring point over Computer One's Pascal for the QL as it means that serious applications can be written in Pascal and then distributed as commercial software. And this must be regarded as fundamentally important.

Hisoft Pascal, in common with its QL partner, allows easy access to machine code and host machine facilities via the USER and INLINE procedures for machine code and the EXTERNAL procedure for the Amstrad RSXs. It also supports all the usual data types amd all the Pascal reserved words and expected built-in functions except for a few not too serious omissions:

No file types
No variant fields in records
Pointers cannot address pointers
Procedures and functions cannot be used as parameters

The first two are currently being rectified for the next release of the compiler, although they will undoubtedly be seen on the Spectrum first. The floating point (real!) mathematics routines are also being improved to allow numbers of up to 12 significant digits precision. The pointers' limitation means that structures (such as linked lists) have to be constructed in a non standard way. This means that this section of code would not compile on other machines and the ability to use functions and procedures as parameters is a little used and a 'definitely not recommended' feature of Pascal anyway.

As I mentioned earlier, this compiler produces pure Z80 machine code. In theory this means it should execute faster than the interpretative code produced by the QL compiler. Tests show that in most cases it does, and comes out to be on average 13 per cent faster using the *PCW* Pascal Benchmarks (see December issue, page 195). However, it is slower at handling FOR . . . DO loops, integer assignments and procedure calls of all varieties. Not very much slower, but it could be significant in certain applications. Taken together, the QL and Amstrad compilers seem to compete in terms of operating speed just as expected, but if the most unlikely competitor is taken into consideration, the Spectrum, both products seem to be the real snails of the Pascal race! The Spectrum Pascal compiler is incredibly fast, its object code executing two and a half times as fast as the Amstrad's and three times as fast as the QL's. It's only ever slower than either of the other machines in calculations involving reals, and in some cases it is five times faster than Computer One's QL Pascal.

In order to get things into perspective, the QL compiler does produce interpretative code and it has to be looked after by the QDOS scheduler, which handles multi-tasking. This means that although it is the only job (multi-tasking program) in the machine, its speed will be cut down compared to a similar system running on a single-tasking machine. It's difficult to gauge how much speed loss this caters for, but the absolute maximum has got to be 20 per cent. This is almost insignificant compared to the Spectrum but dangerous for the Amstrad.

Discussions with Hisoft as to why Amstrad's Pascal is slower produced the expected answer of 'blame it on the firmware', so I did a few experiments. According to Hisoft the code appears slow because the keyboard check option was not turned off, and the Amstrad keyboard check is a complicated ROM-based routine which is called every time around a loop. This means that if the keyboard checks were turned off, the Amstrad compiler should produce code which runs at a speed comparable to that produced by the Spectrum compiler. To test this out I

took a few representative Benchmark programs and re-compiled them with the specified option switched off.

While this may seem to bias things in the Amstrad's favour it must be remembered that the QL Pascal performs as well as could be expected for an interpretative system, so speed is not the contention with that product. After all, if Amstrad Pascal is *still* slow after the keyboard checks have been turned off, then the conclusion must be that the compiler is badly written, while I am drawing no such conclusions about the QL product. Conversely, if the removal of keyboard checks does noticeably speed up the Amstrad programs, then it must be a reflection on the tardiness of the operating system in the machine.

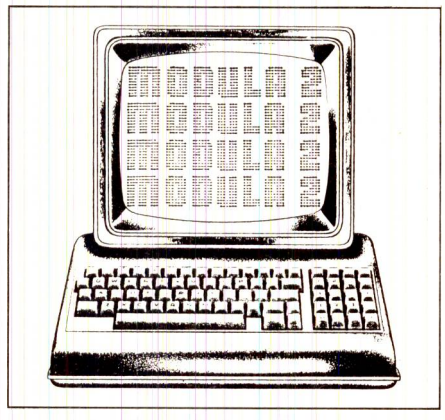
The results were quite startling. The timings now compared favourably with the Spectrum timings, mostly a little higher but often lower. When the keyboard checks were turned off for the Spectrum too, the Amstrad lost ground again, but the results are fairly marginal and the end product shows that the code produced by the Amstrad compiler runs about 30 per cent slower than the corresponding Spectrum code. The Benchmark results are given below with all compilers having keyboard checks, so remember that each product produces very much more reasonable results with these checks off.

CONCLUSION

Computer One Pascal for the QL at £39.95 is a very comprehensive product with many non-standard but useful data types and pre-defined identifiers. Its compilation speed is hindered by the microdrives and by the fact that the compiler itself is written in Pascal. As it cannot provide standalone programs it must be viewed as a system for individual use rather than product development. The near future will see the release of a full ISO Pascal compiler for the QL which will produce native code and thus will support standalone applications programs. This will cost at least £59.95.

Amsoft Hisoft Pascal for the Amstrad (£34.95) is a version of the popular Hisoft compiler for Z80 machines which can produce individual applications programs and is, therefore, more useful in the long term. It is not yet as comprehensive as it might be, but that is mainly because of the limitations of the standard under which it was designed and the comparative lack of memory in a Z80 machine. It is severely hampered by the Amstrad firmware unless special precautions are taken. It is the better product for the beginner.

Both products are very worthwhile provided one is aware of each package's limitations. It is unlikely that any company would attempt to compete with Amsoft in the production of another Pascal compiler for the Amstrad but the QL market is wide open.



Volition Systems' Modula-2 is available for a wide variety of machines. David Lightfoot looks at its implementation on the IBM PC.

Modula-2 is a high-level programming language designed as a successor to Pascal by Professor Niklaus Wirth, who also designed Pascal. It is particularly suitable for systems programming on small computers.

In 1970, Professor Wirth formulated a new programming language, principally for the purpose of teaching structured programming. This language, Pascal, became widely known and used, thanks mainly to the portable so-called p-Code (Pascal code) implementations, resulting from work at Professor Wirth's Institut für Informatik (at ETH Zürich) and at the University of California at San Diego (UCSD).

However, Pascal was never intended to be a systems programming language and it deliberately discouraged knowledge of the underlying hardware and operating system. Its use in this role required the inclusion of additional features and was never entirely satisfactory. During the 1970s Wirth and his colleagues worked on further concepts in programming languages, particularly in systems programming which has traditionally been the domain of assembler (low-level) languages, and in expressing the concepts of concurrency in high-level languages. This work resulted in the experimental language Modula ('MODUlar LAnguage').

Although Modula-2 was designed with a particular machine in mind, 'Lilith', it is also an appropriate programming language for most machines and is available for a variety of systems including the IBM PC. On the PC, the system can be run free-standing — that is, without needing support from the IBM's operating system. On the XT model, and optionally on the PC, Modula-2 is run on top of the operating system and can access data produced by programs in other languages. It is especially suitable for systems-level programming but has significant advantages over Pascal for applications programming.

Modula-2 offers advantages over Pascal in four distinct areas:

Modern syntax — the BEGIN and END compound statements of Pascal have been replaced by the notion of a statement sequence and each structured statement has an explicit terminator — END. The CASE statement has an ELSE-part, as does the variant record.

There is no GOTO statement but instead a LOOP...EXIT...END statement, RETURN for premature quitting of a procedure (or module) and a HALT statement. Further small improvements have been made on Pascal in many areas of the language.

Modules — the module is a new device for structuring programs. It adds to the familiar hierarchical block structure and forms the basis for a method of separate compilation which retains full type-checking across separate program texts, unlike the traditional *independent* compilation schemes of Fortran and C.

The module as a compilation unit allows complex operations (including all input-output) to be supplied in library modules, provided either by implementors or software houses, or by users themselves.

Low-level facilities — unlike Pascal, it's possible to take advantage of details of the machine, but unlike the C programming language this access is made

Benchmarks

	Spectrum	Amstrad	QL
magnifier	0.85	2.95	1.00
forloop	7.10	29.50	11.00
whileloop	8.90	33.80	45.10
repeatloop	7.80	30.50	40.10
literalassign	7.50	30.50	22.00
memoryaccess	7.80	30.40	20.70
realarithmetic	20.70	19.90	43.80
realalgebra	21.40	20.80	37.90
vector	17.00	40.50	77.50
equalif	10.60	33.50	42.50
noparameters	6.50	18.60	15.30
unequalif	10.60	33.40	40.50
value	7.20	19.50	18.70
reference	7.20	19.40	17.50
maths	9.30	9.00	10.20

All results are in seconds and each was run with keyboard checks ON. Times drastically improve if these checks are removed.



SCREENTEST

explicit and can even be denied by implementations if required.

Concurrency — Modula-2 offers a low-level device for concurrent programming in the form of the 'coroutine'. This simple device allows more sophisticated synchronisation facilities to be programmed as needed. The source code of a scheduler based on 'signals' is presented in Professor Wirth's book as a practical example of the use of coroutines, and this forms the body of one of the library modules.

One of the main difficulties with high-level languages is their relatively poor portability. Even Pascal suffers, despite the recent ISO standard. It also frequently needs sections to be written in low-level language due to its restricted areas of application. This use of low-level code limits portability further.

Modula-2 offers improvements in several ways:

(1) The language is defined by a thirty-page document called *Report on The Programming Language Modula-2* which forms part of Professor Wirth's book on the language — *Programming in Modula-2*. Although this document is too informal in style to be ideal for implementors, it's very readable and is therefore of value to the ordinary programmer.

(2) Unlike Pascal, modifications to the language made by implementors must be reported to ETH Zürich. Implementors are working with Professor Wirth to agree on improvements and to agree the content of the library modules, which form an essential part of every implementation. Fortunately, there is a high degree of cooperation in these areas and within MODUS — the Modula-2 Users' Association.

(3) The module facility of the language allows system details to be hidden from the normal, applications-level programmer and, although library modules may be implemented differently from one machine to another, they can all present a consistent interface to the programmer.

The package consists of the:

Compiler. This generates an intermediate code (p-Code) which must then be interpreted. Unfortunately, Volition has implemented the language with a one-pass compiler. This approach is quite suitable for Pascal, which was designed to make one-pass compilation natural, but does not work well for Modula-2. In particular, it upsets Modula-2's rules of scope and also necessitates a change to the language (the directive FORWARD must be used with mutually recursive procedures — as in Pascal).

Otherwise, the compiler conforms well to Wirth's report. There are no apparent omissions, and extensions are available only on the inclusion of a compiler directive. Certain differences in implementations can be attributed to the somewhat informal style of Wirth's report which leaves certain points unclear. Volition understands the spirit of the language well and appreciates the value of minimising the number of extensions or differences.

The major extension is the retaining of the concept of a *packed* data-structure from Pascal. This is the only mechanism which allows the programmer control over the representation of data in the machine, but there is disagreement as to whether or not this facility should be incorporated in the language. Fortunately, Volition's extensions can be used only if a compiler directive is given, so the programmer who likes to keep programs standard should not get confused.

'Modula-2 is an excellent programming language for implementing software on small systems such as the IBM PC. It offers all the benefits of Pascal with the flexibility of C, without the complexity of Ada.'

A small implementation requirement is the inclusion of the SEG loader directive in definition modules. The DIV and MOD operators do not work for variables of type CARDINAL (non-negative integers) when the values exceed the maximum integer. This does not sound serious but it has upset one of my programs and limits the usefulness of the type CARDINAL.

The most recent minor changes to the language have not yet been incorporated, but this is not surprising and I know of only one implementor who has so far made all the changes.

One standard extension (used by Wirth for the Lilith) is the possibility of including low-level language instructions in a so-called 'code procedure'. In this implementation the low-level language can be either p-Code or the IBM PC machine code. This facility can be used to overcome to some degree the disadvantages of interpretative code in time-critical sections of programs.

Modula-2 Library. The module concept and separate compilation make it possible for the Modula-2 language to be very simple. For example, there are no statements for input and output in the language; procedures for accomplishing these operations must be *imported* from standard modules. Although the language permits primitive input/output operations to be programmed, in terms of interrupts, input ports, and so on, the normal programmer will not wish to do this. Wirth has defined a small number of standard modules for this and similar purposes which have been implemented by Volition.

The following four types of modules are supplied:

Library — as defined by Wirth in his book. Implemented by Volition except those relating to high-resolution raster graphics, windows and mice. Later to be extended to include those agreed by implementors and by MODUS.

System-dependent— in this case those particular to Volition and the p-system. Volition has devised a set of file control and input/output routines which will be common to all implementations. These will eventually be replaced by a standard set of modules, after discussion among implementors and MODUS.

My only dislike is Volition's tendency to offer operations as functions which return a value indicating the degree of success. This is a style of programming more appropriate to an expression-based language such as C and is unnatural in Modula-2. I prefer functions to be used for evaluation of a result only, and for operations to be performed by procedures. For example: *function* IsOpen returning TRUE or FALSE and *procedure* Open to cause the file to be opened.

Machine-dependent — modules IBM-Stuff and SYSTEM86 pertain directly to the IBM PC, in particular they relate to low-level facilities. These supplement the (standard) facilities offered in all implementations by the module SYSTEM.

User-defined — those constructed by particular users for their own purposes.

Linking loader. One of the pleasures of developing programs in Modula-2 is the way that management of the component modules is done for you by the system. You can use a module library, similar to the library of units in UCSD. During program development you don't need to use libraries: linking is done dynamically and version checking is performed rigorously by the system. For example, it is possible to put together a small modular program consisting of a main module and a subsidiary module very simply. The subsidiary module must, by the rules of the language, be composed of two separate source files, called the *definition* module and the *implementation* module. The definition describes *what*

facilities are offered by the module to its clients, and the implementation states *how* the facilities are implemented. It follows that the implementation module can be changed without necessitating a recompilation of its clients, as long as it does not conflict with its former definition.

The system ensures that the definition module is compiled before either its clients or its implementation. The process of editing an implementation module, recompiling it and running the suite again, is much faster and safer than the equivalent in older languages.

UCSD p-system. This is very similar to the operating system on other machines such as the Apple II.

Advanced System Editor (ASE). This is an improvement on the normal p-System editor with additional facilities. The ASE can handle large text files by automatically swapping data in and out of memory, and it allows the user to define special 'function keys'. It can display catalogue information so that you can move from editing one file to another without having to quit the editor, enter the Filer, request a listing of the volume and then return to the editor. I found this facility very useful, as is the possibility of displaying the first line of each file.

Pascal compiler (VS). VS Pascal is a dialect of standard Pascal with many UCSD features but not including UNITs.

'p-nix' shell. A useful facility of (most implementations of) Modula-2 is the possibility to call up another program 'on top of' an existing program. This makes it possible to write command language interpreters, or shell programs, as simple Modula-2 programs. This implementation includes a Unix-like shell, unfortunately named 'p-nix'. It includes the better-known Unix utilities and can be extended by the user. It also includes 'I/O redirection' and 'pipes'.

RAM disk. When using a machine with large amounts of random-access memory (RAM), parts of this memory can be designated to appear to programs to be a disk. This means that data normally handled slowly on the disk is handled very quickly on the RAM disk. It is important to remember, however, that the RAM disk is volatile. Unlike a real disk, of course, its contents disappear when you turn the power off, so you need to remember to make copies on to a real disk.

The documentation includes a copy of *Programming in Modula-2* by Niklaus Wirth which includes the *Report on the Programming Language Modula-2*. The *Report* is the definitive document on the language, and the book includes several example programs which illustrate the programming of graphics and the Lilith computer. This is a well-produced book but it's not intended as a tutorial for beginners.

However, it should be possible for anyone with a reasonable knowledge of Pascal to master the syntax of the language in a few hours.

In addition, there are several documents produced by Volition which come in a fashionable, small-format binder. These are: the *Modula-2 User's Manual* — an introduction to the sections that follow; the *Introduction to Modula-2* — this is essentially for Pascal programmers and includes good examples contrasting Pascal and Modula-2. It concentrates on those areas of Modula-2 which will be new to Pascal programmers, such as modules, procedure variables, coroutines; *Standard library* — this is the text of the definition modules with explanations of some of the modules prescribed by Wirth (InOut, RealinOut, Terminal, Storage, Program, Processes) and those defined by Volition, which are standard across their implementations of Modula-2 on a range of machines (Texts, Reals, Files); the *Utility library* — this includes Wirth's MathLibO (sin, cos, and so on) and Volition's Decimals, Strings, Conversions, ASCII. I am not quite sure of the distinction between 'standard' and 'utility' in this context. One small complaint is Volition's technique of documenting a type as if it is *opaque* (its structure is not visible to the client) when it is in fact visible. Although this is done for a good reason, it confused my understanding of opaque types; the *Modula-2 on the UCSD Pascal system* — this covers the library system, the compiler and how to use the system. It includes compiler directives for listings, non-standard features and half-ASCII keyboards; the *Modula-2 Operating System* — this covers the batch command interpreter (used to automate repetitive system tasks), the shell command interpreter ('p-nix'), the file manager, the Pascal compiler, the utility programs; the *Modula-2 on the IBM PC* — this document shows where the IBM PC version differs from the others and how Modula-2 interacts with the IBM's operating system. It includes machine representations of data types and definitions of modules IBMStuff and SYSTEM86, and the module Wides which gives access to the IBM's 8087 coprocessor; the *ASE User's Manual*; and *Example Programs* — these are provided on disk and are designed to demonstrate aspects of the language. Each one contains documentation in the form of a comment and can be compiled and run.

'The user who is very much concerned with speed may be bothered by the interpreted nature of the implementation, but, to a certain extent, the code procedure can overcome this problem.'

The documentation is well-produced and comprehensible. It has been produced using the ASE and a 'SPRINTER-2' text formatter. The advantage of this is a relative scarcity of typographical errors.

A small objection is the placing of the indexes at the end of each section. This is obviously very convenient to the writers, but does make it hard to find sections until you are familiar with the structure of the manuals.

Volition's documentation has a tendency to imply that certain of its extensions are part of the standard language. These extensions include: return type of functions being any type, SET OF CHAR, and prescribing the address of a variable.

CONCLUSION

Modula-2 is an excellent programming language for implementing software on small systems such as the IBM PC. It offers all the benefits of Pascal with the flexibility of C (without sacrificing security), and without the complexity of Ada. It's easy for a Pascal programmer to learn the syntax of Modula-2.

Volition Systems' Modula-2 is a well-engineered implementation of the language with only minor points that would upset a purist. On the whole it keeps to the spirit of the language, unlike many implementations of Pascal. In addition to the language, you get the Unix-like shell, the Advanced System Editor and a practical library.

The user who is very much concerned with speed may be bothered by the interpreted nature of the implementation, but, to a certain extent, the code procedure can overcome this problem.

If you use other machines for which Volition implements Modula-2 (for example, Apple II, Sage), then you will probably value the portability that Volition's modules give across this range. In any case, the portability of Modula-2 across all implementations is relative and will improve as the standardisation of the library proceeds.

I am slightly bothered by the effects of the one-pass compilation, but they do not affect many of my programs. I'd have liked to get at the graphics (and a mouse) of the IBM through a convenient module (such as the Turtle-Graphics available in UCSD Pascal and in Volition's Modula-2 on the Apple 2). However, I know that the situation regarding graphics on the IBM PC is complicated, so perhaps I should not complain. I can probably do the work myself using the low-level facilities of the language. These are small complaints and I would not let them prevent me from recommending this implementation.

The Volition package for the PC is available in the UK from Triangle Software, 14 Honeywell Road, London SW11 (tel: 01-223 4192). It costs £365, as does the Apple II version, but the Sage II or IV implementation costs £439. An Apple II package without ASE is available for £279. All prices exclude VAT.





SCREENTEST

Adam Denning looks at Metacomco's Lisp interpreter for the QL.

Lisp is different from other computer languages in that it is more suited to dealing with objects than numbers. These objects can range from single items known as 'atoms' to a collection of items known as a 'list'. Indeed, Lisp takes its name from LISt Processing, which is just what it does. A list can be a collection of atoms or other lists from none (the empty list) to an arbitrary number.

Three basic functions — CAR, CDR and CONS — are provided in every Lisp system to handle lists. The first returns the first element in a list, the second returns the list minus the first element and, finally, CONS constructs a list out of simpler objects. The first two take their names from the internal registers of the original machine on which Lisp was implemented, and, in theory at least, every Lisp function can be built in terms of these three fundamentals. (It wouldn't be a very pleasant task to attempt, though.)

A Lisp *program* consists of a number of functions, which may well call themselves or other functions, which in turn call the original function. These techniques are known as recursion and mutual recursion respectively, and are fundamental to the language. Although modern Lisps make it easy to write non-recursive functions using LOOP, WHILE, UNTIL and other similar functions, older Lisp programmers are loath to use them. Nevertheless, recursion remains as important to Lisp as 'types' are to Pascal.

What *is* Lisp used for? Well, generally, anything that doesn't involve too much number-crunching; the obvious and almost *clichéd* applications being knowledge-based systems and artifical intelligence programs.

An introductory tutorial to Lisp was recently published in *PCW* (see 'Teach Yourself Lisp', July-December 1984), but having a book and a representative interpreter is by far the best way to gain familiarity with the language.

One recent interpreter for the QL comes from Metacomco of Bristol, which already offers a range of languages for this machine. The company now provides an assembler, an editor, a BCPL compiler and this Lisp system, and it is shortly to add ISO Pascal.

QL Lisp costs £59.95 and is supplied on microdrive cartridge with a fairly large manual and numerous example programs. This implementation is seen by Metacomco as a development system for learners and experimenters, as the company intends to release the very large Cambridge Lisp system as soon as enough additional RAM is available for the QL.

'Metacomco sees this Lisp interpreter as a system for the experimenter and the person who wants to know "what all the fuss about Lisp" is based on. It could be seen as an alternative to SuperBasic although it needs a certain frame of mind to leave the relative simplicity of SuperBasic behind . . .'

QL Lisp is based around the Lisp sold by Acornsoft for the BBC Micro and shares the same authors — Dr Arthur Norman and Professor John Fitch. It was written in BCPL and, like all Metacomco's products, will run concurrently with other QDOS tasks.

Obviously the use of this feature will decrease the amount of space available to Lisp, and it must be borne in mind that the interpreter grabs as much space as is available to it at the time of invocation. Therefore, if your intention is to run other jobs with Lisp, then these jobs must be loaded first. With no other jobs in the machine the interpreter has around 55k of heap space, which is more than reasonable.

When the interpreter has been loaded and activated it automatically loads a file called 'image' which contains all the predefined Lisp functions and variables, mostly written in Lisp. These functions are similar to the ones available with the BBC Micro implementation but more have been added to take advantage of the QL (and simply because a number of the functions not directly available in Acornsoft Lisp are undeniably useful).

The system also includes a full turtle graphics package which allows relatively simple implementation of complex graphic problems — although Lisp does have the problem of being thoroughly slow in this respect. As this version and the Acornsoft one are so close, the book for the latter system is very much applicable to this version too. Called *Lisp on the BBC Microcomputer* (Acornsoft) and written by Dr Arthur Norman and Gillian Cattell, it's available in most bookshops for £7.50.

The examples supplied with the interpreter are almost all taken from this book and hence full explanations are not to be found in the QL Lisp manual. Instead you are referred to Norman and Cattell.

To aid in the production of programs, this Lisp comes equipped with a comprehensive backtrace system, which details the cause of an error and the functions being executed prior to the error condition. An editor written in Lisp is also provided and, although seasoned Lisp fanatics will be quite familiar with it, novice users will find it frustrating. It takes a function (or whatever) as its argument and 'prettyprints' it onto the console. Various single-letter commands then allow the programmer to step through the function by treating it as a list. This means that it's relatively easy to edit particular sections of a function, but when the editor is confronted with the more convoluted examples of the *genre*, it becomes less useful. Metacomco is obviously aware of this, as the company has supplied a screen editor with the package.

Programs can be built up with this editor and added to the Lisp object list by treating the file as if it were keyboard input. This is most usefully done with the 'rdf' function, which also allows the output of any program to be sent to a designated file. File handling is in fact handled surprisingly well in Lisp, and all sorts of functions exist to open and close files, read and write characters, lists or entire files, and detect anomalous conditions such as end of file.

The list structure of Lisp also makes it ideal for constructing tree structures, such as those produced by compilers, so it should be an excellent language in which to implement other languages. Likewise, sorting and critical path problems would be easy to write. An example of the former is given in the Norman and Cattell book and is also supplied as an example file with the interpreter. Although Lisp itself is rather slow, this sorting function is capable of very efficient sorts — the entire object list can be sorted in just

over six minutes. Although this may sound slow, it puts many other interpreted languages to shame.

Metacomco sees this Lisp interpreter as a system for the experimenter and the person who wants to know 'what all the fuss about Lisp' is based on. It could also be seen as an alternative to SuperBasic . . although it needs a certain frame of mind to leave the relative simplicity of SuperBasic behind for the comparative complexity of Lisp. Give me 68000 assembly language any day — although that's rather unfair, as Lisp is a very powerful language which is quite easy to learn if you have the right tutor.

The example programs supplied with the interpreter are all excellent instances of the *genre* and include such things as a program to calculate the shortest distance between two towns, a mini-68000 'compiler-assembler', an adventure game, an animal guessing game and the aforementioned turtle graphics demonstrations.

The Cambridge Lisp system, which includes a compiler, will be further fun, as it's capable of compiling itself. This means that as it compiles it gets faster and faster as each piece of the interpreter is converted into 68000 machine code! QL Lisp, however, will almost always be slower than an equivalent SuperBasic program, but it's nevertheless capable of doing most of what SuperBasic can do. It includes functions to deal with the more esoteric of the QL's facilities, such as windowing and general screen-handling, and it can handle integers up to 28 bits long, which gives it a range of −134217728 to 134217727. Coupled with the arithmetic functions PLUS, DIFFERENCE, TIMES, QUOTIENT and REMAINDER, it is also quite possible to do more mundane mathematical routines in Lisp.

Another important feature of Lisp is its ability to associate properties with variables, so things like an address book wouldn't be too difficult to write. A problem is that the parenthesis is rather important to the language and it will in most cases print out a property list as just that — a list in brackets. Printing routines and other functions can get round this but it's rather disconcerting for the novice Lisp programmer to see the output of his first Lisp programming attempt appear like this:

((Smith) (John) (16 Nowhere Street) (Berwick))

and might even persuade him to stick to paper for his list of addresses!

As far as Lisp is concerned a function is just another list which may or may not be evaluated, which is why (edit myfunction)) will produce the desired effect and so will (myfunction a b). If we had typed (edit (myfunction)), then the editor will fail with an error, as enclosing the argument (myfunction) in brackets causes it to be evaluated before being passed as a parameter to edit.

This causes the invocation of myfunction, which will obviously produce the wrong results.

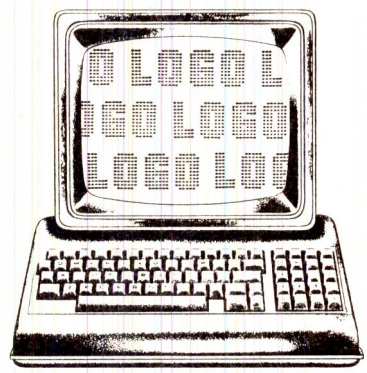
QL Lisp can be activated with either EXEC or EXEC_W and will then load the main core of the interpreter. From here the option is given to change the size and position of the window which the interpreter will use and then the current image is loaded. This could be a user image or the standard one supplied. An installation program is provided to set up the window defaults before the system is loaded for both the editor and the interpreter, obviating the need to move the window each time the system is used.

CONCLUSION

At £59.95 the whole package may look a little expensive, but this is only because Acornsoft sells its BBC Micro version for considerably less. In general Lisp systems are far more expensive than this.

For example, the CP/M-68K version of Cambridge Lisp costs $500, which is about £400, although when Metacomco supplies this product for the QL it's unlikely to cost that much. Metacomco explains that the price will be scaled in accordance with comparable software costs.

For the QL owner who knows Lisp, then £60 is the only outlay required, but the novice will need to buy at least one book to augment the product. In the long run it's got to be worth it, as long as potential purchasers can assure themselves of applications for it.



Julian Pixton of the Walsall Logo Project looks at three versions of Logo for the BBC Micro.

In terms of ancestry and structure Logo is closely related to Lisp: both can manipulate lists in many different ways. A full implementation of Lisp contains many features not found in Logo, but the language is much harder for a beginner (non computer science graduate) to learn. As well as being a very friendly and powerful problem-solving environment in its own right, Logo offers the average person an outstanding way of learning Lisp.

Logo is a structured language, like Pascal and C. It does not have line numbers — you can organise instruction sequences into procedures which can be invoked by name. The interpreter relies solely on the logical structure of the written procedures rather than on line numbers.

Until recently, the only versions of Logo available ran on mainframes using a great deal of memory. In the last few years, thanks to the pioneering work of Seymour Papert and his colleagues at the Massachusetts Institute of Technology in Boston, there have been implementations for a variety of 8-bit micros, notably the Apple and Atari, which tried to offer a usable subset of Logo within 64k. But things moved more slowly for the BBC Micro in the UK.

Faced with the seemingly random educational policy of Acorn, two versions of Logo have been commissioned: one from the Open University — marketed by BBC Enterprises as the 'official BBC Logo'; and one written by LCSI/SOLI in Paris and marketed by Logotron Ltd of Loughborough. Now, belatedly, an offering from Acorn itself has arrived. The Open University implementation is written in assembler and comes on two 16k ROMs — estimated price is £69.95. The LCSI version is also in assembler, but comes on one 16k ROM and costs £59.95. The Acorn Logo is written in BCPL, comes on two 16k ROMs and costs £69.95.

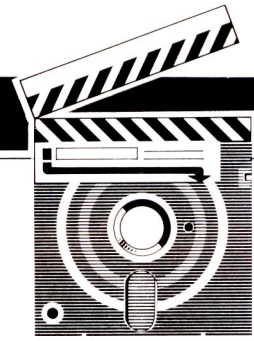
In discussing these three versions of Logo I will look at various features of the language and compare the way each offering implements those features.

Two of the implementations on test, Acorn and Logotron, share a broadly similar syntax, known as the LCSI standard. It is possible to transfer Logotron files directly into Acorn Logo by using *EXEC and many simple procedures will run without alteration. Thus: SIZE would be interpreted as the value of a variable called SIZE, "SIZE would be interpreted as a literal name and SIZE would be interpreted as a defined procedure. While this apparently odd syntax can initially confuse beginners, it's soon accommodated and offers a powerful precision which is lacking in implementations which try and make things easier for the beginner. The Open University version has done away with the convention of having a preceding colon to denote the value of a variable. There is little evidence to suggest this makes anything easier for beginners, but it does lead to immense confusion when reading procedures written by others. It becomes impossible to distinguish between variable names and procedure names, save by noting the context in which they occur.

Here are some examples of lists (note that in Logo lists are delimited by square brackets).

[HAMMER SCREWDRIVER PLIERS SAW]; list of four objects

[A B C D E F G]; list of seven objects



SCREENTEST

[1 2 3 4]; list of four objects
[[TEMPERATURE 103] [PRESSURE [120 60]] [PULSE 72]]; list of three objects, each of which is another list containing a mixture of objects.

The command FPUT allows you to add an object to the front of a list, that is:
FPUT "HELLO [JOHN GOTTA NEW MOTOR]
yields the list
[HELLO JOHN GOTTA NEW MOTOR]
LPUT "END [THIS IS THE]
yields the list
[THIS IS THE END]

'The fact that both Acorn and Logotron are selling 10 ROM sets and documentation to schools and colleges for approximately £300 makes Logo a practical alternative to Basic as a teaching and learning language.'

A list may be created from individual objects using the LIST command.
(LIST "FRONT "MIDDLE "END)
yields the list
[FRONT MIDDLE END]

The SE (SENTENCE) command can glue together any combination of words numbers and lists.
SE [HELLO JOHN] [GOTTA NEW MOTOR]
would yield the list
[HELLO JOHN GOTTA NEW MOTOR]
(SE "NAME [ARTHUR DALEY] "OCCUPATION [DEALER IN HIGH CLASS GOODS] "AGE "UNKNOWN)
would yield the list
[NAME ARTHUR DALEY OCCUPATION DEALER IN HIGH CLASS GOODS AGE UNKNOWN]

Given a list, you can extract its first object using FIRST (analagous to CAR in LISP) and extract everything but the first object with BUTFIRST (analagous to CDR in LISP).
FIRST [NAME AGE OCCUPATION]
would yield the word "NAME
BUTFIRST [NAME AGE OCCUPATION]
would yield the list
[AGE OCCUPATION]

The commands LAST and BUTLAST operate in the same way from the other end of a list. Thus the Logo list is the fundamental data object. It is a far more powerful tool for modelling abstract structures than, say, the array in Basic. One particularly attractive feature is that list elements can be any type of object, numbers, words or lists, whereas array elements must usually be all the same type, and their extent has to be pre-declared. It should be realised that all programming activity in Logo involves the construction and destruction of lists, since there is no distinction between programs and data. This may be a largely unconscious activity, as in a young child doing turtle graphics, or a more conscious one as older learners attempt to model a variety of more abstract structures.

The operations FIRST BUTFIRST and BUTLAST are best not viewed as the tools with which to manipulate lists but rather as the building blocks to construct such tools. If we had a list like:
[GOOD MORNING MARGARET SO NICE OF YOU TO COME]
and we wished to replace every occurrence of MARGARET with NEIL, we could construct a general purpose REPLACE procedure which would replace occurrences of any object in any list with another object. Something like:

```
TO REPLACE: OLDTHING:
NEWTHING: LISTNAME
IF: LISTNAME=[] [OUTPUT:
LISTNAME]
IF: OLDTHING=(FIRST: LISTNAME)
[OUTPUT FPUT: NEWTHING
REPLACE: OLDTHING: NEWTHING
(BUTFIRST: LISTNAME)] [OUTPUT
FPUT FIRST
:LISTNAME REPLACE: OLDTHING:
NEWTHING (BUTFIRST: LISTNAME)
END
```

So REPLACE "MARGARET "NEIL [GOOD MORNING MARGARET SO NICE TO OF YOU TO COME]
would yield
[GOOD MORNING NEIL SO NICE OF YOU TO COME]

```
TO BE
REPEAT 10 [PRINT REVERSE :HAMLET]
END

TO REVERSE :LIST
IF EMPTY? :LIST [OUTPUT []]
OUTPUT LPUT FIRST :LIST REVERSE BF :LIST
END


MAKE "HAMLET [THEM? END OPPOSING, BY AND TROUBLES,
OF SEA A AGAINST ARMS TAKE TO OR FORTUNE, OUTRAGEOUS OF
ARROWS AND SLINGS THE  SUFFER TO MIND THE IN NOBLER TIS
WHETHER QUESTION. THE IS THAT BE, TO NOT OR BE TO]
```

HAMLET: the TO BE procedure simply reverses the list: HAMLET 10 times, using a recursive reverse procedure, and prints it to the screen

All the Logo versions under review implement the standard list-handling features, although Open Logo does not have a SENTENCE primitive. It has some fundamental differences in the way it deals with variables. It incorporates useful things like dynamic lists, which are evaluated into static lists. This is quite a nice feature. However, unlike the other versions, when the user workspace is saved to disk, global variables are not included as part of the file. Couple this with the fact that existing global variables cannot be manipulated in the editor, and you have a pretty unfriendly system. While considering files, only Logotron Logo incorporates the primitives SETREAD and SETWRITE which allow files to be opened, read and closed. This is a major omission from both Acorn Logo and Open Logo.

Logo provides you with a full screen editor to write, change and amalgamate procedures. This should operate in the same way as any text editor, allowing you to move a cursor around the screen in order to insert characters or to add or delete lines. If a line contains more characters than will fit on a

```
TO SIEVE :NUMBER
PRINT SIEVE.OF.ERATOSTHENES ON.ALL.DIGITS.UP.TO :NUMBER
END

TO SIEVE.OF.ERATOSTHENES :LIST
OUTPUT IF EMPTY? :LIST [:LIST] [SE FIRST :LIST SIEVE.OF.ERATOSTHENES PRIME? FIRST :LIST :LIST]
END

TO ON.ALL.DIGITS.UP.TO :THIS.NUMBER
MAKE "DIGITS 1
REPEAT :THIS.NUMBER - 1 [MAKE "DIGITS SE :DIGITS 1 + LAST :DIGITS]
OUTPUT BUTFIRST :DIGITS
END


TO PRIME? :NUMBER.BEING.TESTED  :LIST.OF.NUMBERS
IF EMPTY? :LIST.OF.NUMBERS  [OUTPUT []]
MAKE "DIGITS ( FIRST :LIST.OF.NUMBERS ) / :NUMBER.BEING.TESTED
OUTPUT SE ( IF :DIGITS = INT :DIGITS [[]] [FIRST :LIST.OF.NUMBERS] ) PRIME? :NUMBER.BEING.TESTED BF :LIST.OF.NUMBERS
END
```

The SIEVE procedure uses ON.ALL.DIGITS.UP.TO to create a list of integers from 2 to :NUMBER, which is then passed to SIEVE.OF.ERATOSTHENES. This proceeds to eliminate all multiples of the first element of the list using PRIME? and collect any resultant primes into a list

screenline, the text should wrap around while preserving its integrity as a logical line for the interpreter.

The Open University editor is restricted to MODE 7. This results in all square brackets being displayed as teletext arrows, a thoroughly unsatisfactory state of affairs. It is also the only editor that did not work with the ARIES B-20 RAM board, a major fault in my opinion.

It was also incompatible with the 6502 second processor. I understand an alternative disk-based version of Open Logo will be made available specifically for use with the second processor. Unfortunately Open Logo allows only one procedure at a time in its editor, so it is impossible to undertake fundamental problem-solving activities such as splitting one procedure into several (or vice versa) as both of the other versions allow. Having said that, however, it is a well organised full screen editor, incorporating a help window which operates in conjunction with the red function keys, and is very pleasant to use. In each of the editors, line length is limited only by the size of the editor buffer (typically 1000-1500 characters).

```
TO TREE :SIZE :ANGLE :LEVEL
IF :LEVEL = 0 [STOP]
LEFT :ANGLE
FORWARD :SIZE * 2
TREE :SIZE :ANGLE :LEVEL - 1
BACK :SIZE * 2
RIGHT 2 * :ANGLE
FORWARD :SIZE
TREE :SIZE :ANGLE :LEVEL - 1
BACK :SIZE
LEFT :ANGLE
END

TO WILLOW
PENUP
BACK 150
PENDOWN
TREE 40 15 8
BACK 150
END
```

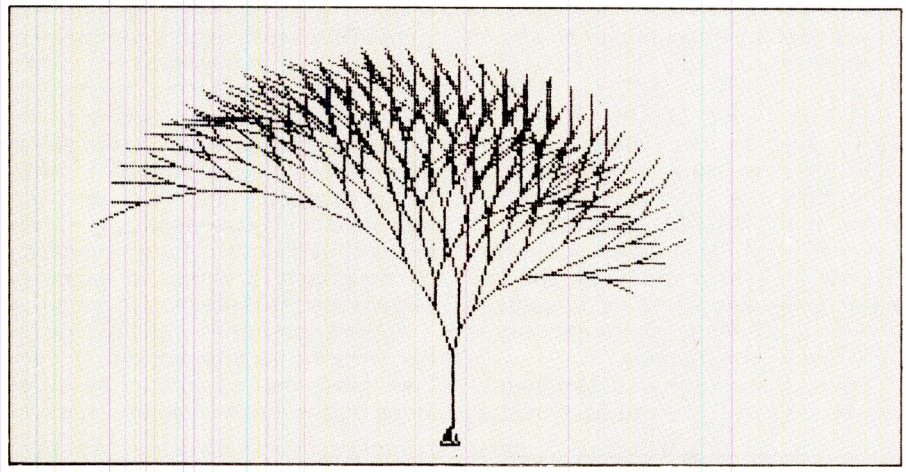
WILLOW: a recursive tree-drawing program with a little skew introduced to make it more attractive

The Acornsoft editor is restricted to MODE 6 on the standard BBC machine, and can take the best part of half a minute to fill up with text. This can be immensely irritating when a group of procedures are being continually edited. It is due to the fact that to try and speed up the run time performance of what is a sluggish system, Acorn Logo compiles procedures the first time they are interpreted. To combat the consequent memory problems of having textual procedures and compiled procedures in memory at once, the text is handled in a tightly tokenised form. Thus whenever a procedure is read into the editor, it has to be de-tokenised and hence the slow filling of the edit buffer.

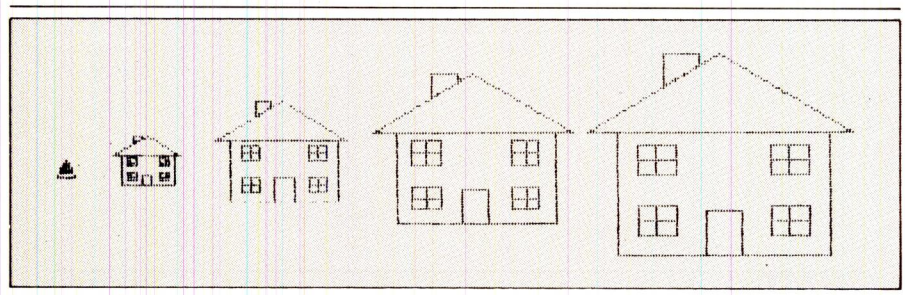
The Logotron editor is delightful to use. It will operate in any mode, given sufficient free memory, and has a number of innovative features. It utilises a kill buffer, similar to the one found on the Open University system, which enables a line of text to be deleted at one place and inserted elsewhere. It also has FIND and FIND and REPLACE facilities which you soon realise you can't manage without. In addition, the Logotron advanced Logo extension offers a primitive called SETEDIT, which allows the size of the edit buffer to be expanded, particularly useful when using the 6502 second processor.

All the versions of Logo have aids to assist in the debugging of procedures. Logotron has a TRACE primitive which prints out inputs and outputs of running procedures. It offers STEP and DEBUG on an extension. Open Logo has two primitives WALK and BUG. WALK allows a procedure to be single-stepped, and BUG prints out the value of any variable whose assignment changes. By far the most powerful and comprehensive debugging facility is offered by Acorn Logo. It incorporates a TRACE primitive that offers an almost limitless combination of options. This is by far the best Logo debugging package I have seen.

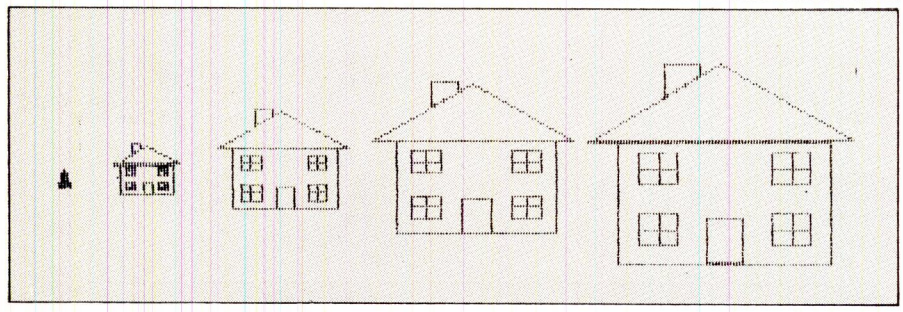
Because it is impossible to fit all the primitives offered by a full version of Logo onto a micro, it's useful to incorporate a facility to load language extensions into the computer as and when they are needed. This can cope with a variety of requirements: from driving floor turtles and other robotic devices to incorporating screendump routines and adding further primitives to the language. Open Logo has a



Example of the WILLOW tree-drawing program



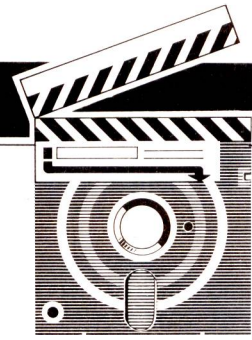
Paul Anderson's recursive STREET scene



Another example of the STREET scene procedures

Benchmarks

Test	Logotron Logo	Open Logo	Acorn Logo
SIEVE	18secs	34secs	50secs
HAMLET	9secs	25secs	55secs
WILLOW	2mins 3secs	7mins 1sec	3mins 13secs
STREET	49secs	3mins 29secs	1mins 22secs
Average	49.75secs	172.25secs	95secs



SCREENTEST

documented facility to interface with external devices like a floor turtle.

Acorn Logo comes with a disk holding a number of printer and turtle drivers, and a range of language extensions such as the MOS primitives which interface with machine code, MULT primitives which allow multiple turtles, CALC which contains advanced mathematical functions, PROP which is a property list extension, and so on.

Logotron Logo incorporates a powerful USE facility which allows similar extensions to be incorporated. There is a ROBOT module to drive a floor turtle, and an ADVANCED module in preparation which incorporates primitives to directly set the Accumulator and X and Y registers, REDEF, HEX, FILL, SETTIME, DEBUG, STEP, ADVAL, SETITEM, BUEY, LOCAL, TEXT, DEFINE, and so on. There are also .RESERVE, to chop a hole in Logo nodespace for machine code programs, and .INSTALL which allows a user selected list of advanced primitives to be loaded into RAM. This is a particularly nice touch on a machine like the BBC Micro where memory is very much at a premium.

Open Logo comes with a beginners' guide and a reference guide, which, as you would expect, are comprehensive and well written.

The reference guide explains in great detail how the system works, up to how Logo's mathematical routines can be used by assembly language programmers. This is to be highly commended, and contrasts greatly with the accepted practice of most software companies.

Logotron Logo comes with a helpful beginners manual and a full reference manual, which explains each primitive in the language and gives some imaginative context examples. The loose leaf manuals suggest future expansion to document a range of language extensions, the Sprite board, and so on.

Acorn Logo comes with three manuals: an introductory booklet, a reference guide and a guide to the extensions and examples which come with Acorn Logo. Again this is comprehensive and useful.

Speed is very important in list processing. Nothing is more frustrating than waiting for the machine to move objects around lists. To give the versions of Logo on test a good workout, I ran a recursive SIEVE.OF.ERATOSTHENES procedure with an input of 50 which gives any micro version of Logo a great deal of work to do.

CONCLUSION

Open Logo's strong points are its reference documentation and beginners' tutorial manual. The range of built-in control structures is another plus, WHILE and CHOOSE (CASE) are available, and it incorporates an excellent flood fill feature, accessed via the PAINT primitive. Its weak points are the editor, which crashes with a silly error message when you attempt to *EXEC a text file into it, which allows only one procedure at a time to be manipulated (and doesn't handle global variables), the non-standard syntax which can lead to confusion in distinguishing between variable names and defined procedure names, the lack of compatibility with the second processor and expansion RAM boards, and the slowness of its graphics plotting.

Strong points in Acorn Logo are the wide range of primitives built into the system, the variety of extension materials which accompany the standard package, the superb debugging and trace facilities which are unequalled, to my knowledge, on any other micro implementation.

Its weak points are the extremely slow speed of list processing, which makes anything more than turtle graphics painful, the fact that Logo always reserves 10k for the screen memory, even when in MODE 7, thus cutting an already small workspace down to minuscule proportions, and the need to tokenise and detokenise procedures in and out of the text editor.

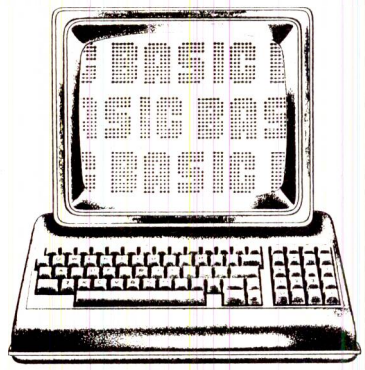
Logotron Logo's strong points are the consistently fast speed of processing, the advanced features of the editor, the fact that it only uses one sideways ROM socket, the power of the USE command for incorporating extensions to the language, the optional sprite board which adds 32 hardware sprites to Logo and the facilities to read and write data files. Its weak points are the lack of a multiple turtle facility without paying extra, the omission of a number of primitives due to lack of room on the ROM, (although they are included on the extension), and a feature of the WRAP screen that doesn't allow triangle plotting to work satisfactorily when using an input of 85 with the .SETNIB primitive.

The fact that both Acorn and Logotron are selling 10 ROM sets and

```
TO RECTANGLE :SIZE
REPEAT 2 [FORWARD :SIZE RIGHT 90 FORWARD :SIZE * 1.45 RIGHT 90]
END

TO SQUARE :SIZE
REPEAT 4 [FORWARD :SIZE RIGHT 90]
END

TO START
PENUP
SETPOS [200 -350]
PENDOWN
HOUSE 200
END

TO TRIANGLE :SIZE
FORWARD :SIZE * .61
CHIMNEY :SIZE
RIGHT 70
FORWARD :SIZE * .61
RIGHT 145
FORWARD :SIZE
RIGHT 145
END

TO CHIMNEY :VALUE
BACK :SIZE * .25
LEFT 55
FORWARD :SIZE * .15
RIGHT 90
FORWARD :SIZE * .13
RIGHT 90
FORWARD :SIZE * .057
LEFT 125
FORWARD :SIZE * .092
END

TO FRAME :SIZE
REPEAT 2 [REPEAT 2 [SQUARE :SIZE FORWARD
  :SIZE] RIGHT 90 FORWARD :SIZE * 2 RIGHT 90]
END

TO ALONG.TO.NEXT :AMOUNT
FORWARD :AMOUNT * 2.35
RIGHT 90
FORWARD :AMOUNT * .25
PENDOWN
END

TO DOOR :SIZE
FORWARD :SIZE * .45
PENDOWN
RECTANGLE :SIZE * .25
PENUP
END

TO WINDOW4 :AMOUNT
FORWARD :AMOUNT * .25
RIGHT 90
PENUP
FORWARD :AMOUNT * .5
PENDOWN
FRAME :AMOUNT * .125
PENUP
FORWARD :AMOUNT * .4
RIGHT 90
END

TO WINDOW3 :AMOUNT
FORWARD :AMOUNT * .25
RIGHT 90
PENUP
FORWARD :AMOUNT * .9
PENDOWN
FRAME :AMOUNT * .125
END

TO WINDOW2 :AMOUNT
PENUP
FORWARD :AMOUNT * .5
PENDOWN
FRAME :AMOUNT * .125
END

TO WINDOW1 :AMOUNT
RIGHT 90
PENUP
FORWARD :AMOUNT * .15
LEFT 90
PENDOWN
FRAME :AMOUNT * .125
END

TO ROOF :AMOUNT
LEFT 90
FORWARD :AMOUNT * .2
RIGHT 145
TRIANGLE :AMOUNT * 1.8
LEFT 145
BACK :AMOUNT * .2
RIGHT 90
BACK :AMOUNT * .85
END

TO WALLS :AMOUNT
RECTANGLE :AMOUNT
FORWARD :AMOUNT
END

TO HOUSE :AMOUNT
IF :AMOUNT < 50 [STOP]
WALLS :AMOUNT
ROOF :AMOUNT
WINDOW1 :AMOUNT
WINDOW2 :AMOUNT
WINDOW3 :AMOUNT
WINDOW4 :AMOUNT
DOOR :AMOUNT
ALONG.TO.NEXT :AMOUNT
HOUSE :AMOUNT - 50
END
```

STREET: a group of procedures which recursively draws a street scene. This Benchmark was contributed by 11-year-old Paul Anderson

documentation to schools and colleges for approximately £300 makes Logo a practical alternative to Basic as a teaching and learning language. This should signal a long overdue change in the world of educational computing, combating the current unhealthy obsession with technology for technology's sake and encouraging a fuller awareness of up-to-date models of thinking and learning. Logo is not just a computer language. The Logo communities in the UK, France and the US are nurturing powerful philosophies of teaching and learning that care about people first and computers second.



Nick Walker looks at Apple's own Basic for the Macintosh.

As a programmer who was seduced by the Apple Macintosh and its two applications programs, Mac-Write and Mac-Paint, I had doubts about programming languages for the Mac. Would it be possible to implement a language that uses the Mac's abilities as well as Mac-Paint does? And would the language provide access to those slick 'quick-draw' ROM routines, pull-down menus and other Mac niceties?

It was thus with a certain amount of trepidation that I received Apple's Mac-Basic. My copy was very much a pre-production version — the documentation was a photocopied rough draft and on numerous occasions I found myself with 'Macintosh has experienced a serious error' on the screen. But I did get a taste of the completed version.

Macintosh Basic arrives on one 3½in disk accompanied by a 200-page-plus manual. Upon booting up and reaching the menu screen you see a range of icons which feature Mac-Basic, the example program file and the empty file for storing programs. Position the cursor over the Basic icon, give the mouse a double click, and you're greeted by a single window awaiting your Basic program and a row of pull-down menus across the top labelled File, Edit, Search, Fonts and Program.

Program entry is via an editor that's closely modelled on Mac-Write, and a program created with Mac-Write will run under Basic. There are, however, a number of advantages in using the built-in editor. For example, all Basic lines that are terminated with a carriage return are checked for syntax, and if incorrect the Mac's traditional speech bubble-type error message occurs. These messages consist of a short English sentence, such as 'Not enough values for input list'. Further explanations of error messages can be found in the manual. The Basic keywords within a correct line are highlighted with a darker typeface which gives a rather elegant-looking program.

Mac-Basic also encourages you to indent lines, resulting in a program that is far removed from the jumble that can result from Basic programming.

Selecting File from the pull-down menus opens up the usual array of filing procedures — New, Save text, Save a copy, Print quick, and so on. The Edit and Search menus include all the functions you would expect of a good editor such as Find, Replace, Copy and Paste, plus a few Macintosh-specific commands such as COPY PICTURE which allows you to copy the output from your Basic masterpiece to the clipboard. Using all these, editing is greatly simplified by the onscreen prompts that appear within a small custom window.

The Fonts menu is less useful. I don't see the point of including seven typefaces in five sizes for program entry, but it might relieve the tedium of typing in a long program.

I had no problems when I entered a short Basic program and ran it, but when I added a line to be inserted at the start of the program it wasn't so successful. Line 5 stubbornly remained at the end of the listing after line 40. It was then I realised that this Basic was different: a proper screen editor and a Basic that realises line numbers for what they are — nasty, dangerous labels. If more Basics were to follow this trend, people wouldn't be tempted to create labyrinth-like programs and would actually have to think before using a GOTO. In fact, line numbers are redundant as it makes far more sense to create an alphanumeric label that's meaningful in the context of the program.

Having acclimatised to Basic without line numbers, I ran a number of simple programs. It's all there — GOSUB, GOTO, REM, PRINT, and so on — very good, very standard and not very exciting. Time to refer to the manual (which promises to be a thorough if not over-friendly document) and look for something interesting. I wasn't disappointed.

In addition to the traditional Basic control structures, there are a number of different and better ones.

First of all there's a DO . . . LOOP which is slightly unusual in that no condition can be applied to either the DO or the LOOP. The exit condition must be expressed as an IF statement within the body of the loop ending in the statement 'EXIT DO'.

'Two miscellaneous niceties of Mac-Basic are a number of SET option environmental controls, which bring Mac-Basic into line with the IEEE standard for floating point arithmetic, and the ability to put comments on the same line as source code.'

As an alternative to GOSUB there's a CALL and SUB mechanism, the advantage being the ability to pass parameters. Both single and multi-line functions can be constructed, and the standard test of recursion worked without problems.

At a higher level it's possible to call another program via PERFORM. Once again it's possible to pass parameters, and sadly it's only at this level that local variables can exist. This program calling provides a rudimentary form of module organisation, but it should under no circumstances be confused with multi-tasking.

With regard to decision constructs, the IF . . . THEN construct can, of course, be extended to a full IF . . . THEN . . . ELSE . . . ENDIF, and there's a comprehensive CASE statement. Probably the most surprising and most useful (especially when dealing with, say, the mouse) is WHEN, which incorporates interrupt-handling into a program. So, it's easy to say

```
WHEN (The mouse moves)
(Deal with mouse)
ENDWHEN
```

and construct an entirely interrupt-

Data type	Symbol	What it holds
Boolean	~	True/false
String	$	Sequence of characters
Character		ASCII character number
Pointer	]	Address in memory
Handle	}	Pointer to pointer
Double-precision real	(none)	15-digit accuracy up to 1E+308
Single-precision real	!	Seven-digit accuracy up to 1E+38
Extended precision real		19-digit accuracy up to 1E+4932
Short integer	%	Four-digit accuracy up to +32767
Comp	#	18-digit accuracy up to +1E18

Fig 1 Mac-Basic data types

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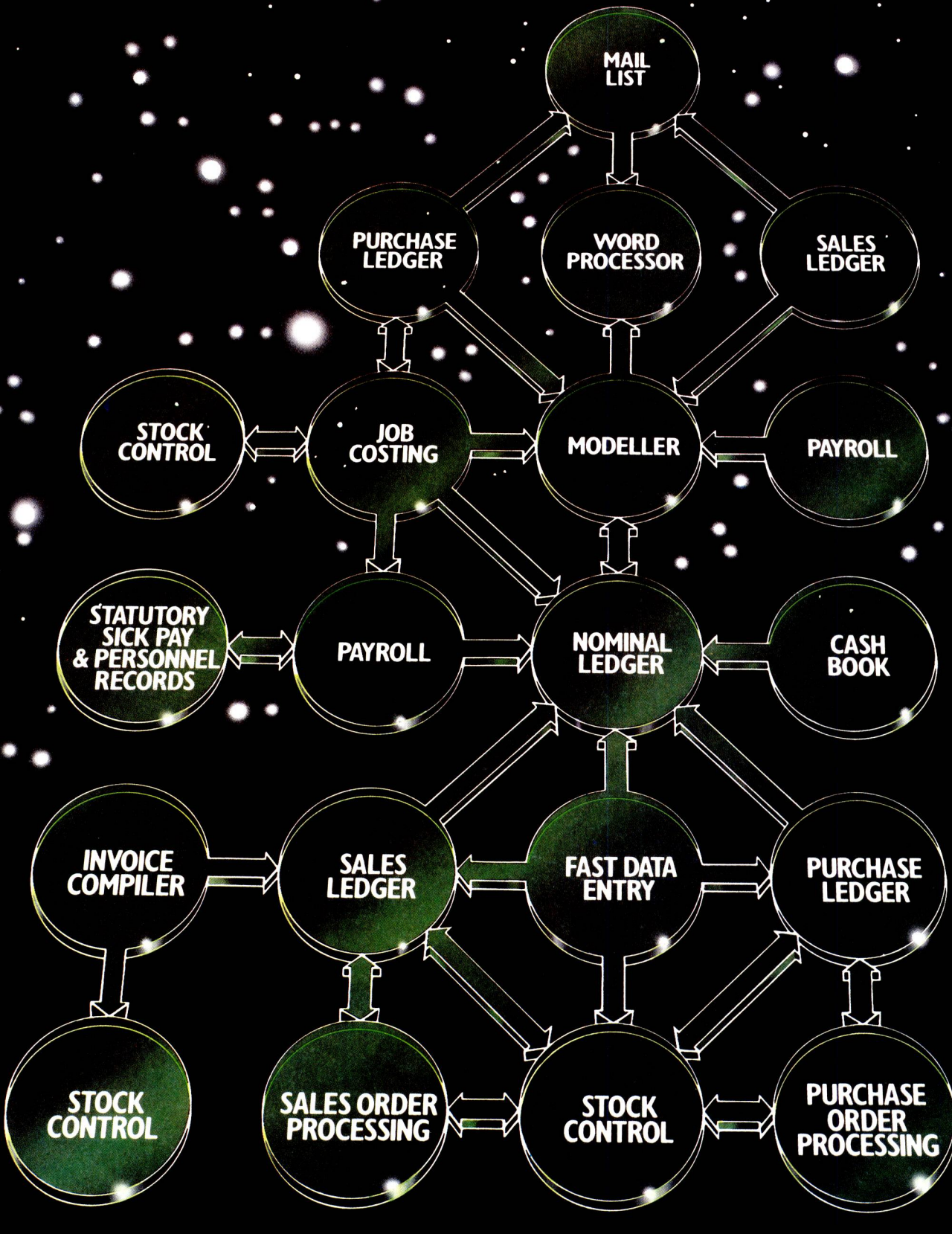

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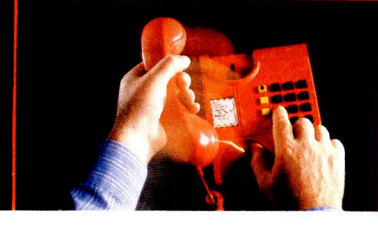
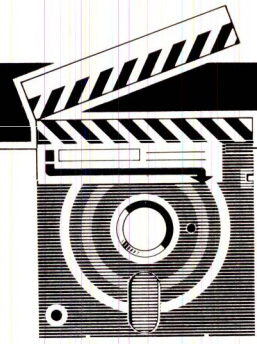




SCREENTEST

driven mouse handler.

Two miscellaneous niceties of Mac-Basic are a number of SET option environmental controls, which bring Mac-Basic into line with the IEEE standard for floating point arithmetic, and the ability to put comments on the same line as source code.

Mac-Basic scores over other dialects of Basic in its data typing (Fig 1). No fewer than 10 different fundamental data types are incorporated, each distinguished by a terminating character on the variable name as in BBC Basic.

There is also a vast array of built-in functions — 34 numeric functions and 12 string functions, excluding Macintosh-specific functions. Four logarithms, three exponents and business functions such as ANNUITY and COMPOUND are among this comprehensive collection.

'Mac scores over other dialects of Basic in its data typing. No fewer than 10 different fundamental data types are incorporated, each distinguished by a terminating character on the variable name . . . '

It's Mac-Basic's specific functions that are the most interesting. Three things that strike me as being essential in a programming language for the Macintosh are: the ability to read the mouse; control of the windows and the graphics within them; and access to the user-definable pull-down menus. Two functions to read the mouse button, and two that return the position of the mouse within a window provide the necessary information for mouse-driven programs.

Providing you're willing to stay within the confines of output windows, the window and graphics commands are excellent. Briefly, PLOT displays individual pixels and lines, and RECT, OVAL and ROUNDRECT display rectangles, ovals and rounded rectangles respectively. The speed at which these are drawn convinces me that these are calls to the respective ROM routines. You can fill outlines with a variety of patterns using PATTERN, and can also invert(INVERT), outline(FRAME) and erase(ERASE) them.

Graphics are drawn by an imaginary pen. PENPOS determines this pen's position within a window, and PENSIZE determines the size of a single mark or dot. PENMODE can provide hours of fun by performing logical operations upon the overlaying of two patterns.

A GPRINT statement allows the selection of a font from those available.

SET options are also used to control the size of the outputs window, with SET OUTPUT determining the size and position of the window and SET LOCATION defining the area to which the graphics displays are limited.

The most interesting of the window commands is SET SCALE, which determines the logical range of coordinates that Basic uses to draw graphics. Drawings can be made to dynamically grow and shrink. One drawback is that no immediately obvious links are available to the pull-down menus and icon design, which limits Basic in terms of large, system-like applications.

The sound commands are less essential. The SOUND statement has parameters for Pitch, Amplitude and Duration. Easy access to Ptolemy's diatonic scale (A,B,C,D,E,F and G) is provided by the TONE command which returns corresponding pitch values.

With all this programming power provided from Basic there's usually one thing that suffers — speed. Even with a full-blown 68000 I was convinced that it would be below par. Not so, because of the way Mac-Basic translates your program into a runnable form.

Mac-Basic hangs on to the 'interpreted' label by the skin of its teeth. Lines are tokenised upon entry, as with any good Basic. However, selecting RUN from the aforementioned Program menu results in the program being further compiled down (see the Benchmarks in Fig 2). The Benchmarks are more than acceptable for a version of Basic, and encroach into the realms of Pascal and Forth.

Further commands on the Program menu are GO and HALT, which resume and stop execution of a running program respectively; RUN ANOTHER, which allows simultaneous running of either multiple copies of one program or of different programs; and the opportunity to save the binary form of a program.

The Program menu also contains a set of debugging options. When you enter the debugger, a tracing finger follows program execution by moving to the line that Basic is currently executing. There are three tracing modes: Step, to single-step the program; Trace, which runs the program at normal speed with the tracing finger; and the most useful, Block Trace, which lets you trace at full speed within control blocks and one line at a time outside control blocks. Although the finger (graphically drawn complete with shirt cuff and jacket) looks rather like a gimmick, it's useful when you're debugging programs.

'The most interesting of the window commands is SET SCALE, which determines the logical range of coordinates that Basic uses to draw graphics. Drawings can be made to dynamically grow and shrink.'

Another option, Show variables, creates a window called Variables and displays the names of all the simple variables in the program, and their current values, while the program is running.

CONCLUSION

Although Mac-Basic has its heritage within the Basic environment, it would be unfair to call it just another Basic dialect. I have reservations about calling it Basic at all: it seems as though a group of C programmers have got together and created the Basic they would like to see. Apple has turned programming languages upside-down: while Mac-Basic is very nearly compiled and very fast, Mac-Pascal (usually a compiled fast language) is interpreted and consequently slow.

Previously I've only considered Basic as a prototype tool to try out ideas before converting them to another language. Mac-Basic is not only ideal in this respect, but could also be used to implement something more serious. My only reservations are the lack of menu control and icon design (Microsoft's Macintosh Basic has provision for these).

Overall, Apple has done an excellent job in turning the Macintosh into a Basic programming environment. If more companies were to follow suit, perhaps Basic programmers might be cured of their bad habits and start to produce structured, understandable code. END

Benchmarks

BM1	0.24
BM2	0.65
BM3	6.00
BM4	6.4
BM5	7.1
BM6	8.6
BM7	15.9
BM8	52.3
Average	12.15

Fig 2



SCREENTEST

WordStar 2000

WordStar has been criticised for its complexity, but there's no denying it's a powerful package. WordStar 2000 purports to be much more user-friendly. Kathy Lang reports.

WordStar has been the market leader in word processors for several years now. A very large number of users are familiar with it; most swear by it, but a substantial proportion swear at it — at least at some of its more irritating idiosyncrasies. As a regular user, I too have a long 'wish-list' of features that I would like to see improved or added. So it was with considerable interest that I set about investigating MicroPro's new offering, WordStar 2000.

As is so often the case, there are many significant improvements — but there is also some bad news for existing WordStar users. Among the many plus points are some much-needed and well-handled improvements to the ruler features, a better way of showing emphasis (emboldening and underline) on the screen, the ability to underline spaces (if you must use underlining), to check spellings as you type, to display text from several parts of a document or from several documents alongside one another in windows, and a host of other improvements.

Among the less helpful features are some significant changes to the command sequences used to activate identical functions — for example, all block movement is now activated via sequences which begin with the character CTRL/B, rather than with the familiar WordStar CTL/K — so longstanding users will have some unlearning to do. Most of the common features are, however, implemented through function keys. There are other changes which some at least will think for the worse, especially if you normally use 12-pitch type wheels. Nevertheless, I suspect that for many existing users the worst news will be that, at the moment, WordStar 2000 is available only on the IBM PC.

Popular though WordStar has been, there are many people who have never tried it, and many others who dislike its complexity. For them, the new product will be of interest *per se*, not as an improvement on WordStar as it now is. To try to suit both groups, I have concentrated here on looking at WordStar 2000 as a word processor in its own right. In Fig 1 you will find a summary of the most significant differences (good and bad) from its predecessor. (The use of that word should not be taken to imply that WordStar 2000 is intended to replace WordStar — the extent of the customisation needed means that WordStar 2000 will probably never be available on all systems, but only on the most popular.) In a later issue of *PCW*, I hope to provide some help for existing WordStar users.

Drawbacks
Major changes to CONTROL keys
Reduced flexibility with line height and pitch
Mismatch between ruler and text on 12-pitch documents
No justification onscreen (though line endings are correct)
No indexing yet

Improved facilities
Undo
Stored rulers, tabs and indents
Windows — especially good for repeated text
Lots of extra function keys
Abbreviations
More direct cursor movement
Arithmetic
Column sorting
DOS directories usable through Path command
Automatic reformatting
Emphasis shown on screen
Excellent onscreen Help
Better footer and header features
Footnotes
Conversion to and from WordStar

Fig 1 WordStar 2000 for WordStar users

Editing facilities

Cursor movement in WordStar 2000 is flexible and fast. You can move by character, word, line, to the start and end of line, screen, block or document, and to a specific page or point in the file containing a particular character string. For most of these movements, a single function key or a function key used with CTRL is needed, if you use the usual keyboard set up by WordStar 2000. You can also move to previously marked places in the document. All these movements involve moving the cursor, and perhaps the text too. There are some limitations on their use: in particular, the command to move the cursor down a screenful does not have any effect if you are at the end of the document already. So, if you are adding text at the end of a document, and don't like entering it all on the bottom line, you must use the single-line scroll to shift text up every 15 lines or so.

WordStar 2000's normal mode of working is Insert mode, so that new text is automatically inserted, rather than overtyping existing text. You can alter this during editing — for example, when editing tables — or you can change the normal mode to Overtype — this is an option when you first install the system.

Text can be deleted by character, word, line, part of line, and block. The deletion of characters uses the two PC keys correctly — that is, backspace is, as it is in DOS, a destructive backspace, while DEL deletes the character above the cursor. For those who change their minds, the UNDO command could be a life-saver — you can use it to restore the most recent deletion done (except for deletions of single characters).

A powerful search-and-replace function is provided, which allows repetitive searching and replacement with a variety of options including the ability to search for end of paragraph. The searching is invoked through a set of

question-and-answer prompts.

Blocks of text may be moved or copied within a document, or written out to a separate file. You can also use the window facility to view the section of text you want to copy from one part of the document together with the section into which it is to be copied. Care has to be exercised when working in this way, however, since you may only edit and save the text version in one of the windows, but provided you are sensible about it this could be a very valuable feature.

It can also be used to view parts of two or three different documents; this could give you ways of handling standard paragraphs. You could also use it to, say, import a spreadsheet table into a report, provided your spreadsheet can send printable output to a disk file.

When you have done some editing, you have the ability to save the file and return to the main menu, to save and continue, or to abandon. It is unfortunate that the function key for ABANDON is placed (on the PC) between the SAVE AND END and SAVE AND CONTINUE keys. You are, it's true, asked to confirm that you want to abandon, and you could, of course, change the function key assignment through the installation procedures—but personally I think it would have been better to keep ABANDON well away from SAVE in the first place. Editing is in fact done on a copy of the file; when you save, the oldest version is deleted, the version from which editing began is renamed ".BAK", and the edited version becomes the current version. There is thus reasonable protection against mistakes, provided you don't keep re-editing a file when something appears to have gone wrong.

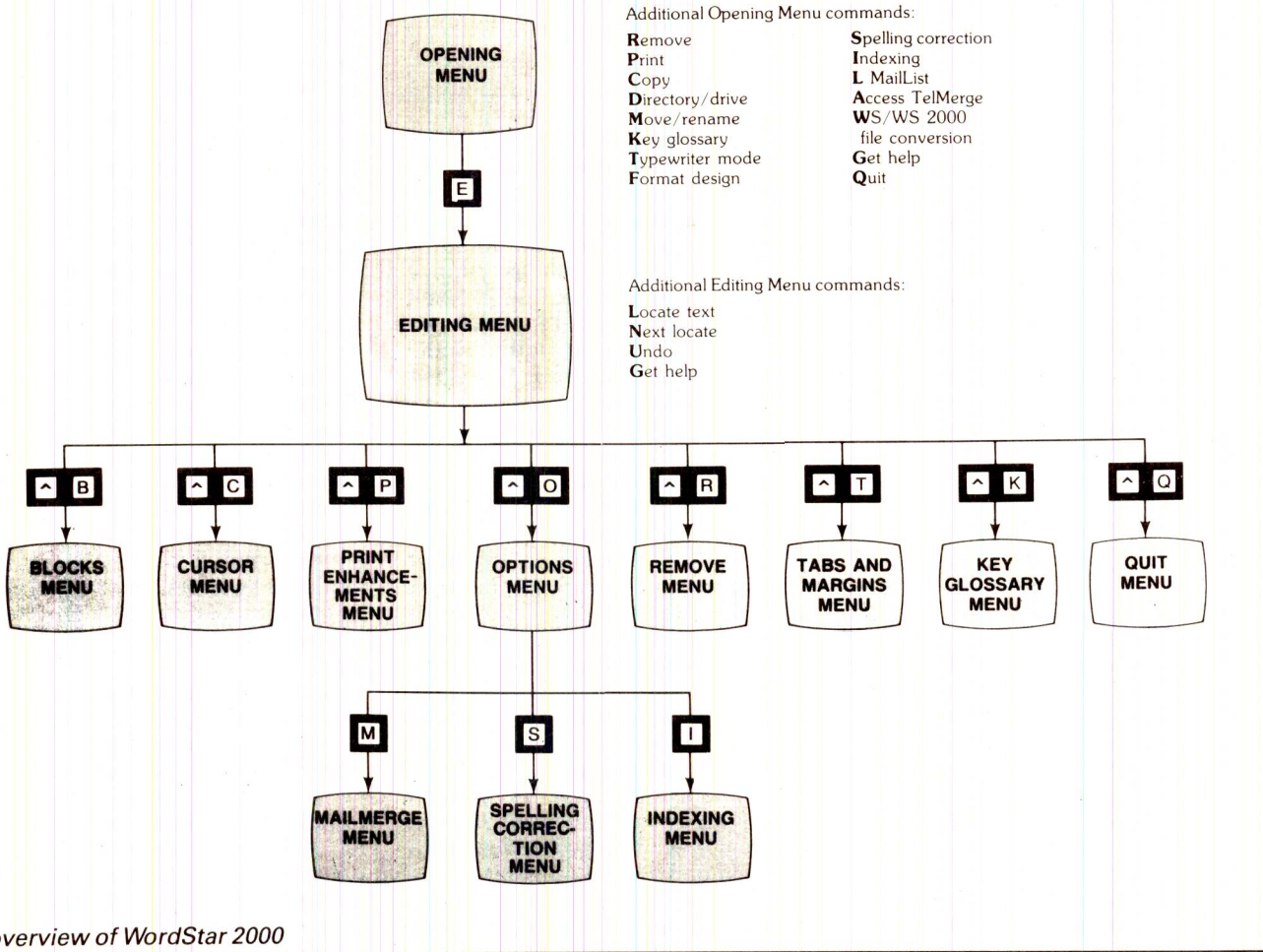
Text formatting

The handling of text formatting is a mixture of the excellent and the downright silly — though if you always print in 10-pitch, you will not notice the silliness at all. The excellent features include the basic ruler, margin and tab facilities. Text may be between 10 and 240 characters wide; where the text exceeds the screen width, you can inspect parts of lines by 'sideways scrolling' — as the cursor moves across the screen, the screen 'pans' over the document so that the text under the cursor is always visible. When you change margins — by pressing a function key and responding to a request for the column number to be used, for which the default is the cursor position when the request was made — WordStar 2000 automatically sets up an appropriate ruler line, which is embedded in the text, stored in the document, and activated when the cursor passes through the ruler.

This approach extends to the provisions for indenting paragraphs. When one or more tab markers have been set in the ruler line, you can request that the left margin, or both left and right margins, are indented to the tab markers. This indentation stays in force until it is turned off, or until a further indentation is requested; as with margins, WordStar 2000 remembers the position of the indent, and activates it automatically. Indenting is indicated in the current ruler line by a colour change, one of many which you can adapt to your own tastes through the installation process.

As text is entered, inserted and deleted, WordStar 2000 automatically reformats text to the current margins. Many people will regard that as good news. I have mixed feelings, because while it is good not to have to remember to request reformatting when editing 'on the fly', it is bad, when you are editing from a printed draft, to lose the relationship between the way the current paragraph is displayed on the screen and the draft print version.

The form of the current ruler is displayed at the top of the screen; rulers embedded within the text are displayed only on request, along with other formatting controls, such as emboldening, justification, headers, footers and so on. This is on the whole a helpful approach, but it can lead to problems when moving blocks of text. It is advisable to turn the display of text controls on before moving or deleting blocks of text, because the controls are physically part of the text, and may be moved with it — in some circumstances, with undesired effects, such as



An overview of WordStar 2000



SCREENTEST

a complete reformatting of the rest of the document. You cannot, however, delete format controls unless they are visible.

Vertical spacing in WordStar 2000 is controlled in two ways. When you create a document, you specify which format file is to be used with it. This file contains information about the page length to be used when printing the document, the number of lines per inch (restricted to whole numbers), whether hyphenation is to be automatic, and the pitch of the typewheel to be used. This information is used to ensure that pagination is correctly shown; the current page, line and column number are shown on the line above the current ruler at the top of the screen, and, if you request it in the format file, a slotted line appears on the screen where each page break will be. Line spacing may be changed while editing, and if it is, then pagination will correctly reflect these changes. In addition to the pagination supplied by WordStar 2000, you can specify that a particular number of lines must be kept together, or that a page break must take place.

Tabular formats are provided in a similar manner to indenting — that is, you set up the positions in which you wish the tabs to appear. If you use the TAB key to move to the start of each column as you enter figures, then if the tab settings are subsequently changed, the layout is changed to match. Table columns can be manipulated as blocks; they may be moved, or sorted in ascending or descending order, or, if they contain numeric values, be used in calculations.

All these features work very well, provided you are working with text which is to be printed on a 10-pitch type wheel. If you wish to use another typeface — for example, the 12-pitch format which is common in the UK — there are some drawbacks. The ruler lines are dimensioned, not in character positions, but in terms of tenths of an inch. In order to get your document printed correctly, you must specify in the format file that you require 12-pitch; the right margin should be set in terms of the number of inches of text width, specified in characters assuming 10 characters per inch. The ruler line will then show as a bar divided into sectors, whose dividing numbers represent not tens of characters but inches. The text will, however, extend beyond the ruler to occupy the appropriate number of actual character positions. To quote the WordStar 2000 Reference Manual:

'The ruler line that appears onscreen is set up for a 10-pitch font (10 characters per inch). If you select a 12-pitch or narrower font, the text will not align with the ruler onscreen but line breaks will occur in the same place onscreen and on the printed page. If the left margin is at column 1 and the right margin at column 60, 60 characters of 10-pitch and 72 characters of 12-pitch text fit in each line onscreen and on the page.' (p60)

This approach has the merit that if you change pitch within a document, you do not have to change margins to match — the system will take care of it for you. However, I find it very confusing to have the text formatted apparently to a different margin from that shown in the ruler, and would gladly trade a more conventional approach for the dubious advantage of proper display of mixed pitch text. (I have yet to meet anyone who mixes pitch to any great extent, because you have to change the daisywheel each time you do so. On printers which can change pitch by software this would not be a problem, but such printers are still extremely rare in the word processing world.) Indeed, even WordStar 2000 does not extend this logic to displaying text differently according to the vertical spacing used — if you change line height, the appearance remains the same.

'A novel feature of WordStar 2000 is the Typewriter mode, in which what you type on the screen is echoed directly to the typewriter, either one character or one line at a time.'

For running text, this problem is probably no more than a nuisance and a distraction (and, I repeat, only applies to printing other than in 10-pitch). For tables in 12-pitch, it could be a bit more than just a nuisance. If you are used to setting up tables by counting, then this approach could be very confusing. You would find it safer to use the alternative method, which will usually be safe unless your table is very tightly packed, of typing in the longest line in the table, spaced the way you want it. You then set up a ruler line with tabs in the positions of the first character of each column, and finally go back to your 'template' line, and replace the spaces between columns by tab characters (to prevent misalignment caused by spaces rather than tabs). But you cannot, whatever your method, rely on visual inspection of the ruler to see how much space is left in the current column.

For documents of any length, it's often useful to have a header and perhaps also a footer on each page; WordStar 2000 allows several lines for each if you need them — the only restriction is that you must have at least one line of actual text within your total page length. You can change the header and footer as often as you like, have alternating text on odd and even pages, and include page numbers. (I could not, however, find a way to align the page number to the right margin when the page number is either a header or a footer.) You can also have footnotes — these are indicated by a subscripted number in the text (which is incremented automatically, so that if a footnote is inserted all remaining notes are correctly renumbered), and the textual tags are collected and printed at the end of the document. That feature would be invaluable in much academic writing.

Printing

A novel feature of WordStar 2000 is the Typewriter mode, in which what you type on the screen is echoed directly to the typewriter, either one character or one line at a time. I can't imagine any self-respecting typist needing that much reassurance of the friendliness of the word processor, but I suppose it may help to sell the package to some managers who like to think they have timid secretaries. It might also be useful for very short letters and memos, to avoid having to save them and subsequently to delete them.

I've already mentioned the facilities for emphasis during printing. You can also request multiple copies, chain printing from one file to another, and include sub- and super-scripts. The mechanisms for requesting sub- and super-scripts are, however, separate, and both are 'toggled', so it is not possible to have sub-sub-scripts — whereas if the mechanisms used were to request plus and minus half-line spacing, sub-subs and super-supers would be possible. Most of you will care nothing for this, but for those who need this facility, this is a real opportunity lost.

A by-product of the tab feature is that it's easy to set up a template for printing address labels, and a description of the correct procedure is included in the manual. Another really important goodie is the ability to print one file while editing another; this is achieved with no noticeable effect on keyboard activity by the system printing to a file first, and then doing the physical printing in 'background' giving the

editing process priority.

WordStar 2000 comes with drivers for a wide variety of printers, including all the most popular. A *'Read Me'* file gives an up-to-date list of all those shipped with your copy of the software, so it should be easy to check at the dealer's whether your printer is listed.

The drivers do not, however, give access to the full flexibility of the more powerful printers — or perhaps it's just the way the implementation is presented. The more powerful daisy-wheel printers permit line height to vary in units of 1/48th of an inch, yet WordStar 2000 only offers choices of 2,3,4, 6 and 8 lines per inch. Character spacing could be in units of 1/120th of an inch, but you can only get at 10, 12 and 15 pitch, plus proportional spacing where appropriate. Certainly it's important to offer simple choices to naive users, but this can easily be achieved by offering the simple choices plus an option called 'special' or some such at the top level, with more sophisticated users getting access to the complete range of facilities through the 'special' sub-menu.

Repeated text

Words or phrases which you use often may be stored in an abbreviation dictionary; you can have one for each document, containing up to 20 abbreviations. These are set up with a short form which you type, and a long form which WordStar 2000 uses to replace what you type in the document. The long form may contain up to 560 characters, provided that all long forms and all short forms do not exceed 2000 characters in total for that document. I found this facility very useful for short phrases — in this instance, for the name WordStar 2000! The short form may be no more than two characters if you like — you enter the chosen short form, and then press ESCape to tell the package that you want to replace it with the long form.

For longer sections of repeated text, there are two possibilities. You can include complete files anywhere in your document. Or you can open a window on either the current document or any other. If you had previously set up a file of standard paragraphs, marked appropriately to make it easy to find the right one, you could then open a window on that file, use the Search facility to find the correct text, and use the BLOCK MOVE commands to move the test into the document you are editing.

Finally, for personalised letters and other template processing, there is a mail-merge section, which allows you to set up a template document, plus a separate file of data to be merged into it. These facilities include conditional processing, so that you can repeat operations a given number of times, or test whether conditions are true before a letter is printed.

In use

With the single exception of the 12-pitch problem I've already mentioned, I found WordStar 2000 exceptionally easy to use for so powerful a package. You could say that I have the advantage of some years' experience with WordStar, but in some respects this is a disadvantage, since many features are similar but sufficiently different to cause trouble.

I liked the approach to providing onscreen help, which allows you to have extensive help all the time, for sub-menus only, or not at all. Whatever the level of 'automatic' help, you can always get more by pressing the HELP key, so experienced users can turn all the automatic help off, and just request it when they really need it, while users whose knowledge is patchy can increase the time delay before sub-menu help is displayed in order to take advantage of what they do remember. The function key implementation has been sensibly done, although everyone will have a few they will want to change; this is readily accomplished through the installation program.

Where a function is not available in this way, however, it requires three keys to access it — for example, the command to turn block highlighting off is CTRL/B D. Nevertheless, the advantages of grouping commands together, with appropriate menus, probably outweigh the drawbacks of long command strings.

If you have a colour monitor, you can tune all the colour combinations to your liking, to get contrasting displays of ruler, help, highlighted blocks, and so on. My only complaint here is that embedded rulers are displayed in the same colours as the text — it would have been a simple matter to allow another colour combination for that, to make them stand out more. I would also like to be able to see them while hiding the other markers, such as bold and indent, rather than have them all on or all off.

Documentation & training

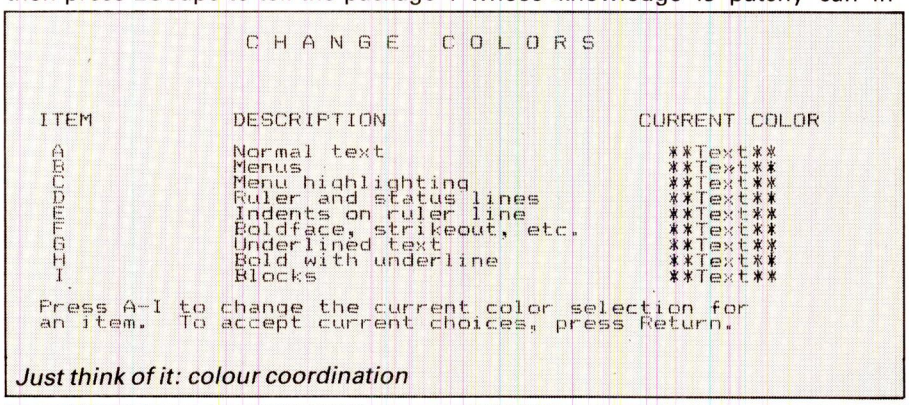
WordStar 2000 comes with a full set of manuals to a high standard of layout and content. The *Training Guide* refers constantly to a set of training documents which come with the package, and cover all the main features of the package, not just a beginners' subset. There are, in addition: a *Getting Started* booklet which promises to get you off the ground in 15 minutes (and it might just do that), and includes a menu map; the *Command Summary*; a *Reference Manual* of procedures which is well-written and agreeably comprehensible and has a good index; and an *Installation Guide* which should be easy enough for most people. All in all, I was impressed with the documentation and the self-training provided.

Conclusion

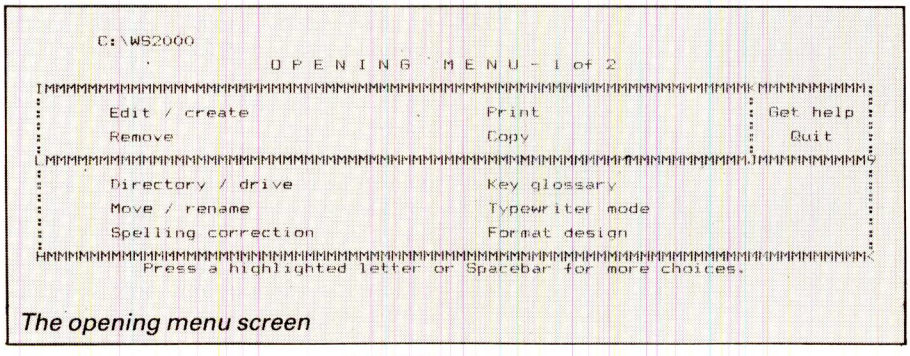
WordStar 2000 is a powerful word processor, with facilities beyond those of many of the dedicated systems, yet it should be easy enough for most beginners to use at least the basic facilities. To some extent, the needs of novices have been allowed, quite unnecessarily, to reduce the access to the nitty gritty facilities which WordStar itself has provided for so long.

In most respects, the user image of the package is excellent, apart from a couple of rough edges. It *is* on the pricey side, but I suspect that many people will find that, given the inclusion of calculator facilities, simple windowing, a spelling corrector and mail-merge facilities, it's well worth the cost.

WordStar 2000 costs £440 (£200 as an upgrade from WordStar). Further details from MicroPro on (01) 879 1122. **END**



Just think of it: colour coordination



The opening menu screen



Penman

The Penman graphics turtle-cum-plotter should never find itself discarded as a 'toy': it has many potential uses, from illustrating spreadsheet models to educational graphics. Simon Craven keeps it under control.

Personal computers are rarely a threat to domestic harmony. You hear about the occasional dedicated hacker who spends all night staring blurry-eyed at the screen, to the anguish of a neglected marital partner, and the Saturday evening squabbles about whether the Trinitron gets used for watching *The A Team* or playing *Manic Miner*, but causing real chaos is not the *metier* of the humble personal computer or its peripherals.

Unless, of course, you have a suspicious and aggressive cat.

If the Penman in the photograph looks a little the worse for wear, don't blame it on the materials used or the standard of workmanship. Considering the number of times it's been pounced upon and cuffed spinning across the floor, it's a miracle the thing still works.

Assuming that you can defuse household tension or establish an 'Animal Free Zone', the Penman is an interesting add-on for a micro equipped with an RS232 or RS423 serial interface. It's hard to classify, as a number of potential uses spring to mind, but I suspect that most *PCW* readers will be interested in employing it as a graphics turtle in educational environments, using Logo as the controlling language. A less obvious application is as a low-cost plotter for the production of graphs and charts from spreadsheet models.

Hardware

The Penman is in two main parts: a controlling box which includes the RS232 interface; and the mobile element, about five inches by four in plan form and two inches deep. Although Penman claims that any RS232 machine can be used, controlling software will have to be hand-written unless you have a BBC Micro, Apple II or IBM PC. The review machine came complete with a BBC demonstration disk in accordance with its textured beige finish.

The design is devoid of unnecessary components, following the design principles of Bill Lear, who lived by the golden, though ungrammatical rule 'Simplicate and add more lightness!'

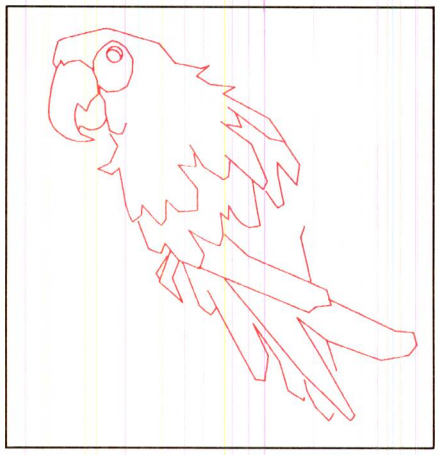
Motive power comes from a pair of small DC motors, the shafts of which are extended to form roller-type wheels. A free-castoring nosewheel is unpowered, and steering is on the caterpillar-track principle of differential power.

Power comes from a nine-volt AC adaptor, and is passed from the 'garage' box to the turtle itself through a thin, metre-long ribbon cable, along with control information. 'Cable twisting is prevented by anti-tangle logic,' thunders the manual — what this seems to mean in real life is that the turtle never turns more than 360° in one direction before stopping and unwinding itself. It works well in practice, and the Penman got stuck only when I had pulled out an insufficient length of cable.

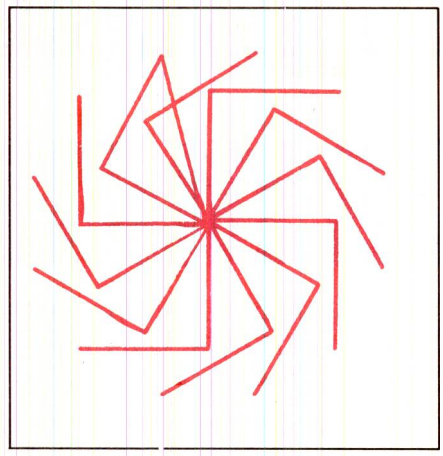
The Penman leaves its traces by drawing with Pentel 'rolling ball' writer refills which can be picked up at reasonable cost at your local stationery shop. If you are determined to have the best-dressed turtle in town, Hewlett-Packard plotter pens can also be used, but these cost considerably more. Three front-loading pens can be raised or lowered by remote control, used independently or together, and a central socket, which accepts the Pentel refills only, can be used as a permanent trace for Logo.

Underneath the unit, a pair of opto-electronic sensors allow it to differentiate between light and dark surfaces; this ability is seen on initialisation when the turtle finds a corner of the paper on which it's resting and automatically aligns itself to avoid running off the edge — clever as well as useful.

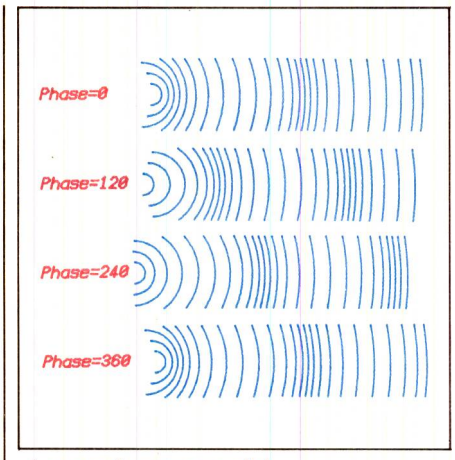




Pretty Polly courtesy of Penman



Plotting in Logo



A sound wave model

If the turtle encounters any obstruction during its travels, it beeps and stops. The level of obstruction required is very low, and even gentle pressure from a finger is enough to suspend operation. This sensitivity is very useful to programmers who want to get feedback from the device when using it as a more general-purpose robot, but it sometimes proves a little too fussy in operation at the furthest reaches of the cable. If it baulks towards the end of a long, complicated plot, the frustration can be considerable.

The RS232 connection is simple enough — it runs at 300, 1200 or 9600 baud and needs one start bit, eight data bits and one stop bit. Handshaking is hardwired through CTS or DTR, or can be carried out in software if required. The connector on the Penman is a standard 25-pin D plug, so interfacing is unlikely to be a problem. The Penman even detects which of the three permissible baud rates has been selected and adjusts accordingly.

In use

Once communication has been established, the desire to see your latest investment perform is unbearable. After watching the power-up self-test routine a few times while you delve into the manual, you will be dying to show the beast who's boss. The best arrangement for ease of use is to have a terminal emulator program (on the BBC Micro your intrepid scribe used Termi II from Computer Concepts).

Basic could also be used if command strings were printed to the RS232 port.

The command language is very straightforward and Logo-like, with 'I' to initialise, 'H' to seek out the home position, and so on. Moves can be *absolute* or *relative* — the advantage of the latter is that you don't have to work out which way the thing is pointing before you give it a command, but the corresponding disadvantage is that it can't find its way back home under this mode of operation and the automatic cable-untangling does not function.

'As a plotter, it (the Penman) has several advantages over more conventional types. It's relatively inexpensive and uses easily (and cheaply) obtainable pens.'

As well as straight lines, arcs and circles, a number of text options are available. The character size can be varied between 1mm and 127mm, and any one of four orientations can be produced from a given home position. Text can also be slanted left or right.

Not all users want to play around with this kind of device directly, especially if it's considered as a low-cost graphics plotter for serious use rather than an educational robot. Most software can-not drive the unit, but for the BBC Micro, Apple II and IBM PC, demonstration and utility packages are available from the manufacturer. Another package supported is Acornsoft Logo.

The Robographics Bitstik package running on the Apple II is a powerful computer-aided design system which can use the Penman for the output of hard copy, and it's a great shame that the BBC Micro version of this system is not yet supported. Acorn has yet to release a plotter driver for this high-priced package (one of the few programs to need the 6502 second processor), which makes it little more than an expensive toy at present.

Perhaps the serious application with the highest number of potential uses for a low-cost plotter is the production of business graphics from spreadsheet models. Penman produces a program for the IBM PC which takes standard spreadsheet DIF files and plots graphs and charts. VisiCalc, dBasell and Lotus 1-2-3 are among the programs which can create DIF (Data Interchange Format) files.

Price

The price of the Penman plotter is £217 plus VAT. The RS232 cable retails at £20 and the demonstration/utility disk costs £25. A smooth, laminated backing sheet for plotting, with a dark border to improve contrast, costs £12.50.

Conclusion

The commercial success or failure of the Penman probably rests on the amount of software which appears to support it. As a plotter, it has several advantages over more conventional types. It's relatively inexpensive and uses easily (and cheaply) obtainable pens. Since it has no frame, it takes up little space and can use any kind of paper. Its speed is less impressive than that of most other plotters, but the sales figures for cheap daisywheel printers prove that people are prepared to wait for hard copy.

As an educational device it has much to offer. It is well suited to use with Logo (especially on the BBC Micro) and could have many applications in science classes. END

Technical specifications

Step size:	0.03mm in any direction
Plotting units:	0.1mm in Cartesian mode
Pen speed:	50mm per second
Interface:	RS232C/ RS423 compatible
Power supply:	External AC adaptor, 9.5V DC, 1A
Power consumption:	10 watts max
Dimensions:	340 × 130 × 55mm
Weight:	1.2kg

Pick a number

Premium bond owners may already be familiar with the idea of random number generation in the form of ERNIE. But for those who want to learn about number-crunching and arithmetic on their micro, Donald Knuth's second volume in his trilogy may be the answer, as Mike Liardet explains.

Seminumerical Algorithms is not the most welcoming title for a book. But when the author is Donald Knuth and the volume in question is the second in his *The Art of Programming* trilogy, then any reservations are worth overcoming.

The title of this second volume is in fact a little strange, but Knuth justifies the '*Semi*' prefix on the grounds that the book also concerns itself with the tactics of implementing efficient algorithms for numerical work: it deals with random numbers, and arithmetic. It does not get heavily involved in the specialist field of numerical analysis, although many of the topics would be of interest to numerical analysis workers.

Random numbers

Random numbers — that is, numbers 'chosen at random' — are useful for simulation, modelling, software validation, games playing and a variety of other applications. Perhaps the best-known random number generator is the now defunct ERNIE (Electric Random Number Indicating Equipment), which is used to generate winning numbers for Premium Bonds. Unlike the random number sequences generated by software, ERNIE is more truly random in that it generates numbers on the basis of measuring random physical phenomena. Strictly speaking, pure software can only generate 'pseudo-random' numbers: if you know or can guess the underlying algorithm, then the sequence will appear completely non-random, to you at least, since you will be able to predict the entire sequence. Thus the randomness is only an illusion for the uninitiated.

John von Neumann, the father of the modern electronic computer, was the first to propose a simple algorithm for generating pseudo-random (from now on 'random') numbers: to generate the next random number in a sequence, square the previous one and pull out the middle digits as the next random number. The following Basic code generates four-digit random numbers:

```
DEF FNCMOD (U,V) = U-INT (U/V)*V
  :REM REMAINDER FUNCTION
DEF FNCVN (X) = FNCMOD
  (INT (X*X/100), 1000)
```

Given some starting value for X, say 9876, then successively evaluating the expression X = FNCVN(X) will generate 5353 (middle four digits of 9876 × 9876 = 97535376), 6546 (middle four of 5353 × 5353 = 28654609), and so on. It should be obvious that sooner or later our *random* sequence will repeat itself. This happens immediately it generates a number previously generated. At best this could happen after 10,000 iterations, when every number from 0 to 9999 had occurred precisely once.

But, in practice, it happens much sooner. Starting from 9876 the generator quickly gets locked into a 'cycle' of four values: 5600, 4600, 3600, 9600, 5600, and so on. Starting from other values: if 0 is generated, then it continues to produce just 0 thereafter — hardly random behaviour!

The solution to this difficulty is to:
(a) use a better random number generator; and
(b) ensure that it works with numbers which are larger than you really need (you can always truncate unwanted digits from a large number)

'Unlike the random number sequences generated by software, ERNIE is more truly random in that it generates numbers on the basis of measuring random physical phenomena.'

Knuth introduces his own early effort to improve upon von Neumann's method which I will not discuss here because it is too complicated; however, in essence, it iterates a random number of times through several lines of arithmetic, starting at a random place for each iteration. Superficially this appears to be fairly promising but Knuth quickly discovered that it started repeating fairly quickly and was little better than von Neumann's method.

In fact very effective but simple and comprehensive random number generators can be written using the 'linear congruential method'. This is frequently used as the basis for the RND() function, familiar to most users of Basic. Given the previous random number, x, in a sequence, the next random number is calculated as:
(ax + c) mod m
where a, c and m are some, carefully chosen constants. The term 'linear congruential' describes this expression — 'ax + c' is linear (that is, a straight line graph) in x, and congruential arithmetic is that which uses the mod function. Some versions of Basic are reputed to have fairly poor random number generators and this is probably because of a bad choice for the three constants. If your Basic is in this category, then you can easily use your own random number generator with:

```
DEF FNCLC(X) = FNCMOD (A*X+C,M)
```

The numbers generated by this method all lie in the range 0 to m–1 (the 'mod', or remainder, function guarantees this), so at best the sequence will repeat after m numbers have been generated. Choosing a large value for m can help, but bad values of a and c can also produce poor results. For example, a=1, c=2 produces 0, 2, 4, 6, and so on, from a starting value of 0. Much of Knuth's description of the method is devoted to the choice of good values for a, c and m.

We have already noted that m should be large, even if the required range of the random numbers is small. For example, for coin-tossing we could try m=2, then conveniently each random number would be either 0 (for heads) or 1 (for tails). However, this would, at best, produce the repeating sequence 0, 1, 0, 1, . . . Choosing a high value for m would be far more satisfactory, then heads or tails could be denoted by the parity of the number, but the number itself would be retained as the input for the next random number.

When working in assembler it is simpler to code and faster to execute if m is restricted to a power of 2, especially the byte or word-size of the computer (this is irrelevant in Basic). For most values of m, mod m can only be calculated by using division, but, for example, if m = 2^8 = 256, then mod m for any number is produced by zeroing everything except the least significant byte of the number: for example, (in hexadecimal) 4321 mod 100 = 0021, or 6789 mod 100 = 0089. Knuth also shows

an easy method for calculating mod 101, which is given here for those who are well versed in hexadecimal arithmetic. For 4321 mod 101:

Complement 4321: BCDE
Subtract low byte from high:
  00BC – 00DE = FFDE
If result negative (which it is
  because BC < DE)
    then add 101:
    FFDE + 0101 = 00DF
And that's the answer!

Obviously these techniques can be readily extended for m = (hexadecimal) 10000, 10001, 1000000. The advantage of using 101 instead of 100, in a random number generator, is that with the latter the right-hand digits are much less random than the left.

Clearly a linear congruential random number generator must repeat after m numbers have been generated, but is it possible to choose values for a and c, such that m different values are always generated before repetition? The answer is yes. Trying a=c=1 always does this, although it is rather a predictable random sequence. But there are generally more effective values that can be chosen, as long as the following rules are observed:

**none of c's prime factors can be prime factors of m;*
**a-1 must be a multiple of every prime factor of m; and*
**a-1 must be a multiple of 4 if m is a multiple of 4.*

(The prime factors of a number are the prime numbers — numbers only divisible by themselves and one — which must be multiplied together to produce the number. For example, the prime factors of 100 are 2 and 5, since 2 and 5 are prime, and $2 \times 2 \times 5 \times 5 = 100$.) If $m = 2100 (= 2 \times 2 \times 3 \times 5 \times 5 \times 7)$, then c could be any number without these factors: 11, 13.. 121, and so on. a-1 must be a multiple of each of 2, 3, 5, 7, and also a multiple of 4 (because m is). Therefore, one possible value for a-1 would be $2 \times 2 \times 3 \times 5 \times 7 = 420$, meaning a = 421.

All random numbers generators need to be 'started off' with some initial random, or 'seed' as it is termed. Generally, during program development it is expedient to assign some arbitrary constant as the start-up value. This means that the same sequence will be used every time the program is run, and any bugs in the software will be repeatable, and easy to correct.

Once the program is working correctly, it is undesirable to use the same sequence every time — if it's a card game you do not always want to be dealt the same cards! A useful way to create the seed is to access the date and time, if available, or to loop and increment the seed value when waiting for keyboard input, or restart with the last random number used at the end of the previous session. In any of these cases the random number generator should get off to a different start every time.

Knuth outlines many other possible algorithms for random number generation, involving slightly more complex calculations. An obvious extension to the linear congruential method is the quadratic congruential:

```
DEF FNCQC(X) =FNCMOD
  (A*X^2+B*X+C,M)
```

and there are many interesting generators that use two or more previous values to generate the next random number, including the simple, but poor, Fibonacci sequence:

```
DEF FNCFIB(X,XPREV) =
  FNCMOD(X+XPREV,M)
```

(This must be used by:

```
XNEW=FNCFIB(X,XPREV):XPREV=X:
  X=XNEW)
```

Of course, much of the foregoing provides a great deal of fertile ground for creating random number generators, but neatly skirts around methods for evaluating how good they are. For example, we have considered possible and convenient candidates for a, c and m in a linear congruential generator, but m=2100, a=421 and c=11 (all mentioned above) generate random numbers that are alternately odd and even. Much of Knuth's treatise on random number generators is dedicated to tests, which should trap the unsatisfactory generators, and pass the good ones.

One of the simplest tests is known as the chi-squared test. This is a test used widely by statisticians, but in this context we can use it to gauge the evenness of distribution of a random number generator. If we use a generator a thousand times to generate numbers in the range 0 to 50, we would expect each number to turn up roughly 20 times, but even with truly random numbers we would, on average, expect a few oddities: perhaps one or two numbers would only turn up a few times.

With the chi-squared test, we can measure this evenness of distribution (using the program in Fig 1), by calculating the variance, V. This value can be looked up in a table (see Fig 2) which indicates what percentage of the time it would be expected. When I ran this program in Microsoft Basic, V was 60.1 on the first run. Examining the table shows that $56.33 < 60.1 < 67.5$. We can expect V to be greater than 56.1 in 25 per cent of cases, so this run of the random number generator produced a fairly 'average' distribution, which is what we want. (Very low values of V are 'too good to be true', and very high values indicate obvious biases.)

There are many other tests that can be applied to random number generators, with intriguing names like the poker test, spectral test, and so on, and Knuth outlines them all in detail. To get the seal of approval, a random number generator should pass all of them. But what about those in a hurry, who need a highly recommended generator *on a plate*? Knuth outlines his own recommendation for such people at the end of this chapter (Fig 3). As presented by Knuth, the generator produces random numbers from Fortran routines in the range 0 to 999999999. I have translated it to Basic, using a floating point array to hold integer values in the range 0 to 9999999. (Basic integer arrays only handle numbers up to 32767 and Microsoft Basic floating point is only accurate to seven digits.)

Once an initial sequence of numbers has been set up, this random number generator generates the next random number from the difference between the random numbers given 55 and 24 times previously. The result is taken mod 10000000. Most of the complications in the software arise from the book-keeping necessary to maintain 55 previous values in the sequence. The use of '55' and '24' are highly significant, and were definitely not picked at

```
20000 REM CHI-SQUARED TEST FOR MSBASIC RND() FUNCTION
20010 DIM NUMCOUNT(50):REM HOLDS NUMBER OF OCCURENCES OF EACH NUMBER
20020 REM GENERATE 1050 RANDOM NUMBERS IN RANGE 0 TO 50...
20030 FOR I=1 TO 1050
20040 RAND=INT(RND(1)*51):NUMCOUNT(RAND)=NUMCOUNT(RAND)+1
20050 NEXT I
20060 REM NOW CALCULATE VARIANCE V...
20070 V=0
20080 FOR I=0 TO 50
20090 V=V+(NUMCOUNT(I)-20)^2/20
20100 REM (20 IS EXPECTED NUMBER OF OCCURENCES)
20110 NEXT I
20120 PRINT"V =";V
```

Fig 1 Calculation of variance for chi-squared test

random. With these values, the random number generator will not start repeating for several millennia, even at computer speed! Knuth gives a number of other pairs of values that also work very well.

Arithmetic

The chapter on arithmetic is primarily concerned with the basic operations of addition, subtraction, multiplication and division. Subsequently, it introduces a number of related topics such as factorisation, exponentiation and polynomials. Users of high-level languages may think that much of this is of little interest, since the algorithms are already written for them. This attitude is a little short-sighted, as a good understanding of these underlying algorithms should enable the user to program with maximum precision!

The simplest form of computer arithmetic is fixed-point arithmetic. In fixed-point arithmetic the amount of storage space for every number is the same, and the decimal point is always understood to be in the same place. The most usual convention is for it to be after the last (least significant) digit; and in this case the computer is performing integer arithmetic. The advantage of integer arithmetic is that it is fast, and excepting loss of remainders in division, completely accurate for the four main arithmetic operations. The disadvantage is that it cannot represent very large magnitude numbers, at least not without allocating a lot of storage.

Fixed-point software for 8-bit micros usually allocates two consecutive bytes, totalling 16 bits of storage for each integer. Some software or 'double precision' options may offer more. As each bit (='binary digit') can hold just two values (0 or 1), 16 bits together allow $2 \times 2 \times \ldots \times 2 = 2^{16} = 65536$ different integer values to be represented.

Generally it is undesirable that only positive numbers be accommodated, and Knuth describes different methods for handling negative numbers. The most popular is the 'two's complement', where the most-significant bit (that is, the leftmost when writing the number on paper) is always 1 for negative numbers:

1000 0000 0000 0000 = −32768
1111 1111 1111 1111 = −1
0000 0000 0000 0000 = 0
0000 0000 0000 0001 = 1
0111 1111 1111 1111 = 32767

p=1%	p=5%	p=25%	p=50%	p=75%	p=95%	p=99%
29.71	34.76	42.94	49.33	56.33	67.50	76.15

Fig 2 Chi-square values for distribution on 51 random numbers

```
25000 REM KNUTH'S RANDOM NUMBER GENERATOR
25010 DIM RAND(55):REM GENERATES 55 NUMBERS AT A GO
25015 DEF FNCMOD(U,V)=U-INT(U/V)*V:REM BASIC'S MISSING MOD FUNCTION
25020 SEED=1234567!:REM VALUE TO GET IT STARTED
25025 GOSUB 30000:REM INITIALIZE
25030 PRINT"HERE'S A HUNDRED RANDOM NUMBERS..."
25035 FOR I=1 TO 100
25040 GOSUB 32000:PRINT X
25050 NEXT I
25060 STOP
30000 REM INITIALIZATION RAND() ARRAY STARTING WITH SEED VALUE
30010 RAND(55)=SEED:J=SEED:K=1
30020 FOR I= 1 TO 54
30030 II=FNCMOD(21*I,55)
30040 RAND(II)=K
30050 K=J-K:IF K<0 THEN K=K+10000000£
30060 J=RAND(II)
30070 NEXT I
30080 REM NOW WARM UP THE GENERATOR...
30090 GOSUB 31000:GOSUB 31000:GOSUB 31000:RETURN
31000 REM RESET RAND() ARRAY WITH NEW VALUES IN RANGE 0 TO 9999999
31010 FOR I=1 TO 24
31020 J=RAND(I)-RAND(I+31)
31030 IF J<0 THEN J=J+10000000£
31040 RAND(I)=J
31050 NEXT I
31060 FOR I=25 TO 55
31070 J=RAND(I)-RAND(I-24)
31080 IF J<0 THEN J=J+10000000£
31090 RAND(I)=J
31100 NEXT I
31110 NEXRND=1
31120 RETURN
32000 REM AFTER INITIALIZATION, RETURNS RANDOM NUMBER IN RANGE 0 TO 9999

32010 IF NEXRND>55 THEN GOSUB 31000
32020 X=RAND(NEXRND):NEXRND=NEXRND+1
32030 RETURN
```

Fig 3 Knuth's recommended random number generator

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This representation is somewhat analogous to a counter on a cassette recorder. If you set it to zero in the middle of a tape, and then rewind, it progresses back through 999, 998, and so on. One advantage of it is that no special action need be taken for adding negative numbers: the computer's normal binary add instruction should work. Negating a number is also fairly easy: just 'complement' it (a single computer instruction that changes all 1s to 0s and vice versa) and add one. For example to negate 1:

Complement 0000 0000 0000 0001 =
1111 1111 1111 1110
And add 1: 1111 1111 1111 1111

With 16-bit two's complement arithmetic there is no facility for representing numbers less than −32768 or greater than 32767, and correctly implemented software will generate an 'overflow' error if a calculation oversteps the mark. If you try this in Basic (for example, PRINT 32767+1) you may be surprised to see that the correct answer is displayed instead of an error, (but you can force the error by typing LET X% = 32767 + 1). Many versions of Basic avoid integer overflow by converting the result to floating point.

Floating point numbers

The representation of floating point numbers in the computer is analogous to the scientific notation, where very large or small magnitude numbers are represented by a fraction and exponent part. For example, in scientific notation Planck's constant would be written as 1.0545 × 10^−27. (Basic uses a minor variant of this notation: 1.0545E−27.) The fractional part is 1.0545, and the exponent is −27. This number could otherwise be written (with spaces added for readability):

0.00000 00000 00000 00000
00000 010545

Notice that this number is the original fraction 1.0545 with the decimal point shifted 27 places to the left. In scientific notation the convention is to place the decimal point of the fraction only after the first digit. For example, 105.45 × 10^−29 and .010545 × 10^−25 also equal Planck's constant, but not in the normal representation. This principle also holds for most floating point software.

Typical floating point software on an 8-bit micro represents a number by using at least four consecutive locations: the first is used to hold the exponent of the number, and the remainder are used for the fractional part. It is obviously desirable to accommodate both negative and positive exponents, so the positive integer value stored in the exponent must have some 'excess' quantity subtracted to reveal its true value. A single byte could hold any value from 0 to 255, which, if the excess were 128, would allow the exponent to range between −128 and 127. The decimal point for the fractional part is usually to the left of the most significant digit, and the normalisation requirements say that this (binary) digit should be 1. To avoid confusion between normalised and unnormalised numbers, the position occupied by this bit can be used to store the sign of the number. The number zero is uniquely represented by all bytes including the exponent, being zero.

All floating point operations, even addition, can introduce inaccuracies into the results. This is because the fractional part of the result can easily require more space than is allocated for it to be represented with complete accuracy, and it must be 'rounded' to fit in. These inaccuracies can be lessened by arranging for double precision storage during the calculation, but the returned result must be returned at normal size.

It is possible to gain some intuition into the workings of floating point software, by working with scientific notation, and restricting the number of digits in both the fractional and exponent parts. For example, with just four digits for the fraction and one for the exponent, consider the following addition and multiplication:

(1) Add 8.765E−2 to 9.998E1
Adjust 8.765E−2 to have exponent E1:
0.008765E1
Add 0.008765E1 to 9.998E1 =
10.006775E1
Normalise the result: 1.0006765E2
And round to four digits: 1.001E2
(2) Multiply 3.111E7 by 9.000E−4
Add exponents: 7 + −4 = 3
Multiply fractions: 3.111 × 9.000 =
27.999
So the product is: 27.999E3
Normalise it: 2.7999E4
And round to four digits: 2.800E4

As with fixed point arithmetic, it's possible to have an overflow condition in a floating point operation. This occurs if the exponent part gets too great. This would have happened in the above multiplication example if the second number had been 9.000E4 and not 9.000E-4: the product's exponent would then be two digits, and one more than we allowed for. In practice, real floating point software allows larger exponents than this, typically accommodating numbers as big as 10^38.

With floating point arithmetic it's also possible to have 'underflow'. This occurs if the exponent part gets less than the lowest negative value permissible — that is, when the number is very close to zero. Computer users pay far less attention to underflow than they do to overflow or rounding, but Knuth rightly points out that its affects are just as insidious. In Microsoft Basic any number smaller than 2.938735E-39 underflows to zero. This may not appear to be worth worrying about, and indeed many language implementors, Microsoft included, do not give an error message for underflow. But underflow can cause a gross calculation error, with answers inaccurate by thousands, as you will gather if you can solve the following puzzle using your Basic interpreter:

Assign values to A, B, C and D such that ((A×B) ×C) D differs from (A×(B×C)) ×D by a thousand (solution in box at the end of article).

Conclusion

Knuth's section on arithmetic covers a great deal more than I have been able to mention here. For example, there are other, less commonly used ways of representing numbers in the computer, and efficient algorithms for multiplication, and more besides — a veritable treasure trove for number-crunchers everywhere!

Readers after more treasure should look at last month's review of the first volume in the series, *Fundamental Algorithms*. Next up is a look at the final title, *Sorting and Searching*.

References
The Art of Computer Programming by Donald E Knuth; (Addison-Wesley Publishing Company).
Volume 1. Fundamental Algorithms.
Volume 2. Seminumerical Algorithms.
Volume 3. Sorting and Searching.

Puzzle solution

Of course the two expressions are equal. The presence of rounding error can result in minor differences when they are evaluated on a computer, but to obtain such a gross difference we have to arrange for one expression to underflow and the other not to.

This solution is specific to Microsoft Basic, but the principles should hold for any language that does not trap arithmetic underflow as an error. There are many possible values that will work, but I have checked the following on both CP/M and MS-DOS versions of Microsoft Basic:

A = 1E-30
B = 2.938735E-9
C = 1.701412E38
D = 2000

Evaluating A×B in the first expression causes an underflow, so the whole expression evaluates to zero. The second expression does not underflow, and returns a correct result, approximately 1000. (You can verify this by hand if you know that 2.938735 × 1.701412 = 5). By choosing ever larger values of D you can make the discrepancy even worse! END

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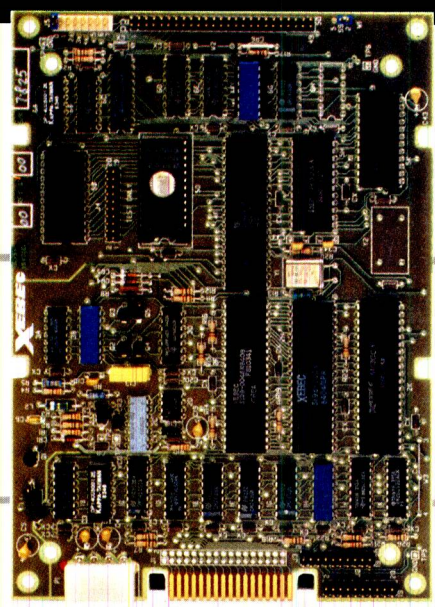

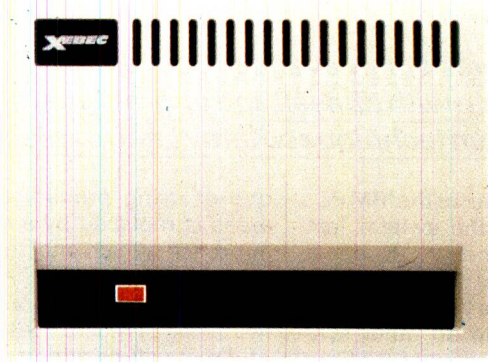

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Two into three will go!

dBaseIII is not yet widely available, but don't let that hold you back—begin with dBaseII and upgrade, using various conversion techniques. Kathy Lang explains.



Illustration by Nick Davies

dBaseIII is now available for the IBM PC; *PCW* reviewed it on the system last November, and found it to be a considerable advance on its popular stablemate, dBaseII. As yet, however, it is not widely available on other systems: indeed, at the time of writing, dBaseIII is available only on the PC and compatibles, although an Apricot version will soon be available.

dBaseIII comes with some significant aids to conversion from dBaseII, sufficient to make it a reasonable tactic to begin in dBaseII and convert when dBaseIII becomes available. (A dBaseIII upgrade kit is available to existing dBaseII licence holders for £130.) If you do this, there are precautions you can take to minimise the problems of conversion. There are also steps you can take during the conversion to speed up the process. Finally, there are techniques you can use to mitigate some of the deficiencies of dBaseII which still remain in dBaseIII.

dBaseII data, memory, report and screen format files are not directly readable by dBaseIII, but the dBaseIII conversion program, Convert, will automatically translate such files into dBaseIII format. Index files are treated slightly differently: Convert sets up a command file which can then be run to recreate the index in dBaseIII format.

So far, so good. Convert doesn't, however, automatically convert the whole of every dBaseII command file, and it's in this area where you can ease the job of checking conversions by taking some precautions in your use of dBaseII. Here I'll summarise the main features of dBaseII which will not work in the same way in dBaseIII, and which Convert cannot handle automatically. In all but two cases, you can either avoid problems by taking precautions, or make straightforward changes quickly with the help of a word processor.

The major exception is the use of multiple files, where the dBaseII technique of using primary and secondary areas is replaced by a rather different approach which includes the use of aliases to distinguish fields in different data files. The other area of difficulty is in the use of macros — the substitution of direct values and variables through the use of the ampersand with memory variables. Convert takes the conversion of these statements as far as it can, but you'll need to check, and in most cases adapt, programs which use more than one file, or use macros. And while the use of Convert, together with the changes discussed here, will in the great majority of cases be sufficient to get dBaseII programs working under dBaseIII, it will still pay to look carefully at the new features provided in dBaseIII to see how they can be used to improve the performance of your programs. This is again especially true of programs which use several data files, since you should be able to make substantial reductions in the number of times files are opened and closed.

Precautions

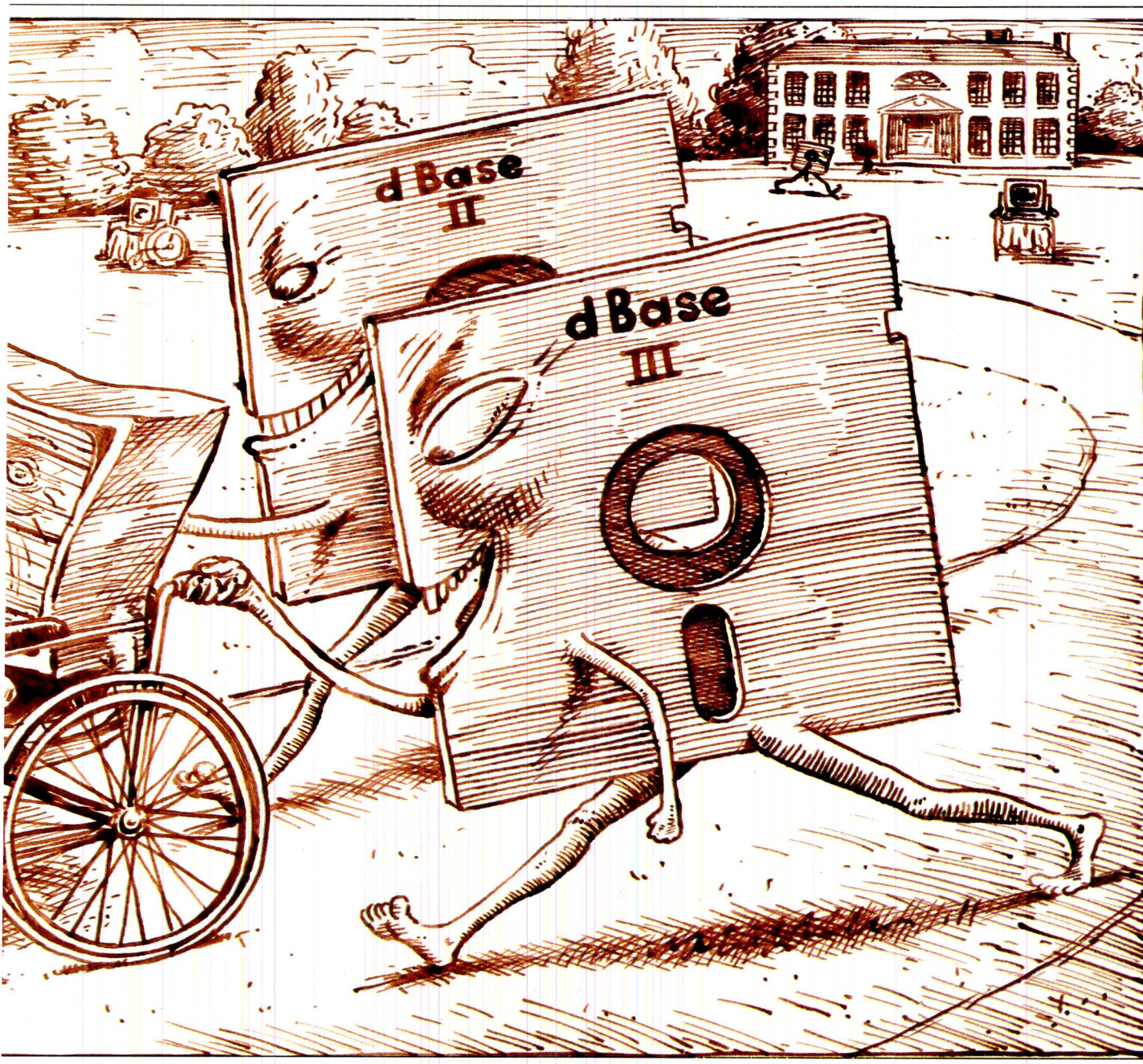
dBaseIII no longer uses the hash sign to signify the value of the current record number, but instead uses the new function RECNO(). If you use this function in your programs, Convert will, as far as possible, make the change automatically. In order to do so, however, it must detect (by discerning the context) the difference between hash as used to denote the record number, and hash as used to mean 'not equal to' in conditional expressions. To avoid any dangers of misinterpretation, it's better to use the alternative symbol <> to denote 'not equal to'.

If you're skipping backwards in a file, in dBaseII you can detect the top of the file by testing to see if the record number is zero. This is no longer possible in dBaseIII, which has a new function called BOF() (for 'beginning of file' — but a bit unfortunate as GOTO BOTT still takes you to the bottom/end of the data file!). Convert cannot detect that your test of the record number is actually a test for top of file, so this change would have to be made manually. An alternative would be to execute these two lines before starting the backwards search:

```
GOTO TOP
STORE # TO TOPREC
```

You would then test for the record number equal to TOPREC before doing the skip backwards each time. This technique would not work if your file were indexed *and* you were adding records to it while executing the loop which included the backwards skip. In all other circumstances, it would work as expected in both versions.

A major change to the use of memory variables has been made in dBaseIII. In dBaseII, all memory variables are global: that is, if you call a command file from within another and create memory variables in the subprogram, these variables are still available when you



return to the main program. In dBaseIII, this is no longer true: memory variables created in subprograms are normally local to that program, and 'disappear' when you return to the calling program. This change has distinct advantages, since it economises on the use of memory variables. It also makes life much easier when you are creating a large system, or when two or more people are working on a cooperative system, since you need only agree and be disciplined about the naming of variables which must appear in the main program.

This change will, nevertheless, cause some excitement with converted programs unless they are 'tuned' to take advantage of the new feature. The alternative is to ensure that, in converted programs, all memory variables are global, as they are at present in dBaseII. There are two ways to do this. Under dBaseII, you can initialise all memory variables at the start of the main program, and this ensures that they will be global when the programs are converted to dBaseIII. The alternative is to ignore the problem while using dBaseII, but after conversion, and before running under dBaseIII, to use the PUBLIC command at the start of the main program to define all memory variables as global.

If you use ACCEPT or WAIT in a set of stored commands in either version, you must cater for the situation where the person using the program does not reply positively but just hits RETURN. In dBaseII, this action results in a single space being stored in the string specified in ACCEPT or WAIT, and it's usual to test for this with a command line of the form:

IF 'Answer=" "

In dBaseIII, responding to ACCEPT or WAIT by pressing RETURN will result in the string specified being null: that is, not containing anything. Unfortunately, you cannot test for this simply by changing the test to read:

IF Answer=''''

If you do, this test will *always* be true, whatever characters the user enters.

In dBaseIII there are two ways to test for a carriage return, represented by a null string entered to ACCEPT or WAIT. One way is to test the length of the string entered, since for a null string the LEN function will return a value of zero. The alternative is to reverse the 'natural' order of testing, and have a test of the form:

IF ''''=Answer

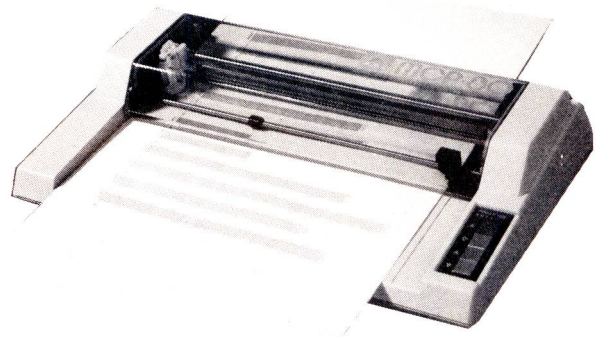
which will be true *only* if Answer is a null string. For those working in dBaseII and expecting to convert to dBaseIII, this gives an alternative to the test normally used in dBaseII. If you substitute a test of the form:

IF ''''=Answer

the test will have the desired effect in dBaseII, and be much easier to modify in dBaseIII. You'll just need to check (using a word processor with a search and replace function) every occurrence of the character sequence " "=

and, where appropriate, accept a sub-

MCP-80



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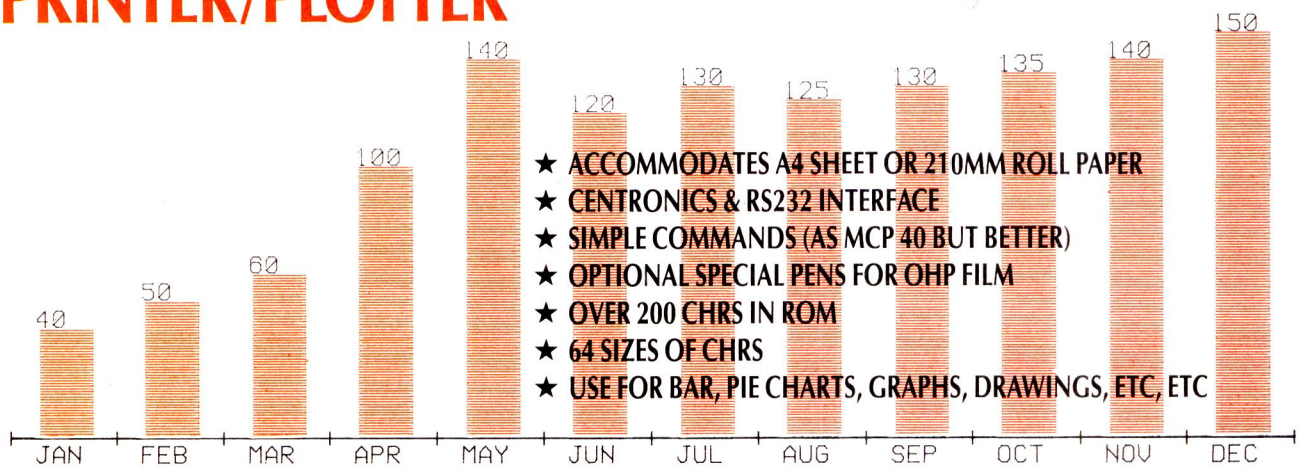

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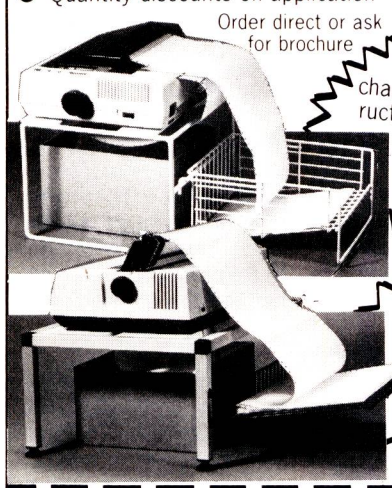

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stitution of the sequence " "=

Conversion

There are several other ways in which using a word processor with search and replace facilities can help the conversion process. In dBaseII, if the FIND command is unsuccessful in locating a record which matches the desired key, the current record number is set to zero, enabling you to test for this condition. This action is changed in dBaseIII to leave the record pointer at the bottom of the data file, and the test must be for whether end-of-file has been reached (via the EOF() function). Convert cannot detect this requirement, so the simplest approach is to use search-and-replace to change relevant occurrences of the test for a record number equalling zero with a test for EOF() being true. Another necessity may be to modify statements which use the TRIM command, since trimming a string of blanks in dBaseIII results in a null string, rather than the string containing a single space which dBaseII gives.

In dBaseII you will not be warned if you issue a SORT command which results in the overwriting of an existing file. In dBaseIII a warning is issued — which might be a bit offputting for a novice user working with a tailored version of the package.

You can prevent this warning appearance by including the command SET SAFETY OFF at the beginning of the master command file.

Changes

dBaseIII has many improvements over dBaseII, as readers of the November review will know. All is not sweetness and light, however. Some of the changes are for the worse, while some of the omissions from dBaseII have not been rectified.

The major change which will irritate many who regularly use dBaseII directly, rather than through someone else's command files, is the replacement of the three single-character functions by functions with much longer names. The capitalisation function, !, is now UPPER; the substring function, $, is now SUBSTR; and the record number function, #, is now RECNO(). These changes will certainly add to most people's typing load.

You can mitigate the problem to some extent by using the macro facility to rename these functions, but it's probably only worth doing for RECNO(). You can get this down to two characters by typing STORE "RECNO()" to R and using the characters &R wherever you would need to use RECNO(). But where a function takes arguments, the need to have a space between the macro name and the arguments means that the best you can do is to reduce the reference to, say, &S followed by a space, whereas in dBaseII you could use a single character.

Another feature which will be unpopular with experienced users is the new prompt 'Do you need help?' issued every time you make a typing error. You can turn this off with the SET command. A time-saving ruse is to set up a command file (called, say, STARTUP) which contains those commands issued to personalise the system in this way — including not only appropriate options in SET, but also initialisation of memory variables to provide abbreviations and other features such as colour of foreground and background display where appropriate. You can then have this file executed when you enter dBase by typing dBASE STARTUP (don't forget to declare as PUBLIC any memory variables initialised in this way).

Features

Everyone has their own requirements of a data management system, so I'm sure many dBaseII and dBaseIII users will have their own personal 'wish list' for dBaseIV. One popular requirement is better data validation features, plus a table reference facility. These two really go together, as you can use a table either to check that a code entered is valid, or to match a code to a longer description which makes reports more meaningful. In dBaseIII, you can check that a numeric variable falls within a particular range, and that — apart from ensuring that a value matches the type of the field — is that. You can simulate requirements for checking and for expansion of abbreviated codes in two ways; the first works in memory and is limited to short sequences; the other exploits the increased number of files available in dBaseIII.

Suppose you have a file of data about staff in your firm, in which the department to which each member of staff belongs is represented by a code. If there are just a few departments, you could store in a memory variable a character string which contained each valid code, followed by an appropriate delimiter such as a colon or comma. For example:

```
STORE "GL,HA,LU," TO DEPTAB
```

As the information about each person is entered into the personnel record, you could then use a test of the form:

```
IF (DEPTCODE+",")$DEPTAB
```

which would test to see if the value entered in the field DEPTCODE were a valid code as shown in the memory variable DEPTAB. (The use of the comma or other delimiter is, of course, necessary to prevent spurious matches.)

When displaying information based on the records, or constructing printed reports, you can use another memory variable or variables to map the abbreviations onto the desired expansions. If just a few coded values are being used, the expanded labels may fit into a single string, in which case their position should correspond with the position of the corresponding code in the abbreviation string.

Assume that the abbreviation string was as shown, and the expanded string had been stored with the command:

```
STORE "Gloves Haberdashery-
  Luggage " TO LABELS
```

The following command sequence could then be used to find the right expanded label:

```
STORE DEPTCODE TO MDEPTCODE
STORE (AT (MDEPTCODE, DEPTAB) +
  2)/3 TO MPOINTER
DISPLAY SUBSTR (LABELS,
  (MPOINTER* 12-11), 12)
```

(Note that each label in the string LABELS is 12 characters long.) An extended version of this sequence, using the AT function to detect separators, could be used where the labels are of dissimilar length to save memory variable space.

Where there are more codes, there's a neat way to use the value of the abbreviated code as a pointer to find the right label. The trick is to set up each label in a memory variable with the name of the code which denotes it. So, in our example, the string 'Gloves' would be stored in a variable called GL, the string 'Haberdashery' in a variable named HA, and so on. To find the appropriate label, all you then need to do is to execute this sequence:

```
STORE DEPTCODE TO MDEPTCODE
DISPLAY &MDEPTCODE
```

dBase will then display, not the value of the code, but the variable which has that name. This technique has many and varied uses, and can be used to help avoid some of the disadvantages caused by the absence of array variables in dBase. In particular, it can be used to accumulate sets of subtotals of coded fields which are not indexed — the 'official' subtotal facility requires that the file be correctly sorted or indexed, with the least significant subtotal field specified first.

Finally, where you start to run out of memory variables, or where you want to add extra codes quite often, it can be most helpful to keep one or more data files for storing sets of codes with their expanded labels. If these code files are indexed on the code, it's then a quick and easy matter both to check valid codes, and to retrieve labels when reporting. If you frequently use this approach, you will of course, start to run out of files, since you'll need at least one and ideally two files for each set of codes.

An alternative is to use memory variables as described for checking the codes, which are usually short, and then to keep all the labels in a single file — provided you are careful to avoid ambiguity in matching codes and labels from several fields. END



SCREENTEST

KnowledgeMan

KnowledgeMan features 'loose' as opposed to the tight integration of window-based packages. Kathy Lang looks at this powerful command-driven data management system for experienced users.

Most computer users need to use several different approaches to information processing. Very often, people start by wanting to automate a card index system just to make it easier to extract selected items. Later they may find that they need to include some of the information in personalised letters, use the current information to project future trends, or make the representation of their information clearer by illustrating it with graphs. These requirements have led a number of suppliers to feel that there's a big market for the so-called 'integrated' package, which has all these facilities and more under one umbrella.

Maximum file size	65,535 records
Max record size (ch)	65,535
Max no fields	255
Max field size	65,534
Max digits	14
Max prime key length	65,534
Special disk format?	N
File size fixed?	N
Link to ASCII files?	YV
Data types	N,C,L,M
Fixed rec structure?	Y
Fixed record length stored?	Y
Amend rec structure?	Y
Link data files?	Y
No data files open	UL
No sort fields	UL
No keys	UL
Max key length (chars, fields)	UL, UL
Subsidiary indexes kept up-to-date?	UTD
Data validation	A
Screen formatting	P, D
Unique keys	N
Report formatting	P, L, I
Store calculated data	IN, ED, BA
Totals & statistics	Y
Store selecn criteria	P
Combining criteria	A, O, N, X
>1 criterion/field?	Y
Wild code selection?	SW
Browsing methods	AK
Interaction methods	C, FT
Reference Manual+	***
Tutorial Guide+	**
Reference Card+	N
Online Help+	**
Hot-line?	P

Fig 1 Features and constraints

Most suppliers feel that people also need to be able to see information presented in several different ways simultaneously, and this has led to the current fashion for windows, which provide a way of dividing up the screen so that one portion can be displaying part of a spreadsheet, another part of a text document, and so on.

This approach has two disadvantages. Firstly, it's very hard to provide window facilities in a way which does not lead to an extra load of initial learning before the poor novice can start to do anything useful. Secondly, it's not always the easiest way to provide facilities for system developers: that is, for people who are setting up complex systems for others to use. (Some suppliers of integrated packages which use windows would, of course, deny this, but the proof of the pudding is yet to come.)

An alternative approach, taken by an American package called KnowledgeMan, is to make a greater separation between the various aspects of the package while retaining sufficient integration to allow easy movement from one function to another. The central core of KnowledgeMan is a powerful data management system which, unlike many integrated packages such as Symphony and Framework, does not require that all information to be processed be resident in the computer's memory. This is another advantage of the kind of 'loose integration' used in KnowledgeMan, in contrast to the tighter integration of window-based packages. Linked with the data management features is a spreadsheet facility, which is sold together with the data management system. In addition there are modules for graphics and word processing which are purchased separately, but once installed may all be used from within the basic KnowledgeMan system.

KnowledgeMan's data management facilities are powerful and flexible. Besides the usual range of features such as data selection, sorting, calculation and formatted display, there's also a set of control commands which provides facilities comparable with a full programming language. Sets of records are stored in files, called tables by KnowledgeMan; all the records in a file must have the same format, and are fixed in length. The basic approach of the data management part of the package is very similar to that of Ashton Tate's dBaseIII, but unlike dBase it places no limits (other than those imposed by the operating system and the hardware) on the numbers of files and on the number of memory variables which can be accessed at the same time. The use of commands rather than menus, together with the complexity of some of the facilities, makes KnowledgeMan more suitable for system designers and experienced users than for novices.

KnowledgeMan is produced by Micro Data Base Systems Inc, an American company which also wrote MDBSIII (a full database management system which largely follows the CODASYL Committee recommendations). The basic KnowledgeMan system (data management and spreadsheet) runs under PC-DOS, MS-DOS and CP/M-86, and needs at least 192k RAM and about 500k disk space to run properly (it won't

load on a 128k machine). The graphics module was, at the time of writing, available only on the IBM PC, but the Apricot version should be ready by the time you read this, with the HP150 and several other systems very close behind. KnowledgeMan also supports the MicroSoft mouse on the IBM PC. Substantial modification features are provided, so that if you have a colour monitor and a 'soft' keyboard you can set up the system closely tailored to particular applications.

The basic unit of information in KnowledgeMan is the table processed by the data management functions. The Calc part of KnowledgeMan has the matrix structure usual in spreadsheets: data values my be literals or calculated values, and may include information taken from data management files using the CONVERT command. All the modules other than data management use ASCII text format files, so transfer between them is relatively easy.

KnowledgeMan is operated by commands. The package has a very flexible macro facility; you can use it for tasks from the simplest, like abbreviating one detailed command for use in a single session, to storing complex sequences of commands in a file to be executed together. When used in this way, command sequences can include programming-type instructions like looping. All KnowledgeMan procedural commands are available in the other modules too, so you can, for example, use a whole procedure to calculate a cell value, or construct template letters with considerable economy of effort.

Constraints

Files and records may be large — see the table in Fig 1. Indeed, most of the limits on KnowledgeMan are those imposed by the hardware, rather than by the package itself. In particular, there are no software limits to the number of files you can handle at once, nor to the number of indexes which can be kept up-to-date at a time. Data values may be character, numeric, logical or calculated. There weren't any special facilities for handling dates and times, although you can access the current date and time.

File creation and indexing

The initial step in setting up a table is to define the name, type and size of each field by responding to screen prompts. Calculated fields are allowed — these are called virtual fields in KnowledgeMan — and are not stored in the table but recalculated each time the record is updated. You may also define a 'picture' of what the format of a field should be, which is used for displaying fields as well as for checking data on entry. For example, you can specify that an account code must consist of two digits followed by three letters.

If you subsequently decide you want to change the structure of the records in a data management file, you just have to alter the table definition. If this involves changing definitions of existing fields, then data values in existing records are adjusted automatically.

Having defined your file or table structure, you can go straight on to enter data. Using the CREATE command, KnowledgeMan will display a default data entry format with one field per line. Alternatively, you can create a screen format tailored to your every whim. Data in KnowledgeMan tables is held roughly in entry order, but you can create indexes which will allow you to see the information in other orders. A file may have as many indexes as you like; before a file is used it must be opened, and any indexes named in the command will be kept up-to-date automatically. The first index named normally determines the order in which the records are displayed for any form of retrieval, but this can be overridden at display time.

Data input and updating

Entry of information into a data file can be from the keyboard, or under the control of programs using sequences of stored KnowledgeMan commands. Data in spreadsheets and word processing files is entered either from the keyboard or from file, while the graphics module can take data only from the spreadsheet form as it relies on the spreadsheet structure to define what is to be plotted.

When data has been entered into the file, you can retrieve individual records for amendment (using an index if you wish), or browse through the file retrieving one record after another. Where an index is needed, this will be the first index specified when the file is opened, unless you specify an alternative on the PLUCK command which is used for index retrieval. (This makes it much easier to swap between different keywords than is the case in dBaseIII.)

Records retrieved in the above-mentioned way may then be edited using the cursor controls, or you can carry out changes in a 'batch' mode. You specify conditions which, if met, will result in field values being changed — very like REPLACE in dBaseIII.

However, there seems to be no direct equivalent of the UPDATE command — you would need to program that using a stored command sequence.

Screen display

When editing individual records, these may be displayed in a standard format. Alternatively, you can set up one or more forms using a sequence of commands which specify cursor addressing and give you the ability to set colours, reverse video, blinking and other goodies. These commands may be set up directly, by entering the commands into a file, or by using the K-Paint module, which gives 'paint-a-screen' facilities. Once formats have been set up, they are available for use with any of the display commands. An unusual feature of these forms is that they may extend beyond the screen to a maximum of 255 lines.

If you want to display records simply to look at them, rather than change them, you can use the SELECT command. Instead of showing one record on the screen at a time, the default format for SELECT gives tabular output with one record per line.

Another option is just to display statistics about the records in a file such as totals, averages, and so on.

Printed reports

The Form facility is also used to define printed reports giving, with K-Paint, a full paint-a-screen capability. For situations where you need to incorporate information from data management into running text, such as template letters, you can use K-Text to define the template, including references to data fields where appropriate. This gives you a powerful mail-merge facility from within the package.

Selection & sorting

Reordering of information can be carried out in any of three ways. You can use the indexes, as described earlier, to permit records to be edited or displayed in order on fields which will most often be used for this purpose. Where you

Package	Cost (£)	Summary
Know-ledgeMan	545/850	Powerful data management system, few software limits on processing. Spreadsheet included, word processing and business graphics as add-ons, all loosely integrated. Features for experienced users and system developers excellent, complex for novices.
dBaseIII	495	Powerful data management system with ability to store command sequences. Maximum of 10 data files, 15 total files in use at once. Good indexing and selection features. Command-driven, with menu front-end for novices.
Symphony	550	Integrated package with data management, spreadsheet, word processing and graphics, all handled through windows. Amount of information processed at one time limited to computer's memory. Well-produced but bulky documentation includes reference summary.

Fig 2 Comparison of similar data management packages



SCREENTEST

want a file resorted permanently, you can ask KnowledgeMan to physically sort it. For temporary reordering when displaying fields, you can specify a display order when using the SELECT command.

When extracting information selectively, you can specify which records you want SELECTed with the usual range of comparison operators, including an IN operator. When this is used with string variables, the string to be matched may include 'wild code' characters; the default case? will match any one character and * any group of characters. However, you can change the characters used for wild code matching by invoking the LET command to change the appropriate environment variables. Tests may be combined with and, not, inclusive and exclusive or, and brackets may be used to ensure correct evaluation.

Calculation

Calculations in the data management section can be carried out within records, across records and across files. Memory variables, including one- and two-dimensional arrays, may be used to store intermediate results; the number of these is limited only by the memory capacity of the hardware. You can, of course, use calculations to create cell values in spreadsheets. KnowledgeMan provides the usual arithmetic operators (including brackets), plus a large number of numeric, string and logical functions. These include finding the length of a string, determining whether a file exists, whether end-of-file has been reached, and calculating logs, natural logs and trigonometric functions.

To extract aggregate information from KnowledgeMan, you can either use the STAT command interactively, or employ memory variables (using the LET command) where STAT is insufficient. Again, you have the full range of arithmetic operators and functions available, including some aimed at helping with array processing.

Multiple files

Association of data from several files is a straightforward matter — you just open all the files first, then specify the fields by file and field name to avoid ambiguity, in the form <filename>.<fieldname>. Where the command concerned creates a table, whether for display (for example, in SELECT) or for storage in another file, quite complex joining and projecting operations may be involved.

KnowledgeMan uses relational algebra techniques to accomplish these operations. You don't need to understand the low-level algebra in detail, but if your data has a complex structure, then these facilities must be used with care. The KnowledgeMan manual says that, since it uses a relational model for structuring the data, combining data from several files will work as expected provided the data is in third normal form. But the package cannot enforce the integrity of the data in that sense — it's up to you to see that records 'depend on the key, the whole key and nothing but the key.'

Tailoring

In addition to the interactive commands, KnowledgeMan also has a wide range of procedural commands which can be stored in a file and run as a group. These include conditional and interactive execution commands but no GOTO — although there is a BREAK command to execute from loops when abnormal conditions arise. The form of most of these features is very similar to that in dBaseIII, but with the substantial advantages of the ability to use arrays and of much greater limits on memory variables.

Some of KnowledgeMan's operations are controlled by a set of switches or default values which can be altered by the user. For example, when entering data into records on the screen, KnowledgeMan can echo the contents of the previous record in the current record display, so that if much of your data entry is repetitive you only have to type what actually changes. Whether this happens or not is controlled by a flag which you may set on or off (the default is on, which didn't seem quite right, but you can change that permanently). KnowledgeMan has a lot of these flags, including a number concerned with the operation of the printer such as lines per page, start characters, and so on. All have default values, so you can ignore them to start with if you can work with the defaults.

Security & housekeeping

Coming from a supplier used to the conventions of large database management systems, it's no surprise to find that KnowledgeMan pays a lot of attention to data security in the sense of preventing unauthorised access. You can set levels of protection on fields and files which can be different for read and write access. You can also set up a username, with a password for each user, to prevent unauthorised people getting in at all.

In addition to the full facilities within KnowledgeMan for handling its own files, you can also execute any operating system command directly. This means that not only can you do simple things like listing an external file within the program, you can also run another word processor or Basic, including coping with the problems of the limitations of the MS-DOS/PC-DOS subdirectory facilities. For a package which provides so many features to aid the building of tailored systems, this is a substantial advantage.

Links with outside

You can write text files from data files using one of three formats: DIF (for use with VisiCalc *et al*), Basic (comma delimited, quotes around strings), and word processing (one field per line followed by carriage return). You can also send values or groups of values to individual cells or groups of cells in a spreadsheet for subsequent processing by Calc. Importing files is allowed either from Basic (comma delimited) files created outside KnowledgeMan, or from files created by the Calc part of KnowledgeMan.

Benchmarks

BM1	Time to add one new record	Inst
BM2	Time to select record by primary key	Inst
BM3	Time to select record by secondary key	Inst
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	50s+
BM5	Time to access record using wild code	Inst
BM6	Time to index 1000 records on three-character field	1m 3secs
BM7	Time to sort 1000 records on five-character field	2m 10secs
BM8	Time to calculate on one field per record and store result in record	1m
BM9	Time to total three fields over 1000 records	1m 33secs
BM10	Time to add one new field to each of 1000 records	5m 27secs

Time to import a file of 100 records: 8m 25secs

Notes: NT = Not tested NP = Not possible + = including scrolling
Where two times are given, first is access to first record, second is access to each subsequent record

Benchmarks recorded on IBM PC/XT with hard disk

K-Text is used from within the basic system simply by issuing the TEXT command; you can then use the editing facilities to create text files. These can be conventional documents, or they may be templates into which data from structured files is inserted. All KnowledgeMan commands proper are accessible from within K-Text by prefacing them with a backslash. These facilities are extremely powerful, but many people will find the approach rather difficult to begin with. All layout is handled by print-time commands, so this is no 'What-you-see-is-what-you-get' word processor. The result is an extremely powerful formatter, allied to an editor with all the basic facilities, but with less appeal to the average user than more office-oriented systems.

Like the word processor, the spreadsheet is accessed with a single command from the data management package, and the full range of commands can be used by prefacing them with a backslash. Files can be converted to spreadsheet format with a single command, but this must be done explicitly. Spreadsheets may occupy a maximum of 255 rows by 255 columns, which is probably sufficient for most purposes and more generous than many. Several spreadsheets can be combined together if necessary. As with the other parts of the system, colour can be used to brighten up the display. The ability to include in cell definitions any legal KnowledgeMan command, including a complete set of stored commands, gives substantial processing power.

The graphics facilities provide the usual range of business graphics, with bar graphs, pie charts, scattergrams and so on, all in as glorious technicolour as your monitor will permit. Using KnowledgeMan commands, you can set up quite complex functions to be plotted, but this is basically a DIY operation — there is, for example, no least-squares regression fit provided as part of the package.

User image

KnowledgeMan is a command-driven package: if you like that approach, then you'll find it easy to use. The structure of the command language is quite straightforward, and is so similar to that of dBaseII and dBaseIII that anyone familiar with either package should pick it up very quickly. There are some clumsy areas — for example, there's no way to get the printer to echo what is shown on the screen (although you can dump a screen in K-Text). Nor is there a simple facility for producing printed reports using a standard format with totals and subtotals. To do that you must create your own format, with the form facilities common to both formatted screen and printed reports, using the K-Paint module. When direct screen editing is in use, the default cursor control keys are largely the same as their equivalents in WordStar — CTRL/S for move right one character, and so on. However, the IBM PC keyboard is set up so that the cursor arrow keys move one field at a time, not one character, which I found hard to get used to. (You can, of course, use the key management utility to change this.)

'The structure of the command language is quite straightforward, and is so similar to that of dBaseII and dBaseIII that anyone familiar with either package should pick it up very quickly.'

The connection between the data management and spreadsheet features is less direct than in some packages: having to write a file in a different format to go either way is a nuisance. On the other hand, the ability to use all the KnowledgeMan procedural commands in the other modules gives them considerable power.

A particularly good feature is the adaptability of the package to the vagaries of particular situations. For example, being able to change the characters used for wild code matching could be a big help if your data contained a lot of asterisks. The MACRO command, which allows you to define one string as equivalent to another, could save a lot of typing, and could also help people transferring from one system to another. If you thought the SELECT command had a confusing name, you could call it something completely different with MACRO.

Documentation

The KnowledgeMan manual is bulky and turgid, as are many such documents. It does, however, have a lot of redeeming features. There are dividers separating each section, with names on the tabs. The whole manual includes three levels of information: one for a first reading; the second containing extra information and indicated by a thin black bar in the margin; and the third level, shown by a thick black bar, is for experienced KnowledgeMan users wanting to exploit the full capabilities of the package. There's an introductory section which at least gives a nod in the direction of helping people to get started. There's also a book on using KnowledgeMan, which provides some much-needed extra help for novices at £17.50 a copy.

An alternative to making extensive use of the manual is to rely on the Help facility. This gives basic information about each command and about the use of the keyboard, using plenty of colour if your system can display it. As is so often the case, the Help is quite good when you know what you want to ask, but much less helpful when you're in a muddle, or when you need further elaboration of the often terse error messages.

Conclusion

For those who want combinations of spreadsheet and data management facilities with 'boilerplating' word processing, and for those who are looking for a powerful data management package, KnowledgeMan is well worth investigating. It's not suitable for novice users. Nevertheless, some beginners who need a variety of features may find it easier to approach their problem by mastering one area first before going on to another, rather than having to learn a lot at the start, as is the case with the more closely integrated packages. For those who feel windows are for them, the current version of KnowledgeMan already has the hooks to allow you to use it under IBM's TopView system — when that becomes available in the UK.

Those with some computing experience should be able to cope with the command language approach and the rather dense manual. For such people, especially those who want to develop systems tailored to particular applications, KnowledgeMan looks a very interesting product, particularly in view of the possibilities of including word processing and graphics under the control of a reasonably sophisticated command language. END

Summary

Supplier	Data Base Experts
Telephone	(0753) 840313
Cost (ex VAT)	£450, £545 (inc K-Paint), £850 (inc WP & graphics)
Systems	MS, PC, 86
Version reviewed	PC 1.07
Type	E, S
Features	Data management features include unlimited files, large records, good indexing and selection, powerful stored commands for tailoring. Loose integration to word processing, spreadsheet; business graphics on IBM PC.
Drawbacks	Virtually no 'default' printing features — must use paint-a-screen reports or text processor for most printing.
Ease of use	Good for experienced users and system developers, less easy for novices.

Is anybody there?

The world of microcommunications holds exciting possibilities: just imagine accessing a computer bulletin board via satellite. Martyn Croft explores different methods of data transmission.

What is a network? The dictionary definition is as follows: 'an arrangement with intersecting lines and interstices; a chain of interconnected persons or operations or electrical conductors; a group of broadcasting stations connected for simultaneous broadcast of same programme.'

Note the spelling of *programme*. By changing this to the usually accepted way of spelling the computer variety, we can see that computer networks are aptly named, being indeed all of those things.

Local Area Network (or LAN) is fast moving to the top of the computer buzzword charts and LANs have been proclaimed as one of the major growth areas for computing. No longer will your desktop micro have to sit in lonely isolation: very soon it could idle away its time chatting up the zippy new 16-bitter in the accounts department, or pass comment to the other management micros about the falling standards in the word processing pool. The LAN is seen as becoming the fundamental cog in the information revolution and can, in its simplest form, be implemented on nothing more sophisticated than a couple of wires. But network techniques are capable of being applied to all the communication modes currently employed by man.

'The LAN is seen as becoming the fundamental cog in the information revolution and can, in its simplest form, be implemented on nothing more sophisticated than a couple of wires.'

Local area networking

Networking systems have been around for some time, and are readily available in one form or another for many of the popular micros. Some networks such as Omninet from Corvus systems and the famous Ethernet and Cambridge ring are true bus systems, while others cheat a little by adopting a star or tree and branch configuration with some form of routing control such as a multiplexer. This switches the stations through to each other briefly but quickly enough for it to appear as a continuous connection. All the systems appear to work satisfactorily, but the network bus is perhaps the most pure form, the intelligence of the system being in each terminal connection onto the network and not in the 'network' itself. After all, how smart can a piece of wire or fibre optic cable be?

Local area networking involves the transmission of data, usually at very high speeds (one megabit per second is not uncommon), between participating nodes on the network. To control this data transfer various protocols exist which ensure a method of recovering data errors, correctly routing data between the nodes and resolving collisions of data on the network.

Basically these protocols govern how the terminal node formats the data into the chunk, or packet, which will be sent along the network, and what to do when the data which has been sent becomes corrupted in transit. The network protocol can range from simple rules in software to complex HDLC (High-level Data Link Control) chips which handle everything for you.

LANs don't intrinsically require high data transmission rates, although in order to function efficiently in a commercial environment, a high data rate is desirable. For the interested hacker, all that's needed is a source of serial data, some wire and a like-minded colleague. A large number of micros already possess, or are capable of being fitted with, a serial port and with suitable buffering of the signal levels, the data in, data out and handshake lines (such as Clear To Send and Request To Send) can be connected to a pair of wires which will form the basic network.

The standard for serial ports, RS232, covers the specifications of devices used for the transmission of data along fairly long bits of wire, usually to another computer or a printer. Tapping other computers into the same piece of wire, providing you don't load the signal so heavily that it disappears down your computer's port, doesn't change anything — except that the eavesdropping machine can, if endowed with some suitable etiquette in the software department, join in the conversation whistling up and down the wire. (The practicalities of doing just this were discussed in *ULCNET: a low cost network*, Clements and Dougherty, *Byte*, October 1981).

The problem with cable network connections is that until we all have wires or fibre-optic cables into each of our homes — which aren't subject to fussy connection regulations and don't cost an arm and a leg to use — networks are limited to use in one building. While you might practically install a network in your school or office, the authorities won't take kindly to you digging a cable into the road for the half mile or so up to your friend's house. Dialling into the local bulletin board or, hopefully, in the future, the network gateway, is about the best you can do. Unless you're a radio amateur.

'While you might practically install a network in your school or office, the authorities won't take kindly to you digging a cable into the road for the half mile or so up to your friend's house.'

Research

The radio amateurs, who are as always at the very forefront of development in technical matters, are at least paralleling, if not leading, research into data transmissions.

Traditionally the radio ham has transmitted data using a mode of communication known as Radio teletype or RTTY. This method is also in widespread use in the commercial world and has been so for some time. The technique in its simplest form employs a coding known as Baudot or Murray code. This consists of five bits (not the

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PCW193

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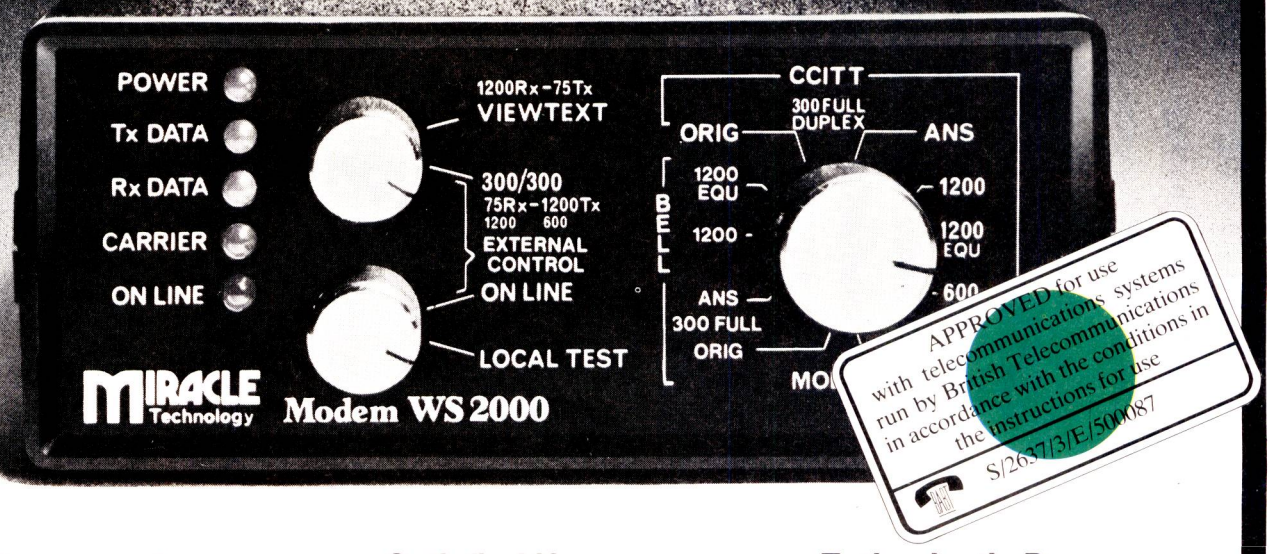

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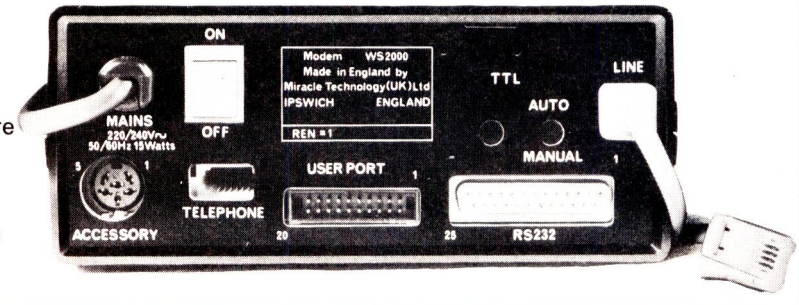

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usual seven or eight) sent serially from a mechanical teletype to a terminal unit which converts the ones and zeros of the binary code into two tones: 1445Hz for a mark and 1275Hz for a space. These tones are then transmitted over a normal radio link to the receiving station at a leisurely rate of something around 45.5 baud. Some commercial stations such as the news services, which, by the way, have been using this method to transmit the news all over the world since the 1930s, occasionally rise to the dizzy speeds of 75 baud. Since teletypes are mechanical devices, it wasn't until the advent of micros that transmission rates could become any faster, but whichever way you look at it, it's a bit on the slow side.

However, one of the advantages of RTTY is that it can be sent and received by anyone who can peck out a message on a keyboard. The system performs tolerably well and the intelligence of the operator is employed in removing the corruptions of the data which occur on the usually noisy signal paths. One of the noisiest signal paths imaginable will occur when several RTTY stations try to operate on the same frequency, forming an embryonic network on the air, if you like.

'Packet radio has many of the features of a LAN but does away with the wires. The network bus is the very "ether". Protocols have been developed to control the exchange of data between the network nodes . . .'

What is missing is some form of controlling protocol to govern the transmissions and create order from chaos.

Packet radio

Packet radio has many of the features of a LAN but does away with the wires. The network bus is the very 'ether'. Protocols have been developed to control the exchange of data between the network nodes and much work has been done on the implementation of 'smart' terminal node controllers, notably in Canada where a change in the regulations concerning radio transmissions allowed, for the first time, the transmission of data in forms other than the traditional RTTY.

There is currently a lot of interest in packet radio; it features in the amateur radio and electronics press with increasing regularity. The Radio Society of Great Britain (the radio amateurs' representative body in this country) stimulates interest in the technique, publishing relevant articles in the society's magazine, *Radcom*. But, as with any mode of data transmission over what are primarily audio frequency channels, packet radio still requires that the digital signal be encoded into tones and some very clever, and expensive, chips can be used as the basis for a terminal node controller. These chips take care of modulating the signal as well as controlling the protocol of the transmissions on the network. Designs published to date have concentrated on putting the intelligence in the node controller which then allows operation of the system through an ordinary VDU.

This seems to be an expensive way of going about things, although the cost of these chips will probably come down in time. It would seem that since the majority of experimenters will have a computer anyway, there could be some interesting possibilities in using one of the oldest modulating standards in existence.

When the first micros became available, cassette tapes were (and still are) used for storage of programs and data. The data, which was sent in serial fashion to the cassette recorder, had to be encoded as audio tones for the tape machine to record on the tape, and this was done on many early micros to a standard known as Kansas City or CUTS.

Each character of the data is serialised and, at 300 baud, a digital one is coded as eight cycles of 2400Hz and a zero as four cycles of 1200Hz. As many Compukit UK101 or Ohio Superboard owners will testify, this method is robust — to say the least — if perhaps a little on the slow side compared to some of the more modern computers around today. The major advantage of CUTS is that it's easy to achieve in either hardware or software. In fact the BBC Micro uses a slightly modified CUTS protocol, the default transmission rate being 1200 baud, although 300 baud is easily achieved, to converse with a cassette recorder. This just goes to show that sometimes the old ways are still the best.

Interestingly enough, Basicode, pioneered by the Dutch *Hobbyscoop* radio programme and since adopted by Radio 4's *Chip Shop*, is still basically CUTS. The data rate is 1200 baud with a one represented by two cycles of 2400Hz and a zero represented by one cycle of 1200Hz. This is just a straight uprating of the 300 baud system.

The Basicode protocol also calls for a header tone of 2400Hz, an ASCII SOT character (start of transmission, 82H), a block of ASCII text, an ASCII EOT character (end of transmission, 83H), a one byte checksum and a final tone of 2400Hz to be sent, in that order. To prove the point, this packet of data is encoded and decoded in software, with no extra hardware required.

By simply adding in two more items of information, namely an identification of the source of the packet and intended destination for the packet, and some suitable software to resolve collisions when two or more stations try to transmit simultaneously, we have a simple basis for experiments in low-cost packet radio techniques.

There is one other reason for adopting 1200 baud CUTS as a data transmission standard.

As well as pushing back the frontiers of packet data transmission, if you didn't already know, the radio hams are now in space. One of the amateur satellites, UOSAT, sends telemetry data to earth encoded in CUTS at 1200 baud. These signals are easily receivable with only a modest receiver and many schools and colleges now incorporate a session with the satellites into their curriculum.

'Although still very much in its infancy, the potential of data transmission via radio is enormous. Already groups are looking to build automatic repeater stations which will, in essence, be computer bulletin boards accessed via the airwaves...'

Conclusion

Although still very much in its infancy, the potential of data transmission via radio is enormous. Already groups are looking to build automatic repeater stations which will, in essence, be computer bulletin boards accessed via the airwaves, offering facilities such as networking operations and the store and forward techniques now beginning to be found on the newer telephone systems. And, due for launch in 1986, is PACSAT, an amateur packet radio satellite.

Obviously this is all very well if you happen to be a radio amateur, but what about the interested hacker? Unfortunately, the one communication method accessible to everyone where great advances could have been made by the hobbyist community cannot take place. At the moment, the regulations covering Citizens Band radio do not allow the transmission of anything other than normal speech.

It looks like the multi-player *Star Trek* game will have to wait. END

Living in the real world

An opportunity to gain first-hand experience of a new subject through the simulation of real or imaginary situations is undeniably innovative. Mary Sargent looks at the development of 'interactive video' and its potential in the fields of commerce and education.

The concept of interactive video has been around for some time, but it's one of those phrases which means different things to different people. Basically, it is about the storage and manipulation of all kinds of data, including both still and moving pictures, to simulate and give experience of situations both real and imaginary in a way which is not possible by television. Such situations might include games presently only played on machines in arcades, where an adventurer is faced with a fully-animated, Disney-style monster, in place of the bloodless text of a contemporary micro trip. Alternatively, the player might experience the thrill of piloting a hang glider across an ever-changing backdrop of the Grand Canyon. Already, on a slightly less exciting theme, JVC has designed a golf game which uses film of a real fairway as the course for the computerised golf ball to negotiate. All these things will, in time, become available to the world at large, and will be run on a home micro-driven system.

More seriously, educationalists recognise interactive video as being potentially more accessible to teachers than the micro. They regard it as a means of enlarging a child's perception of the world in a way not made possible by any other resource. In the words of Bill Plummer, a primary school teacher responsible for writing what is still the only fully interactive educational program on disk, interactive video 'will open out the classroom to the real world.'

In the business world many firms are already running training programmes for their staff, particularly on the sales side, which involve a level of interactive video instruction. Some of these courses have been available for eighteen months or more, using video tape systems, and occasionally stand-alone disk systems, but it is only when a video disk player is put under computer control that a video program has the facility to become fully interactive; and this is where the confusion arises. Without a specific computer link, it's possible to access information at random, both fast and accurately, to scan fast and in slow motion, to freeze a frame and to hold it for a sufficient length of time for the user to absorb detail. But this is only part of the story: such a system should more helpfully be called active than interactive.

Requirements

Interactive video needs a computer control-language, and a suitable program, appropriate to the disk in the video player, run by the control language. Even with this degree of sophistication, the program may still be on a fairly primitive level of interaction, designed merely to create large menus and indexes as an efficient, and impressively fast, method of visual data retrieval.

The higher levels of interaction can be created by the introduction of branching software. For example, once a sequence has been shown, the program has the capacity either to go on to another sequence on any part of the disk, or to show a sequence reinforcing or recapitulating the original. The extent of branching is theoretically controlled only by the storage capacity of the disk, which can involve up to 54,000 frames of still pictures.

Tape systems have neither the massive storage capacity of disks nor the speed of operation, so cannot produce the same impressively high definition images. It is fair to say that such systems are already obsolete. This does not mean that they are not still very much in use; they will almost certainly continue to be used by firms which already have tape system hardware. However, the companies most likely to have influence in the field of interactive video are now using disks for both research and development.

Disk types

There are currently two types of disk in use, VHD (Very High Density) and 'Optical' disks, of which the best known is Philips' Laservision. The difference is not merely one of name. The optical disk is 12in in diameter, double-sided, and its tracks are made up of a series of micron-sized pits illuminated by a low-power, helium-neon laser. These are read by a photodiode and the optical pulses from the micro-pits demodulated to produce both video and audio carrier signals which are subsequently converted into pictures and sound.

The VHD disk is 10in in diameter and capable of storing as much data as the optical. It works in much the same way, except that, instead of a laser, the disk is read by a stylus. Although this is very light, and in no way comparable to the arms used on conventional record players, it, nevertheless, means that the disk is in physical contact and is, therefore, subject to wear.

Wear only becomes apparent when the freeze frame facility is called on, and then only after a frame has been held for a long period of time, or on numerous occasions. Thorn EMI, which produces and markets VHD disks, claims that it would take up to twenty hours before the groove containing the frozen frame was damaged, although others might dispute that estimate. Certainly, once a VHD disk is worn, the damage is irremediable.

There is also some question about the quality of the still picture as produced by a VHD disk. Picture wobble was cited in a report written by Colin Mably of the North East London Polytechnic, following an experiment by Thorn EMI. The experiment consisted of putting video disk players into four primary schools together with active programs on disk, and assessing

teachers' reactions to the systems. Picture wobble was mentioned as a defect, and since an important part of the case for using disks rather than tape rests on the superiority of the image produced, it's a criticism worth noting.

Michael Grove, technical director of Acorn's video subsidiary, is an advocate of the optical disk. He claims that VHD disks are no longer popular in the US, following the less than impressive debut there of video disk sytems in the late seventies/early eighties, and that companies such as Hitachi and RCA, which once marketed VHD, are now moving towards optical technology. Europe, too, is increasingly concerned to establish a working standard for video disks, and prefers laser disks to the stylus-read version. It would certainly seem to be true that the durability of the robust optical disk makes it a natural choice on which to centre future development, particularly where archival material is involved.

There is, of course, a catch: money. Optical disks are currently very much more expensive than VHD. The reasons for this lie in the processes of manufacturing the master from which all subsequent copies are pressed. The premastering technicalities are identical for both types of disk, and are essentially the job of the video tape editors. No matter what the final medium of play (tape, VHD or optical) the process of assembling the film is the same.

However, once the preliminary mechanics are complete, and the program to be put onto disk is assembled in the right order on professional two-inch video tape, the making of the master changes according to the type to be used. The mastering of an optical disk involves exposing a disk made of ultra smooth glass specially coated in photoresist material to laser light, which etches into the disk the micro-pits. These will ultimately be read back by the disk-player's laser.

Once the visible pits have been made, the glass disk is coated with a fine layer of silver, to create the surface needed to conduct the laser signal. It is then plated with nickel and aluminium. The glass master is removed, which damages it beyond repair, and the remaining silver, nickel and aluminium disk is given further electroplatings of nickel. It is, therefore, quite obvious why optical disks are so expensive!

The mastering of the disks is the same whether they are to be used for active or interactive purposes, and the expense is as much due to the precision needed as to the cost of the materials used. For interactive disks, however, the problem is compounded by the very low error rate which can be tolerated. If the contents of a disk are to be manipulated to the fullest advantage, there is no room for poor image reproduction, or inadequate data retrieval. The advantages of disk over tape systems are in the speed of operation and the superior pictures given — the disk itself must be as near perfect as is possible.

In use

The optical versus VHD debate is not a problem for Felix Learning Systems, a company which specialises in interactive video training courses and aims to provide whatever the individual customer needs, from integrated workstations down to specific software.

Its first product was an accessory which linked a video player to a micro. It was specifically designed to enable the customer's existing hardware equipment to run interactive programs. Known simply as the Link, the peripheral is marketed for a variety of video players and computers and makes possible a simple mix of graphics and text on a colour monitor, by synchronising signals from both the computer and the video source, whether that source is a tape system, or a disk player. Using the Link, a picture from the video source can be overlaid by diagrams or text programmed into the computer. Felix cites a program on open heart surgery as a somewhat dramatic example of how this technique can be applied.

Paul Ingram, Felix's manager of programming, emphasises that the software written by Felix to fit an individual customer's requirements is the basis of the organisation. The hardware is merely there to make it possible to run tailored programs. There is, too, an authoring system available, intended to help a customer design his own programs without wasting hours wrestling with heavy technical problems.

The integrated workstations embody hardware designed by Sony, IBM, Apple and others, and whereas they were once exclusively tape-based, there will shortly be a VHD disk-based workstation available. If a buyer needed a laser disk system, the feasibility of such a workstation could and would be investigated.

This does not mean that Felix is not well aware of the potential of interactive video. The company is interested in developing its software in any area in which there is a demand for it, but its approach is representative of the low key pragmatism which has allowed the concept of interactive video to take root in the business and commercial worlds, and is fundamentally different from Acorn Video's attitude.

Acorn knows that, initially, the system it is marketing will be both too expensive and, due to lack of suitable video disk programs, inadequate for use in education. But it is investing heavily in the future, and only time will reveal whether its initiative will pay off.

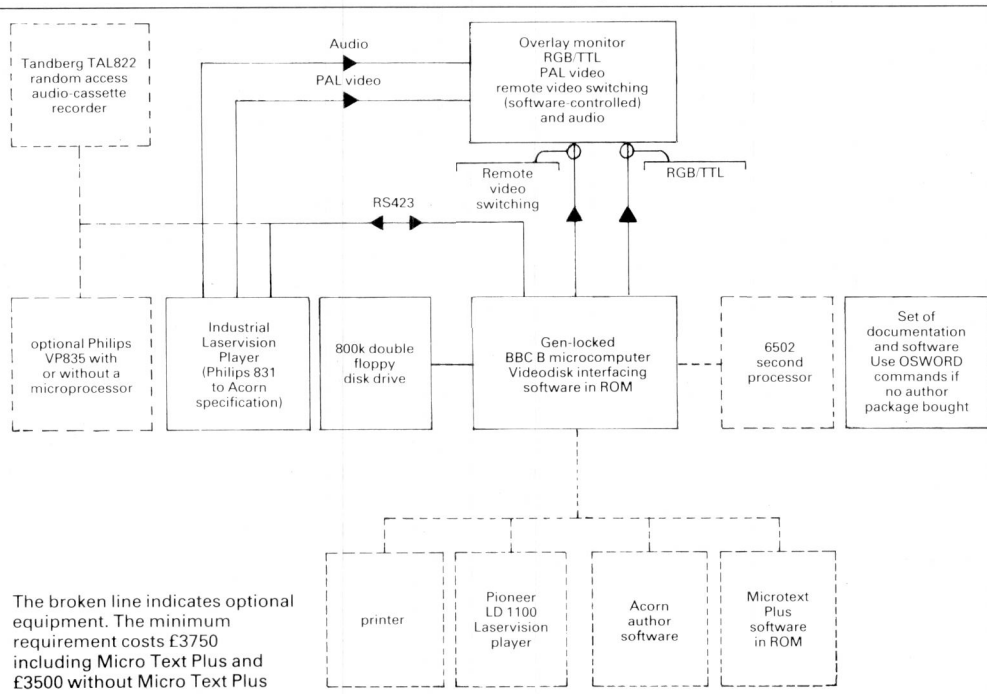

Diagram of an Acorn interactive video specification

The immediate target market includes industry, commerce and the armed forces. To those who have between £3000 and £4000 to spend, Acorn Video can supply a complete system. This consists of a BBC Micro with a Gen-lock board, one of a number of video disk players, including Pioneer and Philips machines, a twin floppy disk drive, a monitor specifically modified to accept signals from both the computer and the video source, including audio signals, and the necessary software to drive the system. This software includes the authoring language, MicroText, which is the basis for the interactive programs written on floppy disk.

The Gen-lock board is vital to the sophistication of the system. It is an interface designed to superimpose a computer-generated display onto a television picture, and affords the user a considerable degree of freedom when designing or implementing interactive programs. While the end-user will take such sophistication for granted, the electronics which allow it to happen are quite complicated — the two sets of video signals from disk-player and computer must be synchronised and this is done by applying phase-lock-loop techniques to the timing components of the BBC's CPU. The adjustments to the CPU clock rate are minute and do not degrade the performance of the computer itself.

Acorn's Interactive System (AIS) also gives the option of using the Tandberg random access audio cassette recorder to create soundtracks for either existing programs or as part of a self-authored package. The emphasis is again on expanding the concept of interactive video to its limits, and Michael Grove expects Acorn Video to be researching and developing those limits for the first few years of the new company's existence. Already, AIS gives greater flexibility and is more sophisticated than any previous system, but there is a major barrier to its use in schools or homes at this time.

Apart from the cost, which will come down as sytems are sold and hardware refinements made, the main problem is one of user software. The industrial market is mainly concentrated on short sequences, usually training films, with a definite end purpose, which need only limited and low level interactive routines, but the home and school markets demand a level of control and flexibility which is not yet economically feasible.

In the first place, there is a shortage of suitable active disks. Candidates spring to mind: if, for example, David Attenborough's *Life on Earth* or *Living Planet* series were issued on active disk, that would create a wealth of source material for interactive video programs, which would span a whole range of ages and educational disciplines. However, no-one has yet done it, and the problem remains of how the interactive program can be produced at a reasonable price. It took Bill Plummer 600 hours writing to produce his interactive program.

Microtext, the basis for Bill's work, is described by the group responsible for its development at the National Physical Laboratory as 'attempting to make ease of use rather than ease of implementation the ultimate criterion for system design.' Roughly translated this means that although a would-be author can quickly understand the authoring procedures needed, it's still a long-winded business, centred around editing frames of text on the screen. The catch is that the disk to be made interactive must incorporate numbered frames, so that the interactive sequences can be fully planned in advance, and the computer programmed with all the frame numbers selected for the particular courseware in preparation. It is this stage which accounts for many of the hours involved and it is likely to remain a problem. As yet, no-one has devised a substitute for human thought and planning!

However, it should not be forgotten that although interactive video's future may be in highly sophisticated applications, its origins were on the 'home experiment' level. Both Michael Grove and Bill Plummer worked initially with non-dedicated hardware. What was done once could be done again. The equipment was standard Acorn issue, with separate monitors for the BBC Micro and Pioneer disk-player removing the need for video-signal synchronisation. Basic was the control language used in those early days (January 1983) and the only specialised piece of hardware was a small interface board which synthesised the serial pulses at a carrier frequency of 28KHz for the Pioneer player. In effect, this took the place of the video player's remote-control keypad.

Conclusion

Inexpensive systems (for those who don't want to wait and see what Acorn has up its sleeve) are likely to involve the 'domestic' range of players, such as the Philips VP830 or equivalent models from the Pioneer stable. But linking the home micro to the home video takes time and patience. The interface to the Pioneer LD 1100 illustrates this point well. The Pioneer is controlled by 35 command signals. The keypad (and hence a computer) once adequately programmed, can tell the player to SEARCH for frame number 22,000 and this it will do with great accuracy — only failing if no frame with number 22,000 attached to it was laid down on the disk at the time of manufacture.

However, there are no handshaking signals returning from the player to the computer, so the computer doesn't know exactly when frame 22,000 has been found. To allow a four second wait, the worst-case time for frame retrieval, would be totally unacceptable on a system where most frame-to-frame jumps will take a fraction of a second. To speed things up it's necessary to devise an interface which continuously monitors the player's video output so that the computer may be informed as soon as the previous command has been executed. The computer can issue commands as fast as it wishes, but the interface will slow the program down for just the right amount of time so that a command is never issued at the wrong moment. The Pioneer computer-interface uses this technique, and similar handshaking protocols have been built into Acorn's Microtest authoring language.

If you can afford to purchase the 'industrial' type of player (for example, one of the Philips VP835-series), then you will be able to enjoy an RS232 serial link with your computer and will be able to receive signals from the video-player rather than just send signals into the void, hoping they will perform as expected. The budget might also allow the purchase of an authoring language, and logically MicroText or Philvas, the Philips authoring package, are prime candidates. Philvas is particularly comprehensive since it allows the authoring process to be taken to its logical limits: the production of ROM cartridges containing various types of courseware for a specific disk or the production of a specific courseware program to be laid down on the tracks of the video-disk itself. This, however, is hardly an area for the interested amateur or the under-funded educationalist.

The whole point of authoring systems is to enable non-programmers to write courseware to accompany the video disk, but for those people who enjoy the challenge of program writing, there are languages that can be written or enhanced to provide the facilities necessary to drive, interactively, a video disk. For example, PILOT, a text-based language akin to Basic, can be set to display computer-screen information, pose questions for the student and then branch to other parts of the program, depending on the student's response.

One step on from PILOT is the little known and under-documented NODDY, a computer-based learning system actually built into the ROM of the MTX series computers from Memotech. NODDY interacts with Basic, and could be extended quite easily to drive a video disk player along the lines already indicated.

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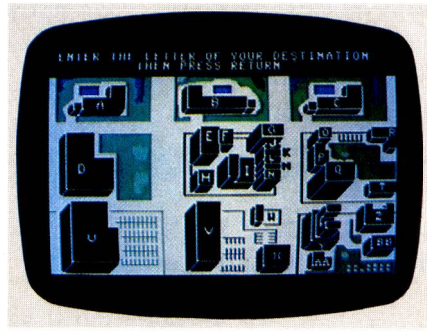
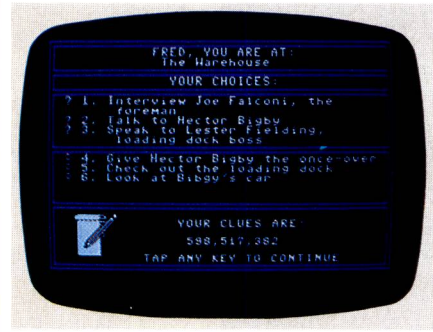
SCREENPLAY



Tired, emotional but brave, Tony Hetherington solves the mystery of the 12 murders and wreaks revenge on the Witchking's daughter. It's all in a day's work as he looks at this month's best games for the Commodore 64, Spectrum and BBC.







And then there were 12

Title: Murder by the Dozen
Computer: Commodore 64
Supplier: CBS Software
Format: Disk
Price: £17.95

Murder by the Dozen is set in the town of Micopolis which is going to have a very busy homicide department — there are to be 12 murders. It's your job to find out who dunnit, either by yourself or in competition with up to three other detectives.

The murder that you wish to tackle is selected from a gruesome screen which illustrates the cause of death of each of the victims. These include a computer programmer who's been shot, a drug dealer hanged in a school and someone who's been beaten to death with a bedpan. When the detectives enter their names the game begins with the facts of the case. From then on it's a race to solve the mystery.

Each player is presented with a list of options which vary from location to location and include interviewing suspects, searching rooms and examining records or accounts. The result of these actions is presented as a list of numbers which corresponds to clues in a book, although many entries are dummy clues to mislead the opposition. These clues are facts or phrases which may string together into useful clues, but if accidently read will be meaningless.

To add to the confusion, and to prevent cheating, the characters in the cases often overlap but in completely different circumstances, so a careless cheat can be horribly mislead.

Each step takes time and a record is kept. You won't return to the keyboard until the other players have used the same amount of time.

When you think you have solved the murder, you must declare your case before looking up the solution in the solutions' book.

If you're wrong, or haven't sufficient evidence, the game continues without you. But if you're right, you win and are rated on your performance. These ratings range from 'lucky guesser' for solving it too quickly through to 'innocent bystander'.

Each rating is complemented by comments which at the time can look very cutting indeed — for example, after the none-too inspiring 'Rotten detective' you're asked 'What took you so long?' and 'Were you trying to put in overtime?'.

Once a crime has been solved it shouldn't, ideally, be played again, but in a package of 12 murders it's certainly worth the money.



Time travels

Title: Time Lords
Computer: BBC
Supplier: Red Shift
Format: Cassette
Price: £9.95

The major starfaring races have been at war for countless years, and they aren't going to let a little matter like the end of the universe interfere with their struggle. Therefore, they've hired Time Lords to continue the conflict by travelling back through time and altering the results of wars that their clients lost. The object of the game: one race must ultimately win the battle.

Up to five players can join in the fun and each can use a number of devices to help him. Scanners are used to trace the path of each planet's history through 15 time zones, time beacons trace the movement of other Time Lords, and time traps catch opponents unawares.

You do, however, have your limitations. To avoid paradoxes caused by meeting yourself, you can only visit a planet if you have a number of points which represent your energy. When that's gone, you're out of the game. These points protect you from other Time Lords and movement throughout history, and influence the outcome of wars.

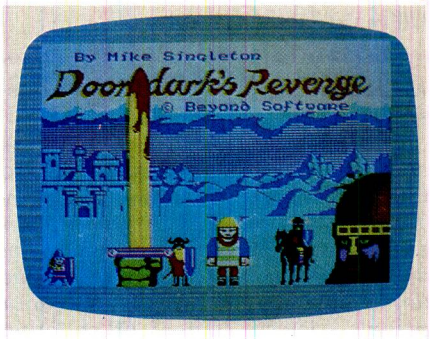
Each time you play the game, the computer generates a different history for each planet and will chart it through the time zones. Consequently, your first task is to scan through time to discover when other planets were colonised and where crucial wars started and finished. You can then change important events to help your client, but beware of the other Time Lords. If you meet an opponent, you can either exchange

information or fight to the death.

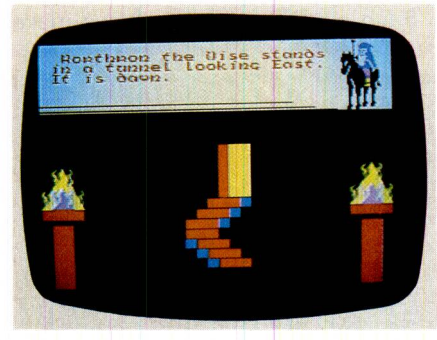
Getting killed is only a temporary setback in a game based on time travel. If you're killed by someone in time zone six and he is subsequently despatched in time zone three, then he obviously didn't kill you. You're back in the action until, of course, another player kills the player who killed you.

If a Time Lord alters history in favour of his race, then he is the winner and the game ends. However, a more likely result is that the Time Lords will run out of energy and the result will be decided by judging which is the most successful race.

It's a challenging and enjoyable game but also mind-boggling.







Revenge is sweet

Title: Doomdark's Revenge
Computer: 48k Spectrum
Supplier: Beyond
Format: Cassette
Price: £9.95

Doomdark's Revenge is the sequel to Lords of Midnight and has a tough act to follow. But it has not only matched the depth and appeal of Midnight, it has actually improved on it.

Morkin, son of Luxor the Moonprince, has been kidnapped by Shareth, daughter of the Witchking of Doomdark. Your task is to journey into the frozen wastes of Icemark (which lies to the North of Doomdark) and rescue him.

You have a number of characters with which to accomplish this: they are Luxor and Rorthon from Midnight, and Morkin's girlfriend Tarithel the Fey. You can also recruit help from the inhabitants of Icemark, but remember you're a stranger from Midnight and this may prove difficult.

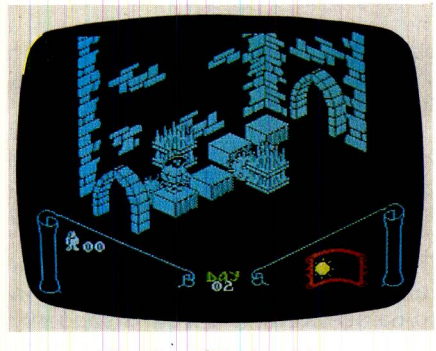
Icemark is divided into five kingdoms which are split by bitter rivalries, but Shareth the Heartstealer is Queen overall. A total of 123 independent Lords command the forces of the races of Giants, Dwarves, Barbicans, Fey and the Icelords. Each Lord has his own allegiances, hates and personal vendettas, and may be more interested in settling an old score than helping you. Similarly the Lords may be involved in their own quest to find one of the 128 treasures littered throughout Icemark. They may have even joined forces with Shareth and their welcome will certainly be hostile.

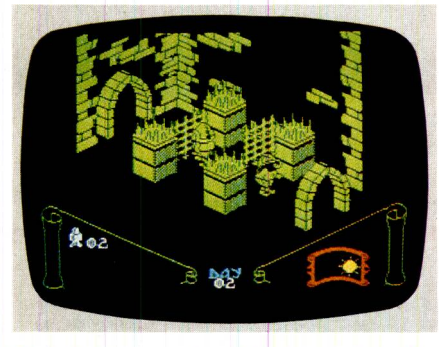
To defeat Shareth you'll need help from these Lords, so you should get to know their personalities and ambitions; perhaps you'll have to help them before they'll help you.

You'll also have to map out the land. The map printed on the back of the instruction booklet is at best vague, as Beyond considered that the map in Midnight made the game too easy. The company will sell you a mapping aid but this will be of little help. The problem isn't alleviated by the fact that Icemark is bigger than Midnight and consists of 48,000 'landscaped' screens. some of the new landscapes feature palaces and temples, gates and pits, and magical fountains. The gates and pits allow access to torchlit underground passages which may provide safe passage under an enemy army, but may also harbour foul creatures.

Doomdark's Revenge is a mammoth challenge, even to those who successfully completed Lords of Midnight.







Once a Wulf, always a wolf

Title: Knight Lore
Computer: 48k Spectrum
Supplier: Ultimate
Format: Cassette
Price: £9.99

When I reviewed Sabre Wulf, Ultimate's sequel to the excellent Atic Atac, I was disappointed because I was expecting something more. Knight Lore is it.

It's the most technically advanced Spectrum game I've seen and features true 3D graphics in the shape of 128 rooms that are viewed from the top corner. They're filled with concrete slabs, spiked balls, tables, chests, and a variety of nasty critters. The contents of each room are arranged to form a problem, or problems, that you must solve. These range from getting to the exit to collecting an object without springing a well-designed trap.

You, as the hero, have a problem — you've been bitten by the Wulf in Sabre Wulf and turn into a werewolf when the moon rises. It appears in a window below the room display and alternates with a sun to show the passage of the forty days in which you must complete the game.

Your main objective is to find a cure for your affliction (turning into a werewolf can seriously affect your social life), but you should also seize the opportunity to find some ill-gotten booty during your travels.

Knight Lore differs from earlier Ultimate games in that it lacks a fire button, and the slightest touch from the critters will lose you one of your lives. These critters don't stream at you as in Atic Atac or Sabre Wulf, but present a more planned and organised attack.

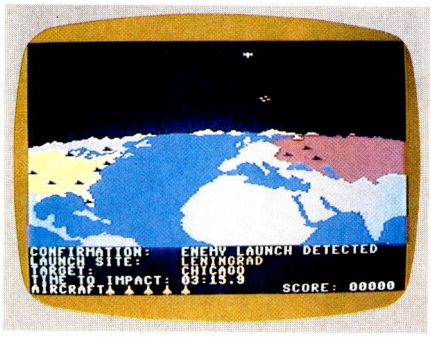
There's certainly no easy fire button fodder in this game. Indeed, some of the critters don't even try and kill you — they just content themselves with getting in your way. For example, there is one who'll try and catch you, then dump you back out of the room.

All this makes Knight Lore the closest thing there is to a true arcade/adventure

program. The problems that you face are challenging and difficult, but all seem to have a logical solution.

Such a design would always make this a good game, but the graphics set it apart from the others. At last you can walk under, over and around things, and looking for objects becomes a search as they really can be hidden from view.

In a word, Knight Lore is the ultimate Ultimate game.



Diplomatic relations

Title: Raid Over Moscow
Computer: Commodore 64
Supplier: Access/US Gold
Format: Cassette
Price: £7.95

Raid Over Moscow was written by Bruce Carver and has a similar format to that of his previous title, Beach-head.

This time your task is to work your way through the various screens in order to destroy the Russians before their missiles blow up America.

The game begins with a view of the world as the first Russian salvo is launched.

You start the game high above the world in the satellite headquarters of the Strategic Air Command, where you monitor the aggression. When the alarm is sounded your pilots race (well, amble) to their planes. You then have to steer the planes out of the hanger, a task which, unfortunately, can take some practice. Eventually you'll be able to fly out backwards, but initial attempts will scatter planes above and around the hanger doors.

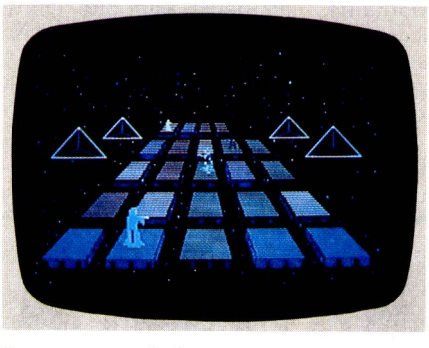
Once launched, you guide your planes down to the Russian launch site where you begin your assault, during which you must fly low through the enemy defences of heat-seeking missiles, tanks and helicopters. A few well-aimed shots will destroy the missile silos.

But those unsporting Russians fire another salvo of missiles and it's back to the planes again. Should you destroy the missile silos of Leningrad, Minsk and Saratov you can attack the Soviet defence centre in Moscow. This looks remarkably like the Kremlin, and your assault consists largely of shooting persistent guards who treat being shot dead as a temporary setback.

Once past the guards you have to destroy a cooling robot doing Chernenko impressions in order to overheat and destroy the reactor.

When you've mastered one level you may consider the challenge of the game's advanced or even suicidal levels, which are difficult and impossible respectively.

Raid Over Moscow isn't the subtlest of games and won't do anything to further the cause of East/West relations, but it's good fun.



Armageddon

Title: Silicon Warrior
Computer: Commodore 64
Supplier: CBS Software
Format: Cassette/disk
Price: £11.95/£9.95

Silicon Warrior is a game of galactic five-in-a-row fought between up to four players (one or two human players and the rest computer-controlled) on a grid suspended in space.

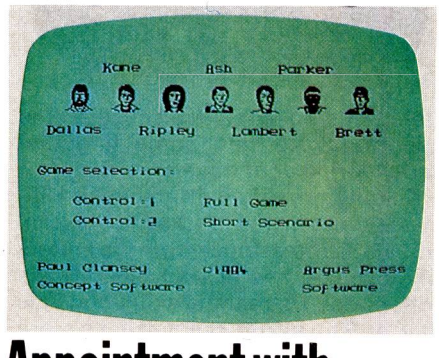
The players represent the Knights of the Houses of new technology in a battle for the supremacy of Silicon Valley. The houses are Peanut, Apple, Adam and Pong.

Silicon Warrior can be played at a number of difficulty levels as the game's features are gradually added to play. The first level involves moving your Knight around the grid and materialising on any square to be converted to your own colour.

If this is too slow for you, then head for the other levels. Here you can blast other players with your lasers while simultaneously protecting yourself with your shield.

In the final level confusion appears in an already chaotic situation in the shape of randomly-appearing black holes.

When a Knight is destroyed, either by being blasted or by falling through a black hole, he returns to his power pyramid in order to recover before returning to the action.



Appointment with death

Title: Alien
Computer: Commodore 64, 48k Spectrum
Supplier: Argus Press
Format: Cassette
Price: £8.95

The Nostromo is a commercial space vehicle on its way home with a comatose crew. The crew is suddenly awakened by the ship's computer asking them to investigate a mysterious transmission. This leads them to a distant planet and an appointment with an alien.

The game is based on the excellent film of the same name, and the action begins when one of the crew has been killed and the alien is aboard ship.

You are in command of the ship and have to organise the crew in an attempt to either kill or capture the alien, or escape from it in the shuttle Narcissus. Each of the crew has his own personality traits and will react differently to situations and orders. You should, therefore, study their personalities and adjust your strategy accordingly, or you may find that at a crucial moment a crew member may disregard your instruction and attack the alien in his own way.

To add to your problems, one of the crew is an android and is destined to sabotage your attempts in order to return the alien to Earth for military research.

The screen display is split into three areas: a map of each of the ship's three levels; a report monitor which displays the ship's and crew's status (who's next on the alien's menu); and a command monitor. The command monitor presents you with the instructions available to you; these can be selected with a joystick. This is a particularly nice feature of the game as it eliminates typing errors.

The alien you encounter can either be a timid beasty or a blood-curdling monster, and no doubt the intensity of your screams will reflect this.

From beginning to end you're looking over your shoulder. END



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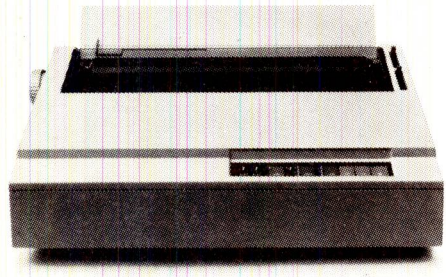

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BIBLIOFILE



For those who dream of robot companions and naughty schoolchildren captivated by micros, this one's for you. David Taylor reviews the best from the bookshelf.

Falling in love again . . .

Title: The Robot Heritage
Author: Neil Frude
Publisher: Century
Price: £2.95

'Within a foreseeable future — some say as near as a decade, others as far as half a century — companion robots will enter the social scene . . . Devotees of the robot literature will experience, in their interactions with humanoid acquaintances, many moments of *déjà vu* as movie heroes and story characters are encountered "in the flesh."'

Thus asserts Mr Frude who, as well as being an anagram of Freud, is himself a psychologist and thus cannot easily be dismissed as off his head. There's no evidence that Frude believes the martians are coming, but plenty that he expects shortly to hob-nob with something along the lines of R2-D2.

Mr Frude is plainly a rare aficionado of the popular, make-believe, sci-fi robot and takes the line that we ain't seen nuthin' yet. His book is a spirited romp through the all-time robot classics of sci-fi, and nothing if not thorough. We start out in 2500BC with the Sumerian myth of Enki and Ninmar. We are given the (16th century) recipe for Paracelsus' homunculus: 'If sperm, enclosed in a sealed glass bottle, is buried in putrefaction of horse dung for

some forty days and correctly magnetised, it will begin to live and move.' We get every detail of Mary Shelley's Frankenstein, are shown the Czech origins of the word 'robot', wade through page after page on Isaac Asimov, and then scuttle into the history of Hollywood's heavy metal, especially HAL in Kubrick's *2001 A Space Odyssey*.

Now all of this is hugely entertaining in a barmy kind of way. Frude mentions today's real-life industrial robots in passing but is plainly bored stiff with them and itching for the walking-talking kind to come. He claims as his book's thesis that science fiction may provide us with more than a glimpse of the real robot future. We must, he adds (without much conviction) 'remain with at least one foot planted firmly on the ground', but hops on to speculate that we may soon have to cope with robots so convincingly humanoid that we risk falling in love with them or finding ourselves unable to switch them off to the great robot graveyard in the sky.

In the end what separates sci-fi fantasists from Frude is that the former dream of centuries hence and the latter seems to think a robotic Shangri-la could surface in the 1990s. 'Characters until now witnessed only from afar, in stories and in films, are almost ready to meet with our acquaintance,' Mr Frude concludes his amazing book.

A case of nutty, but nice.

If you're sitting comfortably . . .

Title: Learning With Adventure Programs
Author: Rosetta McLeod
Publisher: Melbourne House
Price: £5.95

Rosetta McLeod is a teacher who's found that messing about with a Spectrum and such games as The Hobbit, Valhalla and Snowball not only strikes schoolkids as more fun than paying attention to Miss when she merely talks to them, it has the side-effect of improving their skills in the three Rs. In her experience, with a class of dim and sulky 14-year-olds, educational wonders were worked and a fine time was had by pupils and teacher alike.

This slim handbook is addressed primarily to fellow teachers, but with the thought that parents whose kids have a home micro might want to run similar sessions, especially if their offspring have proved unresponsive to more conventional teaching methods. In such specific circumstances, it's an interesting read. Otherwise, it's not.

Holding hands

Title: Working with dBasell
Author: M de Pace
Publisher: Granada
Price: £7.95

Hard cheese for Mr de Pace that just as he comes out with a handbook on dBasell, Ashton-Tate comes out with dBaselll. Unfortunate timing, but maybe it won't matter too much since upstart dBaselll doesn't, for the moment, supersede ageing superstar dBasell: it sells alongside. Nor is it so very different from dBasell in its essentials: dBaselll is a re-write from assembly to Lattice C with greater capacity, more facilities, but a few shortcomings, too. Sometimes it can prove slow. It's not (yet) multi-user. There's so much of it as to make a hard disk more or less a must. And (good news for Mr de Pace) the documentation may look snazzy, but it isn't so slick for reference. This book could sell to newcomers as well as to existing dBasell users.

There's a need, after all. Dating back to 1980 in its original version (CP/M for 8-bit micros), dBasell may by now be a huge best-seller but its user-friendliness doesn't exactly jump out at you. Mr de Pace, a data processing whiz who's been at his keyboard for almost 20 years, seems to think it's all very straightforward. He sees his handbook more as a time-saving grounding in dBasell's umpteen facilities and can't imagine you'll have much trouble with prompts. What he does is hold hands through a worked example of putting all your books on file, then expands your bookshelf into a make-believe bookshop — for which you can easily read any other shop, warehouse, or business, taking *books* to read *stock*.

In three stages we're led through setting up, manipulating data, and the dBasell procedural language for customising the program. All good, lucid stuff and a big improvement on some of Mr de Pace's earlier *oeuvres*, like his IBM PC primer which had making a sponge cake as its demonstration model and spent time pointing out the location of the on/off switch. If dBasell (or III) is your software, then you should certainly buy this book. If you've yet to choose your database, I'd say bear in mind such mighty recent rivals as Rbase 4000 and KnowledgeMan.

A fat lot of good

Title: QL Assembly Language Programming
Author: Colin Opie
Publisher: McGraw Hill
Price: £12.95

Now that Sinclair's mighty marvel is coming through thick and fast, so are supporting paperbacks. This is one of the fattest and most demanding to date, one that assumes you are *au fait* with the 68000 processor's instructions and anxious to tap QL SuperBasic's ability to merge machine code routines.

Mercifully, a 68000 editor/assembler on microdrive cartridge is available to supplement Colin Opie's text and the risk of going boss-eyed without it is, I'd imagine, pretty high.

For those who see the QL as a means of getting a go on professional-quality software at a budget price, as a machine so powerful that it can perform word processing, set up a database or execute graphics without too much computer smartness on your part, this book will be a deeply mysterious waste of time.

For those who, on the other hand, delight in getting to grips with an operating system's guts, who already have a facility with registers, addressing modes, stack pointers and the like and just can't credit how many sleepness nights of hacking £400 now buys, it'll prove a winner. Of its esoteric kind, this book is excellent.

Preaching to the unconverted

Title: The Writer and the Word Processor
Author: Ray Hammond
Publisher: Coronet
Price: £2.95

Len Deighton (who contributes a foreword to this book) reckons he was the first popular fiction writer to use a word processor and wild horses wouldn't now part him from it. Iris Murdoch, on the other hand, vehemently believes that you can't beat pen and paper. Ray Hammond shows that if you summarise the arguments for and against word processing between these two extremes of empathy and add a spot of practical advice on method, in no time you have a paperback.

It's a lively debate. Curiously, although word processing is by far the most accessible application for a PC and although an estimated two-thirds of professional American writers now use it, no-one can yet point to one truly outstanding work written with the new technology. Few would deny the added convenience which electronic editing allows, yet the benefits to a writer's muse remain in doubt.

There's a great divide between writers prepared to give computers a go and those who still aren't altogether convinced that a steam typewriter might not be the devil's work. Convert Hammond despairs. He does his best to proselytise, making out a convincing case for the user-friendliness of today's systems, chucking in such carrots as the thought that access via modem to remote reference databases is a tool no conscientious writer can afford to dismiss (although he neglects to mention one of the most useful UK electronic cuttings libraries, Datasolve's *World Reporter*).

If there's a snag, it's that discussion of the more philosophical aspects of high-tech and creative writing doesn't mix too happily with straightforward instruction on choosing and using kit. Nevertheless it's a stimulating book, if not likely to be shortlisted for the Booker Prize. END



TJ'S WORKSHOP

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.*

ATARI FILL

To use this routine, execute GOSUB 30000 having set A and B as the coordinates of the starting point, and also having specified a fill colour using the COLOR instruction. Memory is soon eaten up when filling large shapes due to the thousands of nested GOSUBs that are encountered in a large shape. However, everything goes back to normal as the corresponding RETURNs are executed. No tests are included for off-screen coordinates (this allows use in any mode without modification), so always ensure that your shape to be filled is fully enclosed and that your seed point is somewhere inside the shape and not outside it or right on the perimeter. For an interesting variation, change line 30000 to read:

30000 LOCATE A,B,C:IF C=0 THEN PLOT A,B

C=0 THEN COLOR INT (RND(0)*3)+1: PLOT A,B

There are two things to look out for when using the routine. Firstly, it can appear that the program has missed out large areas or even individual pixels, but don't worry — it'll come back for them! Also, there may sometimes be a relatively long period of time when no pixels are being filled in. Again, don't worry, the program is only moving (slowly) through an area of already-filled pixels.

I have also included a demo program which allows you to draw a shape in mode 7 with a joystick and then fill it by pressing the trigger. To draw another shape, press the trigger again on completion of the FILL operation when the program beeps.

Who needs recursive PROCs when good old-fashioned GOSUBs will do!

Chris Simon

```
29999 REM Enter with A,B = coordinates o
f seed point. Also set fill COLOR before
 using.
30000 LOCATE A,B,C:IF C=0 THEN PLOT A,B
30010 A=A+1:LOCATE A,B,C:IF C=0 THEN GOS
UB 30000
30020 A=A-2:LOCATE A,B,C:IF C=0 THEN GOS
UB 30000
30030 A=A+1:B=B+1:LOCATE A,B,C:IF C=0 TH
EN GOSUB 30000
30040 B=B-2:LOCATE A,B,C:IF C=0 THEN GOS
UB 30000
30050 B=B+1:RETURN


FILL Demonstration
------------------

  Use in conjuction with the above
subroutine.

0 REM FILL DEMO.   Use joystick to draw
an ENCLOSED shape.   Then position anywh
ere INSIDE the shape and press
1 REM the button.   Program will beep wh
en finished.
10 GRAPHICS 23:DIM STX(15),STY(15):FOR I
=5 TO 15:READ X,Y:STX(I)=X:STY(I)=Y:NEXT
 I:X=20:Y=10:COLOR 3
15 DATA 1,1,1,-1,1,0,0,0,-1,1,-1,-1,-1,0
,0,0,0,1,0,-1,0,0
17 IF STRIG(0)=0 THEN 17
20 PLOT X,Y:ST=STICK(0):X=X+STX(ST):Y=Y+
STY(ST):IF X<0 THEN X=0
21 IF X>159 THEN X=159
22 IF Y<0 THEN Y=0
23 IF Y>95 THEN Y=95
30 IF STRIG(0) THEN 20
40 A=X:B=Y:COLOR 2:GOSUB 30000:FOR I=0 T
O 100:SOUND 0,121,10,15:NEXT I:SOUND 0,0
,0,0
50 IF STRIG(0) THEN 50
60 RUN
```

SPECTRUM TIPS

Here are some applications for RAND USR which other Spectrum owners may find useful.

RAND USR 7032 operates 'break'. It can be used in a program as if the Spectrum had a command BREAK, to produce the same effect as pressing the BREAK key.

RAND USR 8000 operates like PAUSE 4e4, to pause until a key is pressed.

RAND USR 3207 causes the machine to ask 'scroll?', whether the screen is full or not.

RAND USR 6040 is interesting. It has the same effect as pressing ENTER after a program has run — that is, it lists the line where the cursor is positioned.

Simon Smith

BBC LABEL UTILITY

Despite the generally structured approach of BBC Basic, there are many occasions when the use of GOTO and GOSUB are unavoidable. This utility offers the use of named labels in GOTO and GOSUB statements with full independence from line numbers. This is especially useful when building a library of routines for inclusion in other programs. Using this utility, named labels may be used in such routines without fear of corruption from renumbering.

Two versions are given here: a Basic version and a machine code version which is accessed from Basic via a USR call. The Basic version has the following format:

```
100 LABEL = ?(?12*256+
  ?11-2)*256+?(?12*256+
    ?11-1)
```

When the line is executed, LABEL will be given the value 100. If the line is subsequently renumbered to line 20, then LABEL will

contain the value 20 when the line is executed. This means that the statement
200 GOTO LABEL
will find the right line even after renumbering.

To run the machine code version, PROCINIT must be called at the start of the program to set up the machine code routine.

```
1000 DEF PROCINIT
1005 DIM L 24
1010 L!0 = &E9380BA5
1015 L!4 = &A5378502
1020 L!8 = &8500E90C
1025 L!12 = &B100A038
1030 L!16 = &B1C8AA37
1035 L!20 = &6037
1040 ENDPROC
```

The routine may then be called as follows:

```
100 LABEL =
  USR(L)AND&FFFF
```

The major disadvantage of this method is that the label is undefined until the line containing the label is executed.

In effect this means that forward label references cannot normally be resolved.

Ray O'Donnell

BBC SLOW POKES

Here are two interesting POKEs for the BBC B which alter the rate of the processor and slow it down thousands of times. The second number of each POKE can be changed to alter the speed. The slowest speed is achieved by typing:

```
?&FE45=1
?&FE46=0.
```

For example:

```
?&FE45=3:?&FE46=4
```

is slightly faster.

Run a simple program, press ESCAPE, then wait until the BBC works out the line numbers!...

Some programs, including Snapper, will work with these slow POKEs, but very slowly.

Andrew Smith

NO SOUND ON THE BBC

If you play Space Invaders at night but don't want to wake the neighbours with the sound effects, you'll want to be able to turn the sound off.

What if there's no 'sound off' function?

The solution is, before you load the program, type:
"*FX210,1".

The sound will be disabled, and the game can be played silently.

To re-enable the sound, type:
"*FX210,1".

B Smith

QL FILE EDITOR

The QL has an annoying inability to copy or delete more than one file at a time, and requires a long typed statement to do even this. It also will not display both microdrive directories at the same time, and does not update the directory on the screen without DIR.

Here is a short program that:

(1) displays the directory from both microdrives simultaneously;
(2) copies or deletes multiple files; and
(3) automatically updates the screen directories.

It functions well on a TV screen but I haven't tried it on a monitor.

David Edwards

```
100 REMark ****TWO MICRODRIVE DIRECTORY AND FILE EDITOR****
110 MODE 4
120 OPEN £4, scr_230X255A20X1
130 PAPER £4,1
140 INKE4,4
150 OPEN £5, SCR_250x255a250x1
160 PAPER £5,1
170 INK £5,4
180 CLS £4
190 CLS £5
200 PRINT £4, "  MICRODRIVE 1"
210 PRINT £5, "  MICRODRIVE 2"
220 DIRE4, mdv1_
230 DIRE5, mdv2_
240 CLOSE £4: CLOSE £5: CLS £0
250 PRINT £0, "For file copying, enter c. For file deletion enter d"
260 DEFine PROCedure c
270 REMark file copying utility
280 CLS £0
290 PAPERE0, 1:INKE0, 7
300 INPUTE0, "How many files do you want to copy?  ";num
310 INPUTE0, "From which Microdrive?               ";from
320 INPUTE0, "To which Microdrive?                 ";into
330 DIM dat$(num,20)
340 FOR i = 1 TO num
350   PRINTE0, "Enter file name      "!i!" "!:INPUT £0, dat$(i)
360 END FOR i
370 file_copy num,from,into
380 DEFine PROCedure file_copy (x,y,z)
390 FOR loop = 1 TO x
400   LET com$ ="mdv1_" & dat$(loop)
410   LET rec$ = "mdv2_" & dat$(loop)
420   LET com$(4) = y
430   LET rec$(4) = z
440   COPY com$ TO rec$
450 END FOR loop
460 GO TO 110
470 END DEFine
480 DEFine PROCedure d
490 CLSE0
500 REMark file deletion utility
510 PAPERE0, 1:INKE0, 7
520 INPUTE0, "How many files do you want to delete?  ";num
530 INPUTE0, "From which Microdrive?                 ";from
540 DIM dat$(num,20)
550 FOR i = 1 TO num
560   PRINTE0, "Enter file name        "!i!" "!:INPUT £0, dat$(i)
570 END FOR i
580 file_deletion num,from
590 DEFine PROCedure file_deletion (a,b)
600 FOR loop = 1 TO a
610   LET com$ ="mdv1_" & dat$(loop)
620   LET com$(4) = b
630   DELETE com$
640 END FOR loop
650 GO TO 110
660 END DEFine
```

ELECTRON/BBC REM STRIPPER

This program is used to set up user-defined key f1 as a REM stripper program on the Electron/BBC. When run the key program deletes all REM statements, including those at line ends, from the program currently in memory. It has been thoroughly tested on an Electron and should work equally well on the BBC.

The program sets up user-defined key f1 to delete all REM statements from subsequently loaded or entered Basic programs. This both speeds up execution and reduces program size. The resident integer variables A% to Z% are used throughout the program as this gives approximately twice the execution speed of real variables. However, it has the disadvantage of using up keyspace — all those % signs! To use real variables instead of integer:

(1) Delete all % signs from key definition (this saves about 30 characters).
(2) Set LOMEM to HIMEM-99 at the start of the key program to reserve space for the variables (*KEY1 LOM.=H.-99:L=PA).
(3) Insert a space between F.L and TOL and between J=P and OR?(J)=244 so that the computer will not become confused.

All user-defined keys are cleared to make sure there's enough room for the key program, as only 255 bytes are allowed for all function keys.

Note: the total number of bytes saved is shown at the end of the program.

Harry Burke

```
   10                          REMSTRIPPER
   20
   30 MODE6
   40 PRINT'''''"This program sets up user-defined key f1"
   50 PRINT"to remove all REM statements from any"
   60 PRINT'"subsequently loaded or entered BASIC"
   70 PRINT'"program."
   80 PRINT'''"Written by: Harry Burke."
   90 PRINT'"Date       : 14th Sept.'84"
  100 FOR I%=0 TO 15:OSCLI "KEY"+STR$(I%):NEXT
  110 *KEY1 L%=PA.:?(TOP+1)=4:J%=L%:REP.:O%=L%?1:T%=J%:F.L%=L%TOL%+?(L%+3)-1:?T%
=?L%:T%=T%+1:N.:P%=J%+J%?3:T%=J%:IF?(J%+4)=244U.O%=&FF:END EL.J%=J%+3:REP.:J%=J%
+1:U.J%=P%OR?(J%)=244:T%?3=J%-T%:U.O%=&FFIMP.L%-J%IM
  120 END
```



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MZ-80K BASIC BOX COMMAND

This routine has been devised specifically for the Sharp MZ-80K but will convert to any machine running Crystal Basic, and can be added, with some work, to any Z80 machine.

It is an extra Basic command called BOX, and prints a box on the screen from the current cursor position. It also tidies up text displays quite nicely.

Box has been submitted to illustrate the ease with which additional commands can be added to Xtal Basic; it uses a number of monitor and interpreter routines which are shown here:

?BLNK: checks the screen vertical blanking, waits until a blanking period and returns.

?PONT: sets the cursor position in HL Crystal routines.

1255: returns expression in range 0-255 in A & DE.

TSTCOM: checks character pointed to by HL and returns 'SYNTAX' error if not ','.

EXPR: evaluates expression.

RPARN: checks for right parenthesis.

ASC1: returns start address of string in DE, first character in A and last byte of string pointed to by HL.

ASNSTR: creates space for temporary string accumulator.

STREND: end string manipulation.

The absolute address included in the listing is where the routine will reside if the extra command has been implemented as set out in *Hack's Guide* and *Basic 3 Guide* for 2.2 & 3.1 respectively. The '80' at the end of the LCS$ reserved word is included as a reminder that this figure *must* reside at the end of the reserved word table on 3.1; also that the number of auxiliary reserved words used must be increased at &4900.

Ian Jennings

BOX X,Y

Command to draw, from current cursor position, a box enclosing X columns by Y lines.

```
REL 0000H          XTAL2.2                XTAL 3.1
0000        3806   CD5024     4A48        CD0D27    CALL 1255       ; Get width in A
0003               FE 01                  FE 01     CP 01           ; Check, if too wide
0005               FA6038                 FAA24A    JP M,OUTSZ      ; or,
0008               FE27                   FE27      CP 27H          ; too narrow, return
000A               F26538                 F2A24A    JP P,OUTSZ      ; a 'QTY' error
000D               08                     08        EX AF,AF'       ; save width
000E               CD4C17                 CD9D13    CALL TSTCOM     ; ','?
0010               CD5024                 CD0D27    CALL 1255       ; get height
0013               FE01                   FE01      CP 01           ;
0015               FA6038                 FAA24A    JP M,OUTSZ      ; too high, etc
0018               FE17                   FE17      CP 17H          ;
001A               F26038                 F2A24A    JP P,OUTSZ      ;
001D               E5                     E5        PUSH HL         ; save text pointer
001E               CDB10F                 CDB10F    CALL ?PONT      ; get cursor position in HL
0021               E5                     E5        PUSH HL         ; save
0022               CDA60D                 CDA60D    CALL ?BLNK      ; check vertical blanking
0025               365C                   365C      LD (HL),5CH     ; and draw top LH corner
0027               CD6538                 CDA74A    CALL DRWLNE     ; go and draw top line
002A               CDA60D                 CDA60D    CALL ?BLNK
002D               365D                   365D      LD (HL),5DH     ; top RH corner
002F               08                     08        EX AF,AF'       ; get height
0030               0E28                   0E28      LD C,28H
0032               0600                   0600      LD B,00
0034               E5                     E5        PUSH HL         ; get current cursor
0035               DDE1                   DDE1      P0P IX          ; position into IX
0037    AGAIN:     E1                     E1        P0P HL          ; original cursor into HL
0038               09                     09        ADD HL,BC       ; move down
0039               DD09                   DD09      ADD IX,BC       ; a line
0038               CDA60D                 CDA60D    CALL ?BLNK
003E               3679                   3679      LD (HL),79H     ; draw vertical line left
0040               DD360079               DD360079  LD (IX+00),79H  ; draw vertical line right
0044               3D                     3D        DEC A           ;
0045               FE00                   FE00      CP 00           ;
0047               20EF                   20EF      JRNZ,AGAIN      ; until A=00
0049               09                     09        ADD HL,BC       ; move down to bottom line
004A               CDA60D                 CDA60D    CALL ?BLNK
004D               361C                   361C      LD (HL),1CH     ; draw bottom LH corner
004F               CD6538                 CDA74A    CALL DRWLNE     ; and across
0052               CDA60D                 CDA60D    CALL ?BLNK
0055               361D                   361D      LD (HL), 1Dh    ; and bottom RH corner
0057               E1                     E1        POP HL          ; get text pointer back
0058               C9                     C9        RET             ; and return
0059 OUTSZ: 3860   1E05       4AA2        1EO5      LD E,O5         ; Load E with error message no
005B               C31915                 C3CF17    JP ERROR        ; and display
005E DRWLNE 3865   23         4AA7        23        INC HL
005F               08                     08        EX AF AF'       ; get width
0060               4F                     4F        LD C,A          ; and move
0061               0600                   0600      LD B,OO         ; into BC
0063               54                     54        LD D,H          ; DE=HL+1
0064               5D                     5D        LD E,L
0065               13                     13        INC DE
0066               CDA60D                 CDA60D    CALL ?BLNK
0069               3678                   3678      LD (HL),78      ; draw line
0068               ED8O                   ED8O      LDIR            ; and repeat until BC=O
006D               C9                     C9        RET
```

Enter reserved word in table:
Xtal 2.2 : 2FD8 C2 4F 58
Xtal 3.1 : 4926 C2 4F 58
B O X

Enter routine address in directory: (in order shown)
Xtal 2.2 : 30A8 0638
Xtal 3.1 : 4952 484A

COMMODORE 64 CENTRONICS NOTES

Here's a routine that, with a cheap cable, will give you a centronics interface for your Commodore 64. The required pin connections are as follows:

Printer		CBM 64
STROBE	1	M PA2
D7	9	L
D6	8	K
D5	7	J
D4	6	H
D3	5	F
D2	4	E
D1	3	D
D0	2	C
GND	16	N, A, 1 or 12
ACK	10	B FLAG 2

See page 397 of the *Programmer's Reference Guide* or page 143 of the booklet Commodore calls a *User Manual* for a diagram of the user port. If you don't want to make your own cable, one may be obtained from Supersoft for £20.

This routine will allow CBM 64 owners to use a good printer from school or work. All Epson printers are supplied with a centronics interface, which is also found on other printers in the same class.

Note: Normal upper case ASCII and punctuation marks can be passed without conversion. Lower case letters can be printed by adding 32 ($20) to the upper case ASCII code. Printer control codes can be sent as usual. Numbers can also be sent as usual.

Steve Mehew

```
10 REM CENTRONICS DRIVER BASIC LOADER.
20 REM (C) STEVE MEHEW 1984.
30 :
40 S=49152:E=49249
50 FOR R=S TO E:READ A:POKE R,A:NEXT
60 PRINT "DATA COMPLETE.":END
70 :
400 DATA 76,43,192,169,255,141,3,221
405 DATA 96,8,72,72,32,35,192,104
410 DATA 141,1,221,173,0,221,41,251
415 DATA 141,0,221,9,4,141,0,221
420 DATA 104,40,96,173,13,221,41,16
425 DATA 240,249,96,32,3,192,160,0
430 DATA 185,60,192,240,6,32,9,192
435 DATA 200,208,245,96,68,82,73,86
440 DATA 69,82,32,38,32,73,78,84
445 DATA 69,82,70,65,67,69,32,70
450 DATA 85,78,67,84,73,79,78,73
455 DATA 78,71,46,13,0,165,255,76
460 DATA 9,192
```

QL MACHINE CODE AND DATA

The QL has a much more complicated memory map than, for example, the Spectrum, and lacks a command such as CLEAR n, which protects memory above n from incursion by Basic or stacks.

The nearest equivalent is the function RESPR. Print RESPR(0) returns the address of the base of the resident procedures area (SV_RESPR) which, on switching on, is the same as the physical RAMtop — 262144 ($40000) on the unexpanded QL. To lower SV_RESPR include a line such as:

100 address=respr(100)

As the QL only alters memory boundaries in multiples of .5k, PRINT RESPR(0) will return an address 412 bytes less than address.

The problem with this approach is that each time the program is re-run, SV_RESPR is lowered by at least .5k until memory runs out. The only way to reduce the size of the area is to reset the computer: NEWing the program has no effect.

Function CLEAR_N allows SV_RESPR to be lowered to an absolute address (that is, the 512—byte boundary <= the address). If SV_RESPR is already <= address, the address of SV_RESPR is returned.

```
32300 DEFine FuNction
  clear_n(addr)
32310 addr=RESPR
  (RESPR(0)-addr)
32320 RETurn RESPR(0)
32330 END DEFine
```

When developing machine code programs using TV mode, it's possible to use the lower 4k of screen memory (the top of the screen) for temporary storage of code or data, as this area is unaffected by any screen operations using the default screen sizes. The addresses are 131072 to 133120 ($20000 to $20800).

If you require room to POKE just a few bytes, there are gaps available in the system variables: for example, 10 bytes starting at 163876 ($28024).

Peter Edwards

ORIC TIPS

In order to find out which key has been pressed without having to use the ASCII value, DEEK (783), the following may be of some help.

45310 No key pressed
48351 Left Arrow
48255 Right Arrow
48319 Down Arrow
48375 Up Arrow

It's possible to set the values of the left-hand attribute on the text screen; these attributes can then be used to control characters on the whole screen. The locations are # 26 B and # 26 C. By experimentation it's possible to simulate any of the control codes, but globally rather than as separate lines onscreen.

The auto-repeat can be speeded up by POKE 839, 16 or values in that region. When a program is to be run, it should be rePOKED with 39 to get execution speed back to normal.

To set up a non-scrolling window on the text screen, location 621 (# 26 D) is used. It usually contains 48000, but POKeing it will stop the top lines from scrolling. For example, to stop the top five lines from scrolling, DOKE 621 with 48000+⑤× 4D, where the number ringed is the number of lines not to be scrolled: that is, DOKE 621, 48200.

The following program demonstrates this:

```
5 CLS:
10 for K = 1 to 5: print "T.J.S
   Workshop": next.
20 DOKE 621, 48200: REM
   base and 5 lines.
30 POKE 623,21. : Rem
   allows other 21 lines to
   scroll
40 For K=1 to 25: print
   "THIS SCROLLS" : next.
50 POKE 623,27. REM reset
   number of lines to scroll
60 DOKE 621,48000 :
   REM reset base addr.
```

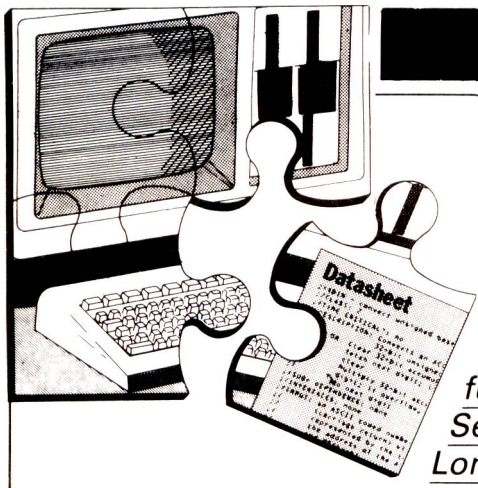
Philip Barker

MTX FUNCTION

Here's a list of keywords stored in the MTX's function keys.

```
F1 . . . . . REM
F2 . . . . . CLS
F3 . . . . . ASSEM
F4 . . . . . AUTO
F5 . . . . . BAUD
F6 . . . . . VS
F7 . . . . . CONT
F8 . . . . . Unknown

<SHIFT> and the Function Keys

F1 . . . . . CRVS
F2 . . . . . CLEAR
F3 . . . . . CLOCK
F4 . . . . . ATTR
F5 . . . . . COLOUR
F6 . . . . . INK
F7 . . . . . CSR
F8 . . . . . DATA
```

Sunil Parekh END



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.

SCREENDUMPS

Barrie Frost would like to see the best method of converting high resolution screen graphics information to the Epson printer 'bit mode' form.

To operate in the normal-density bit image mode, Epson printers must receive the control codes $1B, $4B. This is followed by two bytes — low-order byte sent first — giving the number of bit image data bytes (maximum 480 or $1E0) to follow. Each byte of bit image data represents eight vertical dots with bit 7 as the top dot and bit 0 the lowest dot. This produces a maximum resolution of 480 dots wide by eight dots high in one pass of the print head, as in Fig 1.

Byte:	1	2	3	4	.	.	.	477	478	479	480
	7	7	7	7				7	7	7	7
	6	6	6	6				6	6	6	6
	5	5	5	5				5	5	5	5
Bits:	4	4	4	4	.	.	.	4	4	4	4
	3	3	3	3				3	3	3	3
	2	2	2	2				2	2	2	2
	1	1	1	1				1	1	1	1
	0	0	0	0				0	0	0	0

Fig 1

All memory-mapped high resolution screens, however, treat the bits in each byte as a horizontal sequence of dots. There are wide variations in the number of dots that are encoded in each byte,and in the physical arrangement of the bytes onscreen.

The most straightforward representation is shown in Fig 2 (the source screen for this exercise). It's based on a monochrome display of 40 characters by 24 lines. Each screen character occupies a matrix eight dots square — one byte wide by eight bytes high. This gives a graphics resolution of 320 dots wide and 192 dots high with a total of 7680 bytes.

The first byte of bit image data sent to the printer must be built up from the highest bits (all bit 7s) of graphics screen bytes 1, 41, 81, 121, 161, 201, 241 and 281. The second data byte will be composed of all bit 6s from the same series of screen bytes, and so on. The ninth data byte will hold all bit 7 information from screen bytes 2, 42, 82, 122, 162, 202, 242 and 282. The last data byte sent to the printer will be composed of the low order bits (all bit 0s) of graphics screen bytes 7400, 7440, 7480, 7520, 7560, 7600, 7640 and 7680.

To ensure that vertical spacing is equalised, the line spacing must be set to $^{8}/_{72}$in; this is done by sending the three control codes $1B, $41 and $08 before the screendump begins. Each line of eight vertical dots should terminate with a carriage return (code $0D). To centre the dump on standard 241mm listing paper, each line should begin with 80 zero bit image bytes.

Assume a routine 'PRNTER' which deals with all communications between printer and computer. All control and data bytes to be output to the printer should be sent through this subroutine.

PRNTER accepts one data byte input in an 8-bit accumulator and does not change any register contents.

Because the operation of the printer can be expected to be far slower than that of the screendump routine, speed is not a high priority.

(byte:1) bit:76543210	(byte:2) bit:76543210	.	.	.	(byte:40) bit:76543210
(byte:41) bit:76543210	(byte:42) bit:76543210	.	.	.	(byte:80) bit:76543210
.	.	.	.	.	.
(byte:7641) bit:76543210	(byte:7642) bit:76543210	.	.	.	(byte:7680) bit:76543210

Fig 2

SECURITY CODING

DPRO (Datasheet 1) from Roy Easto of Reigate uses a pseudo-random sequence to encode a block of data. Each successive byte in the data block is exclusively-ORed with the next value in sequence.

The security depends on inputting a 16-bit security code as the initial random value, or 'seed'. Greater security could be built in by having several pseudo-random number generators to choose from, depending on a second input code. DPRO uses just one routine, RNDM2, which can be found in *PCW*, February 1983. Alternatively, a 32-bit generator could be used — again one can be found in the February 1983 issue.

As pseudo-random sequences repeat exactly, DPRO will encode a block of raw data or decode already encoded data. Successful decoding can only be carried out by inputting the same security number as that used for the initial encoding.

The encoding process may be repeated several times with a sequence of different security numbers. No matter how many levels of encoding are used, the data can be recovered by using the reverse sequence of seeds.

DATASHEET 1

```
;=============================================================
;* DPRO      Data block protection by encode/decode.
;=============================================================
;JOB         To encode or decode a data block by exclusive-oring
;           each byte with one byte from each new value obtained
;           from a pseudo-random sequence.
;ACTION      Use input security number as pseudo-random seed.
;           FOR each byte in data block:
;           [ Compute next pseudo-random number.
;             Exclusive-OR data byte with random number byte. ]
;-------------------------------------------------------------
;CPU         Z80
;HARDWARE    RAM containing data block.
;SOFTWARE    RNDM2 - 16-bit pseudo-random number generator.
;                    Input (last number or seed) in HL.
;                    Output (new random number) in HL.
;                    No other registers affected.
;-------------------------------------------------------------
;INPUT       DE addresses first byte of data block.
;           BC = number of bytes in data block.
;           HL contains a security number (pseudo-random seed).
;OUTPUT      DE addresses byte at block +1.
;           A = BC = 0. HL contains random value. F is changed.
;           If input data was unencoded, it is encoded on exit.
;           If data was encoded on entry and HL contained the
;           correct security number, it is decoded on exit.
;ERRORS      None.
;REG USE     AF BC DE HL
;STACK USE   2 + RNDM2 stack use.
;RAM USE     None.
;LENGTH      13
;CYCLES      (67 + RNDM2 cycles) per data byte + 5.
;-------------------------------------------------------------
;CLASS 2       -discreet       *interruptable      *promable
;-*****        *reentrant      *relocatable        *robust
;=============================================================
;
DPRO    CALL RNDM2    ;Get next sequential number          CD lo hi
        LD   A,(DE)   ;Pick up next data byte from block   1A
```

```
        XOR  H        :and encode/decode with current     AC
        LD   (DE),A   :random value, then replace it.     12
        INC  DE       :Index next byte in data block.     13
        DEC  BC       :Count off byte just coded or       0B
        LD   A,C      :decoded, then test for all         79
        OR   B        :bytes processed, repeating         B0
        JR   NZ,DPRO  :until completion.                  20 F4
        RET           :Exit, data encoded/decoded.        C9
;=============================================================
```

PARALLEL MOVES?

Last month I dismissed a suggestion by Hugh Dobbs that intelligent transfer routines should perform the data move even if the source is at the same address as the destination. The routine that prompted Hugh's suggestion was IBTZ8, printed in *PCW*, August 1984; the reason for this apparently meaningless transfer being that the system might support parallel blocks of memory.

My response was that the automatically repeating LDIR and LDDR instructions cannot be adapted to switch banks between the read and write operations.

Hugh has written in with the observation that it's possible, on the Apple, to copy data between parallel ROM and RAM banks. This is achieved by separate soft switches for 'RAM write-enable' and 'RAM read-enable/ROM read-disable'. He sees no reason why the method can't be implemented on a Z80 system, thereby allowing the block moves to be used for parallel bank transfers.

Further discussion on this interesting topic will be very welcome.

Z80 FRAMES

In the early days of SubSet we developed a more or less efficient pair of routines, PUSHM and POPEM, to save and restore the Z80 register set. These could be called on entry to and on exit from any routine, offering a considerable saving in bytes and programming time.

(Extended versions of PUSHM and POPEM can be found in the Z80 SubSet book, *Assembler Routines for the Z80*. Similar routines to save the 6502's registers are in *Assembler Routines for the 6502*. Both books are in the *Best of PCW* series, published by Century Communications.)

ENTRY (Datasheet 2) and EXIT (Datasheet 3), both from Keith Bremer of Chorlton, Manchester, are similar in concept to PUSHM and POPEM but with a subtle difference. With ENTRY called at the start of a subroutine and EXIT jumped to at the end, they both save registers and provide an index to the stacked values throughout the intervening subroutine. Furthermore, 128 bytes below the stacked registers can also be indexed by using negative displacements to IX. Any stack used in the subroutine which called ENTRY need not be tidied up, since this is done automatically by the jump to EXIT. A call, rather than a jump, to EXIT will not produce a stacking error, since the return address is lost when the stack pointer is loaded from IX.

The concept behind these routines is known as 'framing': the subroutine is automatically allocated its own section of stack memory, or frame, for use as workspace. The address in IX is the 'frame top'. The framing process is not complete in ENTRY/EXIT due to the stack pointer not being adjusted to clear the workspace (as, for example, the 68000's stack pointer is in the LINK/UNLINK instructions).

One possibility afforded by ENTRY is the use of both index registers to good effect by returning the address of the subroutine as well as the frame top; data appended to the subroutine may then be indexed. As the subroutine address is loaded into IX by the first instruction, IX becomes the code index and JP (IX) can replace the RET. In the last three instructions involving IX which set the frame, IX can be replaced by IY, making it the frame pointer. EXIT has to be changed correspondingly.

DATASHEET 2

```
;=============================================================
;= ENTRY     Frame entry, saving registers.
;=============================================================
;JOB         When CALLED at the start of a subroutine, to save
;           the register set, index stack and return to the
;           calling subroutine.
;ACTION      Exchange index register with return address.
;           Push other registers.
;           Push index register (return address).
;           Index stack at last register pushed.
;-------------------------------------------------------------
;CPU         Z80
;HARDWARE    None.
;SOFTWARE    Written to act as opening subroutine to the EXIT
;           closing subroutine.
;-------------------------------------------------------------
;INPUT       None.
;OUTPUT      IX, AF, BC, DE and HL are saved on stack (IX in
;           highest memory).
;           IX = SP.
;ERRORS      None.
;REG USE     IX
;STACK USE   10
;RAM USE     None.
;LENGTH      15
;CYCLES      121
;-------------------------------------------------------------
;CLASS 1     *discreet      *interruptable      *promable
;******      *reentrant     *relocatable        *robust
;=============================================================
;
ENTRY  EX   (SP),IX :Save IX, getting return address DD E3
       PUSH AF      :to subroutine calling ENTRY.    F5
       PUSH BC      :Save register set AF, BC, DE    C5
       PUSH DE      :and HL (or extend this part to  D5
       PUSH HL      :save alternate regs. and IY).   E5
       PUSH IX      :Return address on stack top.    DD E5
       LD   IX,2    :Account for return address and  DD 21 02 00
       ADD  IX,SP   :index top of stack.             DD 39
       RET          :Return to calling subroutine.   C9
;=============================================================
```

DATASHEET 3

```
;=============================================================
;= EXIT      Frame exit, restoring registers.
;=============================================================
;JOB         When jumped to, or called, at the end of a
;           subroutine, to tidy stack, restore registers and
;           exit to the calling program.
;ACTION      Move index register to Stack Pointer.
;           Pop other registers.
;           Pop index register.
;-------------------------------------------------------------
;CPU         Z80
;HARDWARE    None.
;SOFTWARE    Written to act as closing subroutine to the ENTRY
;           opening subroutine.
;-------------------------------------------------------------
;INPUT       IX addresses frame stack top.
;OUTPUT      Registers saved by ENTRY are restored from memory at
;           input IX.
;           SP = input IX + 12.
;           Return made to program calling subroutine which
;           jumped to EXIT.
;ERRORS      None.
;REG USE     HL DE BC AF IX.
;STACK USE   None (ENTRY stacking cleared).
;RAM USE     None.
;LENGTH      9
;CYCLES      74
;-------------------------------------------------------------
;CLASS 1     *discreet      *interruptable      *promable
;******      *reentrant     *relocatable        *robust
;=============================================================
;
EXIT   LD   SP,IX   :Reset Stack at saved registers.      DD F9
       POP  HL      :Restore registers saved by ENTRY     E1
       POP  DE      :(this section must match the         D1
       POP  BC      :pushing in ENTRY).                   C1
       POP  AF      :                                     F1
       POP  IX      :Restore index register and exit to   DD E1
       RET          :higher level program.                C9
;=============================================================
```



'What do you mean, it's not educational? I want to be a journalist when I grow up!'

END

COMPUTER ANSWERS

Send your queries to Simon Goodwin, PCW, 62 Oxford Street, London W1. Note that Simon cannot answer questions on an individual basis, so please don't send an SAE with your query.

Juggling with daisywheels

I bought a Quen-Data daisywheel printer because it takes Qume print wheels. However, one of the wheels prints garbage — it appears to be completely in the wrong order. I expected the accents and special characters to need decoding, but all the letters and numbers are wrong too.

My Courier 10 and Gothic 15 wheels are correct, and the Prestige Elite 12 is standard ASCII, but the Boldface PS which is marked as Bilingual/ WPS is wrong. The problem is that I want a 12-characters-per-inch wheel with an English pound sign. I would need a special driver for each wheel unless it conforms to a standard order.

How can I tell which will work and why they are non-standard? Neither the supplier of the wheels nor the machine seem to know.
Derek Trayler, Hornchurch, Essex

The answer to your question is coded into the name of he daisywheel. The wheel which produces characters in jumbled order is 'bilingual proportional spacing' (PS) model, which makes it something of an oddball. You are correct in saying that your printer takes Qume daisywheels, in that they fit on the machine, but some of them are designed to take advantage of features that are not available on low cost printers.

The letters on a daisywheel are always held in a jumbled order, for two reasons.The first is to 'balance' the wheel — it's important that larger letters are opposite one another so that the wheel turns smoothly; the second reason is to minimise the distance between letters that are often used together. The printer works by stepping from one character position to the next, spinning the wheel as it does so, so that the next character required is at the top of the wheel when the paper is correctly positioned.

Obviously some sequences of letters are more common than others. It's possible to speed up a printer by making sure that common sequences are close together on the daisywheel.

Your rogue wheel is a 'bilingual' model, with various special accents for French printout. It is also designed for a 'proportional spacing' printer — one in which letters are packed together so that, for example, a letter 'M' takes up more space than a 'j'. Such a scheme is used on this typeset page but not on typewriters and cheap printers, which always allocate the same width to each letter, making 'M's look rather squashed and exclamation-marks rather well spaced.

Your WPS daisywheel uses a different sequence to the others because it's designed to work with foreign languages, and turn smoothly, even though some letters are smaller than others. Some printers (such as the up-market Qumes) recognise a special sequence of characters which tell them that they are using a bilingual wheel. You print this 'escape sequence' before you use the new wheel, so that the printer can make allowances for the changed order.

A dealer tells me that your printer can't cope with proportional spacing anyway — the Quen-Data always steps a fixed distance from one character to the next. For this reason the PS characters, which vary in width, probably wouldn't look very good even if they came out in the right order.

Luckily there's a wheel which will give the characters you need on the printer you've got. It's called a 'Pica 12 England' daisywheel and can be obtained from Worldwide Computers, 11 Worple Road, Wimbledon, London SW19 4JS. The company also supplies the Quen-Data printer, so it should be able to tell you which other wheels will work in your system.

Prehistoric processing

My school has just unearthed a very old computer. It is a South West Technical Products CT-82 terminal, Motorola M6800 processor unit, with twin disk drives and a teletype. These are all in separate units.

About four years ago something went wrong in one of them and, after several unsuccessful attempts to repair it, the teacher in charge locked it away in a cupboard — until now, when we have been given permission to try to fix it.

The only thing we can get to work is the terminal, and then we can only manage to type in our names. All the system manuals have been thrown out, and no-one remembers how to use it.

We desperately need help from anyone who knows how the system works.
Tony Reeves, 5 Main Street, Howsham, Lincs LN7 6LE

Five years may be a long time in politics — but 10 years in computing is evidently a step into prehistory! The computer you describe was quite popular in the period 1977-79, especially among schools, and cost £3-4000 in 1978.

The main circuit boards in SWTP computers were generally reliable, but many people had problems with poor wiring between them. The most common faults were in the power supply and reset button circuitry, often as a result of poor soldering, so you'd be well-advised to take a close look at the wiring in those areas.

You should be able to test the disk drives and teletype by connecting them to other computers since they use standard interfaces. It sounds as if the fault you mention is in the processor unit.

(If any PCW readers can dig out manuals or circuit diagrams for the STWP machine, please contact Tony directly — Ed)

Death of a ZX81

Seeking to raise a few pennies to buy a printer for my Commodore, I decided to sell my ZX81. To improve its performance I tightened the nine-volt input by fitting a slightly larger jack plug. Carefully noting the positive and negative lead positions I soldered negative to positive and *vice versa*.

Not surprisingly, I ended up with a blank screen. Is there anything I can do other than present it to the dustman?

Have I ruined the 16k RAM pack?
R Clayton, Rownhams, Southampton

You've probably only blown the power supply regulator on the ZX81 circuit board, although you may have killed the video modulator too. Both of these components can be replaced for a few pounds, but you may find that the effort isn't worthwhile — a second-hand ZX81 (with a RAM pack) is only worth £10-20.

Your first step is to rewire the plug the correct way. I'm surprised you tried to make the system more reliable by changing the plug, since the socket is the weak link.

Never test a computer with peripherals (such as the RAM pack) connected, unless you're sure that the computer works when used on its own. In this way you minimise the chance of damaging your entire system.

The supply from a ZX81 plug goes directly to the video modulator, which converts a digital video signal into one that can be received by a TV. Reconnect the supply the correct way round (if you've blown the machine up it's unlikely that you'll damage it further by connecting the supply properly).

Now tune in your TV with the sound turned up. You won't get a normal display (unless the computer is undamaged) but you might find that the TV sound is more regular (a 'burr' sound rather than a 'hiss') around channel 36. The display may also be less speckled. If this is the case, the video modulator is still working, even if the computer isn't giving it a signal to chew on.

The next step is to find out if anything is happening on the processor board. Take a portable medium wave radio and put it on top of the computer — as close as you can get to the circuit board. Tune the radio to a point between two stations. You should hear an electronic crackling noise — radio interference, generated as

circuits in a computer, turn on and off, millions of times a second. This is an old diagnostic trick from the 1950s.

Compare the noises with the computer turned on and off. If there's no difference, the power supply to the board is faulty; replace the regulator and see if that helps. Alternatively you can run the board from a six-volt lantern battery via a silicon diode. Unplug the mains, and connect the battery supply directly to the processor — positive to pin 20 and negative to pin 40. If other components have blown, this may not fix the problem, but it will be a step in the right direction.

If you do get a noise when the computer supply is connected, part of the machine is probably working. The radio signal comes from two main areas — the processor (and memory) and the video generator (the ULA in a ZX81). Move the radio between the two and see if you get a different tone in each position. If the noise justs gets louder or softer, one or other part has been destroyed and it's not really worth fixing the machine.

If the video generator and processor both seem to be working, but the modulator didn't affect the TV display, you may be able to bring the machine back to life by fitting a new modulator.

Don't connect the 16k RAM pack unless the main computer is fixed. You run a small risk that the RAM pack has failed catastrophically — check that it doesn't short out the supply lines on the edge connector before you reconnect it. If you have any foolhardy friends try out the RAM pack on another computer which you know to be working. It should still work, but test it very briefly at first, just in case.

Acorn compatibility

Are the new Acorn micros (ABCs) entirely compatible with the BBC Micro?
Darren Johns, Weybridge, Surrey

The latest computers from Acorn — the ABC range — are business computers designed to compete with the IBM and other 'heavyweight' micros. They feature a variety of processors, including the Z80, 80286 and 32016, but there's no version with the 6502 processor which is used in the BBC Micro and Electron. For this reason (and a host of others — the ABCs are unique designs) the new machines are not compatible with BBC Micro software.

Another Acorn machine, the Torch, runs CP/M or BBC software. This is a hybrid business system which contains a BBC Micro circuit board and a separate Z80 processor. A lot of BBC Micro software will run on the machine, but you will be wasting the power of the Z80 if you only use the BBC part of a Torch system.

Screen damage

My brother says that using my Spectrum on a normal colour television set will damage the coating on the tube. Is this a myth or reality? He says graphics and games are the worst offenders.
D E Avison, Mosely, Birmingham

It's unlikely that your micro will damage the coating on the TV tube. Very early video games used crude block graphics (such as the border on a tele-tennis game) and some of these could become 'burnt in' to the screen if the game was used for many hours with the TV brightness turned up to maximum.

The problem can be seen on some old black and white video games. The area where the screen border appears can become scarred, so that you can see its outline even when the display is turned off. Such machines are used to display one bright picture, day after day, for months or years, so it's hardly surprising they become worn out.

In theory you could damage your TV if you played a game with bright, static graphics for several weeks without respite, but in practice I've never known it happen. Modern computer games use finely detailed graphics in graduated colours — it's most unlikely that these would leave a permanent impression on a TV tube, even if you played the same game for several months.

With typical attention to detail, Atari builds a feature called 'attract mode' into its computers: this automatically turns down the brightness of a display, and cycles through the colours, if the computer is left unattended for more than seven minutes. This safety feature probably stems from Atari's experience producing arcade machines.

Ideally you should not run programs with the TV brightness turned up to maximum, and should avoid leaving the computer for long periods showing a static display. Normal micro use will have no damaging effect on a TV tube.

Taking the quantum plunge

I'm thinking of buying a Sinclair QL. Will all my Spectrum software be completely compatible, or is it just advertising hype?
Robert Bromley, Edgware, Middlesex

I don't think Sinclair claims that you can run Spectrum software on a QL, although one software house has pretended that it can write a program to translate machine code from one machine to the other. In fact that announcement was made before the company had recruited programmers to do the job; but I think it's impossible to write such a program.

The instruction set, hardware addresses, display format, system variables, ROM calls, and so on, are completely different on the QL. You can't write an 'automatic code translator' that will work in any but the most trivial of cases.

You can't load Spectrum tapes onto a QL because the latter doesn't have a cassette interface. The QL microdrives use an improved format — this makes them more reliable than the Spectrum version, but unfortunately also means that they can't read cartridges written by a Spectrum.

You can get a Spectrum and a QL to communicate via Sinclair's Interface One — messages can be sent either way, via the network or RS232 link. This works fine for text (as long as you remember that the QL uses CHR$ 10 to mark the end of a line and the Spectrum uses CHR$ 13), but it isn't very useful for program transfer since the keywords used on the Spectrum are quite different to those on the QL. It's possible to translate programs by hand and it should be possible to do some automatic Basic translation, but the technique will only ever be useful for simple Basic programs. There's no reliable way of translating PEEKs and POKEs from one machine to another since they work in quite different ways.

To be fair to Sinclair, QL SuperBasic is a lot better than the ZX Spectrum version. It wouldn't have been possible to make the two machines entirely compatible without imposing limitations on the QL design (attribute graphics, 32 character lines, and so on), and the QL programs I have seen are a far higher quality than direct Spectrum translations could be.

Sometimes software compatibility is a millstone rather than a benefit. The Commodore 64 uses a Basic interpreter designed in 1978 for the PET. In a bid to remain compatible with programs for the old machine, it contains no commands to take advantage of the graphics and sound features of the 64. The newer computer would have been a much more useful machine if Commodore had sacrificed compatibility and produced a new Basic — it's not often you see a Commodore 64 owner running programs written for the old black & white PET, after all! END



'That's not user-friendliness — that's obscene!'

Subtle C

In part two of our five-part Teach Yourself C series, Les Hampson explains how to construct functions and useful programs in C.

C is a powerful and versatile language which puts very few restrictions on programmers. Although it is a high-level structured language for general use, C can also replace assembly language in many applications. It has a good selection of data types, easy means to define new types and useful combinations to suit your problem at hand. There are also a wide range of operators which allow you to write concise and efficient programs, and express subtle concepts.

Data

Fig 1 lists the available data types and the ranges of values they can store. The actual sizes are not fixed and depend on the machine, but those shown are common for micro versions of C. If you are writing code to run on both a Spectrum and an IBM mainframe you will have to consider these differences, along with your other problems.

The basic types are 'char', 'int' and 'double'; these are used most and this is reflected in how expressions are evaluated. The others were added as the language was developed and specific needs recognised. A char can hold one of the character set (like 'A' or 'b') and can be built up into strings. The most fundamental type is 'int' and this is used for the basic counting operations in a program, such as the number of times round a loop. In many situations C assumes that int is meant if a type is not defined.

An int can be usefully modified with one of the keywords 'short', 'unsigned', or 'long'. The real purpose of unsigned is not to increase the possible size of a positive number, but relates to direct addressing of memory through pointers. The availability of long widens possible applications (most people's salaries could be adequately handled even if figuring in pence). Floating point operations, which are slower, can then be reserved until they are really needed.

All data items must be declared before use to reserve some memory, define which parts of the program will have access, and warn the compiler which types of manipulation need to be used. This is done by statements which declare the type of a list of named items, such as:

```
int var1,var2;
unsigned int hours,mins,secs;
long bignum;
float voltage;
extern int var3;
```

Where data is declared defines the access allowed to it. Data items declared outside functions are global and can be used by any part of the program. These can optionally be specified as 'extern' which means that the actual definition is elsewhere, perhaps in another source file to be linked later, and so the declaration only makes the name known without creating extra storage.

Local data is declared in a function and is not available from outside. By default, local variables disappear on leaving a function and release the memory used. Every function in a program could use a local variable named, say, count, and each would be different and the compiler, at least, would not get confused. A local variable has precedence over a global variable with the same name so even this can't cause conflict. When required, you can define 'static' local data which retains its value between calls but is still 'private' to the function. Some possibilities are illustrated in Fig 2.

Initial values can be set when data is declared (Fig 3).

If not initialised in this way, then

Type	Size	Value
char	1 byte	0 to 255 (sometimes −128 to 127)
int	2 bytes	−32768 to +32767
unsigned int	2 bytes	0 to 65535
short int	2 bytes	same as int
long int	4 bytes	−2147483648 to +214748647
float	4 bytes	single precision floating point to E38
double	8 bytes	double precision floating point to E308

Short serves no purpose in this scheme; but for large computers it may provide a smaller alternative to int.

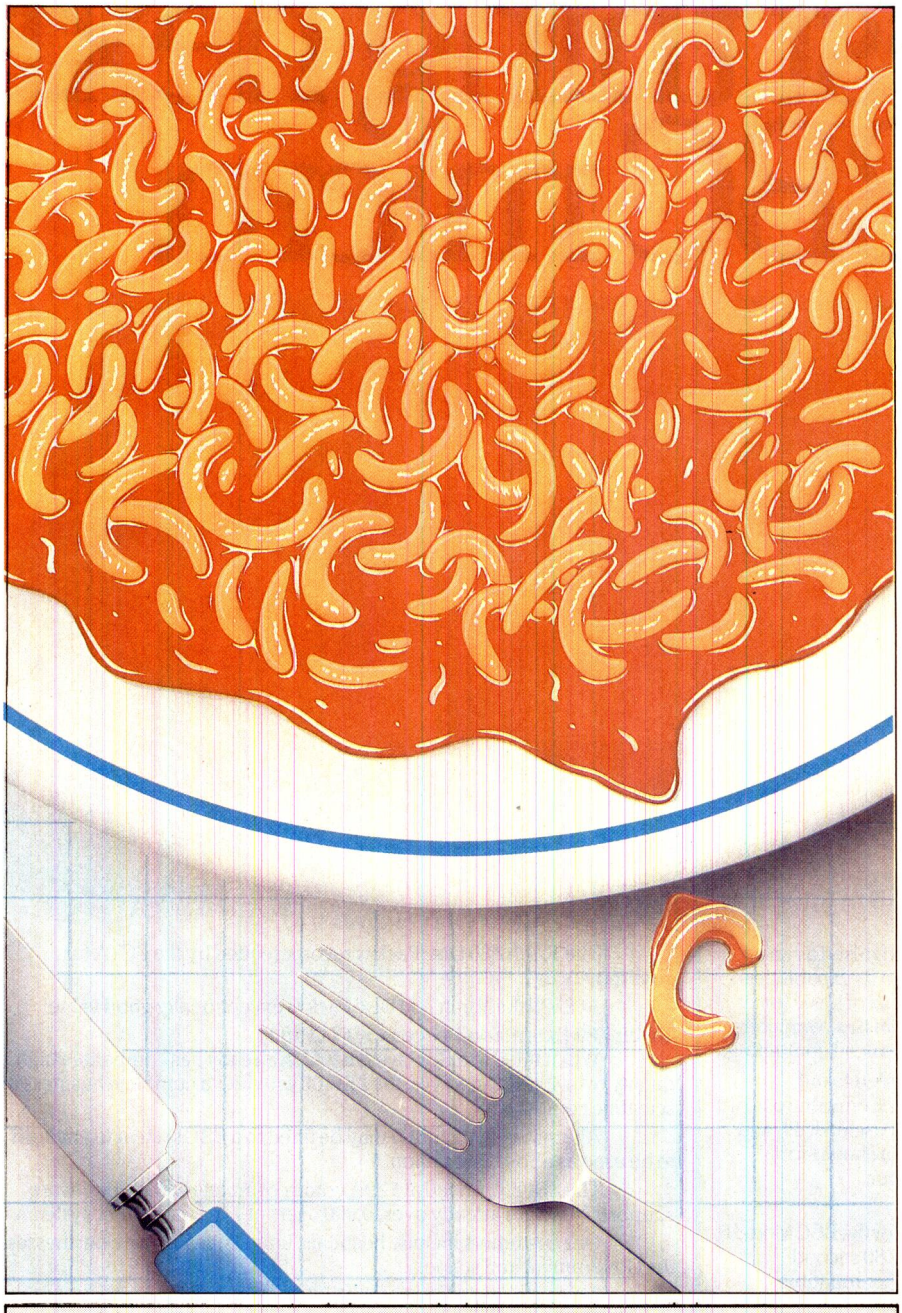
Fig 1 Data types

```
int sum;                    /*global data known throughout the program*/
main()
  {
  int num1,num2;            /*local data known only in the function main*/

  num1=3;
  num2=4;
  sum=add(num1,num2); /*values only passed to function add*/
  }

add(x,y)
int x,y;                    /*parameter names to be used*/
  {
  int rval;                 /*local data known only in add*/
  static int numdone=0;     /*only set to 0 at start of execution*/

  rval=x+y;
  numdone++;                /*stores number of times function called*/
  return rval;
  }
```

Fig 2 Local and global data

```
char c='P';
int var1=89;
extern int var2;            /*extern data cannot be initialised*/
int var3,var4=3567;         /*initialiser applies only to var3*/
float num=1.27e-3;
```

Fig 3 Initial values can be set when data is declared



```
switch(c)              /*c is the character to be tested*/
    {
    case UP:           curs_up();break;      /*do this if c==UP*/
    case DOWN:         curs_down();break;
    case LEFT:         curs_left();break;
    case RIGHT:        curs_right();break;
    case BS:           curs_left();          /*note no break*/
    case DEL:          delete();break;
    default:           printf("unknown command");
    }
```

Fig 4 Key-dependent cursor movement

```
int x;
for(x=0;x<=100;x+=2)
        printf("%d",x);/* display even numbers 0-100 */
```

Fig 5 Basic for-to-step-next construction

```
#define CR 13/* continue until return pressed */
int count;
char c;
char str[80];
for(count=0;((c=getchar())!=CR)&&count<79;count++)
                        str[count]=c;
str[count]=0;/*add the NULL*/
```

Fig 6 Obtaining a character from the keyboard

global and static variables are automatically set to zero when execution begins, but local variables have undefined values.

The basic data types can be part of complex constructions like arrays and structures. These will be considered in detail in a future article, but it's useful to consider strings because they're so widely used. Character strings such as words, messages, and keyed-in values are simple arrays of type char.

An array is declared by following the name with the number of elements in square brackets. For example:
char str[128];

The elements are accessed by str[0], str[23], and so on. Because the index begins at 0 the last element in the example is str[127]; at first it's easy to forget and use str[128]. The last element of a character string is always NULL (that is, zero), so in the example we would have up to 127 slots to use. This enables the end to be recognised, for example, by the function which displays a string.

It may seem strange that there are no facilities for dealing with strings as units, as in Basic. C simply provides a consistent method of storage and complete flexibility in manipulation. Function calls are used to do things like joining and comparing strings.

Decimal constants have already been used to initialise variables and hexadecimal can also be used with the prefix 0x, such as OxFF for decimal 255. An integer constant can be followed by L to indicate it is a long, such as 2123L; one use is for functions which must have a long parameter passed to them.

Character constants written as 'A', 'B', and so on, are exactly the same as the value in the character set; 'A' being 65 in the ASCII series. Some special characters have predefined values including '/n' for a newline, '/t' for tab, and '/0' for null.

String constants are surrounded by double quotes as in 'the end is nigh.' The special characters can be used so that when '/nthe end is nigh' is displayed it goes on the next line. The compiler arranges to store such strings in arrays in the form discussed. Remember that 'A' is not the same as 'A';—the latter is a string whose end is marked with a NULL char.

Operators and expressions

C has a comprehensive range of operators for manipulating data. The basic operators, which will be familiar from using alternative languages, are supplemented by others which help in expressing ideas efficiently.

The basic arithmetic operators are:
addition + subtraction −
multiplication* division / modulus %

The division of two integers truncates any fraction so that 5/2 gives 2, but dividing a floating point value by an integer gives a floating point value. The

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modulus operator can only be used for integers and gives the remainder after division, so 5%2 is 1. When one of these operations causes overflow or underflow of an integer, then some information is lost, although divide by zero is always treated in some special way.

Simple assignment expressions can be formed from these operators:

```
x=y+4    x=x+3    x=x+1
x=y*2    x=x/3    y=y-1
```

Such assignments can be compressed if the same variable occurs on both sides using a combined operator such as += or /= . Similarly to increment or decrement, ++ or -- is preferred. Some of the expressions above could be rewritten as:

```
x=y+4    x+=3     x++
x=*2     x/=3     y--
```

At this stage you may say why bother — it doesn't save much typing. One benefit is that the compiler will try to produce a more efficient translation. If you can understand assembler, look at Fig 3 which demonstrates the point. Also, the left-hand side is only evaluated once, which is of special value if it's something complicated like an element of a multi-dimension array.

When an expression in C is evaluated it 'leaves behind' the result of a quantity. The left side of an assignment must be something, like a variable, which has an address in memory into which this value can be placed. Clearly you can't say 3=x+1, but neither is x++=6 acceptable because x++ increments x and gives a value (which can't have an address). More subtle mistakes of this kind can creep in — the compiler will give a complaint like 'need 1value'.

It's possible to use the value left behind after evaluation as in the statement x=y=6; which efficiently does what you would expect. But you can be too clever and not get the expected result as in a>b>c. A type of construction which occurs often in C programs is illustrated by

```
while ((c=getc(my_file))! = EOF)
```

What happens is that the function getc returns a value read from a file and this is assigned to the variable c. The value of the assignment, which is of course the value read, is then compared with that indicating end of file. Perhaps this isn't very obvious at first, but it soon becomes natural and can produce concise and readable programs. In forming complex expressions the precedence of the various operators has to be taken into account and, as in the example, brackets used to make the intention clear.

The ++ and -- operators are more powerful than just altering by 1 because they can be used before or after a variable. In a complex expression, ++x increments x *before* using the value whereas x++ increments *afterwards*. So that

```
x=0;
y=str[x++];
```

sets y to the first element of the array str and then increases x ready to access the next element. In a statement which only increments a number (for example, a loop counter), it does not make any difference whether x++; or ++x; is used.

In evaluating expressions involving different data types, automatic conversion takes place but will not lose accuracy. For example, in an expression involving a long and an int, the result is long.

Of course if the expression were then assigned to an int, information would be lost if the value were too large. Two important features are that char (and short) are always converted to int before evaluation, and floating point expressions are evaluated using double.

It is a questionable feature of C that all floating point arithmetic is carried out in double precision; on many micros the time penalty can be noticeable.

A set of operators which act on the separate bits of a char, int or long are available in C:

& and, | or, ^xor, « left shift,
» right shift, ~ 1's complement

These are useful for tinkering with the contents of variables. For example, to set the high bit of a character to zero so that it's in the ASCII range, you could use c&=0x7F. Care is needed in using these operators in complex expressions because the precedence is not obvious — use brackets to show what is intended.

The type of thinking needed in writing portable code is illustrated by using

```
x&=0xFF00;
```

to set the lowest eight bits of an int to zero. This will only work for a 16-bit size but can be made to work for any size using

```
x&=~0xFF;
```

Decision making

The flow through a program is controlled by evaluating expressions to be either true (non-zero) or false (zero).

Comparisons can be made using <, <=, >, >=, ==, and !=. The use of == to test equality distinguishes it from assignment and != is available for testing inequality. Complex conditional expressions are built up using && (logical AND) and || (logical OR). Each element of the expression is evaluated and combined but only until the result is known. So, in constructions like (x>3 && (y<2||y>5)) the tests can be ordered for efficiency.

Conditional branches can be made using the usual if (expression) statement with an optional else. You could say:

```
if(numleft>0)
    printf("some left");
else
    printf("all gone);
```

As the expression is only tested to see if it is zero, you can simply say if(numleft) and not bother with the comparison if this is clearer. On the other hand, the expression could be a complex combination such as if(number>lower && number <higher). The not operator ! can be used on its own using if(!number) instead of if(number==0).

In the example, only a single statement is executed but this could equally well be a block of statements surrounded by braces. This allows the if-else construction to be used for complex decisions. Suppose we wanted to count non-zero numbers greater and less than a particular value:

```
    {
if (number)
      if(number>target)
```

```
for(x=0;x<100;x+=2)
    {
    if(x==50)continue;
    printf("%d",x);/*display even numbers except 50*/
    }
```

Fig 7 Continue statement to force iteration

```
    if(condition)goto error;
    .
    .
    error:      /*note colon after label name*/
```

Fig 8 A label within a function

x=x+1;	x+=1;	x++;
movAX,x addAX,1 movx,AX	addwordptrx,1	incwordptrx
RegisterAXas temporary store		Use of fast increment instruction

Fig 9 8086 assembly language from C expressions

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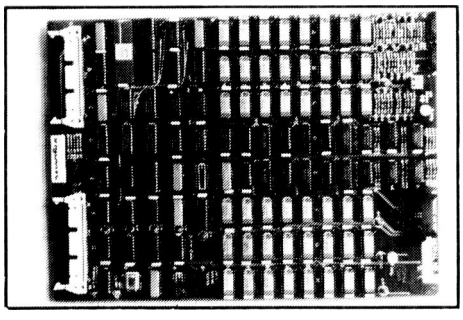

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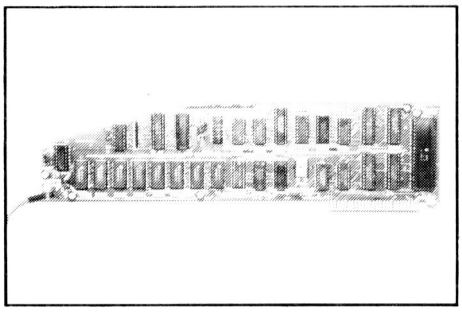

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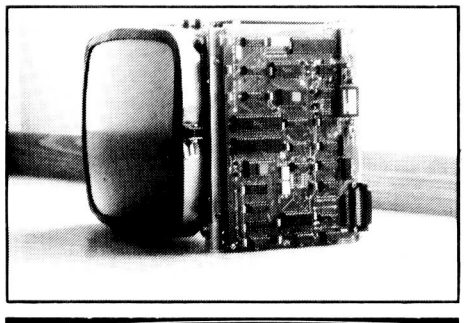

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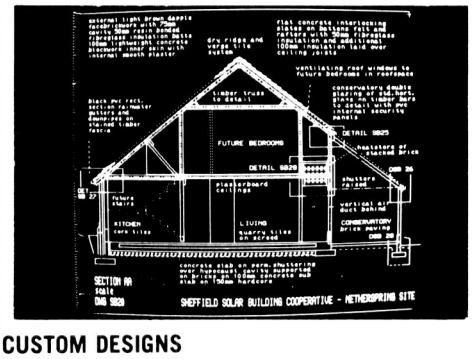

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```
            bigs++;
        else if(number<target)
            smalls++;
        }
    else printf("zero");
```

The important point is that an else is associated with the previous available if. If this is not what's wanted, then braces are used to make the intention clear.

An alternative way to write some conditional expressions is to use the ? operator in an expression which evaluates to one of two values. The expression x= (y>z)? y:z is equivalent to

```
if(y>z)
    x=y;
else
    x=z;
```

This can produce compact constructions as in the expression (c>='A' && c<='Z')? c+('a' – 'A') : c, which will convert an upper case letter to lower case but leave other characters unchanged. If you don't see why c+('a' – 'A') is used then look at an ASCII character table.

Rather than use a long succession of if-else statements, the switch construction provides a neat way of choosing between numerous options which depend on the value of a single variable. This might be used to move a display cursor according to which key is pressed (Fig 4).

There are a few points worth noting. The 'case' values must all be different constants and would have been previously given by '#define' directives The 'break' statements are necessary to exit the switch when a condition has been met; otherwise the next statement is executed. This is used here for BS which moves the cursor left and then 'falls through' to delete a character. The default case can be omitted but is useful for dealing gracefully with unexpected values.

Looping

The while(expression) statement is the basic way of repeating one or a group of statements. For example, to find the length of a string:

```
while (str[x++]!=0)
  /*loop until terminating zero*/
        len++;
```

The expression can be complex or just a variable; in any event, it's tested to see if it's non-zero. Continuous looping can be achieved using while(1) since 1 can never be zero, but some way is needed to exit the loop if this is to be useful. As always in C, a block of statements can be executed by enclosing between braces.

An alternative method of looping is the 'for' statement. This keeps the three controls usually required together: the initial condition, the test which determines when to stop, and a statement executed each time through. A simple example like the for-to-step-next construction in Basic is shown in Fig 5.

The controlling expressions are not restricted to single variables and so, for example, the test could get a character from the keyboard (Fig 6).

Whether while or for is used and what makes up the controlling expressions should be decided by the need for clarity. It's best to keep additional computation outside loop controls.

The while and for constructions do not loop even once if the conditional test is not met. Occasionally, it's useful to force a loop by testing at the end using the do-while construction as in:

```
do
    {
    action1();
    action2();
while(expression);
```

A break statement can be used to exit a for, while, or do loop at any time and can be used with a 'forever' loop. Similarly a continue statement is available to force the next iteration without executing any statements which follow (Fig 7).

Break and continue complicate the structure of a program and beginners tend to over-use them instead of fully working out the underlying logic of a problem. The example in Fig 7 would be better written as:

```
if(x!=50) printf("%d ",x)
```

C also has the much maligned GOTO statement. It is never essential (because you can always test an extra variable) and is usually avoided since it disrupts the logical flow. It can be useful for breaking out of several nested loops, perhaps when some error condition arises. The target is simply a label within the same function, such as that shown in Fig 8. END

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	CP/M-80, MS-DOS	DeSmet C and *C Programming Language*	£155 (normal price £185.40)
		Aztec C86 Compiler and *C Programming Language*	£190 (normal price £255.40)
	Apple DOS 3.0 or Prodos	Aztec C][Compiler and *C Programming Language*	£165 (normal price £220.90)
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C DISCOUNT VOUCHER

All systems go!

Peter Tootill's step-by-step guide shows you how to connect up your micro to an online system

Connecting up to an online system *sounds* simple enough — but it's not always as straightforward as it sounds. The first thing to remember is to connect up with everything *switched off* — some micro equipment doesn't take kindly to being plugged in with the power on and you could cause expensive damage if you try. Also, read the instructions first. This is another way to avoid damaging things!

Let's start with the micro and work through from there. Firstly, connect the RS232 adaptor (if you need one) to your micro, then connect the RS232 output from the adaptor to the modem. If you find that you have problems with connectors of different types, then contact the supplier of the equipment to get the correct connectors. The normal standard for RS232 connectors is a 25-way 'D' shaped plug, but there are a variety of others around — the RS232 output on the BBC Micro, for example, uses a 5-way DIN type socket.

If you're using a 'hard wired' modem, the next thing is to connect it to the telephone point — you'll normally need one of the new style telephone sockets to do this. You'll obviously need to be able to connect both the modem and the telephone to the line simultaneously so that you can dial the number you want. Many modems have a socket for the telephone on the back: if not, you will need a double adaptor to connect the phone to the line in parallel with the modem. If you're using an acoustic coupler, you don't connect it up until you have dialled the number of the system you want to use.

With everything connected up, switch on the system — peripherals first, micro last — as usual. Now load and run your terminal software.

At this stage you may have to set up certain parameters on your RS232 interface, such as baud rate and word length. This is often done from the software, but occasionally you may have to alter switches on the interface itself. If you have a software/hardware package dedicated to one particular system — a Micronet adaptor, for example — then these parameters will probably be preprogrammed into it already. The manuals should help you to decide what is needed and tell you how to go about it.

Your parameters will depend on the system you're planning to call.
For a bulletin board try:
— 300 bits/sec
— word length :eight bits
— no parity
— one stop bit
For Prestel try:
— 1200 bits/sec receive
— 75 bits/sec transmit
— word length :seven bits
— even parity
— one stop bit

(Your manuals may call the data speed 'baud rate' instead of 'bits/sec', although they mean the same thing.)

If the modem provides a range of different speeds, you'll also have to set it to the same parameters as the RS232 interface, and to originate mode. Most modems are single-standard (for example, the Buzzbox) and you only need to make sure that it's in originate mode — because you are 'originating' the call. Others such as the WS2000 and the Nightingale have more controls and you should refer to the manual for details of how to set them up.

All should now be ready for you to make your first call, so check the number of a system you want to contact — see the table here for some to try. If you're going to call a BBS you'll probably find it hard to get through in the evenings as they are very popular. The best time to try is in the early hours of the morning — but only to 24 hour systems, please!

Dial the number you've chosen and when it answers you should get a high pitched whistle (called a 'carrier tone') from the modem at the other end. (Some systems require you to dial the number and when it rings, hang up and call again; these are called 'ring-back' systems. The table tells you which work this way). As soon as you hear the whistle, switch your modem to the 'online' or 'line hold' position. If you're using an acoustic coupler, push the handset firmly into the coupler.

At this point the two modems should lock together and, if you have a carrier detect light on yours, it will light up. The computer at the other end will probably start sending a welcoming message at this point. If nothing happens try sending a few carriage returns; some systems need this to trigger them.

If you're calling Prestel, the sequence is the same. Switch your modem online as soon as you hear the carrier tone at the other end and the modems should lock together. Prestel will send you a welcome page straightaway: there's no need to send carriage returns.

Both types of systems will ask you to log in at this stage. Prestel wants your account number and then your password; BBS want your first and last name and the location you are calling from.

With Prestel you'll then get a welcoming message and the main menu. You can then start to explore.

The first time you call a bulletin board, it will need to know certain things about the micro or terminal you're using to talk to it. This is so that it can talk to you in a way your system can handle. Some systems (TBBS, for example) will show you a list of micros and ask if yours is one of these. If so you won't need to worry about the settings, it will set them for you (you may be asked to confirm them, but if you're not sure you should be safe to answer yes). If your micro is not on the list, you will probably be asked how wide your screen is, whether or not your system can handle lower case, and about nulls and line feeds. The first two questions are self-explanatory. The last two need a bit of explanation.

Nulls are just 'do nothing' characters. The BBS will send these after every carriage return, if asked, to give your system time to scroll to the start of the next line. Most micros don't need any, but they are needed for printer-type terminals — those that use paper. These take quite a bit of time to move the paper forward one line and to get the print head back to the start of the next line. Hence the need for nulls. If you are not sure and want to play safe, you could choose five. If you have too few, you may lose the odd character at the start of a line.

The line feeds question is to check whether or not your system needs to be sent a line feed after a carriage return.

This is because some systems just move the cursor to the start of the line when they get a carriage return and don't scroll. My NEC portable is like this, and if I don't get line feeds from a BBS I call, then everything is printed on one line. Very confusing! The safest answer to the line feeds question is 'yes'. If you then find that everything is double-spaced, you don't need them after all.

Most systems will let you change your terminal parameters later, if you should find that they are wrong — look for a 'format' option somewhere.

After this log-on sequence you may be shown a news file and even a new user file to help you on your first call. Eventually you will find your way to a menu of some sort, and at this point you can start to explore.

Next month we'll look at what to do if things don't work as well as some of the popular BBS systems to see how they fit together.

In the meantime a few useful commands are listed in Fig 1.

Pause output:
Control S (most systems)
P — TBBS, Forum 80
S — CBBS
Restart output:
Control Q (most systems)
Carriage return — TBBS, Forum 80
S — CBBS
Stop output (return to menu):
S — TBBS, Forum 80
K, Control K — CBBS

Fig 1 Useful BBS commands END

UK free networks

Bulletin Board	Phone Number	Notes
BABBS-Bath	(0225) 23276	300/300 baud rate; 9pm-8am weekdays, 9am-noon weekends; Atari-based system
BABBS-Felixstowe	(0394) 276306	300/300 baud rate; 24 hours daily; Apple users' group
BABBS TWO-Basildon	(0268) 778956	300/300 baud rate; 24 hours daily; Apple users' group with special area for queries to Apple UK
Basug	(0742) 667983	300/300 baud rate; 24 hours daily
Bettisfield	(094875) 378	300/300 baud rate; 9pm-9am daily; remote CP/M system
Blandford Board	(0258) 54494	300/300 baud rate; 24 hours daily
CABB	(01) 631 3076	300/300 baud rate; 24 hours daily
CBBS SW	(0392) 53116	300/300 baud rate; 24 hours daily
CBBS Woking	(0626) 890014	1200/75 and 300/300 baud rates; 24 hours daily; jokes, jobs, reviews, news
CNOL Lancaster	(0524) 60399	300/300 baud rate; 24 hours daily; Clinical Notes Online service, mainly for medical users; works in conjunction with a database on the Datastar network
Computers Incorporated Newcastle	(0207) 543555	300/300 baud rate; 24 hours daily; primarily business-oriented
Forum 80 Hull	(0482) 859169	300/300 baud rate, 5-11.30pm weekdays, noon-11.30pm weekends; Bell 103 standard, midnight-8am daily; international electronic mail, library for up/downloading
Forum 80 SPA	(0926) 39871	300/300 baud rate; 11pm-midnight daily; TRS-80 and Genie users' group
Forum 80 Wembley	(01) 902 2546	300/300 baud rate; 7-10pm weekdays, midday-10pm weekends; electronic mail, library for downloading; ring and ask for Forum 80
Hamnet Hull	(0482) 497150	300/300 baud rate; 6pm-8am daily
Liverpool Mailbox	(051) 4288924	300/300 baud rate; 24 hours daily; electronic mail, program downloading, TRS-80 information; messages for *PCW* can be left on the board and will normally be read by us within 24 hours
Mailbox-80 Stourport	(0384) 635336	300/300 baud rate; 6pm-8am daily
Manchester Open Bulletin Board	(061) 7368449	300/300 baud rate; 24 hours daily
MBBS-Mitcham	(01) 640 2617	300/300 baud rate; 10am-8pm Thursday and Sunday; BBC-based system with jokes, graffiti, electronic mail, and Atari and BBC sections
MG-Net CBBS London	(01) 399 2136	300/300 baud rate; 5-10pm Sunday; electronic mail, program downloading
Microweb Manchester	(061) 4564157	300/300 baud rate; 24 hours daily; *Micro User* magazine, mainly for BBC users
NBBBS-North Birmingham	(0827) 288810	300/300 baud rate; 24 hours daily
OBBS Manchester	(061) 4271596	300/300 baud rate; weekdays except 7pm-9pm, weekends except 10am-10pm
PIP-Sheffield	(0742) 667983	300/300 baud rate; 24 hours daily
Southern BBS	(0243) 511077	300/300 baud rate; 8pm-2am daily; ring-back system (dial the number, let phone ring once, and then ring back); messages, downloading
Stoke ITEC	(0782) 265078	300/300 baud rate; 24 hours daily; remote CP/M system
TBBS London	(01) 348 9400	300/300 baud rate; 9am-7am daily
TBBS London Metro	(01) 348 7840	300/300 and 1200/75 baud rates (including Prestel compatibility); 24 hours daily; temporary number for the TBBS Nottingham system
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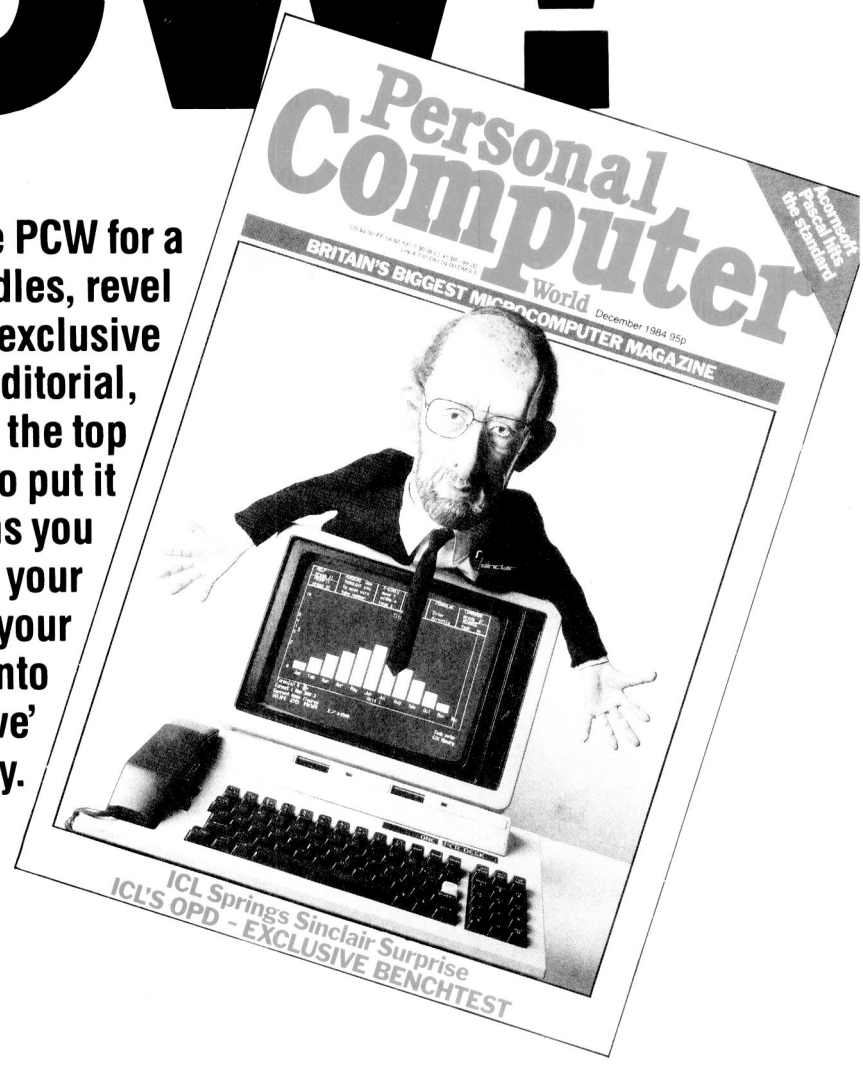


LEISURE LINES

Brain-teasers courtesy of J J Clessa

Quickie

This month's quickie was submitted by Mr John Deft of Hartlepool. Nice one John.

Three full wine glasses and three empty wine glasses stand in a row as shown below. By moving only one glass, can you arrange them so that full and empty glasses alternate.

In other words:

from this 

to this 

Prize Puzzle

This month's prize puzzle should not be too difficult for those of you with micros or programmable calculators, so key-in and go.

Find a 3-digit perfect square which is the average of two other 3-digit perfect squares (numbers with leading zeros are not allowed).

Answers, on postcards only, to: *PCW* Prize Puzzle, February 1985, Leisure Lines, 62 Oxford Street, London W1. Entries to arrive not later than 28 February 1985.

October Prize Puzzle

The marathon event at Little Dingblat seemed to be more difficult than we had thought — only 70 entries were submitted — and several of these gave wrong solutions.

The winning entry came from Jonathan Jackson of Leek in Staffordshire. Congratulations, Jonathan, your prize is on its way. The solution to the problem is 23 entrants in the race.

By the way, if you have any ideas for problems that can make micros whirr (or even explode) please send them in.

END

NUMBERS

Mathematical mind-benders from Mike Mudge

A palindromic number, or simply a palindrome, is a number which reads the same in either direction: for example, 121. This is a base-dependent property, since, for example, if we convert to binary 121_{10} the result is 1111001_2, which is not a palindrome.

Our problems are in three sections, the first of which could be answered by searching suitable tables. However, this would not enable progress to be made in the second part, and should only be used as a check. The third part has tested the ingenuity of many programmers, and certainly contains at least one presently unsolved element.

A) Determine the sequence of palindromic squares: for example, the fourteenth is $836^2 = 698896$. Repeat for cubes where the sixth is $111^3 = 1367631$. If you become fascinated by this problem, consider higher powers.

Determine the sequence of palindromic pentagonal numbers given by $P_n = n(3n-1)/2$; the eighth is $P_{2173} = 7081807$.

Determine the sequence of palindromic primes; the thirtieth is 13831.

B) Repeat the above calculations for various number bases. How do the palindromic fractions of each of the above type of number vary with bases?

C) The palindromic attempt function: A(n) is defined to be the integer generated when n is added to the integer obtained from n by reversing its digits:

for example, A(91) = 91 + 19 = 110.

How many times must this function be applied to a given integer before a palindrome is produced?

For 91 the answer is 2, since A(91) = 110, A(110) = 110 + 011 = 121 a palindrome. For 136 the answer is 1, since A(136) = 136 + 631 = 767 a palindrome. For 994 the answer is 3, 994.. 1493..5434..9779.

Determine the answer for all n less than, say, 200. *Particular interest centres on the number 196.*

How does the palindrome attempt function work in other (palindromic) number bases?

Readers are invited to submit their program listings, together with hardware descriptions, run times, any comments and, of course, the output relating to their selection from these problems. These will be judged for accuracy, originality and efficiency (not necessarily in that order) and a prize will be awarded to the 'best' entry received by 1 May 1985.

Please address entries to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffordshire WV4 5NF. Tel: (0902) 892141.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided. Expanded reviews of previous 'Numbers' problems together with, subject to the approval of the contributor, copies of detailed programs from the prize winning entry may also be requested. END

MICROCHESS

Kevin O'Connell looks at Cray Blitz's outstanding performance in the North American Computer Chess Championship.

White: Cray Blitz. Black: Fidelity X. Sicilian Defence. Notes by Kevin O'Connell.

The following game was played in the first round of the 15th North American Computer Chess Championship, held in San Francisco last October.

Cray Blitz started as it meant to go on. It won the next three games as well, to win the tournament with a 100 per cent score, a whole point ahead of the competition — a huge margin in a four-round event with 14 competitors.

The game is delightful proof of the old adage that one should not try too hard to hang onto a gambit pawn.

1	e2–e4	c7–c5
2	d2–d4	c5xd4
3	Ng1–f3	e7–e5?

(Black should play 3 . . .d7–d6 with a good position.)

4	c2–c3	Qd8–a5

(4 . . .d4xc3 5 Nb1xc3 Nb8–c6 6 Bf1–c4 leaves White with some advantage but is the normal line here.

The text seems to be a completely new move in this position — not too surprising really since it has nothing to commend it.)

5	Qd1–b3	

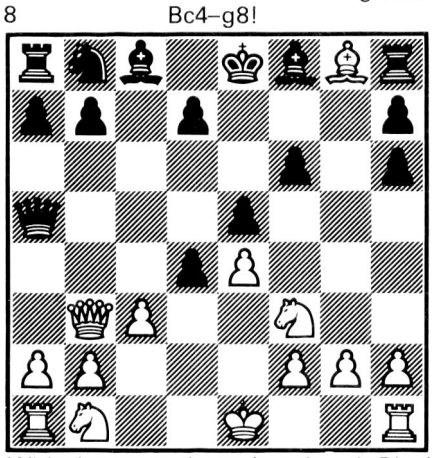
(A slightly curious move, probably not the best, which, however, brings White a rich reward.

5	. . .	f7–f6?

(When I was at school, some friends of mine liked to play 'losing chess', the object of which was to force the opponent to win the game. This weakening of the light squares brings those schoolday memories flooding back.)

MICROCHESS

6	Bfl–c4	Ng8-h6
7	Bclxh6	g7xh6
8	Bc4–g8!	



White is a pawn down, but already Black is lost

8	. . .	Ke8–d8

(If 8 . . .Qa5–c5, to protect the bishop, then 9 Qb3–f7+ Ke8–d8 10 Qf7xf6+ wins the rook.)

9	Qb3–f7	Rh8xg8

(Or 9 . . .Bf8–e7 10 Qf7–g7.)

10	Qf7xg8	Kd8–e8
11	Qg8xh7	Qa5–b5

(Quite irrelevant. Black is busted, but should at least set about developing some pieces instead of chasing after a pawn.)

12	b2–b3	Qb5–c6
13	O–O	d4xc3
14	Nblxc3!	

(Of course! If 14 . . .Qc6xc3 then 15 Ral–cl means immediate annihilation.)

14	. . .	b7–b6
15	Nc3–d5!	

(With a similar threat to the last note: 16 Ral–cl Qc6–b7 17 Nd5xf6+ and 18 Qh7–f7 threatening 19 Qf7–e8 mate).

15	. . .	Qc6–d6
16	Nf3–h4	

(A fine example of when it is good to move a knight to the edge of the board.)

16	. . .	Bc8–a6
17	Nh4–f5	Qd6–a3
18	Qh7–g6+	Ke8–d8
19	Qg6xf6+	Kd8–c8
20	Rf1–cl+	Ba6–c4

(Oh dear! But if 20 . . .Bf8–c5 then 21 Nf5–d6 is mate, while 20 . . .Nb8–c6 would also meet a mate after 21 Rclxc6+ d7xc6 22 Qf6xc6+ Kc8–d8 23 Qc6–c7+ Kd8–e8 24 Nd5–f6. The best move was undoubtedly 'resigns'.)

21	Rclxc4+	Qa3–c5

(Why didn't Black play 21 . . .Kc8–b7 instead? The answer is: 22 Qf6–d8 (threatening mate on c8) 22 . . .Nb8–c6 23 Qd8xd7+ Kb7–a6 24 Nd5–c7+ Ka6–a5 (24 . . .Ka6–b7 25 Nc7–b5+) 25 Rc4–a4+ and Black is no better off!)

22	Qf6xf8+	Kc8–b7
23	Rc4xc5	b6xc5
24	Qf8xc5	Nb8–c6
25	Nf5–d6+	Kb7–b8
26	Qc5–b5	mate

END

ACC NEWS

Rupert Steele gives his monthly round-up of club news

The ACC (in its present form) is one year old this month. It is celebrating this occasion by holding a meeting of the ACC Council (the Association's governing body, composed of representatives of all affiliated clubs) at 2.30pm on Saturday 23 February 1985 at County Hall, London SE1. County Hall is at the south end of Westminster bridge, the nearest tube station being Westminster.

All ACC-affiliated clubs are entitled to send representatives to the ACC Council. If your club is not yet affiliated, you may do so at the meeting. This will be your opportunity to air your views on the ACC in a formal way.

Club spot

Now here's this month's club round-up. Chris Haine of 4 Cord Lane, Easenhall, Rugby, Warwickshire CV23 0HZ, writes to tell me of the Revel Computer Club, so-called because it's aimed at the villages centred around Newbold Revel. Chris is secretary of the club, so write to him for more information.

Also in Warwickshire is T Schweiger of 3 Greenside Close, Whitestone, Nuneaton CV11 6PB. He's secretary of the Nuneaton Computer Club and the person to contact for more info.

In Wolverhampton there's the West Midland Sinclair Users' Group, which also caters for Commodore 64 and Jupiter Ace users and is aimed at those who are bored with playing games. It has a massive software library, from spreadsheets to games, various kinds of technical help, news sheets and members' discounts, all available at the weekly meetings. These are held at the Dunsdale School, Wombourne, near Wolverhampton, in the dinner hall and the typing room. For details contact Graham Walden, WMSUG, 80 Planks Lane, Wombourne, Wolverhampton, West Midlands, or call him on (0902) 894744.

In Solihull there's the Croft Soft Computer Group. It's run by Susan and Michael Jay, and if you're interested in their activities, ring them on (021) 744 3653 or write to 17 Colebrook Croft, Shirley, Solihull, West Midlands B90 2JD.

The Birmingham (Atari) User Group is an independent group for Atari users with an annual subscription of £6 (£2.50 for under 16s), which includes copies of the *Page 6* Atari magazine, and a further charge of 25p/meeting to cover costs. It has an extensive software library which features both games and technical software. Meetings are held on Thursdays at 7.30pm at the Malaga Grill of the Matador Public House, Birmingham Bull Ring. On the first Thursday of the month there's a club night, usually involving an organised talk or demonstration, while on the third Thursday there's a games night. For more details contact the secretary, Mr CS Boswell on (021) 359 4346 or at Flat 31, Central Fire Station, Lancaster Circus, Birmingham B4 7DD.

Also in the Midlands is the Towcester Micro User Group, whose secretary is Mr SJ Clark of 83 Watling Street West, Towcester, Northants NN12 7AG. Full details can obtained from Mr Clark.

Mark Lee, of 89 Rotherham Road, Maltby, S Yorkshire runs the Maltby TI Users Club. The club meets from 6.15pm to 10.15pm on the second Tuesday of each month, upstairs at a mystery pub (contact Mark to find out which), and is trying to provide some support for users of the TI-99/4A, a machine which Mark finds is not well catered for by local shops or other clubs.

Mr Howard Walker, of 2 Barrett Clough Head, Slaithwaite, Huddersfield, HD7 5UU is the chairman of the Huddersfield BBC Micro User Group. If you have, or are thinking of buying, a Beeb, he'll be glad to hear from you.

More specialised is a Scarborough offshoot of the British Computer Society, the ACC professional counterpart. Its full title is BCS Primary Health Care Specialist Group/BBC Micro Subgroup, and the contact (for those of you interested in using Beebs in medical applications in Scarborough) is the software librarian, Mr KS Walker, 178 Scalby Road, Scarborough, North Yorkshire.

The Preston Area BBC Microcomputer Users' Group is interested in computer communications. Why not contact the secretary, Duncan Coulter, on (0772) 725793 or at 8 Briar Grove, Ingol, Preston PR2 3UR.

I'm pleased to report the formation of the Kensington and Chelsea Computer Society (KCCS), which covers not only the Royal Borough, but also Fulham, Westminster, Shepherds Bush and Hammersmith. This should complement the West London Club, which is aimed mainly at the Acton area. I am

chairman, and enquiries should be addressed to me at the usual address or by telephone, (01) 370 0601. The club is aiming to meet weekly, probably on Wednesdays, with the majority of meetings being of the 'bring micros and play or program' type. There will, however, be some structured presentations and talks on specific subjects occasionally. The club is still very young, so if you're interested in contributing to its growth, let me know.

Mr T A Bell, of 18 Azalea Close, Uxbridge Road, Hanwell, London W7, is the founder of the Chemical Engineers' Computer Club. Drop him a line for further information.

Tom Drake, of 143 Glebe Avenue, Ickenham, Middlesex UB10 8PF, is setting up a user group in West London to assist users of the Sanyo MBC 550 series machines. If you have one, let him know.

Andrew Allen is newsletter editor of the Dai UK User Group in Hounslow. He's at 22 Greenham House, Stanborough Road, Hounslow, Middlesex TW3 1YF. Also Mr GP Townsend, of Lampton School, Lampton Avenue, Hounslow TW3 4EP is involved with a Research Machine User Group,

The Iver Computing Society (ICS) is a general club open to all micro users although there are many BBC Micro owners. It has a number of 'experts', and provides short teach-ins about programming in an attempt to wean some of the younger members from arcade games programs. ICS meets on the second and fourth Thursdays of each month at the New Iver Village Hall. The man to contact is PA Seal, 1 Ormonde, Church Road, Iver Heath, Bucks SL0 0RP.

The ACC provides various services to existing clubs, advice on setting up new clubs, and a referral service to put people in touch with their local computer club.

If you'd like to take advantage of these services, write to me (stating clearly what you require), Rupert Steele, 17 Lawrie Park Crescent, London SE26 6HH, or call (01) 370 0601. 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.

Swansea	(Leisure Centre), Micro Show. Contact: Temple Conferences & Exbns: (0202) 304641	17-29 Jan
London	(Barbican) Hi Technology & Computers in Education Exbn. Contact: Computer Mkt Place Ltd: (01) 930 1612	23-26 Jan
London	(Kensington & Chelsea Town Hall). Apricot & Sirius Computer Show. Contact: Paradox Group Ltd, (01) 241 2354	5-7 Feb
London	(Wembley Conference Centre) Micro Development Show. Contact: Project Presentations Ltd: (01) 242 3621 Ltd: (01) 242 3621	12-14 Feb
USA	(Anaheim) COMDEX (Computer Conference & Exbn.) Contact: Interface Group Inc, 300 First Ave, Needham, MA 02194	21-24 March
USA	(Atlanta) COMDEX. Contact as above	6-9 May

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● MICROSOFT MS-DOS basic compiler for IBM-PC, unused, £180 ono. Tel: 01-300 3353

● CBM64 software sale. Superbase 64, £50; Easyscript, £20; Macro assembler, £15; Games less than half price, also TI99/4A software starter pack 1 & 2, gamewriter 1 & 2, unwanted prizes, all £10. Tel: Oxford (0865) 54084 after 7.30pm.

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● APPLE II Europlus with disk drive and 12in monitor, 16k RAM card, serial and parallel interface cards, and DOS manual, hardly used, bargain £500. Tel: Maidstone (0622) 891496

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● SHARP MZ-80K, 48k, very good condition, includes Basics, manuals, £150. Tel: Kingston Blount 52807 (Oxon).

● SHARP MZ-80K, good condition, plenty of software, assemblers, games, etc, one manual, nearest offer £190. Tel: Thatcham 66307. D. Means, 14 Crowfield Drive, Thatcham, Berks RG13 4RY.

● NEWBRAIN MODEL A, and compatible recorder with manuals and tapes, all leads, £110, can deliver North West. Must sell, Apricot PC arrived. Tel: Mike on 051-256 0123 after 6pm.

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● NEWBRAIN MODEL AD, with cassette recorder, books and printer lead, all in good working order, come on chaps, who'll give me £100 for it? Tel: 01-943 2891 evenings.

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END

WRITING FOR PCW

Your chance to contribute to the magazine.

We're offering readers a chance to get rich (well, at least richer) and to influence what's published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It's often users with practical experience who have the most interesting things to say, so don't worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature write, with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing with ample margins top and bottom and on each side.

Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

We'll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well.

Bear in mind that it's worth taking a look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in reinventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is £65 per 1000 words, and payment usually follows about four-six weeks after publication. **END**

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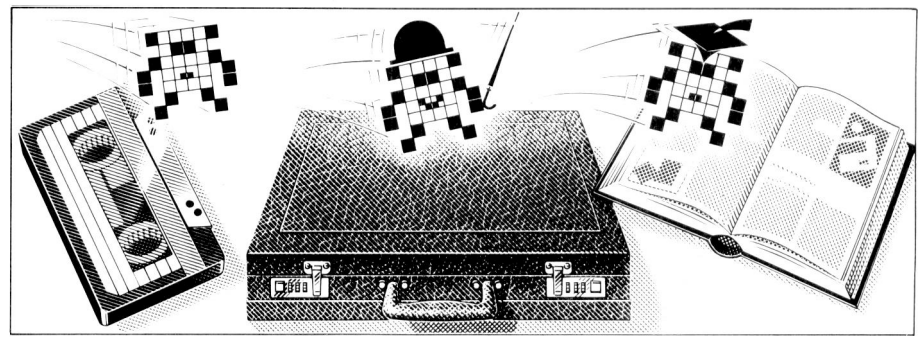
PROGRAM FILE



Nick Walker selects the best of readers' programs — for details on submitting your own, see the end of this section.

During my time programming mainframes and minicomputers I heard a lot about the wonderful utilities available to aid program development, such as debugging and language extensions.

My one attempt to drag one of these from ancient magnetic tape archives proved they were fantastically complex and best forgotten, but microcomputer programmers seem to take a different view: they create simple, easy to use, very specific utilities.

The program of the month for the BBC is an example of this as it gives a bar graph representation of the number of times each line of Basic is executed within a program. From this it's possible to determine which parts of the program would benefit the most from optimisation or translation into machine code.

In the programming aid utility line there's a disk sector examiner for Atari home computers, an assembler for the NewBrain, a screendump for the QL and a user-defined function key program for the VIC-20.

On the entertainment front we have a strategy game for the Acorn Atom, a Zap-'em-up arcade game for the unexpanded TI99/4 and another game of skill, based on the arcade game Qix, for the 16 and 48k Spectrum.

Games

Scientific/mathematic

Business

Toolkit/utilities

Educational/Computer Aided Learning

Program of the Month

BBC Basic Line Profiler

by Ian Elliot

Running programs under the Basic interpreter can prove rather slow, even though BBC Basic is comparatively fast. This is especially true if your program involves a lot of number crunching or searching. The combination of assembler and Basic is one way round this problem and avoids the time-consuming and complex task of writing pure assembler.

Having written your Basic program and found it too slow, your main consideration will be deciding which part to optimise into assembler. The following utility produces a bar graph of the number of times each program statement is executed; from this it's possible to detect the most frequently executed statements and thereby determine the most effective part to optimise.

There are two parts to the profiler, which will run on micros with tape or disk. The first listing is the assembler code, but before typing this in set PAGE to &1DOO. After careful typing SAVE the program before running. Run the program and *SAVE and machine code at &1900.

The second listing is the Basic procedures profiler and displayprofile which will be called from within your program. Type in both, RENUMBER with high line numbers and *SPOOL them to a single file.

You can now use the profiler on your Basic program: set PAGE to &1DOO, LOAD your Basic program, *LOAD the machine code part, *EXEC the spooled file containing the profiler and displayprofile procedures. Now insert the call to PROCprofile at the start of your program and the two statements MODE 0 and PROCdisplayprofile at the logical

end of your program.

Finally, renumber your program using RENUMBER 0,1 and RUN.

The profiler will request a line number to start at, and will profile for 250 lines starting at the given line number. Your program will run as normal and finally display the profile for the requested section of program.

The length of the line number frequency axis is 512 and the display will include a factor which indicates the scaling made to the frequency axis to enable complete display of the profile. During the run of your program the count of executions for some line numbers may exceed maximum capacity (64k-1).

When this happens the count for that line number is set to the maximum value and the profile display will indicate that overflow has occurred.

To save space when using tape, make the following changes to addresses:

(a) Assembler code: first listing
line 80 &1B00 to &1000
line 100 &1900 to &0E00

(b) Profiler code:
line 40 &1B00 to &1000
line 60 &1900 to &0E00

(c) Displayprofile code:
line 240 &1B00 to &1000

```
  10 templ=&8E:temph=&8F
  20 linenol=&8C:linenoh=&8D
  30 lowerbound1=&8A:lowerboundh=&8B
  40 upperbound1=&88:upperboundh=&89
  50 addr1=&86:addrh=&87
  60 wrch=&84
  70 isoverflow=&83
  80 linecounttable=&1B00
  90 FORI%=0TO3STEP3
 100 P%=&1900
 110 [OPT I%
 120 .prof
 130 LDA  £0
 140 STA  isoverflow  \initialise overflow flag
 150 LDA  &20E
 160 STA  wrch
 170 LDA  &20F
 180 STA  wrch+1
 190 LDA  £enter MOD 256  \divert OSWRCH calls
 200 STA  &20E
 210 LDA  £enter DIV 256
 220 STA  &20F
 230 LDA  £loop MOD 256  \store first entry point
 240 STA  entry
 250 LDA  £loop DIV 256
 260 STA  entry+1
 270 RTS
 280 \***** DIVERTED OSWRCH CALLS *****
 290 .entry:BRK:BRK
 300 .char:BRK
 310 .xreg:BRK
 320 .yreg:BRK
 330 .enter
 340 STX  xreg  \save X,Y regs & acc. for restoring on exit
 350 STY  yreg
 360 STA  char  \save i/c character
 370 JMP  (entry)  \jump to correct entry point saved from previous call
 380 .loop
 390 LDA  char  \ensure new charcter is placed in accumulator
 400 CMP  £ASC("[")
 410 BNE  testcontrolch
 420 JMP  leftsqbracket
 430 .testcontrolch
 440 CMP  £31  \check for a control char
 450 BCC  controlch
 460 BEQ  controlch
 470 .otherwise  \send character out
 480 JSR  APWRCH
 490 JSR  getch
 500 JMP  loop
 510 \************ END OF MAIN LOOP ***********
 520 .extras:BRK
 530 .extrastable
 540 ]
 550 PROCfillextras(I%)
 560 DATA 0,1,0,0,0,0,0,0
 570 DATA 0,0,0,0,0,0,0,0
 580 DATA 0,1,2,5,0,0,1,9
 590 DATA 8,5,0,0,4,4,0,2
 600 [OPT I%
 610 .controlch
 620 JSR  APWRCH
 630 TAX    \put char in X reg
 640 LDA  extrastable,X
 650 STA  extras  \store extras count
 660 JSR  getch
 670 .whileextras
 680 LDA  extras
 690 BEQ  endwhileextras  \check if extra chars remain
 700 DEC  extras
 710 LDA  char
 720 JSR  APWRCH
 730 JSR  getch
 740 JMP  whileextras
 750 .endwhileextras
 760 JMP  loop
 770 \******* CHECK TRACE LINE NO *******
 780 .digit:BRK
 790 .leftsqbracket
 800 JSR  initstore  \initialise storing of following char sequence in case not
a trace lineno
 810 JSR  storechar
 820 JSR  getch
 830 CMP  £ASC("0")  \test for digit char
 840 BCC  notdigit
 850 CMP  £ASC("9")
 860 BEQ  isdigit
 870 BCC  isdigit
 880 .notdigit
 890 JMP  nottrace  \char is not a digit
 900 .isdigit
 910 AND  £15
 920 STA  linenol  \start to calculate line number
 930 LDA  £0
```

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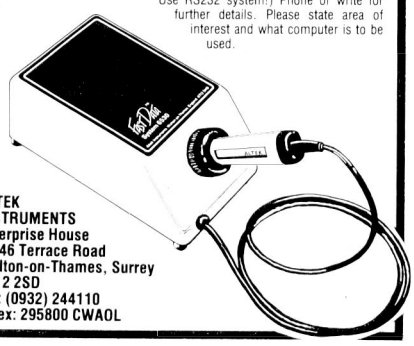

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PROGRAM FILE

```
 940 STA  linenoh
 950 JSR  storechar
 960 JSR  getch
 970 .whiledigit  \check for sequence of digits
 980 CMP  #ASC("0")  \zero
 990 BCC  endwhiledigit
1000 CMP  #ASC("9")
1010 BEQ  isanotherdigit
1020 BCC  isanotherdigit
1030 JMP  endwhiledigit
1040 .isanotherdigit
1050 AND  #15
1060 STA  digit
1070 LDA  storecount  \check possible trace for too many chars
1080 CMP  #6
1090 BCS  nottrace
1100 JSR  updatelineno
1110 JSR  storechar
1120 JSR  getch
1130 JMP  whiledigit
1140 .endwhiledigit
1150 CMP  #ASC("]")
1160 BNE  nottrace
1170 JSR  storechar
1180 JSR  getch
1190 CMP  #ASC(" ")
1200 BNE  nottrace
1210 JSR  processlineno
1220 JSR  getch
1230 JMP  loop
1240 .nottrace
1250 JSR  opstorechars
1260 JMP  loop
1270 \*********** SUBROUTINES ***************
1280 \
1290 \********* GET CHARACTER *********
1300 .getch
1310 PLA          \take return address off stack
1320 CLC          \add 1 to get correct address
1330 ADC  #1
1340 STA  entry   \and store in entry to use
1350 PLA          \for the entry point on receipt
1360 ADC  #0
1370 STA  entry+1 \of the next character
1380 LDX  xreg    \restore X and Y registers and accumulator
1390 LDY  yreg
1400 LDA  char
1410 RTS          \return executed is from OSWRCH call
1420 \*********** UPDATE LINENO ******
1430 .updatelineno  \update lineno to lineno*10 + digit
1440 CLC
1450 ASL  linenoh
1460 ASL  linenol
1470 BCC  nocarry0
1480 INC  linenoh
1490 .nocarry0
1500 LDA  linenol
1510 STA  templ
1520 LDA  linenoh
1530 STA  temph
1540 LDX  #2
1550 .again
1560 CLC
1570 ASL  linenoh
1580 ASL  linenol
1590 BCC  nocarry1
1600 INC  linenoh
1610 .nocarry1
1620 DEX
1630 BNE  again
1640 LDA  templ
1650 CLC
1660 ADC  linenol
1670 STA  linenol
1680 LDA  temph
1690 ADC  linenoh
1700 STA  linenoh
1710 LDA  digit
1720 CLC
1730 ADC  linenol
1740 STA  linenol
1750 LDA  #0
1760 ADC  linenoh
1770 STA  linenoh
1780 RTS
1790 \********* PROCESS LINE NO *******
1800 .processlineno
1810 LDA  linenol  \check lineno (= upperbound
1820 CMP  upperboundl
1830 BNE  notequpperbound
1840 CLC
1850 .notequpperbound
1860 LDA  linenoh
1870 SBC  upperboundh
1880 BCS  exitprocesslineno
1890 .checklowerbound  \get lineno-lowerbound and store in lineno
1900 LDA  linenol
1910 SEC
1920 SBC  lowerboundl
1930 STA  linenol
1940 LDA  linenoh
1950 SBC  lowerboundh
1960 STA  linenoh
1970 BEQ  iswithinrange
1980 JMP  exitprocesslineno
1990 .iswithinrange
2000 \by here lineno is within range and is normalised
2010 JSR  getlinecountaddress
2020 \increment the linecount table entry
2030 LDY  #0
2040 LDA  (addrl),Y
2050 CLC
2060 ADC  #1
2070 STA  (addrl),Y
2080 LDY  #1
2090 LDA  (addrl),Y
2100 ADC  #0
2110 STA  (addrl),Y
2120 BCC  exitprocesslineno
2130 \By here overflow. Insert high values into linecounttable and set overflow
flag
2140 LDA  #&FF
2150 STA  (addrl),Y
```

PROGRAM FILE

```
2160 LDY  £0
2170 STA  (addrl),Y
2180 LDA  £1
2190 STA  isoverflow
2200 .exitprocesslineno
2210 RTS
2220 \******* GET LINE COUNT ADDRESS *****
2230 .getlinecountaddress  \put address of linenumber entry in addrl, addrh
2240 LDA  £linecounttable DIV 256
2250 STA  addrh
2260 LDA  £linecounttable MOD 256
2270 STA  addrl
2280 LDA  £0
2290 STA  temph
2300 LDA  linenol
2310 ASL  A
2320 BCC  cont
2330 INC  temph
2340 .cont
2350 CLC
2360 ADC  addrl
2370 STA  addrl
2380 LDA  addrh
2390 ADC  temph
2400 STA  addrh
2410 RTS
2420 \********* APWRCH **********
2430 .APWRCH
2440 JMP  (wrch)
2450 RTS
2460 \**** STORE CHARS DATA & ROUTINES ****
2470 .storecount:BRK
2480 .initstore
2490 LDA  £0
2500 STA  storecount
2510 RTS
2520 .storechar
2530 LDX  storecount
2540 LDA  char
2550 STA  storebuffer,X
2560 INC  storecount
2570 RTS
2580 .opstorechars
2590 LDX  £0
2600 .repeat
2610 LDA  storebuffer,X
2620 JSR  APWRCH
2630 INX
2640 TXA
2650 CMP  storecount
2660 BCC  repeat
2670 RTS
2680 .storebuffer
2690 ]
2700 NEXT I%
2710 END
2720 REM_____________________________
2730 DEF PROCfillextras(pass%)
2740 LOCALi%,s%
2750 FORi%=0TO31
2760 IFpass%()3THEN GOTO2800
2770 READ s%
2780 PRINT;~P%,i%,s%
2790 ?P%=s%
2800 P%=P%+1
2810 NEXTi%
2820 ENDPROC
```

```
  10 REM_____________________________
  20 DEF PROCprofiler
  30 LOCALlinecounttable,prof,lowerbound,upperbound,startline%,i%
  40 linecounttable=&1B00
  50 lowerbound=&8A:upperbound=&88
  60 prof=&1900
  70 INPUT"Profile start line number ";startline%
  80 ?lowerbound=startline%MOD256
  90 ?(lowerbound+1)=startline%DIV256
 100 startline%=startline%+249
 110 ?upperbound=startline%MOD256
 120 ?(upperbound+1)=startline%DIV256
 130 FORi%=0TO500
 140 ?(linecounttable+i%)=0
 150 NEXTi%
 160 CALL prof
 170 TRACEON
 180 ENDPROC
 190 REM_____________________________
 200 DEF PROCdisplayprofile
 210 LOCALxorig%,yorig%,factor%,freq%,maxfreq%,i%,j%,linecounttable,lowerbound,
startline%,isoverflow%
 220 TRACEOFF
 230 ?&20E=?&84:?&20F=?&85
 240 linecounttable=&1B00
 250 lowerbound=&8A
 260 startline%=?(lowerbound+1)*256+?lowerbound
 270 isoverflow%=&83
 280 xorig%=200:yorig%=20
 290 GCOL0,3
 300 VDU5
 310 MOVExorig%,yorig%
 320 PLOT1,0,1000
 330 FORi%=0TO5
 340 MOVExorig%,yorig%+i%*200
 350 PLOT1,-16,0
 360 PLOT0,-180,0
 370 IFi%)0THEN PRINT50*(5-i%)+startline%
 380 FORj%=1TO4
 390 MOVE xorig%,yorig%+i%*200+j%*40
 400 PLOT1,-4,0
 410 NEXTj%
 420 NEXTi%
 430 REMdraw frequency axis
 440 MOVExorig%,yorig%
 450 PLOT1,1024,0
 460 FORi%=1TO4
 470 MOVExorig%+i%*256,yorig%
 480 PLOT1,0,-16
 490 NEXTi%
 500 REMfind maximum frequency
 510 maxfreq%=0
 520 FORi%=0TO249
```


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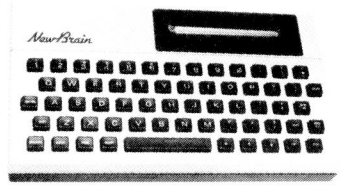

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PROGRAM FILE

```
530 freq%=?(linecounttable+2*i%)+256*?(linecounttable+2*i%+1)
540 IFfreq%)maxfreq%THENmaxfreq%=freq%
550 NEXTi%
560 factor%=maxfreq%DIV512 + 1
570 VDU4:PRINT TAB(0,1);"Fac.":PRINT;" "factor%
580 IF?isoverflow%=1THEN PRINT"O/F"
590 GCOL0,1
600 FORi%=0TO249
610 freq%=?(linecounttable+2*i%)+256*?(linecounttable+2*i%+1)
620 MOVExorig%,yorig%+(250-i%)*4
630 PLOT1,(freq%DIVfactor%)*2,0
640 NEXTi%
650 ENDPROC
```

Atari Disk Sector Editor

by Jon Simmons

Two of the greatest mysteries in the world of computing are operating systems (OS) and disk operating systems (DOS). With a good book and a few well-placed PEEKs you can discover a great deal about an OS. However, DOS needs a 'sector editor', such as the one given here, before you can do anything substantial; for example, create your own custom DOS or protection system.

The program is very professional and enables the examination and modification of sector data on disk. It will display this data in ATASCII together with hex or decimal.

On running the program, a summary of available commands is presented and a prompt will ask for the sector to be examined; entering a number between 1 and 720 will display that sector. To change the data in the sector use the <and> keys in order to move the flashing cursor over the data until you reach the byte(s) you wish to alter. Now press (A) for alter: you will be prompted to enter either hex, dec or ATASCII.

Use the following format to enter data:

HEX.....ZZ (Return) for a single byte
ZZ ZZ ZZ ZZ ZZ etc (Return) for a succession of bytes.
DEC.....ZZZ (Return) for a single byte.
ZZZZZZZZZZ etc (Return) for a succession of bytes.
ASC.....Z (Return) for a single byte
ZZZZZZZZZ etc (Return) for a succession of bytes.

If all is correct, press (S) for save.

The commands HEX X and DEC (H and C) display the sector contents in either hex or decimal respectively. 1 2 3 and 4 are used to access drives no 1-4. FIND is used to locate an ATASCII string on the disk. CHECKSUM will add up all the 128 bytes on a sector (useful for comparisons). RECOVER enables you to load sectors directly into memory and can, therefore, be used to recover corrupted files. The START, SELECT and OPTION keys allow you to increment, decrement and enter a new sector number.

If all this is beyond you, why not use the program to customise your favourite game or as a means of cheating in adventure games?

```
10 REM DISK SECTOR EDITOR-BY J.M.SIMMO
NS 31-3-84
20 GRAPHICS 0
30 POKE 709,255:POKE 710,144:POKE 712,
144
40 FLAG=0:REM SET TO 1 TO DEFAULT TO D
ECIMAL
50 FOR I=1536 TO 1540:READ J:POKE I,J:
NEXT I
60 DATA 104,32,83,228,96
70 POKE 82,0
80 DIM A$(128),B$(122),C$(4),Q$(16)
90 Q$="0123456789ABCDEF"
100 OPEN #1,4,0,"K:"
110 CONS=53279:KEY=764:PG6=1541:DRIVE=
1
120 POSITION 10,0:PRINT "DISK SECTOR E
DITOR"
130 PRINT :PRINT :PRINT
140 PRINT "OPTION   - CHANGE SECTOR TO
 EXAMINE"
150 PRINT "SELECT   - DECREASE SECTOR
BY ONE"
160 PRINT "START    - INCREASE SECTOR
BY ONE"
170 PRINT "< >      - MOVE CURSOR TO C
HOOSEN BYTE"
180 PRINT "1 2 3 4  - DISK DRIVE TO AC
CESS"
190 PRINT "SAVE     - SAVE DATA TO DIS
K"
200 PRINT "ALTER    - ALTER SECTOR DAT
A"
210 PRINT "DECIMAL  - DISPLAY IN DECIM
AL"
220 PRINT "HEX      - DISPLAY IN HEXAD
ECIMAL"
230 PRINT "FIND     - FINDS ANY STRING
 ON DISK"
240 PRINT "CHECKSUM - SUM OF BYTES IN
SECTOR"
```

```
250 PRINT "RECOVER  - LOAD SECTORS INT
O MEMORY"
260 PRINT :PRINT
270 PRINT CHR$(66);CHR$(89);CHR$(32);C
HR$(74);CHR$(79);CHR$(78);CHR$(32);
280 PRINT CHR$(83);CHR$(73);CHR$(77);C
HR$(77);CHR$(79);CHR$(78);CHR$(83)
290 CO=82:TRAP 300
300 GOSUB 2060:POSITION 0,21:? "WHICH
SECTOR TO ACCESS(1 TO 720)";:INPUT SNU
M
310 POKE KEY,255:GOSUB 1830
320 STAT=PEEK(771)
330 IF STAT=1 THEN 370
340 GOSUB 2040:POSITION 0,19:PRINT "ER
ROR NO ";STAT
350 DRIVE=1
360 GOTO 300
370 PRINT CHR$(125);"BYTE       SECTOR
";SNUM;"     (TRACK ";INT((SNUM-1)/18)+
1;")"
380 POSITION 36,0:PRINT "DR ";DRIVE
390 X=-4:Y=2:Z=31:POKE 752,1
400 FOR I=0 TO 127
410 X=X+4:Z=Z+1:IF X>29 THEN Y=Y+1:X=0
:Z=32
420 GOSUB 1660
430 NEXT I
440 GOSUB 1760
450 X=3:Y=2:I=0
460 REM MAIN LOOP
470 IF PEEK(CONS)=6 THEN SNUM=SNUM+1:G
OTO 310
480 IF PEEK(CONS)=5 THEN SNUM=SNUM-1:G
OTO 310
490 IF PEEK(CONS)=3 THEN 300
500 IF PEEK(KEY)=55 THEN X=X+4:I=I+1:P
OSITION X-4,Y:PRINT " ":IF X>32 THEN X
=3:Y=Y+1:IF Y=18 THEN Y=2:I=0
510 IF PEEK(KEY)=54 THEN X=X-4:I=I-1:P
OSITION X+4,Y:PRINT " ":IF X<1 THEN X=
31:Y=Y-1:IF Y=1 THEN Y=17:I=127
520 IF PEEK(KEY)=57 THEN FLAG=0:GOTO 3
10
530 IF PEEK(KEY)=40 THEN POKE KEY,255:
GOTO 1420
540 IF PEEK(KEY)=56 THEN GOTO 1170
550 POSITION X,Y:? "<"
560 IF PEEK(KEY)=58 THEN FLAG=1:GOTO 3
10
570 IF PEEK(KEY)=42 THEN POKE KEY,255:
RUN
580 IF PEEK(KEY)=63 THEN POKE KEY,255:
GOTO 760
590 IF PEEK(KEY)=62 THEN GOTO 710
600 IF PEEK(KEY)=18 THEN GOTO 1370
610 IF PEEK(KEY)=8 THEN POKE KEY,255:P
RINT CHR$(125):DOS
620 IF PEEK(KEY)=31 THEN DRIVE=1:GOTO
310
630 IF PEEK(KEY)=30 THEN DRIVE=2:GOTO
310
640 IF PEEK(KEY)=26 THEN DRIVE=3:GOTO
310
650 IF PEEK(KEY)=24 THEN DRIVE=4:GOTO
310
660 POSITION 5,0:PRINT I;"  "
670 POKE KEY,255:POSITION X,Y:PRINT "
"
680 FOR P=1 TO 20:NEXT P
690 GOTO 470
700 REM SAVE TO DISK
710 GOSUB 2040:POSITION 0,19:PRINT "SA
VE-TYPE 'Y' TO SAVE TO DISK"
720 POKE KEY,255
730 GET #1,N:IF N=89 THEN CO=87:GOSUB
1830:CO=82:GOTO 320
740 GOSUB 1760:GOTO 470
750 REM ALTER SECTOR DATA
760 GOSUB 2040:POSITION 0,19:PRINT "AL
TER ATASCII DECIMAL OR HEXADECIMAL?"
770 TRAP 1790
780 GET #1,N
790 IF N=65 THEN 940
800 IF N=68 THEN 840
810 IF N=72 THEN 1070
820 GOSUB 1760:GOTO 470
830 REM ALTER IN DECIMAL
840 GOSUB 2040:POSITION 0,19:PRINT " D
EC START BYTE=          VALUE="
850 POSITION 16,19:PRINT I:POSITION 32
,19:PRINT PEEK(PG6+I)
860 POSITION 0,21:POKE 752,0:INPUT B$:
POKE 752,1:POSITION X,Y:PRINT " ":X=X-
3:T=1
870 B$(LEN(B$)+1,LEN(B$)+1)=" "
880 FOR V=1 TO LEN(B$):IF ASC(B$(V,V))
=32 THEN POKE PG6+I,VAL(B$(T)):T=V+1:Z
=INT(X/4)+32:GOSUB 1660:X=X+4:I=I+1
890 IF X>31 THEN Y=Y+1:X=0
900 IF I=128 THEN Y=2:X=3:I=0:POP :GOS
```


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PROGRAM FILE

```
UB 1760:GOTO 470
910 NEXT V:X=X+3
920 GOSUB 1760:GOTO 470
930 REM ALTER IN ATASCII
940 GOSUB 2040:POSITION 0,19:PRINT " A
SC START BYTE=  (       VALUE=  ("
950 POSITION 19,19:PRINT I;")":POSITIO
N 35,19:PRINT PEEK(PG6+I);")"
960 POSITION 16,19:M=I:GOSUB 2010:POSI
TION 32,19:M=PEEK(PG6+I):GOSUB 2010
970 POSITION 0,21:POKE 752,0:INPUT B$
980 POKE 752,1:POSITION X,Y:PRINT " ":
X=X-3
990 FOR V=1 TO LEN(B$)
1000 POKE PG6+I,ASC(B$(V,V)):Z=INT(X/4
)+32:GOSUB 1660:X=X+4:I=I+1:IF X>31 TH
EN Y=Y+1:X=0
1010 IF I=128 THEN Y=2:X=3:I=0:POP :GO
SUB 1760:GOTO 470
1020 IF I=128 THEN X=3:I=0:POP :GOSUB
1760:GOTO 470
1030 NEXT V
1040 X=X+3
1050 GOSUB 1760:GOTO 470
1060 REM ALTER IN HEX
1070 GOSUB 2040:POSITION 0,19:PRINT "
HEX START BYTE=          VALUE="
1080 POSITION 16,19:M=I:GOSUB 2010:POS
ITION 32,19:M=PEEK(PG6+I):GOSUB 2010
1090 POSITION 0,21:POKE 752,0:INPUT B$
:POKE 752,1:POSITION X,Y:PRINT " ":X=X
-3:T=1
1100 B$(LEN(B$)+1,LEN(B$)+1)=" "
1110 FOR V=1 TO LEN(B$):IF ASC(B$(V,V)
)=32 THEN C$=B$(T,V-1):GOSUB 1910:GOSU
B 1800
1120 IF X>31 THEN Y=Y+1:X=0
1130 IF I=128 THEN Y=2:X=3:I=0:POP :GO
SUB 1760:GOTO 470
1140 NEXT V
1150 X=X+3:GOSUB 1760:GOTO 470
1160 REM FIND ATASCII STRING
1170 PRINT CHR$(125):POSITION 0,5:? "F
IND-ENTER ATASCII STRING"
1180 PRINT :PRINT
1190 POKE KEY,255:POKE 752,0:INPUT B$
1200 IF LEN(B$)=0 THEN 310
1210 PRINT :PRINT
1220 PRINT "ENTER STARTING SECTOR(1 TO
 720)"
1230 PRINT :PRINT
1240 TRAP 1240:INPUT SNUM:POKE 752,1
1250 PRINT CHR$(125):POSITION 0,15:PRI
NT "FIND-LOOKING FOR '";B$;"'"
1260 POSITION 0,17:PRINT "CHECKING SEC
TOR ";SNUM
1270 GOSUB 1830
1280 FOR P=1 TO LEN(D$)
1290 POKE 1668+P,ASC(B$(P,P))
1300 NEXT P
1310 FOR I=0 TO 127
1320 IF PEEK(PG6+I)=PEEK(1669) THEN GO
TO 1610
1330 NEXT I
1340 IF PEEK(KEY)<>255 THEN POP :GOTO
310
1350 SNUM=SNUM+1:POSITION 16,17:PRINT
SNUM;"  ":POKE 77,0
1360 GOSUB 1830:GOTO 1310
1370 CKSUM=0:FOR P=0 TO 127:CKSUM=CKSU
M+PEEK(PG6+P):NEXT P
1380 REM CHECKSUM
1390 GOSUB 2060:POSITION 0,21:PRINT "C
HECKSUM =";CKSUM
1400 FOR P=1 TO 600:NEXT P:GOSUB 1760:
POKE KEY,255:GOTO 470
1410 REM RECOVER
1420 POKE 752,0:TRAP 310:PRINT CHR$(12
5):POSITION 0,5:PRINT "RECOVER-ENTER S
TARTING SECTOR";:INPUT SNUM
1430 IF SNUM<1 OR SNUM>720 THEN 1420
1440 TRAP 310:PRINT :PRINT "ENTER NO O
F SECTORS TO LOAD";:INPUT NSEC
1450 IF NSEC>=(720-SNUM) THEN ? "TOO M
ANY SECTORS!!":GOTO 1440
1460 TRAP 310:PRINT :PRINT "ENTER LOAD
 ADDRESS(";
1470 IF FLAG=1 THEN PRINT "DECIMAL)";:
INPUT DECVAL
1480 IF FLAG=0 THEN PRINT "HEX)";:GOSU
B 1900
1490 POKE 752,1
1500 FOR P=1 TO NSEC:POKE KEY,255:GOSU
B 1830
1510 PRINT :PRINT "LOADING SECTOR ";SN
UM;" INTO MEMORY"
1520 FOR I=0 TO 127
1530 IF PEEK(KEY)<>255 THEN POP :POP :
GOTO 310
1540 POKE DECVAL+I,PEEK(PG6+I)
1550 NEXT I
```

```
1560 DECVAL=DECVAL+128:SNUM=SNUM+1
1570 NEXT P
1580 PRINT :PRINT CHR$(253);"SECTORS "
;SNUM-NSEC;" TO ";SNUM-1;" NOW LOADED
INTO MEMORY"
1590 FOR P=1 TO 600:NEXT P:GOTO 310
1600 REM CHECK ATASCII STRING IN SECTO
R
1610 FOR P=1 TO LEN(B$)
1620 IF PEEK(PG6+I-1+P)=PEEK(1668+P) T
HEN NEXT P:PRINT CHR$(253):GOTO 310
1630 POP :GOTO 1330
1640 X=X+3:GOSUB 1760:GOTO 470
1650 REM PRINT HEX/DEC DATA
1660 POSITION X,Y
1670 M=PEEK(PG6+I)
1680 IF FLAG=0 THEN 1720
1690 IF M<100 THEN PRINT " ";:IF M<10
THEN PRINT " ";
1700 PRINT M
1710 IF FLAG=1 THEN 1730
1720 R=M/16:R=INT(R):PRINT " ";Q$(R+1,
R+1);:R=(M-(R*16)):PRINT Q$(R+1,R+1)
1730 POSITION Z,Y
1740 IF M<26 OR (M>31 AND M<125) OR (M
>127 AND M<155) OR (M>159 AND M<253) T
HEN PRINT CHR$(M)
1750 RETURN
1760 GOSUB 2040:POSITION 0,19:? "ALTER
 SAVE HEX DEC REC < > HELP 1 2 3 4"
1770 POSITION 0,21:? "FIND CKSUM DOS O
PTION SELECT START"
1780 RETURN
1790 X=X+3:GOSUB 1760:TRAP 310:GOTO 47
0
1800 POKE I+PG6,DECVAL:T=V+1:Z=INT(X/4
)+32:GOSUB 1660:X=X+4:I=I+1
1810 RETURN
1820 REM ACCESS SECTOR
1830 IF SNUM>720 THEN SNUM=1
1840 IF SNUM<1 THEN SNUM=720
1850 POKE 779,INT(SNUM/256):POKE 778,I
NT((SNUM/256-INT(SNUM/256))*256)
1860 POKE 769,DRIVE:POKE 772,5:POKE 77
3,6:POKE 770,CO
1870 X=USR(1536)
1880 RETURN
1890 REM HEX-DEC CONVERSION
1900 INPUT C$
1910 PWR=1:DECVAL=0:HEXVAL=0
1920 FOR P=LEN(C$) TO 1 STEP -1
1930 HEXVAL=ASC(C$(P,P))
1940 IF HEXVAL>47 AND HEXVAL<58 THEN H
EXVAL=HEXVAL-48
1950 IF HEXVAL>64 AND HEXVAL<71 THEN H
EXVAL=HEXVAL-55
1960 DECVAL=DECVAL+(PWR*HEXVAL)
1970 PWR=PWR*16
1980 NEXT P
1990 RETURN
2000 REM DEC-HEX CONVERSION
2010 R=M/16:R=INT(R):? Q$(R+1,R+1);:R=
(M-(R*16)):? Q$(R+1,R+1)
2020 RETURN
2030 REM CLEAR TEXT AREA
2040 POSITION 0,19:PRINT "
                          "
2050 POSITION 0,20:PRINT "
                          "
2060 POSITION 0,21:PRINT "
                          "
2070 POSITION 0,22:PRINT "
                          "
2080 RETURN
```

NewBrain Assembler/Editor

by John Samiotakis

As a result of publishing two small programs for the NewBrain recently, *PCW* has been inundated with letters from NewBrain owners requesting something more substantial. Well, here you are, a full assembler/editor for the NewBrain.

I'm not going to try and explain how to write assembler code; this is better done by one of the many Z80 programming books. The program accepts the standard Z80 instruction set and you can reference operating system routines (as they are named in the technical reference manual). Labels are two alphanumeric characters for JP, JR, DJNZ and other call-like instructions. As it stands data is manipulated by its absolute address but a fairly simple assembly language routine to incorporate variables could be written.

The program is menu-driven with eight options:

(1) SAVE. This allows the source code to be saved to tape or, by specifying first and last memory locations, the object code.

(2) PRINT. This prints the source code after the appropriate baud rate has been selected.

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PROGRAM FILE

(3) LIST. This lists your program and also drops you into the editor. The listing is via a menu of selectable pages.
(4) COMPILE. This allows you to compile a program. You will be prompted for the address for the object code, which should be within the reserved memory area. Just pressing RETURN will default the object to TOP.

After compilation, the first and last address of the object code is displayed. The area between 31856 and 32766 is used by the program itself.
(5) LOAD. Select 5 to load either source or object code from tape. The program understands the difference between source and object code, and loads and prompts accordingly.
(6) INPUT. Selecting this clears the current program and enters the editor, ready for the entry of a new program. The program is entered by first entering the instruction and its parameters, then, after pressing RETURN, entering a label (if there is one). A further return will allow for entry of the next line of code. Two debug routines can be typed in at this stage:
CALL 31870 will print a list of the BC,DE,HL,IX,IY,SP,A and flag registers at that point with no halting of execution; and
CALL 31856 will set a break point in the program.
(7) RUN. Select this option to run the program without exiting the assembler/editor.
(8) END. This will drop you out of the program. Machine code routines can be run in the normal way from the NewBrain.

Within the editor there are a number of commands available for program editing. As well as the screen editor, pressing D gives you a block delete: type the two line numbers separated by commas. C gives you a search and replace facility: type the string to find followed by the replacement string. E returns you to the screen editor.

Although this sounds very complicated, it's not. If you're familiar with assemblers the only strange thing is the entry of a label after the instruction; everything else flows naturally.

People who are not familiar with assembler should consult a book before they start.

```
ΓΙΑΝΝΗΣ ΣΑΜΙΩΤΑΚΗΣ 1984

1 DATACP ,DI ,EI ,EX ,IM ,IN ,JP ,JR ,LD ,OR ,RL ,RR ,CALL,CPDR,CPIR
,DJNZ,HALT,INDR,INIR,LDDR,LDIR,OTDR,OTIR,OUTD,OUTI,PUSH,RETI,RETN,RLCA,RRCA,ADC
,ADD ,AND ,BIT ,CCF ,CPD ,CPI ,CPL ,DAA ,DEC ,EXX ,INC ,IND ,INI ,LDD ,LDI ,NEG
,NOP ,OUT ,POP ,RES ,RET ,RLA ,RLC ,RLD ,RRA ,RRC ,RRD ,RST ,SBC ,SCF ,SET ,SLA
,SRA ,SRL ,SUB ,XOR ,DUMMY
2 RESERVE 896: S=32433:FORI=1TO67:READA$:FORJ=1TO4:S=S+1:POKES,ASC(MID$(A$,J,1))
:NEXTJ:NEXTI:READA$
3 DATA50,206,125,237,83,204,125,34,202,125,237,67,200,125,237,115,207,125,245,24
5,209,237,83,152,125,203,67,204,136,125,203,67,196,111,125,237,91,152,125,203,11
5,204,121,125,196,116,125,237,91,152,125,203,83,204,126,125,196,131,125,237,91,1
52,125,203,123,204,106,125,196,141,125,205,76,125,237,91,204,125,205,52,125,205,
96,125,237,91,200,125,205,52,125,205,71,125,237,91,202,125,205,52,125,33,188,125
,1,2,0,205,62,125,237,91,206,125,22,0,205,52,125,205,91,125,237,91,207,125,205,5
2,125,253,34,207,125,205,81,125,237,91,207,125,205,52,125,221,34,207,125,205,86,
125,237,91,207,125,205,52,125,33,190,125,1,1,0,205,62,125,237,91,204,125,42,202,
125,237,75,200,125,58,206,125,241,201,231,40,1,5,5,231,44,1,11,0,30,0,231,61,201
,205,62,125,201,33,197,125,24,23,33,194,125,24,16,33,188,125,24,13,55,185,125,24
,8,33,179,125,24,3,33,191,125,1,3,0,205,62,125,201,33,155,125,24,33,33,173,125,2
4,239,33,167,125,24,234,33,170,125,24,229,33,164,125,24,224,33,161,125,24,219,33
,176,125,24,214,33,158,125,1,2,0,205,62,125,201,0,152,10,80,80,32,32,77,32,32,80
,69,32,80,79,32,90,32,32,78,90,32,67,32,32,78,67,32,83,80,61,73,89,61,73,88,61,6
5,61,13,66,67,61,68,69,61,72,76,61,0,0,63,48,90,124,10,75,102,0,0,86,43,94,34,17
4,126,98,107,231,39,237,83,176,126,42,174,126,43,205,24,126,98,107,34,174,126,17
,0,0,62,13,237,177,226,161,125,19,58,177,126,186,32,242,58,176,126,187,32,236,24
,7,33,255,255,34,172,126,201,237,91,174,126,48,1,63,237,82,24,241,70,43,78,10,25
3,134,26,95,3,10,253,142,27,87,3,237,67,174,126,42,174,126,78,35,70,201,205,24,1
26,237,67,176,126,6,4,33,167,126,35,54,32,16,251,237,75,176,126,237,83,172,126,4
2,172,126,17,168,126,237,176,17,168,126,33,189,127,1,12,1,26,237,185,48,1,63,32,
50,34,174,126,237,83,172,126,237,67,176,126,6,3,35,19,35,26,190,32,35,16,248,237
,75,176,126,203,57,56,25,203,57,56,21,203,64,40,2,203,241,203,128,3,237,67,176,1
26,208,63,201,1,100,0,24,244,42,174,126,237,75,176,126,237,91,172,126,24,180
4 S=31869:FORI=1TO554:READA:POKES+I,A:NEXTI
5 FORI=1TO255:CLOSE#I:NEXTI:OPEN#5,5:OPEN#4,6:OPEN#0,0,"L26":P2$=CHR$(22)+CHR$(2
5)+CHR$(10):P1$=CHR$(31)+P2$
6 DATAZRND,ZPI,ZSTPOS,ZFPONE,ZFPMONE,ZFPZERO,ZNOP,ZNEG,ZNOT,ZABS,ZATAN,ZCOS,ZEXP
,ZINT,ZLOG,ZSIGN,ZSIN,ZSQRT,ZTAN,ZASIN,ZACOS,ZPEEK,ZADD,ZSUB,ZMULT,ZDIV,ZRAISE,Z
AND,ZOR,ZNUMEQ,ZNUMGT,ZNUMLT,ZNUMNE,ZNUMLE,ZNUMGE,ZMATHS,ZINITRAND,ZRANDOM,ZCOMP
,ZFIX,ZFLT,ZROUND,ZINP,ZLDF,ZOUT,ZSTF,ZRELBDD,ZTTCAPS,ZOUTPUT,ZINPUT,ZOPENIN,ZOP
ENOUT,ZCLOSE,ZSTKTST,ZBRKTST,ZMKBUFF,ZGETKEY,ZIMMKEY,ZKLOOK,ZFSTRM,ZBLKIN,ZBLKOU
T,ZFPHLF,ZFPID2,ZBICML,ZRDBYTE,ZRDINT,ZRDNSP
7 DIMOS$(67):FORI=0TO67:READOS$(I):NEXTI
8 DATA0,243,251,0,0,0,0,0,0,0,16,24,0,185,177,0,118,186,178,184,176,187,179,171,
163,0,77,69,7,15,0,0,0,0,0,63,169,161,47,39,0,217,0,170,162,168,160,68,0 ,0,0,0,2
3,0,111,31,8,103,0,0,55,0,32,40,56
9 FORI=1TO65:READPV:POKE32701+I,PV:NEXTI:TP=TOP
10 DATA22,38,1,68,69,76,69,84,22,64,1,231 , 54 , 208 , 49,88 , 2 , 253 , 225 , 2
21 , 225 , 193 , 225 , 209 , 201
11 FORI=1TO11:READPV:DL$=DL$+CHR$(PV):NEXTI:RESERVE14:FORI=31856TO31869:READPV:P
OKEI,PV:NEXTI:CLEARS,A$,I,J,PV:UL=TOP:DELETE-11
12 DEFFNRS(X$)=(@ANDX$="00H")OR(1ANDX$="08H")OR(2ANDX$="10H")OR(3ANDX$="18H")OR(
4ANDX$="20H")OR(5ANDX$="28H")OR(6ANDX$="30H")OR(7ANDX$="38H")
13 DEFFNDD(X$)=VAL(MID$(X$,INSTR(X$,"+")+1,INSTR(X$,")")-INSTR(X$,"+")-1))
14 DEFFNNN$(X$)=MID$(X$,INSTR(X$,"(")+1,INSTR(X$,")")-INSTR(X$,"(")-1)
15 DEFFNLF$(X$)=LEFT$(X$,INSTR(X$,",")-1)
16 DEFFNRG$(X$)=RIGHT$(X$,LEN(X$)-INSTR(X$,","))
17 DEFFNR2$(X$)=RIGHT$(X$,LEN(X$)-2)
18 DEFFNR3$(X$)=RIGHT$(X$,LEN(X$)-3)
19 DEFFNAH$(X)=CHR$(INT(X/256))
20 DEFFNAL$(X)=CHR$(X-INT(X/256)*256)
21 ONERRORGOTO50000
22 DEFFNH(X$)=(ASC(X$)-48ANDX$<":")OR(ASC(X$)-55ANDX$>"@")
23 DEFFND(X$)=FNH(MID$(X$,1,1))*16+FNH(MID$(X$,2,1))
24 DEFFNIM(X)=(70ANDX=0)OR(86ANDX=1)OR(94ANDX=2)
25 DEFFNCN(X$)=(0ANDX$="NZ")OR(1ANDX$="Z")OR(2ANDX$="NC")OR(3ANDX$="C")OR(4ANDX$
="PO")OR(5ANDX$="PE")OR(6ANDX$="P")OR(7ANDX$="M")
26 DEFFNTI(X)=PEEK(105)*256+2+PEEK(106)*256+PEEK(107)
27 DEFFNR(X$)=(0ANDX$="B")OR(1ANDX$="C")OR(2ANDX$="D")OR(3ANDX$="E")OR(4ANDX$="H
")OR(5ANDX$="L")OR(6ANDX$="(HL)")OR(7ANDX$="A")
28 DEFFNRR(X$)=(0ANDX$="BC")OR(1ANDX$="DE")OR(2ANDX$="HL")OR(3ANDX$="SP")OR(3AND
X$="AF")
29 ON BREAK GOTO 29
```

PROGRAM FILE

```
30 PUT31:?:?TAB(10);"1.SAVE";TAB(40);"2.PRINT":?:?TAB(10);"3.LIST";TAB(40);"4.CO
MPILE":?:?TAB(10);"5.LOAD";TAB(40);"6.INPUT":?:?TAB(10);"7.RUN";TAB(40);"8.END":
?:?TAB(25);:INPUT("ENTER YOUR CHOICE ")CH
32 IFCH<1ORCH>8GOTO30
34 ONCHGOSUB8500,8210,7000,70,9000,55,13100,120
35 GOTO30
55 INPUT(P1$+"NUMBER OF BYTES ")NB:?:?TAB(25);
56 INPUT("NUM OF COMMANDS ")NC:P=NC
60 GOSUB12000:CH$(1)="":CLEARCH$():DIMCH$(NC):LL$="":PUT31:FORJ=1TONC:?J(4);:LIN
PUT("")CH$(J)
61 PUT11,9,9,9,9,9,59:LINPUT("")TV$
62 IFTV$=""THENLL$=LL$+"  ":GOTO68
64 LL$=LL$+LEFT$(TV$+"  ",2)
68 NEXTJ:RET
70 INPUT(P1$+"FIRST MEM ADDR.")TV$
71 IFTV$=""LETK=TOP-1:FA=K+1:GOTO80
72 IFNOT(NUM(TV$))GOTO70
75 K=VAL(TV$)-1:FA=K+1
80 PUT31:AS$="":LB$="":TS$="":?TAB(30);"COMPILATION":TS=FNTI(1):FORJ=1TONC:DS$=C
H$(J)
81 IFDS$=""THENDS$="NOP":GOTO100
82 IFMID$(LL$,2*J-1,2)<>"  "THENLB$=LB$+MID$(LL$,2*J-1,2):AS$=AS$+FNAL$(K+1)+FNA
H$(K+1)
84 IFLEFT$(DS$,1)<>"Z"THEN100
86 FORI=1TO67:IFDS$(I)=DS$THENGOTO1100
88 NEXTI:?"SYNTAX ERROR IN ";J[3];DS$:GOTO115
100 LS$=LEFT$(DS$,4):GOSUB10100:CALL32305,LS$
101 I=PEEK(32432):IFI<100THEN110
102 ?"SYNTAX ERROR IN ";J[3];DS$:GOTO115
110 K=K+1:IFK=ULTHEN?"VIOLATE ASSEMBLER'S OWN AREA":GOTO116
112 ONIGOSUB1400,14000,14000,3700,1050,3900,4000,1200,4100,1500,14200,14200,1100
,14100,14100,1300,14000,14100,14100,14100,14100,14100,14100,14100,14100,3400,141
00,14100,14000,14000,3000,3100,1600,2700,14000,14100,14100,14000,14000,3500,1400
0,3600,14100,14100,14100,14100,14100,14000,3800,3300,2800,1900,14000,14300,14100
,14000,14300,14100,4200,3200,14000,2900,14300,14300,14300,1700,1800
115 NEXTJ
116 GOSUB17000:TE=FNTI(1):?"FIRST MEM ADDR=";FA;?"LAST MEM ADD=";K
117 ?(TE-TS)/50;"SEC COMPILATION TIME";?K-FA+1;"BYTES"
118 U=1:CLEARW:AS$="":TS$="":LB$=""
119 ?"PRESS A KEY":GET#5,TV:RET
120 PUT31:END
1010 H$=FNR3$(DS$):LS$=FNLF$(H$)
1015 H$=FNRG$(H$):GOSUB10100:RET
1050 P2=FNIM(VAL(RIGHT$(DS$,LEN(DS$)-3))):GOSUB10000:RET
1100 TV$="0":H$=RIGHT$(DS$,LEN(DS$)-4)
1101 IFINSTR(H$,",")<>0THEN1122
1102 POKEK,205:K=K+1:LS$=H$
1104 IFNUM(LS$)GOSUB10149:RET
1105 GOSUB10100:LS$=LEFT$(LS$,2):GOSUB17500:RET
1122 LS$=FNLF$(H$):GOSUB10100:POKEK,196+FNCN(LS$)*8
1124 K=K+1:LS$=FNRG$(H$)
1128 IFNUM(LS$)GOSUB10149:RET
1130 GOSUB10100:LS$=LEFT$(LS$,2):GOSUB17500:RET
1200 TV$="1":LS$=FNR3$(DS$)
1203 IF INSTR(LS$,",")<>0 THEN 1222
1206 POKEK,24:K=K+1
1208 IFNUM(LS$)THENPOKEK,VAL(LS$):RET
1210 GOSUB10100:LS$=LEFT$(LS$,2):GOSUB17500:RET
1222 H$=LS$:LS$=FNLF$(LS$):GOSUB10100:POKEK,32+FNCN(LS$)*8
1228 K=K+1:LS$=FNRG$(H$):IFNUM(LS$)THENPOKEK,VAL(LS$):RET
1230 GOSUB10100:LS$=LEFT$(LS$,2):GOSUB17500:RET
1300 POKEK,16:K=K+1:TV$="1"
1303 LS$=RIGHT$(DS$,LEN(DS$)-4)
1305 IFNUM(LS$)THENPOKEK,VAL(LS$):RET
1310 GOSUB10100:LS$=LEFT$(LS$,2):GOSUB17500:RET
1400 CS=184:C1=254:GOTO1550
1500 CS=176:C1=246
1550 H$=FNR2$(DS$):ML=1:GOSUB10200:RET
1600 CS=160:C1=230:GOTO1850
1700 CS=144:C1=214:GOTO1850
1800 CS=168:C1=238
1850 H$=FNR3$(DS$):ML=1:GOSUB10200:RET
1900 LS$=CS$:GOSUB10100
1902 IF LS$="RET" THEN POKEK,201:RET
1905 LS$=FNR3$(DS$):GOSUB10100
1907 POKEK,192+FNCN(LS$)*8:RET
2700 CS=1:GOTO2950
2800 CS=2:GOTO2950
2900 CS=3
2950 CS=VAL(FNLF$(FNR3$(DS$)))*8+64*CS
2960 H$=FNRG$(DS$):GOSUB10500:RET
3000 GOSUB1010:IFLS$="A"THENCS=136:ML=1:C1=205:H$=LS$:GOSUB10200:RET
3005 POKEK,237:K=K+1:LS$=H$
3007 GOSUB10100:POKEK,74+FNPR(LS$)*16:RET
3100 GOSUB1010:IFLS$="A"THENCS=128:ML=1:C1=195:H$=LS$:GOSUB10200:RET
3105 IFLS$="HL"THENLS$=H$:GOSUB10100:POKEK,9+FNPR(LS$)*16:RET
3110 IFLS$="I"THENPOKEK,221:K=K+1:LS$=H$:GOSUB10100:POKEK,9+FNPR(LS$)*16:RET
3115 POKEK,253:K=K+1
3120 LS$=H$:GOSUB10100
3125 POKEK,9+FNPR(LS$)*16:RET
3300 GOSUB1010:IFLS$="A"THENCS=152:ML=1:C1=222:H$=LS$:GOSUB10200:RET
3305 LS$=H$:GOSUB10100
3310 POKEK,237:K=K+1
3315 POKEK,66+FNPR(LS$)*16:RET
3350 H$=FNR3$(DS$):CS=193
3355 ML=16:GOSUB3450:RET
3400 H$=RIGHT$(DS$,LEN(DS$)-4)
3405 CS=197:ML=16:GOSUB3450:RET
3450 LS$=H$:GOSUB10100
3452 IFLS$="IX"THENPOKEK,221:K=K+1:POKEK,CS+32*ML:RET
3455 IFLS$="IY"THENPOKEK,253:K=K+1:POKEK,CS+32*ML:RET
3460 POKEK,CS+FNPR(LS$)*ML:RET
3500 LS$=FNR3$(DS$):GOSUB10100
3502 IFLEN(LS$)=2LETCS=11:ML=16:GOSUB3452:RET
3505 CS=5:ML=8:H$=LS$:GOSUB10200:RET
3600 LS$=FNR3$(DS$):GOSUB10100
3602 IFLEN(LS$)=2LETCS=3:ML=16:GOSUB3452:RET
3605 CS=4:ML=8:H$=LS$:GOSUB10200:RET
3700 IFINSTR(DS$,"IX")<>0THENPOKEK,221:K=K+1:POKEK,237:RET
3705 IFINSTR(DS$,"IY")<>0THENPOKEK,253:K=K+1:POKEK,237:RET
3710 IFINSTR(DS$,"(SP)")<>0THENPOKEK,227:RET
3715 IFINSTR(DS$,"AF")<>0THENPOKEK,8:RET
3720 POKEK,235:RET
3800 IFINSTR(DS$,"(C)")<>0THENLS$=FNRG$(DS$):GOSUB10100:POKEK,237:K=K+1:POKEK,65
+FNR(LS$)*8:RET
3805 POKEK,211:K=K+1
3810 POKEK,VAL(FNNN$(DS$)):RET
3900 IFINSTR(DS$,"(C)")<>0THENPOKEK,237:K=K+1:LS$=FNLF$(DS$):LS$=FNR2$(LS$):GOSU
B10100:POKEK,64+FNR(LS$)*8:RET
3905 POKEK,219:K=K+1
3910 POKEK,VAL(FNNN$(DS$)):RET
4000 TV$="0":IFINSTR(DS$,",")=0THEN4010
```


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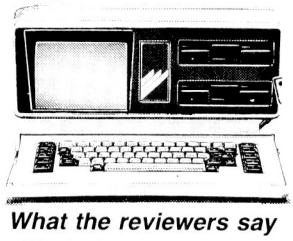

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```
4005 LS$=MID$(DS$,3,INSTR(DS$,",")-3):GOSUB10100:POKEK,194+FNUM(LS$):K=K+1:LS$
=FNRG$(DS$)
4006 IFNUM(LS$)GOSUB10148:RET
4007 GOSUB10100
4008 LS$=LEFT$(LS$,2)
4009 GOSUB17500:RET
4010 IFINSTR(DS$,"IX")<>0THENPOKEK,221:K=K+1:POKEK,203:RET
4015 IFINSTR(DS$,"IY")<>0THENPOKEK,253:K=K+1:POKEK,203:RET
4080 IFINSTR(DS$,"(HL)")<>0THENPOKEK,203:RET
4085 LS$=FNRG$(DS$)
4086 POKEK,195:K=K+1
4088 IFNUM(LS$)GOSUB10148:RET
4090 GOSUB10100
4095 LS$=LEFT$(LS$,2)
4040 GOSUB17500:RET
4100 LS$=MID$(DS$,3,INSTR(DS$,",")-3)
4102 GOSUB10100
4103 IFLS$="(BC)"THENPOKEK,3:RET
4105 IFLS$="(DE)"THENPOKEK,18:RET
4110 IFLS$="(HL)"ANDNUM(FNRG$(DS$))THENPOKEK,54:K=K+1:POKEK,VAL(FNRG$(DS$)):RET
4115 IFLS$="(HL)"LETLS$=FNRG$(DS$):GOSUB10100:POKEK,112+FNRL(LS$):RET
4120 IFINSTR(LS$,"(I")<>0ANDNUM(FNRG$(DS$))THENPOKEK,221:K=K+1:POKEK,54:K=K+1:P
OKEK,FNDD(LS$):K=K+1:POKEK,VAL(FNRG$(DS$)):RET
4125 IFINSTR(LS$,"(I")<>0ANDNUM(FNRG$(DS$))THENPOKEK,253:K=K+1:POKEK,54:K=K+1:P
OKEK,FNDD(LS$):K=K+1:POKEK,VAL(FNRG$(DS$)):RET
4130 IFINSTR(LS$,"(I")<>0THENPOKEK,253:K=K+1:LS$=FNRG$(DS$):GOSUB10100:POKEK,11
2+FNRL(LS$):K=K+1:POKEK,FNDD(DS$):RET
4135 IFINSTR(LS$,"(I")<>0THENPOKEK,221:K=K+1:LS$=FNRG$(DS$):GOSUB10100:POKEK,11
2+FNRL(LS$):K=K+1:POKEK,FNDD(DS$):RET
4140 IFINSTR(LS$,"(")<>0THENPK$=FNNN$(LS$):LS$=FNRG$(DS$):GOSUB10100:GOSUB11000:
RET
4142 IFLS$="R"THENPOKEK,237:K=K+1:POKEK,79:RET
4144 IFLS$="I"THENPOKEK,237:K=K+1:POKEK,71:RET
4145 IFLS$="D"THENPOKEK,221:K=K+1:GOSUB11050:RET
4148 IFLS$="IY"THENPOKEK,253:K=K+1:GOSUB11050:RET
4150 H$=LS$
4152 LS$=FNRG$(DS$):GOSUB10100
4154 IFLS$="HL"THENPOKEK,249:RET
4156 IFLS$="IX"THENPOKEK,221:K=K+1:POKEK,249:RET
4158 IFLS$="IY"THENPOKEK,253:K=K+1:POKEK,249:RET
4160 IFLS$="R"THENPOKEK,237:K=K+1:POKEK,95:RET
4162 IFLS$="I"THENPOKEK,237:K=K+1:POKEK,87:RET
4164 IFLS$="(BC)"THENPOKEK,10:RET
4165 IFLS$="(DE)"THENPOKEK,26:RET
4168 IFH$="HL"ANDINSTR(LS$,"(")<>0THENPOKEK,42:K=K+1:PK$=FNNN$(LS$):GOSUB10150:R
ET
4170 IFLEN(H$)=2ANDINSTR(LS$,"(")<>0THENPOKEK,237:K=K+1:POKEK,75+FNPR(H$):K=K
+1:PK$=FNNN$(LS$):GOSUB10150:RET
4173 IFLEN(H$)=3THENPOKEK,14+FNRR(H$):K=K+1:PK$=LS$:GOSUB10150:RET
4174 IFNUM(LS$)THENPOKEK,6+FNR(H$):K=K+1:POKEK,VAL(LS$):RET
4176 IFINSTR(LS$,"(I")<>0THENPOKEK,221:K=K+1:POKEK,70+FNR(H$):K=K+1:POKEK,FND
D(LS$):RET
4178 IFINSTR(LS$,"(I")<>0THENPOKEK,253:K=K+1:POKEK,70+FNR(H$):K=K+1:POKEK,FND
D(LS$):RET
4179 IFLS$="(HL)"THENPOKEK,70+FNR(H$):RET
4180 IFH$="HL"ANDINSTR(LS$,"(")<>0THENPOKEK,33:K=K+1:PK$=FNNN$(LS$):GOSUB10150:RE
T
4182 IFLEN(H$)=2ANDLEN(LS$)=1THENPOKEK,54+FNR(H$):K=K+1:POKEK,VAL(LS$):RET
4184 PRINT"ERROR";DS$:RET
4200 LS$=FNRG$(DS$)
4210 GOSUB10100
4220 POKEK,194+FNRR(LS$):K=K+1:RET
6000 FORT=0TO39:READA:POKE&B000+T,A:NEXT:DATA33,0,0,58,80,176,254,0,40,5,62,1,5
0,81,176,201,33,0,0,58,80,176,254,0,40,5,62,1,50,82,176,201,0
6005 PUTCH=&B000:GETCH=&B00A
6010 PRINT"GET=";GETCH;"PUT=";PUTCH
6015 PRINT"SET";:INPUT"ADDRESS";A:POKEA,0:PRINT"SET"
6020 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6025 PRINT"PUT";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6030 PRINT"SET";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6035 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6040 PRINT"PUT";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6045 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6050 PRINT"SET";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6055 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6060 PRINT"PUT";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6065 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6070 PRINT"SET";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6075 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6080 PRINT"PUT";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6085 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6090 PRINT"SET";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6095 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6100 PRINT"PUT";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6105 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6110 PRINT"SET";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6115 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
6120 PRINT"PUT";:INPUT"ADDRESS";A:INPUT"VALUE";V:POKEA,V
6125 PRINT"GET";:INPUT"ADDRESS";A:PRINTPEEK(A)
```

PROGRAM FILE

```
9100 IFMR=2THENCH$(L)="":CLEARCH$(L):LL$="":GOTO9200
9110 IFMR<>1THEN"ERROR IN MR ":STOP
9115 NE=T:GOSUB12000
9116 FORI=0TOT-1:GET#2,TV
9117 POKETOP+I,TV:NEXTI
9120 F=TOP:T=TOP+T-1
9125 CLOSE#2:RET
9200 INPUT"#1#+"ENTER NUM OF INSTR,"TV#
9205 IFNUM(TV$)THENDIMCH$(VAL(TV$)):GOTO9250
9210 DIMCH$(T/5)+E+T
9220 NC=F:GOTO9270
9250 IFVAL(TV$)<(TTHENFORI=FTOVAL(TV$):LINPUT#2,ch$(I):NEXTI:FORI=VAL(tv$)+1TOT:L
INPUT#2,11$:NEXTI:LINPUT#2,11$:e=VAL(t$):nc=e:GOTO16000
9260 P=VAL(TV$):NC=P
9270 FORI=FTOT:LINPUT#2,CH$(I)
9280 NEXTI
9290 LINPUT#2,LL$:GOTO16000
10000 POKEK,ASC(K$+1:POKEK+2:RET
10100 IFLEFT$(LB$,1)="'"LET LB$=RIGHT$(LB$,LEN(LB$)-1):GOTO10100
10102 IFRIGHT$(LB$,1)="'"LET LB$=LEFT$(LB$,LEN(LB$)-1):GOTO10102
10105 IFINSTR(LB$,":")=0THENRET
10108 H1$=LEFT$(LB$,INSTR(LB$,":")-1)
10109 HB$=RIGHT$(LB$,LEN(LB$)-INSTR(LB$,":"))
10110 LB$=H1$+HB$:GOTO10105
10115 PK$=LB$
10150 PK=VAL(PK$)
10160 POKEK,PK-INT(PK/256)*256
10170 K=K+1:POKEK,INT(PK/256):RET
10200 IFINSTR(H$,"(")<>0THENPOKEK,33:K=K+1:GOSUB10400:RET
10202 IFINSTR(H$,"[")<>0THENPOKEK,123:K=K+1:GOSUB10400:RET
10204 IFINSTR(H$,"{")<>0THENPOKEK,123:K=K+1:POKEK,123:K=K+1:GOSUB10600:RET
10210 LB$=H$:GOSUB10100
10250 POKEK,33+FNR(LB$):RET
10300 POKEK,33+FNR(VAL(H$)):RET
11400 K=K+1:POKEK,FNLO(H$):RET
11402 IFINSTR(H$,"(")<>0THENPOKEK,33:K=K+1:POKEK,123:K=K+1:GOSUB10500:RET
11404 IFINSTR(H$,"[")<>0THENPOKEK,123:K=K+1:POKEK,123:K=K+1:GOSUB10600:RET
11410 LB$=H$:GOSUB10100
11450 POKEK,33:K=K+1
11452 POKEK,33+FNR(LB$):RET
11500 POKEK,FNLO(H$):K=K+1
11502 POKEK,33+FNR(VAL(H$)):RET
11550 IFLB$="("THENPOKEK,33:K=K+1:GOSUB10150:RET
11552 IFLB$="["THENPOKEK,91:K=K+1:GOSUB10150:RET
11554 IFLB$="{"THENPOKEK,123:K=K+1:GOSUB10150:RET
11556 IFLB$="'"THENPOKEK,253:K=K+1:POKEK,91:K=K+1:GOSUB10150:RET
11600 POKEK,33:K=K+1
11610 POKEK,33+FNR(LB$):K=K+1
11650 K=K+1:POKEK,I:GOTO115
12000 IFNEXTP<TOPTHENRESERVE=TP+TOP:RET
12001 RET
12002 INPUT"#1#+"NUM OF INSRT,"NI
12003 PUT11,8:FORI=1TONI:INPUTTV
12004 PUT11,8:LINPUT(""+T0#
12005 PUT11,8,0,0,0,0,0,50:LINPUT(""+T1#
12006 FORI=T0TOTV+1STEP-1
12007 CH$(I)=CH$(I-1):NEXTI
12008 CH$(TV)=T0$:H0$=LEFT$(LL$,2)ATV-2)
12009 HB$="MID$(LL$,2)ATV+1,8000)"
12010 IFT1$=""LET"1$=""
12010 LL$=H0$+LEFT$(T1$,2)+HB$:H0$="":HB$="":NEXTI:GOTO30
12100 REM CALLTOP:RET
12500 INPUT"LB$:CL,CD:DL=CD-CL+1:IFCD<CL0RDL>60TO12510
12501 IFCL<CD<>0THEN13510
12502 IFCD=0THEN13500
12503 FORI=CD+1TOCL:CH$(I-DL)=CH$(I):NEXTI:H0$=LEFT$(LL$,2*CL-2):HB$=MID$(LL$,2*
CD+1,2000)
12507 LL$=H0$+HB$:H0$="":HB$=""
12510 CM=8:GOTO6000
12580 FORI=CLTOCD:CH$(I)=""
12590 NEXTI:GOTO13510
14000 POKEK,PEEK(32701+I):RET
14100 PD=PEEK(32701+I):GOSUB10000:RET
14200 H$=FNR$("DS$):DS=PEEK(32701+I):GOSUB10500:RET
14300 H$=FNR$("DS$):DS=PEEK(32701+I)
14350 GOSUB10500:RET
15000 PUT32,88,1,67,72,65,78,71,32,83,1:LINPUT(""+C1$:PUT32,88,1:LINPUT(""+C2$
15002 FORI=1TONC:IFINSTR(CH$(I),C1$)=0GOTO15080
15003 T0$=LEFT$(CH$(I),INSTR(CH$(I),C1$)-1)
15010 T1$=RIGHT$(CH$(I),LEN(CH$(I))-INSTR(CH$(I),C1$)-LEN(C1$)+1)
15015 CH$(I)=T0$+C2$+T1$
15020 NEXTI:CM=3:GOTO6000
15080 INPUT"#1#+"NUM OF BYTES,"NB
15090 GOSUB12000:CLOSE#2:RET
17000 FORI=1TOLEN(LB$)-2STEP2
17001 IFINSTR(MID$(LB$,I+2,1000),MID$(LB$,I,2))<>0THEN"THERE ARE TWO LABELS (";
MID$(LB$,I,2);")"
17002 NEXTI
17003 FORI=1TOLEN(T$)STEP5
17005 T$=MID$(T$,1,I):TV=INSTR(LB$,TV$
17050 IFTV=0"JUMP TO NON EXISTANCE LABEL ("+TV$+") IN THE"INT(I/5)+1"LABELED
COMMAND":GOTO17400
17080 PL=ASC(MID$(T$,I+2,1))+ASC(MID$(T$,I+3,1))*256
17082 PD=PC-(ASC(MID$(LB$,TV,1))+ASC(MID$(LB$,TV+1,1))*256
17070 IFMID$(T$,I+4,1)="0"THENPOKEPL,PD-INT(PD/256)*256:POKEPL+1,INT(PD/256):GO
TO17400
17100 IFPD>PLTHEN17150
17105 THEPL=PD
17107 IFPD>32767"ATTEMPT THE RANGE OF A RELATIVE JUMP TO ("+TV$+") IN THE"INT(I/5
)+1"LABELED COMMAND":GOTO17400
17110 POKEPL,256+(TV+1):GOTO17400
17150 THEPD=P
17155 IFPD>32767"ATTEMPT THE RANGE OF A RELATIVE JUMP TO ("+TV$+") IN THE"INT(I/5
)+1"LABELED COMMAND":GOTO17400
17160 POKEPL,TV+1
17300 NEXTI:RET
17500 T$=T0$+LEFT$(LL$+"  ",2*FNLL$(K)+FNLH$(K)-ATV$
17501 IFTV=1"THENRET
17502 K=K+1:RET
30000 IF(ERRLIN>10AND ERRLIN<69)OR(ERRLIN>69AND ERRLIN<6000)OR(ERRLIN>9999
AND ERRLIN<12580)OR(ERRLIN>13999 AND ERRLIN<14999"(ERR:DS#:GOTO115
30005 RESUME
```


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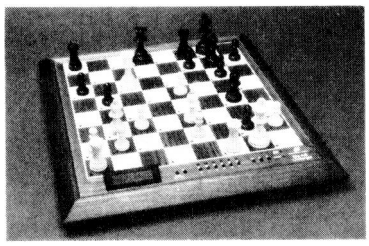

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PROGRAM FILE

Atom Footprints

by Peter Robinson

Footprints is one of those annoying you-versus-the-computer strategy games. It's simple and addictive and runs on the Acorn Atom with at least 12k and a floating point ROM.

The game is played on a 12×12 board and has one simple objective: each side must get its pieces to the other side. You control four pieces (ringed in white) as does the computer (ringed in black). What makes this game so intriguing is that your piece can only move forward (either diagonally or direct) and must be moved directly in front of an opponent's piece. It all becomes obvious when you see it.

All your possible options are displayed on the left of the board. Select the piece you wish to move by pressing the space bar until its border flashes. Pressing RETURN selects the piece and the space bar is then used to select the move and RETURN pressed. To miss a turn, press O.

```
  1REM************************
  2REM***   FOOTPRINTS     ***
  3REM***        BY        ***
  4REM*** PETER ROBINSON   ***
  5REM***      MCMLXIV     ***
  6REM************************
  7REM
  8REM
  9REM
 10G.50
 20!12341256742868753784315635614617268184278523473527531786
 30!18244618435235671342567487157586382162433417216573828254
 40!67384561467318523174218543675826
 50B=#27FF:A=(?18)*256
 55DIMXX8,YY8,MM8
 56F=#81:P.#21:DJSR#FE71:STY#80:RTS:]:P.#6#12
 60F.L=1TO3
 70D0A=A+1:U.?A=CH"!"
 80D0A=A+1:B=B+1:?B=(?A)-48
 90U.A?1=13
100N.:B=#2800
110CLEAR3:COLOUR1
111REM DRAW THE BOARD. IF YOU
112REM PREFER A SQUARE GRID,
113REM THEN DELETE L.115.
115G.151
120F.A=0TO12:C=A*7+6
130MOVE40,C:PLOT6,124,C
140MOVE(C+34),6:PLOT6,(C+34),90
150N.
151COLOUR1
152MOVE2,5:DRAW36,5:DRAW36,91:DRAW2,91:DRAW2,5
155MOVE39,5:DRAW125,5:DRAW125,91:DRAW39,91:DRAW39,5
156COLOUR2
157MOVE0,3:DRAW127,3:DRAW127,93:DRAW0,93:DRAW0,3
158REM***DRAW BOARD COMPONENTS
160F.Y=0TO11:F.X=0TO11
170MOVE(X*7+42),(Y*7+8)
180S=B?(Y*12+X)
190GOS.(2000+S*100)
200N.:N.
205REM***SET UP PIECES***
210F.A=1TO4:YYA=0:YY(A+4)=11
220R=A.R.%12:IF (B?R)&128 G.220
230XXA=R:B?R=(B?R):128
235MOVE(XXA*7+41),7:COLOUR1
236GOS.3000
240R=132+A.R.%12:IF (B?R)&128 G.240
250B?R=(B?R):128:XX(A+4)=R-132
260MOVE(7*XX(A+4))+41),84
264COLOUR3
265GOS.3000
270N.
272REM
273REM***PLAYER'S MOVE***
274REM
280H=0:F.A=1TO4:I=YY(A+4)-1
290MNA=(B?(I*12+XX(A+4)))&15:S=MNA
292REM
295REM***SHOW THE PLAYER IT'S
297REM***POSSIBLE MOVES.
300COLOUR0:F.Z=0TO7:MOVE(A*7),(71+Z):DRAW(A*7+7),(71+Z):N.
310MOVE(A*7),71:GOS.(2000+S*100)
320N.
325A=0
330A=A+1:IF A=5 A=1
340MOVE(41+7*XXA),(7+7*YYA)
350DO COLOUR2:GOS.3000
355WAIT:COLOUR1:GOS.3000
356WAIT
```

PROGRAM FILE

```
360LINK#81;U. ?#80<>255
370IF ?#80=0;DO LINK#81;U.?#80<>0;G.330
371IF?#80=16 H=1;G.600
372IF?#80<>13G.350
373DO LINK#81;U.?#80<>13
3750=A;A=-2
380A=A+1;IF A=2 A=-1
381IF A+XXO <0 A=A+1
382IF A+XXO >11 A=-1
385MOVE(41+7*(A+XXO)),(14+7*YYO)
390DO COLOUR1;GOS.3000
400WAIT;COLOUR2;GOS.3000
410LINK#81;U. ?#80<>255
420IF ?#80<>0;G.430
4250=(B?(A+XXO+12*(1+YYO)))&128;IF0=0;COLOURO;G.428
426E=0;DOE=E+1;U.(XXE=N+XXO AND YYE=1+YYO)OR E=8
427COLOUR1;IF E>4 COLOUR2
428GOS.3000
429DO LINK#81;U.?#80=255;G.380
430IF?#80=15;COLOURO;GOS.3000;G.325
440IF?#80<>13;G.390
445COLOURO;GOS.3000
446N=A
450F=0;0=B?(N+XXO+12*(1+YYO))
451IF0&128=0;G.460
452E=0;DOE=E+1;U.(XXE=N+XXO AND YYE=1+YYO)OR E=8
453COLOUR1;IF E>4 COLOUR2
454GOS.3000
460F.A=1TO4;IFMMA=0;F=1
470N.;IF F=0 P.$7;G.325
480O=XXO+12*YYO;B?0=(B?0):128
490MOVE(XXO*7+41),(YYO*7+7);COLOURO
500GOS.3000
510XXO=N+XXO;YYO=1+YYO
5200=XXO+12*YYO;B?0=(B?0):128
530MOVE(XXO*7+41),(YYO*7+7);COLOUR1
535IFYYO=11 CLEARO;P.$7$7$7"YOU WIN.(YOU WERE LUCKY)";E.
540GOS.3000
550REM
560REM***COMPUTER'S MOVE***
570REM
600F.A=1TO4;T=YYA+1
610MM(A+4)=(B?(T*12+XXA))&15;S=MM(A+4)
611REM 611,612 WILL SHOW THE   COMPUTER'S MOVES (UNREMMED).
612REMCOLOURO;F.Z=0TO7;MOVE(A*7),(30+Z);DRAW(A*7+7),(30+Z);N.
613REMMOVE(A*7),30;GOS.(2000+S*100)
620N.;L=0
630F.A=5TO8;F.C=-1TO1
640IFXXA+C<0 OR XXA+C>11 G.800
6500=C+XXA+12*(YYA-1);F=0
660F.D=5TO8;IF B?0=MMD;F=1;O=A;G=C
670N.;IF F=0 G.800
680L=1
690REMO=A;G=C
800N.;N.;IFL<>0G.820
8011FH=0 P.$7;G.280
802F.A=1TO100;WAIT;N.
803CLEARO;P.''"  NEITHER OF US CAN MOVE, SO IT SEEMS A TRIFLE"
804P." FUTILE TO CARRY  ON. DO YOU WISH TO START AGAIN?"''
805DO LINK#81;U.?#80=57 OR ?#80=46;IF?#80=46 E.
806P."VERY WELL. WAIT A MINUTE,PLEASE.";F.A=1TO100;WAIT;N.;RUN
8200=(XXO+12*YYO);B?0=(B?0):128
8300=(XXO+G+12*(YYO-1));B?0=(B?0):128
840MOVE(XXO*7+41),(YYO*7+7);COLOURO
850GOS.3000
860XXO=G+XXO;YYO=YYO-1
870MOVE(XXO*7+41),(YYO*7+7);COLOUR2
880GOS.3000
890IFYYO=0;G.1000
900G.280
1000REM
1010F.A=1TO20;P.$7;N.
1020CLEARO;P.''''"   ONCE"
1030P." AGAIN I PROVE THAT NO    MERE  HUMAN  CAN  MATCH  MY"
1040P.'" INCREDIBLE ABILITIES.STAND IN   AWE, BELITTLED "
1050P."HUMANITY!"''''';E.
2090REM
2092REM***TILE PLOTTING
2094REM***SUBROUTINES
2096REM
2100COLOUR2;PLOT1,3,3
2110PLOTO,-3,0;PLOT1,3,-3;R.
2200COLOUR1;PLOT1,3,3
2210PLOTO,-3,0;PLOT1,3,-3;R.
2300COLOUR2
2310PLOT1,3,0;PLOT1,0,3;PLOT1,-3,0;PLOT1,0,-3;R.
2400COLOUR1
2410PLOT1,3,0;PLOT1,0,3;PLOT1,-3,0;PLOT1,0,-3;R.
2500COLOUR2;PLOTO,1,0
2510PLOT1,1,0;PLOTO,1,1;PLOT1,0,1;PLOTO,-1,1;PLOT1,-1,0
2520PLOTO,-1,-1;PLOT1,0,-1;R.
2600COLOUR1;PLOTO,1,0
2610PLOT1,1,0;PLOTO,1,1;PLOT1,0,1;PLOTO,-1,1;PLOT1,-1,0
```


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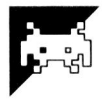
```
2620PLOTO,-1,-1;PLOT1,0,-1;R.
2700COLOUR2;PLOTO,1,0
2710PLOT1,1,3;PLOTO,1,-2;PLOT1,-3,1;R.
2800COLOUR1;PLOTO,1,0
2810PLOT1,1,3;PLOTO,1,-2;PLOT1,-3,1;R.
2990REM
2992REM***DRAW A PIECE
3000PLOT1,5,0;PLOT1,0,5;PLOT1,-5,0;PLOT1,0,-5;R.
4095************************
4096** PETER ROBINSON 1984 **
4097************************
```



TI99 Submarine Hunt

by Steve Hunt

Although the idea of a zap-'em-submarine hunt program is not *the* most original, this one runs on the unexpanded T199 and makes exceptionally good use of its sound and graphic capabilities.

The objective is to destroy as many submarines as possible without being destroyed in the process.

You are in control of a helicopter above the sea and your mission is to drop bombs on the submarines below. The game is joystick-controlled and has three skill levels.

```
 10 REM   ********************
 20 REM   *                  *
 30 REM   * SUBMARINE HUNT   *
 40 REM   *                  *
 50 REM   * AUTHOR: S.HUNT   *
 60 REM   *                  *
 70 REM   ********************
 80 REM
 90 REM
100 RANDOMIZE
110 CALL CLEAR
120 CALL SCREEN(15)
130 REM
140 REM  DEFINE GRAPHICS
150 REM
160 CALL CHAR(40,"0000000000000303")
170 CALL CHAR(41,"000000000000C0C0")
180 CALL CHAR(42,"C0C0000000000000")
190 CALL CHAR(43,"0303000000000000")
200 CALL CHAR(44,"000000000000FFFF")
210 CALL CHAR(45,"FFFF000000000000")
220 CALL CHAR(46,"0303030303030303")
230 CALL CHAR(47,"C0C0C0C0C0C0C0C0")
240 FOR N=1 TO 8
250 CALL COLOR(N,2,1)
260 NEXT N
270 CALL CHAR(96,"0000000000000000")
280 CALL CHAR(97,"003F44C43E0F0706")
290 CALL CHAR(98,"0000001010101010")
300 CALL CHAR(99,"000808080810C2400")
310 CALL COLOR(9,2,8)
320 CALL CHAR(109,"0008081C080800000")
330 CALL CHAR(104,"0000000000000000")
340 CALL CHAR(105,"003F44C43E0F0706")
350 CALL CHAR(106,"0004040C0CFFFF7E")
360 CALL CHAR(107,"0000003C3C000000")
370 CALL CHAR(108,"000808080810C2400")
380 CALL COLOR(10,2,13)
390 REM
400 REM  SEA ON SKY
410 REM
420 CALL CHAR(112,"000008002002061F")
430 CALL CHAR(113,"0000100004406078")
440 CALL CHAR(114,"099FFFFFFFFFFFFF")
450 CALL COLOR(11,13,8)
460 REM
470 REM  DRAW FRAME
480 REM
490 CALL HCHAR(1,3,40)
500 CALL HCHAR(1,30,41)
510 CALL HCHAR(22,30,42)
520 CALL HCHAR(22,3,43)
530 CALL HCHAR(1,4,44,26)
540 CALL HCHAR(22,4,45,26)
550 CALL VCHAR(2,3,46,20)
```

PROGRAM FILE

```
560 CALL VCHAR(2,30,47,20)
570 REM
580 REM  DRAW SEA & SKY
590 REM
600 FOR N=2 TO 11
610 CALL HCHAR(N,4,96,26)
620 CALL HCHAR(N+10,4,104,26)
630 NEXT N
640 CALL HCHAR(12,4,114,26)
650 REM
660 REM  DRAW COPTERS & SUBS
670 REM
680 FOR N=1 TO 10
690 R=2+INT(RND*9)
700 C=4+INT(RND*26)
710 CALL HCHAR(R,C,97)
720 NEXT N
730 FOR N=1 TO 6
740 R=13+INT(RND*9)
750 C=4+INT(RND*26)
760 CALL HCHAR(R,C,106)
770 NEXT N
780 REM
790 REM  MUSIC & TITLES
800 REM
810 GOSUB 3770
820 CALL HCHAR(23,10,32,2)
830 CALL HCHAR(23,28,32,2)
840 FOR N=4 TO 8
850 CALL HCHAR(N,7,32,20)
860 NEXT N
870 A$=" # SUBMARINE HUNT #"
880 R=5
890 C=7
900 GOSUB 3490
910 V=5
920 D=300
930 GOSUB 3560
940 A$=" CHECK ALPHALOCK UP"
950 R=7
960 GOSUB 3490
970 GOSUB 3560
980 A$=" SKILL LEVEL? 1 2 3"
990 GOSUB 3490
1000 GOSUB 3560
1010 CALL KEY(0,K,S)
1020 IF S=0 THEN 1010
1030 IF (K<49)+(K>51)=0 THEN 1060
1040 CALL SOUND(200,110,0)
1050 GOTO 1010
1060 CALL SOUND(200,1000,0)
1070 SK=51-K
1080 A$="BUOYS"
1090 R=23
1100 C=4
1200 GOSUB 3490
1120 A$="DEPTH CHARGES"
1130 C=15
1140 GOSUB 3490
1150 BY=15
1160 DC=5
1170 GOSUB 3690
1180 CALL HCHAR(23,29,DC+48)
1190 REM
1200 REM  POSITION SUB
1210 REM
1220 SR=2+INT(RND*20)
1230 SC=4+INT(RND*26)
1240 SD=1+INT(RND*9)
1250 SRD=1
1260 IF SR<12 THEN 1280
1270 SRD=-1
1280 SCD=1
1290 IF SC<16 THEN 1340
1300 SCD=-1
1310 REM
1320 REM  POSITION COPTER
1330 REM
1340 HR=2+INT(RND*20)
1350 HC=4+INT(RND*26)
```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```
1360 IF SQR((HR-SR)*(HR-SR)+(HC-SC)*(HC-SC))<5 THEN 1340
1370 REM
1380 REM  PLAN VIEW
1390 REM
1400 FOR N=2 TO 21
1410 CALL HCHAR(N,4,104,26)
1420 NEXT N
1430 CALL HCHAR(HR,HC,105)
1440 REM
1450 REM  MAIN POLLING LOOP
1460 CALL  JOYST(1,X,Y)
1470 IF (X<>0)+(Y<>0)<>0 THEN 1680
1480 CALL KEY(1,K,S)
1490 IF S<>0 THEN 1550
1500 CALL KEY(0,K,S)
1510 IF S=0 THEN 1460
1520 IF (K<49)+(K>57)=0 THEN 2150
1530 CALL SOUND(200,110,0)
1540 GOTO 1460
1550 IF K<>18 THEN 1500
1560 IF BY=0 THEN 1500
1570 D=1+300*SQR((HR-SR)*(HR-SR)+(HC-SC)*(HC-SC))
1580 V=SD*2.2
1590 GOSUB 3560
1600 BY=BY-1
1610 IF BY<>0 THEN 1630
1620 CALL SOUND(100,110,0)
1630 GOSUB 3690
1640 GOTO 1460
1650 REM
1660 REM  MOVE COPTER
1670 REM
1680 HRT=HR-Y/4
1690 HCT=HC+X/4
1700 CALL GCHAR(HRT,HCT,Z)
1710 IF Z<48 THEN 1460
1720 CALL HCHAR(HR,HC,104)
1730 CALL HCHAR(HRT,HCT,105)
1740 HR=HRT
1750 HC=HCT
1760 IF (RND*2)<SK THEN 1460
1770 REM
1780 REM  MOVE SUB
1790 REM
1800 SRT=SR+SRD
1810 SCT=SC+SCD
1820 CALL GCHAR(SRT,SCT,Z)
1830 IF Z<48 THEN 1910
1840 SR=SRT
1850 SC=SCT
1860 IF (RND*20)<(SK+18) THEN 1460
1870 CALL HCHAR(SR,SC,109)
1880 CALL SOUND(50,2000,7)
1890 CALL HCHAR(SR,SC,Z)
1900 GOTO 1460
1910 ON (Z-39)GOTO 1920,1950,1980,2010,2040,2060,2080,2100
1920 SRD=1
1930 SCD=1
1940 GOTO 1900
1950 SRD=1
1960 SCD=-1
1970 GOTO 1900
1980 SRD=-1
1990 SCD=-1
2000 GOTO 1900
2010 SRD=-1
2020 SCD=1
2030 GOTO 1900
2040 SRD=1
2050 GOTO 1900
2060 SRD=-1
2070 GOTO 1900
2080 SCD=1
2090 GOTO 1900
2100 SCD=-1
2110 GOTO 1900
2120 REM
2130 REM  SIDE VIEW
2140 REM
2150 CALL SOUND(200,1000,0)
```

PROGRAM FILE

```
2160 DC=DC-1
2170 CALL HCHAR(23,29,DC+48)
2180 CALL HCHAR(HR,HC,104)
2190 FOR N=2 TO 11
2200 CALL HCHAR(N,4,96,26)
2210 NEXT N
2220 CALL HCHAR(12,4,114,26)
2230 CALL HCHAR(3,HC,97)
2240 REM
2250 REM  DC IN SKY
2260 REM
2270 CALL HCHAR(4,HC,98)
2280 FOR N=15 TO 36
2290 CALL HCHAR(N/3-1,HC,96)
2300 CALL HCHAR(N/3,HC,98)
2310 CALL SOUND(-800,(85-N)*25,10)
2320 NEXT N
2330 CALL SOUND(-300,-7,15)
2340 CALL GCHAR(11,HC-1,Z)
2350 IF Z<48 THEN 2370
2360 CALL HCHAR(11,HC-1,112)
2370 CALL GCHAR(11,HC+1,Z)
2380 IF Z<48 THEN 2400
2390 CALL HCHAR(11,HC+1,113)
2400 CALL HCHAR(11,4,96,26)
2410 CALL HCHAR(12,HC,114)
2420 REM
2430 REM  DC IN SEA
2440 REM
2450 FOR N=13 TO (K-36)
2460 CALL HCHAR(N,HC,107)
2470 CALL HCHAR(N-1,HC,104)
2480 D=10
2490 V=27
2500 W=(23-N)*100
2510 GOSUB 3570
2520 NEXT N
2530 CALL HCHAR(12,4,114,26)
2540 REM
2550 REM  HIT?
2560 REM
2570 IF (ABS(HR-SR)>1)+(ABS(HC-SC)>1)=0 THEN 2830
2580 CALL SOUND(500,110,0)
2590 IF DC>0 THEN 1400
2600 CALL SOUND(750,147,0)
2610 A$="  NO DEPTH CHARGES"
2620 REM
2630 FOR N=4 TO 8
2640 CALL HCHAR(N,7,32,20)
2650 NEXT N
2660 REM
2670 R=5
2680 C=7
2690 GOSUB 3490
2700 A$=" PLAY AGAIN? Y OR N"
2710 R=7
2720 GOSUB 3490
2730 CALL KEY(0,K,S)
2740 IF S=0 THEN 2730
2750 IF (K=89)+(K=121)=0 THEN 2780
2760 CALL SOUND(200,1000,0)
2770 GOTO 820
2780 IF (K=78)+(K=110)<>0 THEN 2810
2790 CALL SOUND(200,110,0)
2800 GOTO 2730
2810 CALL SOUND(200,1000,0)
2820 STOP
2830 IF ABS((K-48)-SD)<=1 THEN 3270
2840 IF (RND*2)<1 THEN 2580
2850 CALL HCHAR(N-1,HC,104)
2860 CALL HCHAR(SD+12,HC,106)
2870 CALL HCHAR(SD+11,HC,108)
2880 FOR N=(SD+10) TO 12 STEP -1
2890 CALL HCHAR(N+1,HC,104)
2900 CALL HCHAR(N,HC,108)
2910 CALL SOUND(300,-8,7,200,30,200,30,(32-N)*100,30)
2920 NEXT N
2930 REM
2940 REM  ROCKET IN SKY
2950 REM
```


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PROGRAM FILE

```
2960 CALL HCHAR(12,HC,114)
2970 CALL HCHAR(11,HC,99)
2980 FOR N=10 TO 4 STEP -1
2990 CALL HCHAR(N+1,HC,96)
3000 CALL HCHAR(N,HC,99)
3010 CALL SOUND(-300,-8,7,200,30,200,30,(32-N)*100,30)
3020 NEXT N
3030 REM
3040 REM  EXPLODE COPTER
3050 REM
3060 CALL HCHAR(4,HC,96)
3070 FOR N=0 TO 30 STEP 3
3080 CALL HCHAR(3,HC,96)
3090 CALL HCHAR(3,HC,97)
3100 CALL SOUND(-500,-7,N)
3110 NEXT N
3120 REM
3130 REM  DROP COPTER
3140 REM
3150 FOR N=12 TO 33
3160 CALL HCHAR(N/3-1,HC,96)
3170 CALL HCHAR(N/3,HC,97)
3180 CALL SOUND(-800,(85-N)*25,10)
3190 NEXT N
3200 CALL SOUND(-900,-7,0)
3210 GOSUB 3950
3220 A$=" YOU WERE SHOT DOWN"
3230 GOTO 2630
3240 REM
3250 REM  EXPLODE SUB
3260 REM
3270 CALL HCHAR(N-1,HC,104)
3280 FOR N=0 TO 30 STEP 3
3290 CALL HCHAR(SD+12,HC,106)
3300 CALL HCHAR(SD+12,HC,104)
3310 CALL SOUND(-500,-7,N)
3320 NEXT N
3330 REM
3340 REM  FLOAT SUB
3350 REM
3360 FOR N=(SD+11) TO 12 STEP -1
3370 CALL HCHAR(N+1,HC,104)
3380 CALL HCHAR(N,HC,106)
3390 FOR Q=30 TO 0 STEP -6
3400 CALL SOUND(-300,-8,Q,200,30,200,30,(30-N)*150,30)
3410 NEXT Q
3420 NEXT N
3430 GOSUB 4060
3440 A$=" MISSION COMPLETED"
3450 GOTO 2630
3460 REM
3470 REM  STRING DISPLAY
3480 REM
3490 FOR N=1 TO LEN(A$)
3500 CALL HCHAR(R,C+N-1,ASC(SEG$(A$,N,1)))
3510 NEXT N
3520 RETURN
3530 REM
3540 REM  SONAR PULSE
3550 REM
3560 W=1000
3570 FOR Q=0 TO 30 step 10
3580 CALL SOUND(-300,W,Q)
3590 NEXT Q
3600 IF D>1500 THEN 3650
3610 CALL SOUND(D,40000,30)
3620 FOR Q=V TO 30 STEP (30-V)/3
3630 CALL SOUND(30,1000,Q)
3640 NEXT Q
3650 RETURN
3660 REM
3670 REM  DISPLAY BUOYS
3680 REM
3690 X=INT(BY/10)
3700 Y=BY-X*10
3710 CALL HCHAR(23,10,X+48)
3720 CALL HCHAR(23,11,Y+48)
3730 RETURN
3740 REM
3750 REM  TITLE MUSIC
3760 REM
3770 RESTORE 3840
3780 FOR N=1 TO 33
3790 READ P,L,H
3800 CALL SOUND(P*200,L,(33-N)/1.5,H,(33-N)/2)
3810 NEXT N
3820 CALL SOUND(1000,523,0,392,0,262,0)
3830 RETURN
3840 DATA 3,262,196,1,294,196,2,262,196,1,330,262,1,349,294
3850 DATA 3,392,262,1,440,262,4,392,262
3860 DATA 2,440,349,2,523,440,2,440,349,2,392,330
3870 DATA 2,330,262,1,294,247,1,262,220,2,330,262,2,392,262
3880 DATA 3,262,196,1,294.196.2.262,196,1,330,262,1,349,294
```

```
3890 DATA 3,392,262,1,440,262,4,392,262
3900 DATA 2,440,349,1,440,349,1,494,392,2,523,392,1,494,392,1,523,392
3910 DATA 4,587,392,4,392,247
3920 REM
3930 REM  SOS MORSE
3940 REM
3950 RESTORE 4020
3960 FOR N=1 TO 9
3970 READ P,Q
3980 CALL SOUND(P*100,800,0)
3990 CALL SOUND(Q*100,40000,30)
4000 NEXT N
4010 RETURN
4020 DATA 1,1,1,1,1,3,3,1,3,1,3,3,1,1,1,1,1,1
4030 REM
4040 REM  VICTORY
4050 REM
4060 RESTORE 4120
4070 FOR N=1 TO 4
4080 READ P,L
4090 CALL SOUND(P*300,2*L,0)
4100 NEXT N
4110 RETURN
4120 DATA 1,262,1,262,1,262,4,208
```

QL Screendump

by Eric Hepburn

This short utility for the Sinclair QL will load a picture from a microdrive cartridge onto the screen and print it on a Seikosha GP-80 printer, by way of the parallel printer interface.

The program is fully annotated and should be easy to convert to any other printer with a graphics option.

```
100 REMark
110 REMark SCREEN DUMP PROGRAM FOR SINCLAIR QL
120 REMark
130 REMark                AND
140 REMark
150 REMark SEIKOSHA GP-80 GRAPHICS PRINTER.
160 REMark
170 REMark                BY
180 REMark
190 REMark         ERIC HEPBURN  (1984)
200 REMark
210 init
220 REMark SET UP LINE COUNT
230 FOR c=0 TO 35
240   count=0
250   REMark SET UP LINE START
260   line_start=start+(mult2*c):x=-1
270   FOR segment=0 TO 59
280     REMark SET UP SEGMENT START
290     seg_start=line_start+(segment*2)
300     REMark SCAN FIRST BLOCK
310     FOR b=seg_start TO seg_start+mult1 STEP 128
320       REMark GET SCREEN PIXEL INFORMATION
330       bytea=PEEK(b):byteb=PEEK(b+1)
340       REMark BITWISE OR DATA TO PRODUCE LOGICAL DATA
350       word=bytea || byteb
360       x=x+1
370       REMark CONVERT BYTE TO BINARY STRING
380       FOR e=1 TO 8
390         result1=INT(word/2)
400         bin$=word-(result1+result1)
410         temp$(e)=bin$
420         word=result1
430       END FOR e
440       REMark STORE STRING IN PRINTOUT ARRAY
450       a$(x)=temp$
460     END FOR b
470     x=-1
480     REMark ASSEMBLE PRINTER OUTPUT CHARACTER
490     FOR f=8 TO 1 STEP -1
500       char=128
510       FOR y=0 TO 6
```


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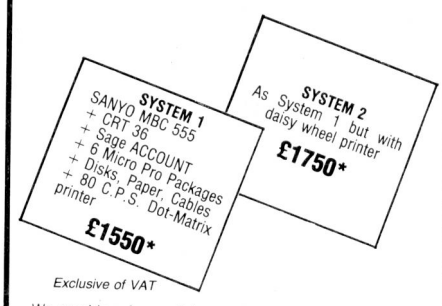

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PROGRAM FILE

```
520          test$=a$(y)
530          char=char+(test$(f)*2^y)
540        END FOR y
550        count=count+1
560        REMark CHANGE TO NEXT PRINTER LINE
570        IF count=472 THEN PRINT #5:EXIT segment
580        REMark OUTPUT CHARACTER TO PRINTER
590        PRINT #5,CHR$(char);
600      END FOR f
610    END FOR segment
620 END FOR c
630 DEFine PROCedure init
640   CLS#0:CLS#1:CLS#2
650   mult1=768:mult2=896
660   start=131078:REMark SCAN START ADDRESS
670   DIM a$(7,8):REMark BINARY ARRAY SETUP
680   INPUT "ENTER OUTPUT SERIAL CHANNEL
      (eg ser2r)",chan$
690   OPEN #5,chan$:REMark OPEN I/O CHANNEL
700   BAUD 9600
710   MODE 4
720   INPUT "ENTER FILE NAME OF PICTURE FILE:
      (eg mdv1_graph_pic)",file$
730   LBYTES file$,131072
740   PRINT #5,CHR$(8):REMark SET PRINTER TO GRAPHICS
      MODE
750   temp$="00000000"
760 END DEFine init
```

Spectrum Qix

by Y Yu

This game for both the 16 and 48k Spectrum is a version of the popular arcade game Qix. For those of you unfamiliar with the arcade game, the idea is to capture as much of the screen as possible without being killed. This is done by moving your player to section off areas of the screen. To stop you in this task there are a number of sparkles patrolling the border and a Qix moving randomly in the unclaimed area. Contact with either the sparkles or the Qix is fatal!

To control your player use the cursor control keys. The game contains no user-defined graphics, so it should cause no problems to type in, although it's a tight fit on 16k machines.

```
 2 REM
 3 REM ************************
 4 REM *                      *
 5 REM *    SPECTRUM QIX      *
 6 REM *                      *
 7 REM *              1984    *
 8 REM ************************
 9 REM
10 REM PROGRAM QIX
20 CLEAR 32476 : GO SUB 5000 : REM INITIALIZATION
25 LET C=0 : LET L=2 : LET SCN=0
30 GO SUB 3000 : REM SCREENO
40 GO SUB 2000 : REM UPDATE_STATUS
50 GO SUB 1000 : REM MOVE_SNAKE
60 GO SUB 2000
70 GO SUB 1500 : REM MOVE_o
90 GO SUB 2100 : REM MOVE_*1
95 GO SUB 2200 : REM MOVE_*2
100 IF L<1 THEN LET C=C+A : GO TO 140
110 IF A > 500 THEN LET C=C+A: FOR I=1 TO 200 : NEXT I :
    GO TO 30
120 GO TO 40
140 GO TO 6000 : REM PRINT_SCORE
160 REM END
997 REM
```

PROGRAM FILE

```
998 REM *** MOVE_SNAKE ***
999 REM
1000 LET XOLD=X1 : LET YOLD=Y1 : IF S=1 THEN GO SUB 1100 :
     GO TO 1010
1005 LET NN=N : LET N=2/H : GO SUB 1100 : LET N=NN
1010 IF X1=X2 AND Y1=Y2 THEN LET X1=XOLD+(ABS H=1)*2*H :
     LET Y1=YOLD+(ABS H=2)*H
1030 LET YNEW=INT ((175-Y1)/8) : LET XNEW=INT (X1/8)
1040 LET STATUS=ATTR (YNEW, XNEW)
1045 IF STATUS=48 OR STATUS=32 THEN GO TO 1070
1050 PLOT INVERSE 1; X5, Y5 : DRAW INVERSE 1;
     X4-X5, Y4-Y5 : LET X5=X4 : LET X4=X3 :
     LET X3=X2 : LET X2=XOLD : LET Y5=Y4 :
     LET Y4=Y3 : LET Y3=Y2 : LET Y2=YOLD : PLOT INK 1; X2, Y2 :
     DRAW INK 1; X1-X2, Y1-Y2
1060 IF STATUS=16 THEN GO SUB 1200
1062 LET XM=XNEW+(ABS H=2)*H/2 : LET YM=YM-(ABS H=1)*H
1063 IF ATTR (YM, XM)=16 THEN GO SUB 1200
1065 RETURN
1070 LET X1=X5 : LET X5=XOLD : LET Y1=Y5 : LET Y5=YOLD :
     LET XOLD=X2 : LET YOLD=Y2 : LET X2=X4 : LET Y2=Y4 :
     LET X4=XOLD : LET Y4=YOLD : LET H=2/H
1080 RETURN
1097 REM
1098 REM *** X1Y1 ***
1099 REM
1100 IF SCN>3 OR RND*(A+S256)>200 THEN GO TO 1105
1101 LET K=RND : LET K1=(K>.75) : LET K2=SGN (.875-K)*K1
1102 LET X1=X1+(ABS H=2)*6*H*(NOT K1)+
     (ABS H=1)*12*K2: LET Y1=Y1+
     (ABS H=2)*12*K2+(ABS H=1)*12*H*(NOT K1)
     : LET H=(NOT K1)*H+K2*(2/ABS H) : RETURN
1105 IF ABS (N)=1 THEN GO TO 1160
1110 LET STATUS=INT ((175-Y1)/8)-Y
1120 IF ABS (STATUS) <>0 THEN LET H= SGN (STATUS) :
     LET Y1=Y1+12*H : RETURN
1130 LET STATUS=INT (X1/8)-X
1140 LET H=-2*SGN (STATUS)
1150 LET X1=X1+6*H : RETURN
1160 LET STATUS=INT (X1/8)-X


1170 IF ASB (STATUS) <>0 THEN LET H=-2*SGN (STATUS) :
     LET X1=X1+6*H : RETURN
1180 LET STATUS=INT ((175-Y1)/8)-Y
1190 LET H=SGN (STATUS)
1195 LET Y1=Y1+12*H: RETURN
1197 REM
1198 REM *** CAUGHT ***
1199 REM
1200 PRINT AT Y, X; "_"
1220 LET X=W : LET Y=Z : LET S=0 : LET S256=0 : LET N=0 :
     POKE 23560, 0
1230 PRINT PAPER 6; AT Y, X; CHR$ 35
1240 RANDOMIZE FN G(16, 56) : RANDOMIZE FN G(17, 56)
1250 GO TO 2300
1497 REM
1498 REM *** MOVE_o ***
1499 REM
1500 LET XOLD=X : LET YOLD=Y
1505 IF ABS (N)=2 THEN LET X=X+N : IF X<0 OR X>30 THEN
     LET X=XOLD : RETURN
1510 IF ABS (N)=1 THEN LET Y=Y-2*N : IF Y<0 OR Y>20 THEN
     LET Y=YOLD : RETURN
1515 LET K= ATTR (Y, X)
1517 IF K=32 THEN LET X=XOLD : LET Y=YOLD :RETURN
1520 PRINT AT YOLD, XOLD; PAPER 6-S*4; "_"
1525 IF S=0 AND K>55 THEN LET S=1 : LET S256=256 : LET W=XOLD :
     LET Z=YOLD : BEEP .1, 10
1530 PRINT PAPER 6-S*4; AT Y, X; CHR$ 35
1531 IF S=0 THEN RETURN
1532 LET YM=(Y+YOLD)/2 : LET XM=(X+XOLD)/2
1533 IF ATTR (YM, XM)=57 THEN GO TO 1200
1534 PRINT PAPER 2; AT YM, XM; "_"
1535 IF K= 57 THEN GO TO 1200
1540 IF K<>48 THEN RETURN
1548 REM
1549 REM SUBROUTINE SCNFIL
1550 LET Q=22528+32*INT ((175-Y3)/8)+INT (X3/8)
1560 RANDOMIZE FN F (Q)
1570 LET A=A+FN G(16, 48)
1575 LET A=A+FN G(56, 32)
1580 RANDOMIZE FN G (40, 56)
1590 LET S=0 : LET S256=0 : BEEP .05, 20 : BEEP .05, 15
1600 POKE 23606, CHRL : POKE 23607, CHRH
1610 PRINT AT 21, 10; A
1620 POKE 23606, CHSETL : POKE 23607, CHSETH
1630 RETURN
1997 REM
1998 REM *** STATUS ***
1999 REM
```


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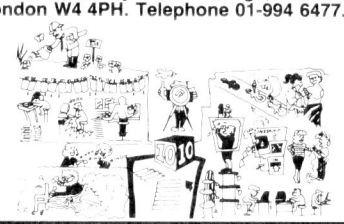

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PROGRAM FILE

```
2000 LET K=PEEK 23560
2010 LET NN=K-55
2020 IF NN >=0 THEN LET NN=NN+1
2030 IF ABS (NN) < 3 THEN LET N=NN
2050 RETURN
2097 REM
2098 REM *** MOVE_*1 ***
2099 REM
2100 PRINT AT V,U; PAPER 6; "_"
2110 IF ABS (M) =1 THEN GO TO 2150
2120 LET V1=V-M
2130 IF ATTR (V1,U) = 48 THEN LET V=V1 :
     LET M=M/2 : GO TO 2172
2135 LET U=U+M
2140 GO TO 2170


2150 LET U1=U-2*M
2155 IF ATTR (V,U1) = 48 THEN LET U=U1 :
     LET M=-2*M : GO TO 2172
2160 LET V=V-2*M
2170 IF ATTR (V,U) <> 48 THEN
     LET M=2/M*(3-2* ABS (M)) : GO TO 2110
2172 PRINT PAPER 6; AT V,U; CHR$ (M+35)
2175 IF X=U AND Y=V THEN GO TO 2300
2180 RETURN
2197 REM
2198 REM *** MOVE_*2 ***
2199 REM
2200 PRINT AT V2,U2; PAPER 6; "_"
2210 IF ABS (M2) =1 THEN GO TO 2250
2220 LET V0=V2+M2
2230 IF ATTR (V0,U2) = 48 THEN LET V2=V0 :
     LET M2=-M2/2 : GO TO 2272
2235 LET U2=U2+M2
2240 GO TO 2270
2250 LET U0=U2+2*M2
2255 IF ATTR (V2,U0) = 48 THEN LET U2=U0 :
     LET M2=2*M2 : GO TO 2272
2260 LET V2=V2-2*M2
2270 IF ATTR (V2,U2) <> 48 THEN
     LET M2=2/M2*(2*ABS (M2)-3) : GO TO 2210
2272 PRINT PAPER 6; AT V2,U2; CHR$ (M2+35)
2275 IF X=U2 AND Y=V2 THEN GO TO 2300
2280 RETURN
2297 REM
2298 REM *** UPDATE_LIVE ***
2299 REM
2300 LET L=L-1
2310 FOR K=0 TO -20 STEP -1 : BEEP .01,K : NEXT K
2320 POKE 23606,CHRL : POKE 23607,CHRH
2330 PRINT AT 21,25;L
2340 POKE 23606,CHSETL : POKE 23607,CHSETH
2350 RETURN


2997 REM
2998 REM *** SCREENO ***
2999 REM
3000 CLS
3005 POKE 23606,CHRL : POKE 23607,CHRH
3010 FOR I=0 TO 20 : PRINT PAPER 6; AT I,0; "_";
     AT I,30; "_" : NEXT I
3020 FOR I=0 TO 31 : PRINT PAPER 6; AT 0,I; "_"; AT 1,I;"_";
     AT 20,I;"_"; AT 21,I; "_" : NEXT I
3025 LET L=L+1 : LET A=0 : LET SCN=SCN+1 : IF L>3 THEN LET L=3
3027 IF SCN=10 THEN LET SCN=0
3030 PLOT 0,7 : DRAW 255,0 : PRINT PAPER 6; AT 21,5;
     "AREA: _0"; AT 21,18;"LIVES: _";L : FOR I=1 TO 6 :
     PRINT PAPER 6; AT I,31;B$(I) : NEXT I : PRINT PAPER 6;
     AT 8,31;SCN
3035 POKE 23606,CHSETL : POKE 23607,CHSETH
3040 LET X=0 : LET Y=0
3050 LET U=28 : LET V=0 : LET U2=28 : LET V2=20
3055 PRINT PAPER 6; AT Y,X; CHR$35; AT V,U; CHR$33;
     AT V2,U2; CHR$33
3060 LET X1=128 : LET X2=128 : LET X3=128 :
     LET X4=128 : LET X5=128
3070 LET Y1=96 : LET Y2=96 : LET Y3=96 : LET Y4=96 : LET Y5=96
3080 LET S=0 : LET S256=0 : LET M=-2 : LET N=2 : LET M2=-2 :
     LET H=SGN (.5-RND)*(1+INT (2*RND))
3090 RETURN


4997 REM
4998 REM  *** INITIALIZATION ***
4999 REM
5000 PLOT 40,60 : DRAW 0,60 : DRAW 40,0 : DRAW 0,-60 :
     DRAW -40,0 : PLOT 60,80 : DRAW 30,-30
5001 PLOT 120,120 : DRAW 0,-60
5002 PLOT 160,120 : DRAW 40,-60 : PLOT 200,120 : DRAW -40,-60
5003 PRINT AT 21,1; "USE CURSOR KEYS"
5005 DEF FN G (ATTR1,ATTR2)= USR 32477
```

PROGRAM FILE

```
5010 DEF FN F (X)= USR 32512
5020 FOR N= 32477 TO 32599
5030 READ B : POKE N,B : NEXT N
5040 LET HC=0 : LET B$="SCREEN"
5045 LET CHSET= USR "a"
5050 FOR N=CHSET TO CHSET+47
5060 READ B : POKE N,B : NEXT N
5065 LET CHRL=PEEK 23606 : LET CHRH= PEEK 23607 :
     LET CHSETH=INT (CHSET/256)-1 : LET CHSETL=CHSET-
     256*(CHSETH+1)
5070 RETURN
5075 REM OBJECT CODE "SCNCHG" 35 BYTES
5080 DATA 221,42,11,92,221,126,4,
     221,78,12,33,
     0,88,17,0,0,6,32,197,6,22,190,
     32,2,113,19,35,16,248,193,16,
     242,213,193,201
5085 REM OBJECT CODE "SCNFIL" 88 BYTES
5090 DATA 221,42,11,92,221,110,4,
     221,102,5,54,1,62,1,33,0,88,
     30,0,245,238,1,79,241,6,32,
     197,6,22,190,32,43,245,62,
     56,229,221,225,221,190,1,
     32,3,221,113,1,221,190,255
     32,3,221,113,255,221,190,224,
     32,3,221,113,224,221,190,32,
     32,3,221,113,32,241,54,40,
     30,1,35,16,207,193,16,201,
     246,1,163,200,121,24,182
5095 REM 6 UDG'S FROM CHR$32 TO CHR$37
5100 DATA 0,0,0,0,0,0,0,0,
     0,60,126,30,30,126,60,0,
     0,60,126,102,102,36,0,0,
     60,126,153,153,255,195,126,60,
     0,36,102,126,126,60,24,0,
     0,60,126,120,120,126,60,0
5997 REM
5998 REM *** PRINT_SCORE ***
5999 REM
6000 CLS
6005 LET HI=2 : LET SC=6
6010 IF SCHC THEN LET HC=C : LET HI=6 : LET SC=2
6015 POKE 23606,CHRL : POKE 23607,CHRH
6020 PRINT PAPER SC; AT 18,1; " YOUR SCORE...";C
6030 PRINT PAPER HI; AT 20,1; " HI-SCORE.....";HC
6035 RANDOMIZE FN G(16,151)
6040 FOR I=1 TO 100 : NEXT I
6045 PRINT AT 20,1; " PRESS Q TO PLAY AGAIN"
6050 LET A$= INKEY$ : IF A$="" THEN GO TO 6050
6060 IF A$="Q" OR A$="q" THEN GO TO 25
6070 PRINT AT 20,1; "GOTO 25 TO RE-RUN_____"
6080 RANDOMIZE FN G(48,176)
6090 RANDOMIZE FN G(151,23)
6100 STOP
```

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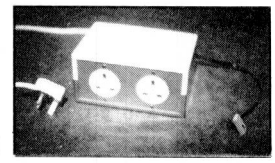

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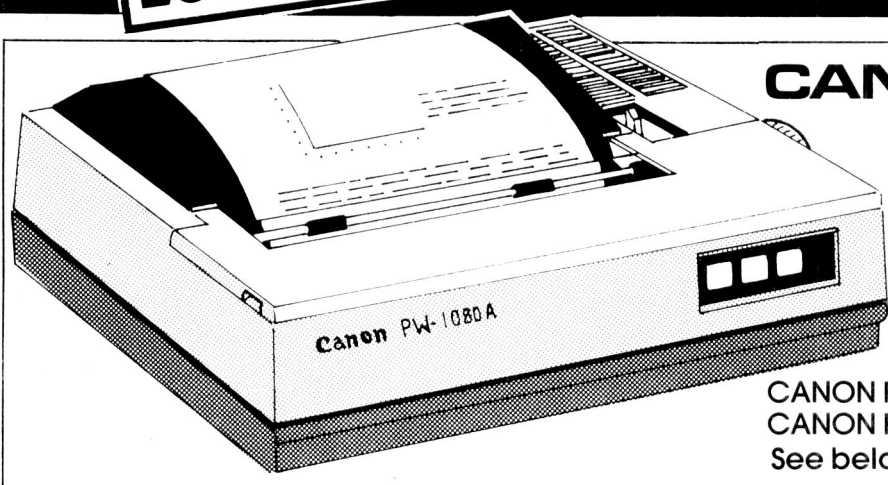

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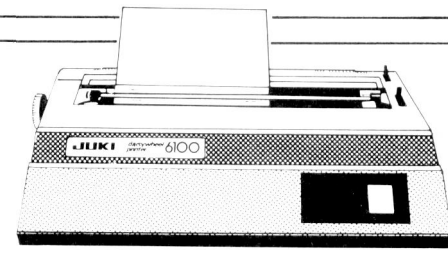

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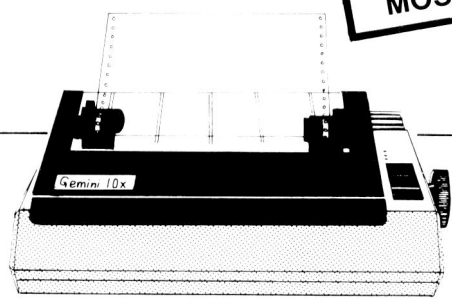

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Y2/D	D/Sided D/Density 48 tpi
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Y2/DD	D/Sided D/Density 96 tpi

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P2/DD	D/Sided D/Density 96 tpi

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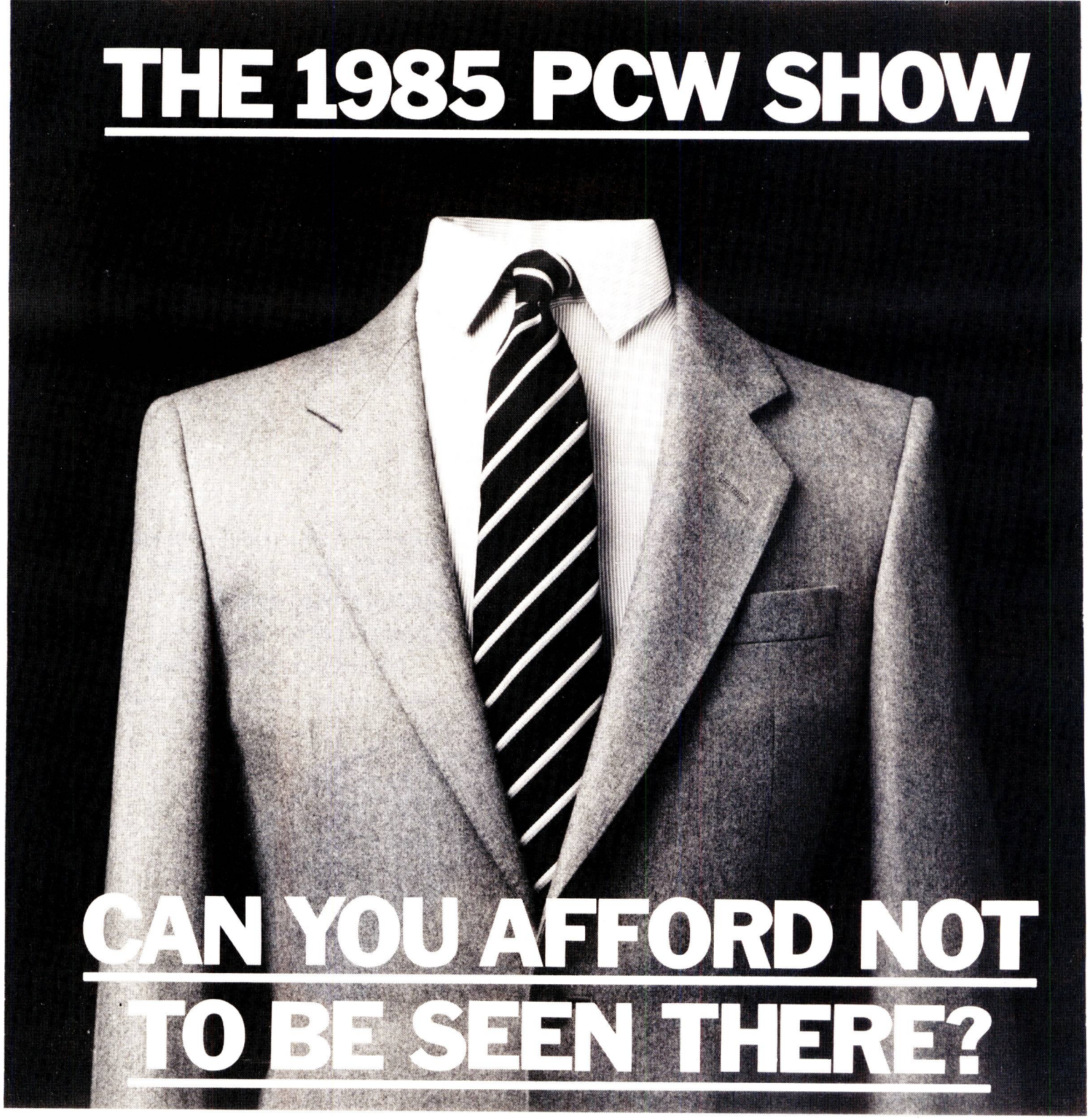

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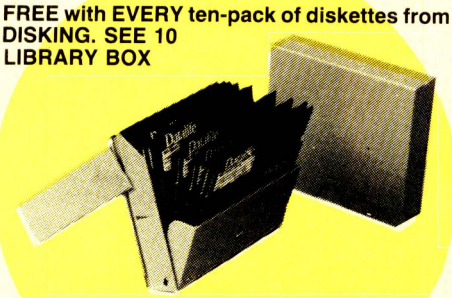

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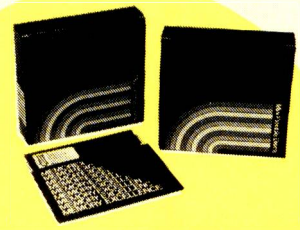

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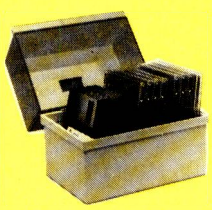

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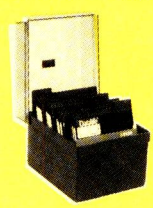

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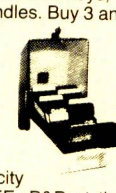

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48 tpi suitable for 35 or 40 track operation
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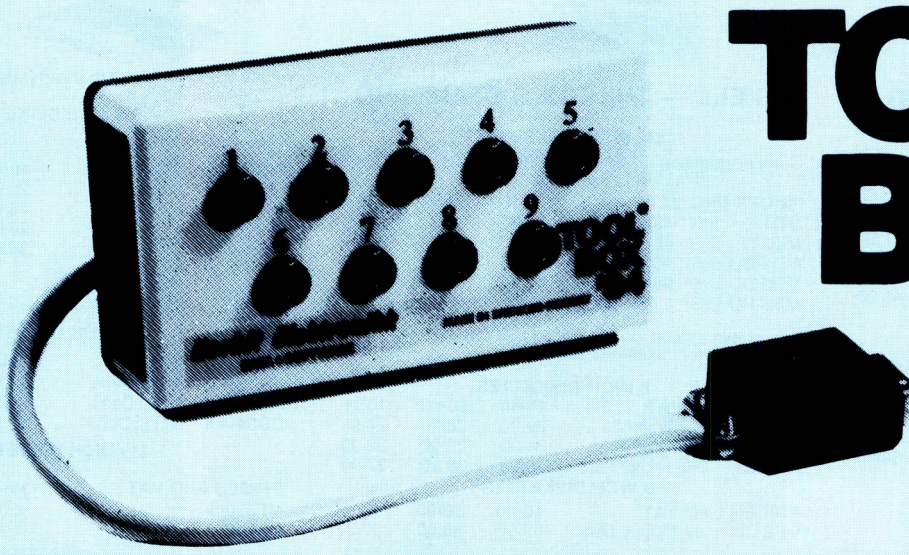

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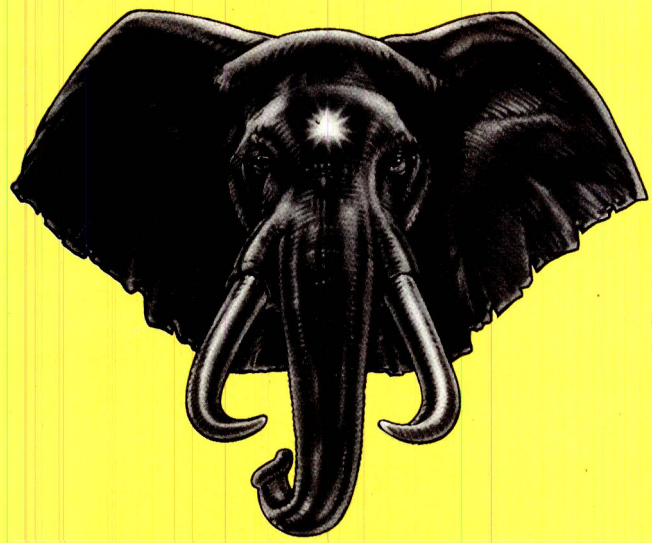

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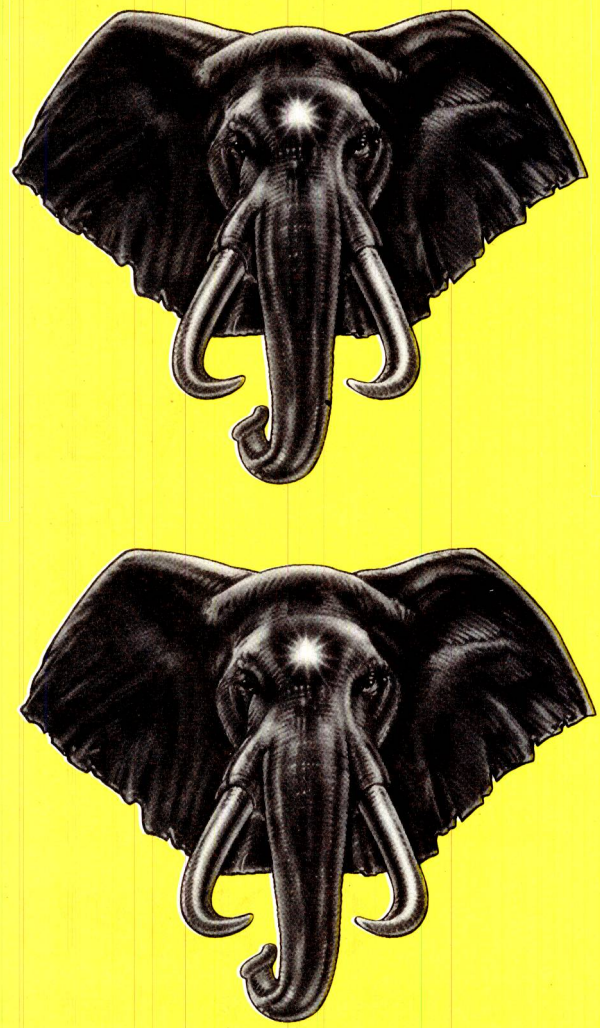

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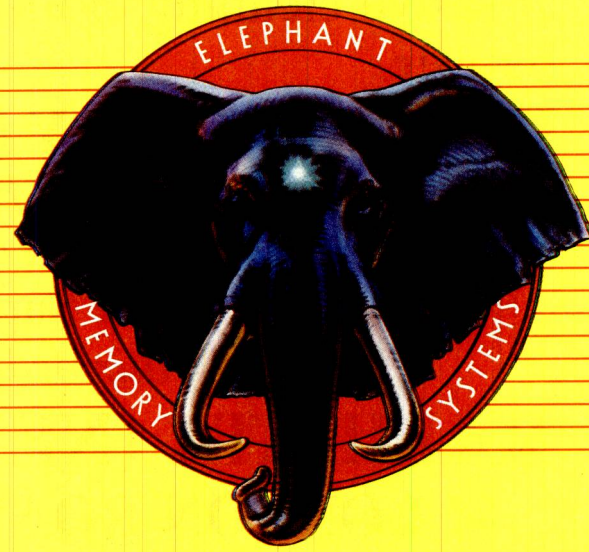

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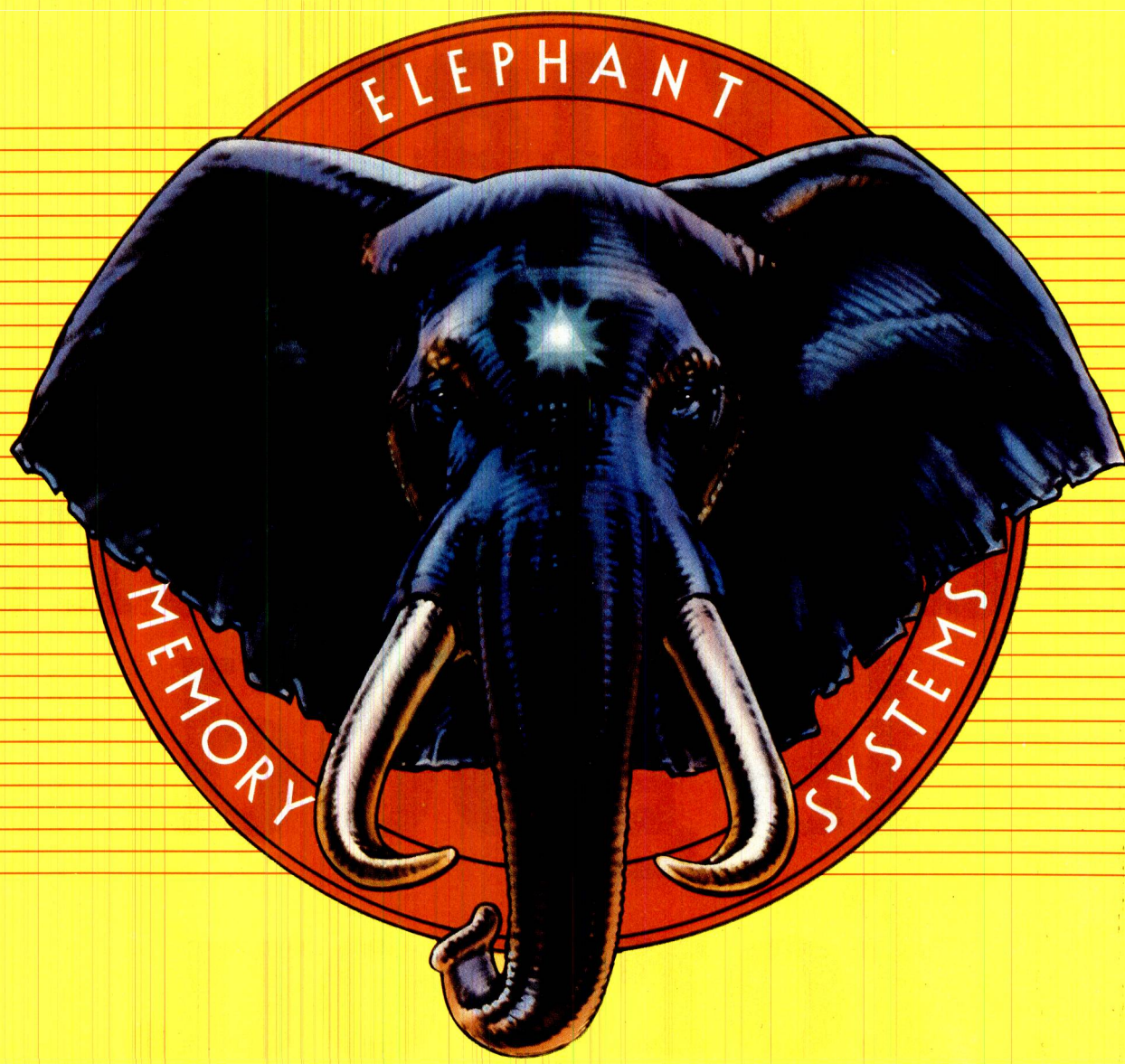

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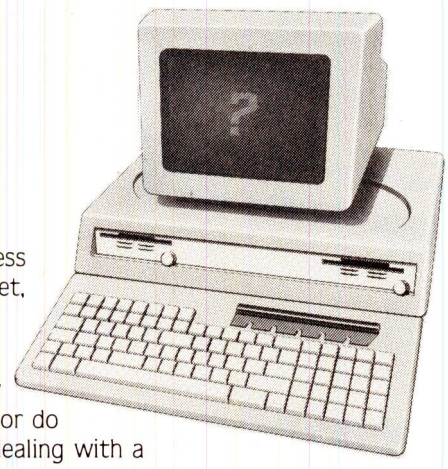

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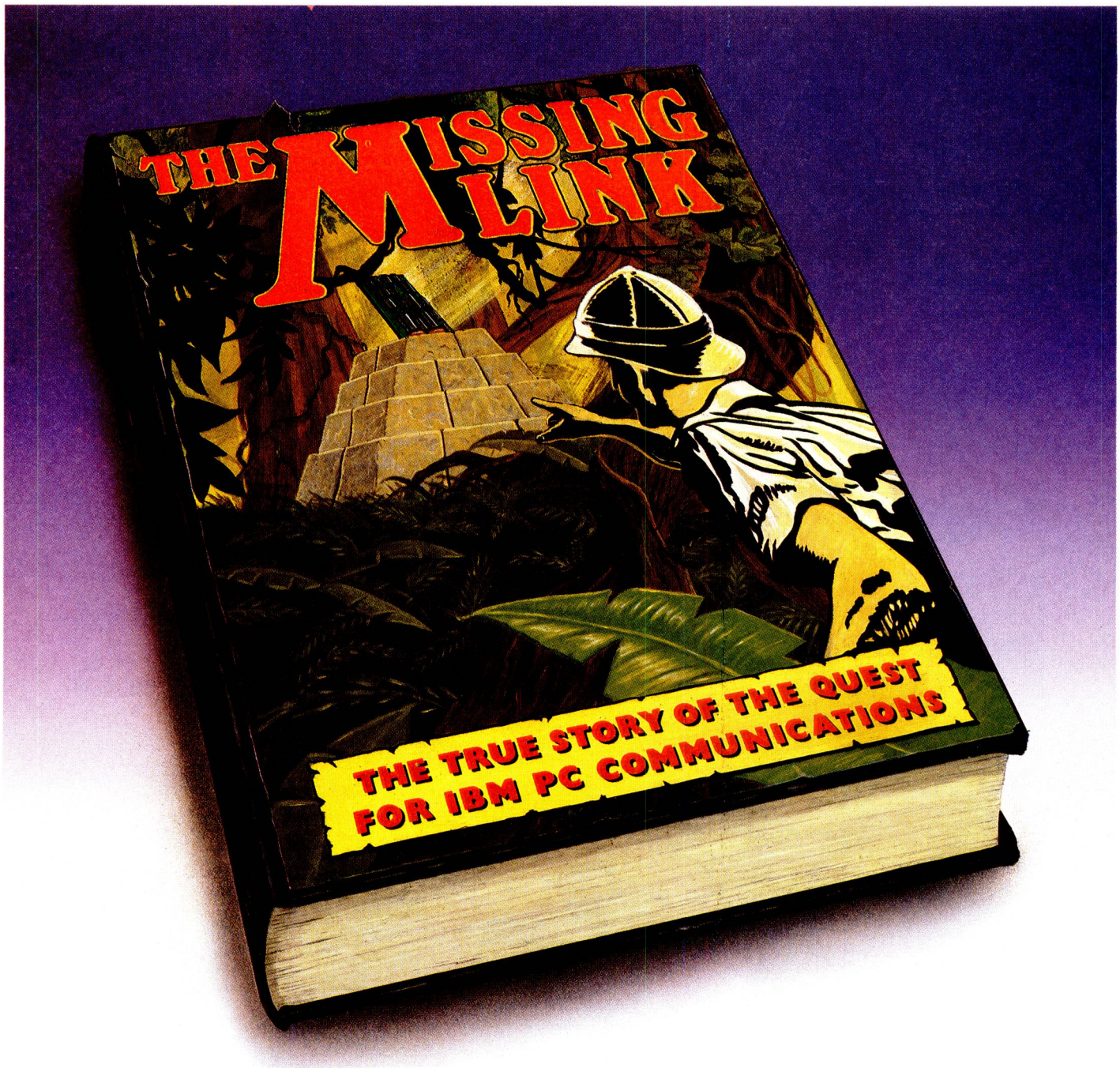

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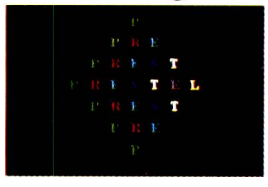

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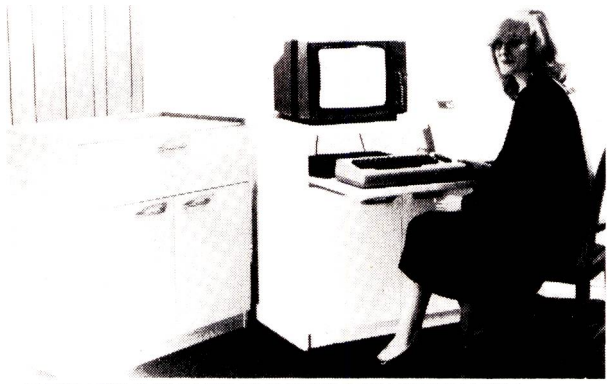

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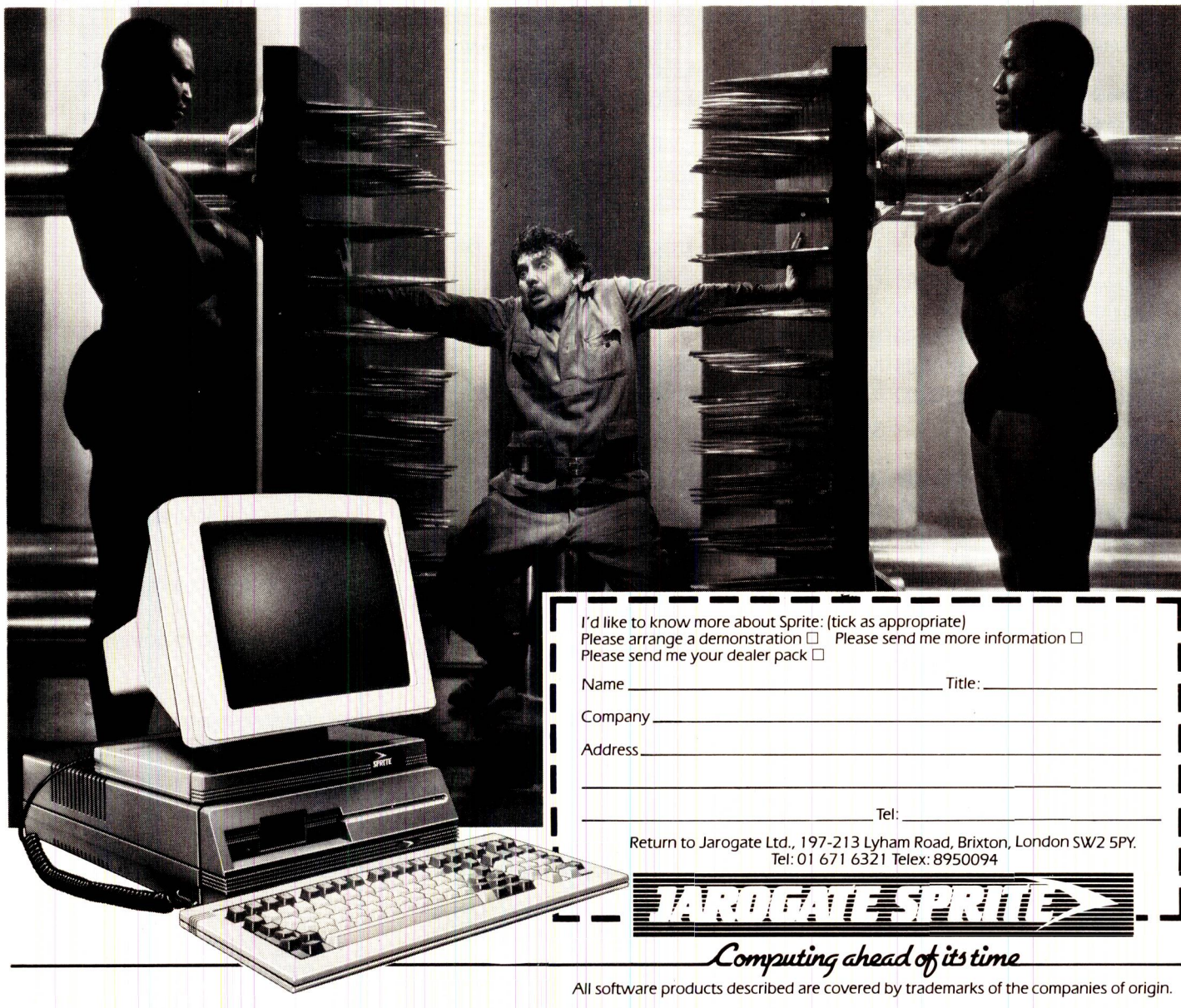

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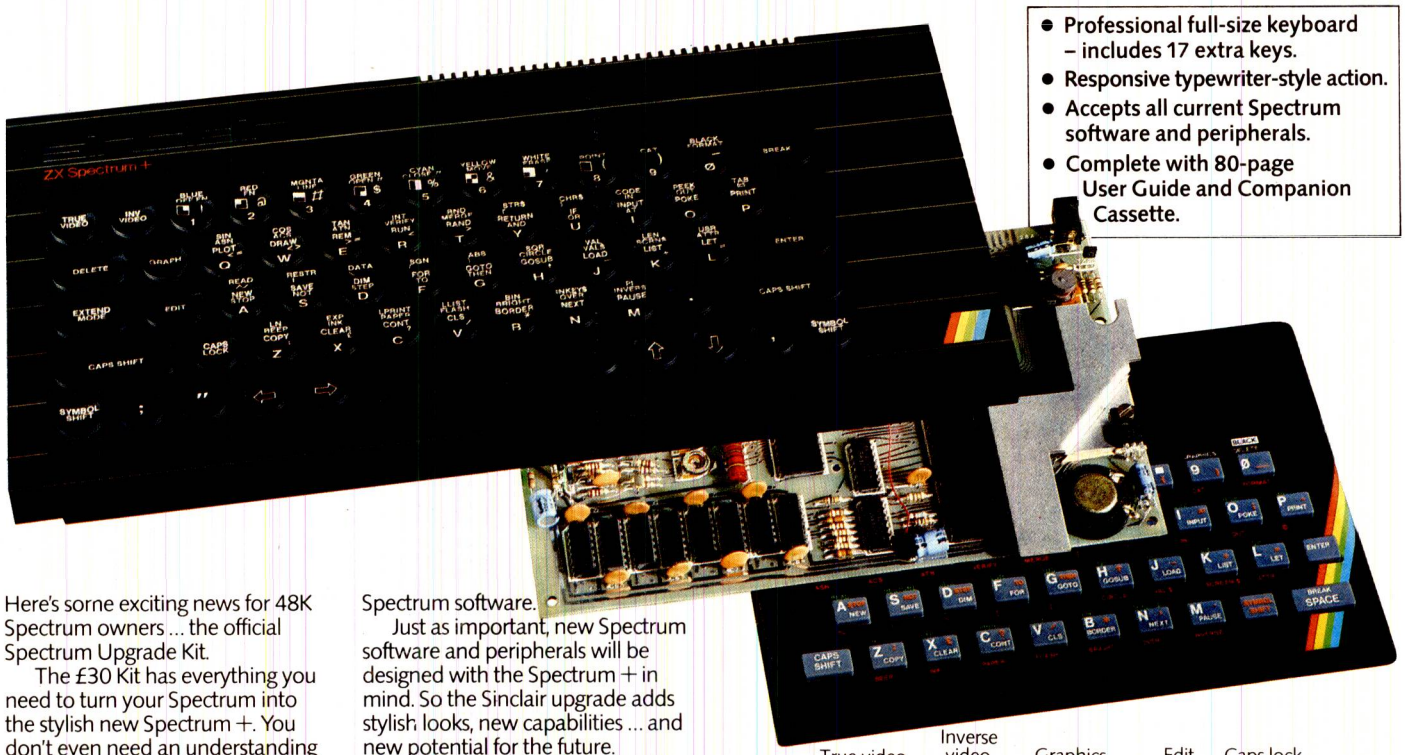

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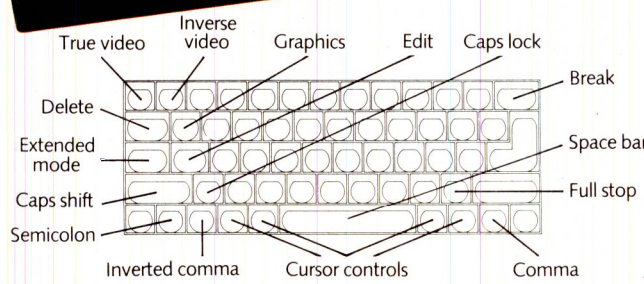

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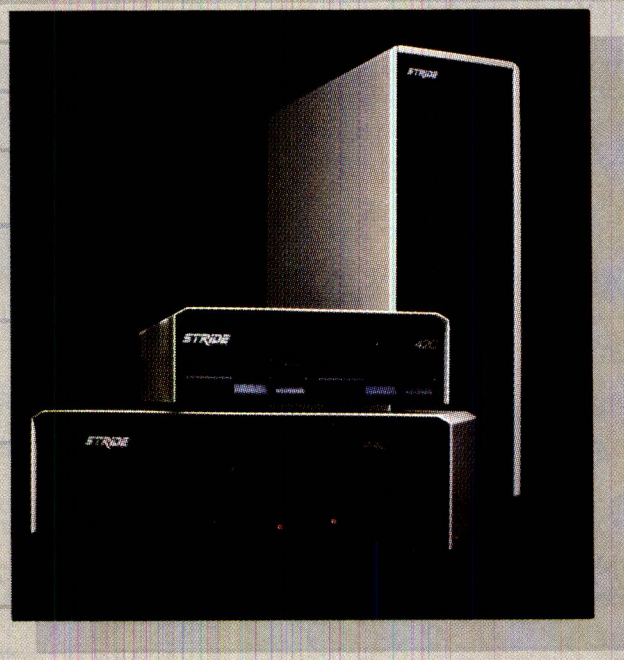

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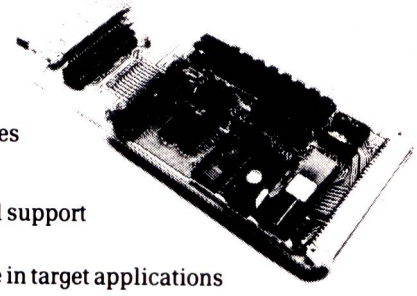

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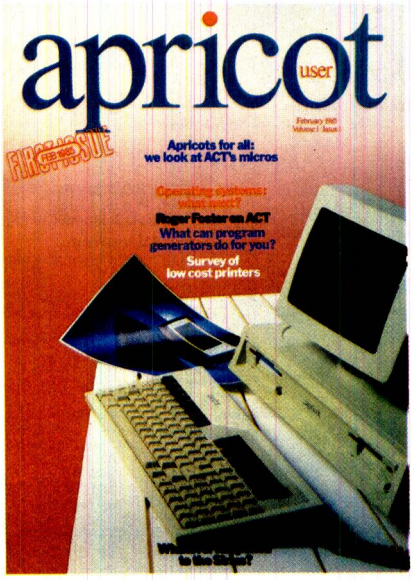

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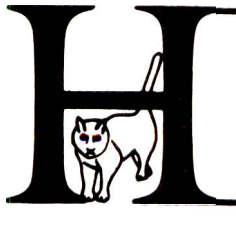

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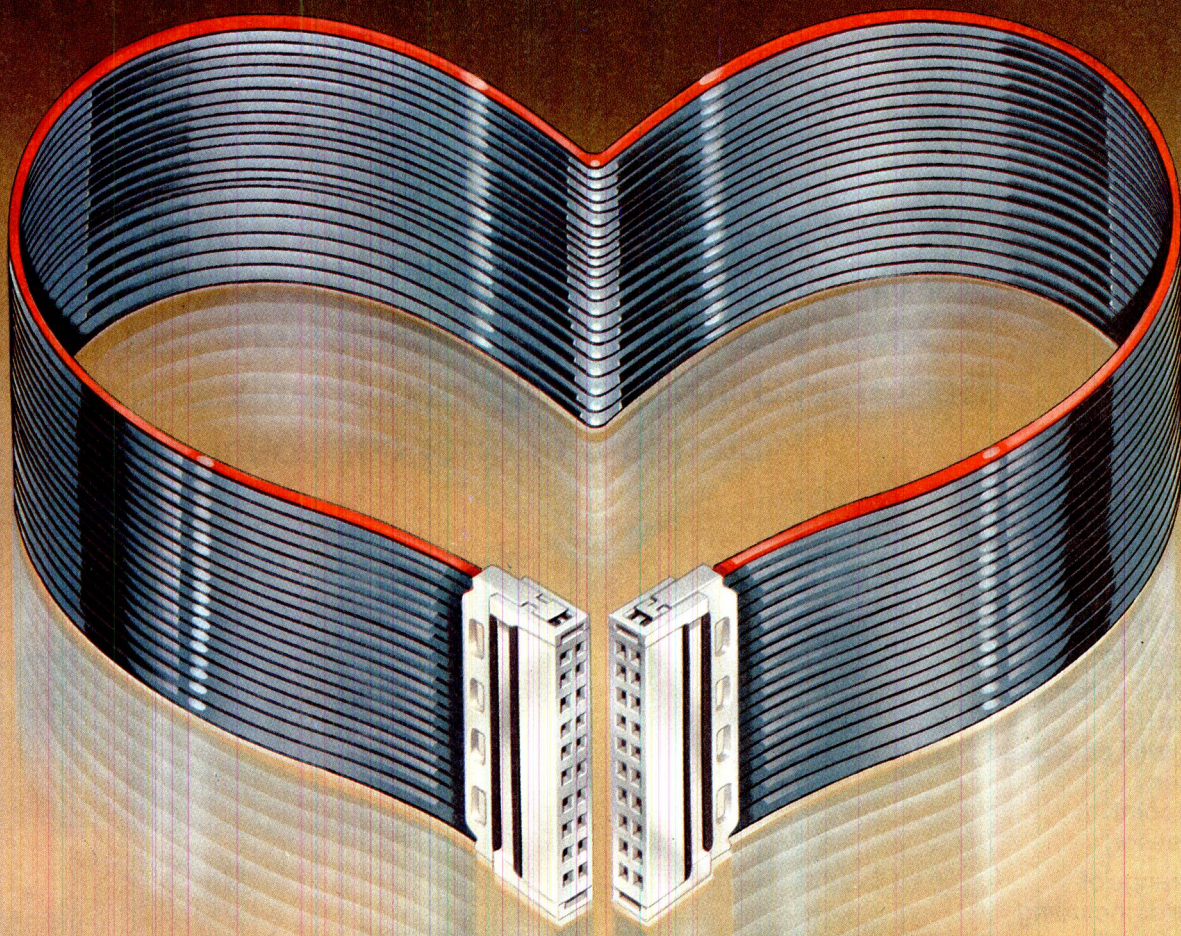

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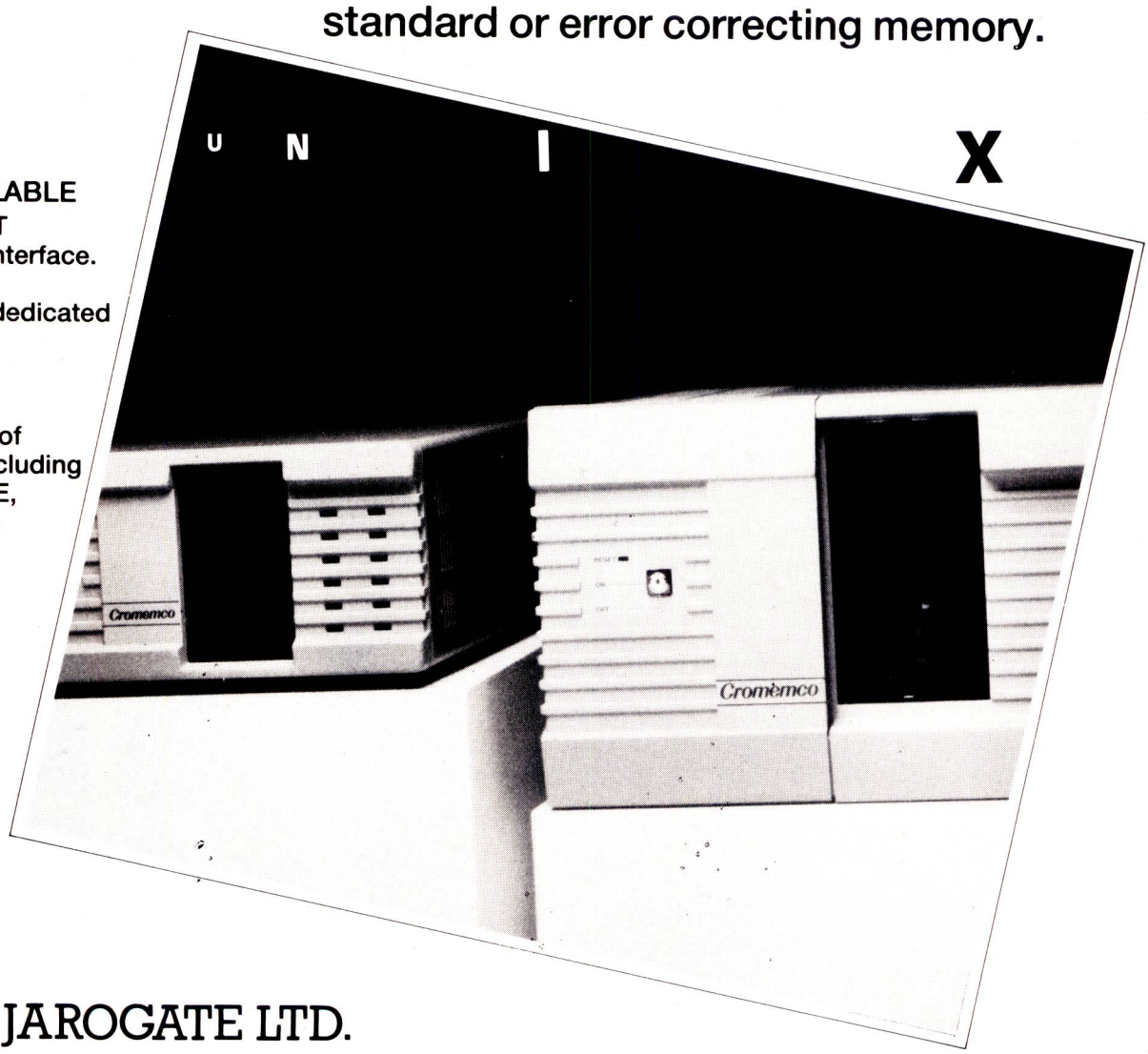

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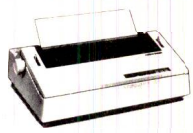

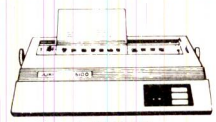

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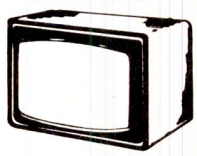

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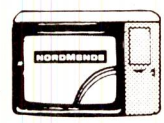

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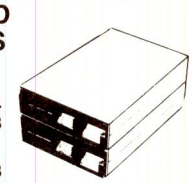

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CHIP CHAT



Sinclair (for the delays on the QL) and Acorn (for its zealous attitude towards software protection) cropped up most often in the captions proposed for the photograph above. Various readers suggested that the micro had been trying to calculate a QL delivery date, or that Acorn was starting to take software protection far too seriously. We've followed the popular vote and chosen Peter Howells of Oxford as the winner for suggesting 'Now that's what I call a good software protection device.'

Honorary mentions go to RF Walker of Birmingham ('He should never have tried to run the program printed on his pullover') and to CL Gardner of Croydon for his more philosophical 'I just entered "Anything I type in is untrue".'

Unbuttoned: in case you've wondered whose hand is inside the leather glove in the Mac advertisement, *PCW* can now reveal all — or at least raise an interesting possibility. Could it be Britain's Page Three Girl of the Year, Samantha Fox? We don't know for sure, but the lady in question invited us to take her photograph test-driving the Mac. Unfortunately, we couldn't make it.

Power to the people: a recent A-Z of computer terminology pauses at 'terminal' to comment that it's 'a people-oriented device'. People-orienting — now that's just what this dictionary needs a lot more of.

Two sugars, please: we can't wait to try the DeskSet desk organising package for the Mac. The one screenshot we've seen so far features a steaming cup in a prominent position on the manager's desk. Sadly, this option isn't available on the pull-down menu.

Jingle, jangle: pound coins, don't you just love 'em? Well, Mars Electronics does — and has written to the press explaining why. Parts of the message are a little hard to understand but one argument is that they create jobs — at the Mints that make the coins and at the companies that convert old coin-operated machines or manufacture new ones. Anyone with any reservations will doubtless lose them when they learn that 'already 100,000 fruit machines in Britain take the pound coin.' It's good to see the arcades staying at the forefront of technological change.

With friends like this . . . US magazine *Popular Computing* asked readers to vote for the most user-friendly piece of software. MacPaint came in a clear first. Second place was a tie between 'none' and 'there isn't any'. And one smart(ing) reader voted WordStar the hardest game to win.

Star-struck: one of our readers who visited the Las Vegas Comdex show is only just recovering. Playing bingo at breakfast and discovering dog biscuits shaped like postmen so put him off his stride that all his stories read like computer-generated poetry. Guy Kewney found it easier to resist the Las Vegas lifestyle.

Exploding galaxies: taking off his *Chip Shop* hat and slipping into his *Film 84* armchair, Barry Norman welcomed the news of a film version of *Hitch-hiker's Guide to the Galaxy* — adding that all we need now is the computer game. Never was a more true word spoken in jest. But what *PCW*'s resident TV fan really wants to know is what will emerge from Douglas Adams' partnership with the Muppets.

On her Majesty's Service: while companies are awarded Royal Warrants for supplying goods to the Royal Family, we understand that the Warrants are actually held by individuals. So who exactly holds this honour at Commodore, purveyor to our Majesties of quality microcomputers? Could it be Gail Wellington (an American), Howard Stanworth (a recluse), David Gerrard (a new boy), or John Baxter (who's still at Commodore despite attempts by some magazines to suggest that he was moving elsewhere)? And what would happen if the Warrant-holder were to leave?

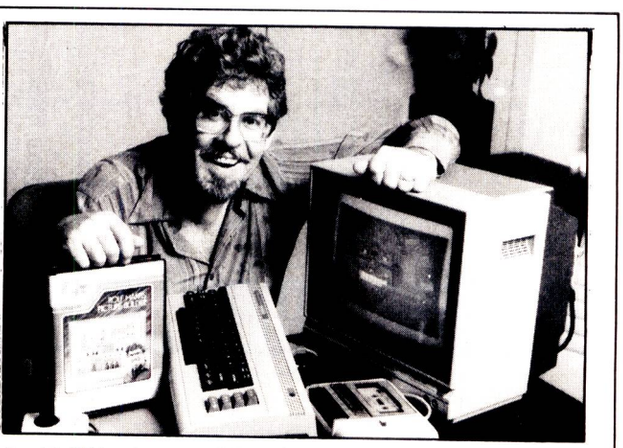
Ghost of a chance: in its drive to compete with the mighty IBM, Apple's US sales people call themselves Bluebusters — but IBM remains unperturbed. Witness one of its executives quoted recently in *Creative Computing*: 'You know, if we really wanted to, we could buy Apple Computer out of petty cash.'

To ram home the message, the executive is then said to have flicked casually at the sleeve of her blouse and said: 'Apple, goodbye.' Make sure you test-drive a Mac before IBM starts flicking more than its sleeves — the Mac's a machine not to be missed.

Ergonomic: thanks go to Bill Warne of Aldershot for sending in a clipping from his local newspaper's classified ads section. Offered for sale was a 'Commodore, new, stool shape, bargain' — and at only £8 who would disagree? Any other readers' contributions always welcome.

Lies, damned lies and statistics: Atari's Jack Tramiel, one man who did leave Commodore, reckons that before he took up his new job only one in ten micros being sold in the US was an Atari — now he's more than turned those figures around so that there's 20 Ataris sold for every one of those nasty other Brand X boxes. At least we think that's what he said.

Nonetheless, at least two people in this office reckon that the Atari 600 and 800XL are bargains now — with enough cartridge software available to mean you never have to worry about tape loading again.



Give Rolf Harris something to really smile about by writing a witty caption to this photograph. Send your suggestions on the back of a postcard to ChipChat,* PCW, *62 Oxford Street, London W1. Remember to write your name and address on as well, in case you should win the £10 prize. The closing date is 28 February.

Frank Ellis of Oxford is the winner of the December crossword which was, unfortunately, the last.

December solutions:

SOLUTIONS ACROSS

8 Apple turnover 9 Bugs 10 Sonar 11 Loud 12 Glitch 14 Operates 16 Operand 18 Utility 21 Salesman 23 Piracy 25 Obit 27 Serif 28 Step 29 Clive Sinclair

SOLUTIONS DOWN

1 Manual 2 Opus 3 Less than 4 Turns on 5 Untrue 6 Oval 7 Argument 13 Three 15 Adler 17 Playback 19 Typeface 20 Android 22 Master 24 Clears 26 Twin 28 Star

END

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MODEL	PROCESSOR	CARD EXPANSION	RAM	DISKETTE STORAGE 5¼"	HARD DISK STORAGE 5¼"	STANDARD INTERFACES
CP 1000 SERIES						
CP 1202	8086 6MHz	7	256kb –IMb	2x790kb	–	2 serial asyn/syn 1 parallel
CP1502	8086 6MHz	6	256kb –1Mb	1x790kb	1x5Mb	2 serial asyn/syn 1 parallel
CP1522	8086 6MHz	6	256kb –1Mb	1x790kb	1x20Mb	2 serial asyn/syn 1 parallel
CP1542	8086 6MHz	6	256kb –1Mb	1x790kb	1x40Mb	2 serial asyn/syn 1 parallel
CP1525M	8086 6MHz	4	512kb –1Mb	1x790kb	1x20Mb	10 serial asyn/syn 1 parallel
Options: additional memory, processors, storage, communications, interfaces.						
CP2000 SERIES						
CP2202	80286 6MHz	7	256kb –1.5Mb	2x790kb	–	4 serial asyn/syn 1 parallel
CP2522	80286 6MHz	6	256kb –1.5Mb	1x790kb	1x20Mb	4 serial asyn/syn 1 parallel
CP2542	80286 6MHz	6	256kb –1.5Mb	1x790kb	1x40Mb	4 serial asyn/syn 1 parallel
	Calendar clock as standard.					
Options: additional memory, processors (including 80287 numeric co-processor), storage, communications and interfaces.						

FEATURES COMMON TO CP1000 SERIES AND CP2000 SERIES SYSTEMS:

- Operating system software: Concurrent CP/M 86 single or multi-user, MPSL BOS/5 and M-BOS/5 optional.
- Keyboard/Display: 80/132 columns, 101 key detached with typewriter, numeric and function key sections, 14" green screen swivel/tilt.
- Printers: choice of daisy wheel, dot matrix and dual function printers with single sheet feeders – speeds up to 300 CPS.
- Expansion – internal: S100 cards, IBM and ICL main frame communications and protocols.
- Expansion – external: stackable modules including high speed tape drive, 8" floppy disks and 5" hard disks providing up to 200Mb of on-line data storage.

Sub – systems

MODEL	STORAGE CAPACITY	STORAGE TYPE	AVERAGE ACCESS TIME	ROTATIONAL LATENCY	RECORDING DENSITY	TRANSFER RATE
FD800	256kb	1x8" diskette SS/SD	130ms	83ms	★	★
HD520	1x22Mb	5¼" Hard/8 surface	85ms	8.3ms	★	★
HD540	1x40Mb	1x5¼" Hard/8 surface	85ms	8.3ms	★	★
CB200	13.4Mb	Cartridge DC300XL	★	★	6400bpi	30kb/sec
CB240	40 MB	Cartridge DC300XL	★	★	8000bpi	90kb/sec
System dimensions: 197x370x525 (HxDxW)						
Sub-system dimensions: 143x370x525 (HxDxW)						
System power requirements 110, 220, 240v ± 10% 50/60 Hz						

COMART WORKSTATION

MODEL	PROCESSOR	RAM	DISKETTE STORAGE 5¼"	HARD DISK STORAGE 5¼"
WS20	80186	256k-512kb	1x720kb	–
WS30	80186	256k-512kb	2x720kb	–
WS40	80186	256k-512kb	1x720kb	1x10Mb

FEATURES COMMON TO ALL COMART WORKSTATIONS:

Memory: 256kbyte (optional expansion to 512 kbyte)
32kbyte display screen memory

Diskette capacity: 5¼" 720kbyte capacity, soft sectored, double sided, 80 track, 9 sector/track, 512byte/sector

Disk capacity: 5¼" 10Mbyte formatted (WS 40)

Display: 14" monochrome (green P39 phosphor) swivel & tilt, 25 line x 80 character (7x9 matrix in 9x12 cell), blinking, underline, dual intensity, normal and reverse video.
Character sets may be downloaded into RAM

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320x200 4 colour (IBM compatible)
320x200 16 colour

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Printer – asynchronous
Modem – sync/asynchronous

Parallel port: Printer – Centronics compatible

Network port: 1Mbit/second, token passing LAN controller

Calendar/clock: Time of day with battery backup

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Keyboard angle 7 degrees or 15 degrees

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Operating System:

Software: Digital Research
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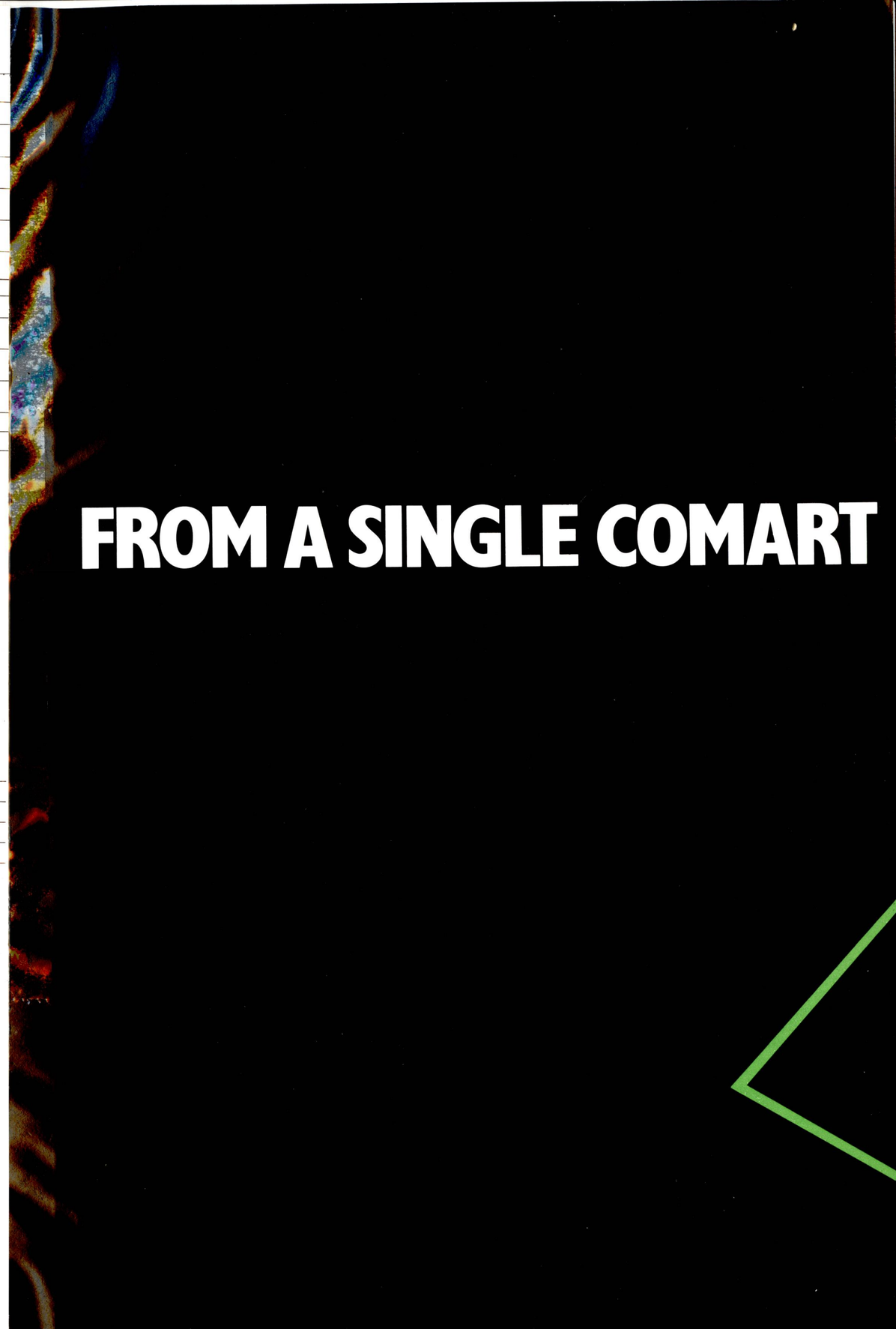

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The fact is that with Comart, wherever and whenever you start, there can be no mistake.

Take for example, a Comart workstation, our latest system with formidable stand alone computing power and built-in networking.

You can join it to other Comart workstations or computers . . . feed multi-user terminals and peripherals (printers, tape streamers) . . . and then add more workstations . . . more computers . . . more and more, in fact – for up to a distance of one kilometre around the building!

You will have the whole place working together, sharing information.

You will have achieved total integration . . . compatibility with the IBM software library . . . and, in addition, compatibility with past, present and future Comart Systems.

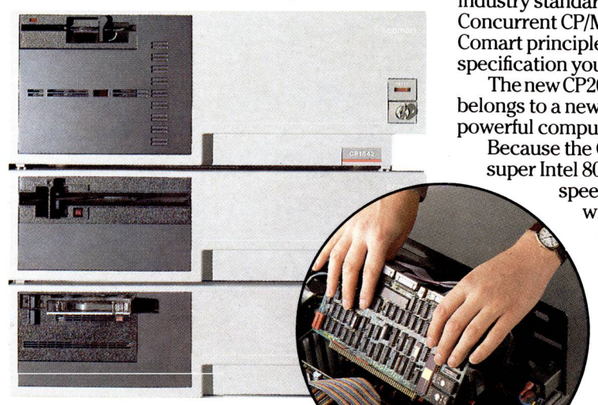
Comart modularity means you can continue to build-on power and facilities without fear of the future (Comart machines may grow old, but never obsolescent).

With so much power to go round, Comart puts an end to frustrating waiting.

And with such an extraordinary degree of flexibility – enabling you to give each individual precisely what is needed – Comart systems are, without doubt, uniquely cost effective.



The Comart WY50 smart editing terminal achieves excellent performance at a very competitive price. Utilising a large 14" screen, 80/132 column display and soft key set up, the terminal has a small footprint and an attractive ergonomic design.



THE SYSTEM

A microcomputer system can solve many business problems by more efficient organisation and more effective use of management resources – but only if you get the combination right.

Unfortunately, most micros offer precious little flexibility and (worse) a limited future because you can't upgrade them. This, however, will never be the case with Comart.

The modular design of our systems ensures that you get the performance you need – both today and tomorrow.

With conventional desk top micros, once outgrown, you simply have to ditch them.

With Comart systems, expansion could just mean changing a circuit board or two . . . extra capacity, a simple matter of additional disk storage and extra memory cards. In this way, you can easily keep abreast of developing technology and expand your computer capability in step with the growth of your business. You just add further users, computers and workstations using the Comart Local Area Network and Comart's built-in modularity. Further, you will also have the benefit of a special Comart software endorsement scheme which works continually to 'field test' the best multi-access software – guaranteeing that it will fully meet your requirements.

COMART COMPUTERS

At the heart of a Comart system you have the choice of two elegantly styled series of Comart computers which provide a variety of storage, memory and user options:

The well-established, excellent value CP1000 series comfortably supports from one to eight users and, in common with all Comart computers, runs the very latest industry standard operating system, Concurrent CP/M. It accords well with the Comart principle of only paying for the specification you require.

The new CP2000 series of Supermicros belongs to a new generation of very fast, powerful computers.

Because the CP2000 Series uses the super Intel 80286 processor it runs at speeds not yet associated with microcomputers at all: up to 8 times faster than ordinary 16 bit machines and 14 times faster than 8 bit computers!

This speed really becomes useful when running the new generation of operating systems like Concurrent CP/M from Digital Research. Whenever up to four programmes and up to 12 users are running simultaneously, the processor's time is shared between them, visibly slowing down the response of ordinary micros. But with the new Comart Supermicro the processor is moving so fast that it copes with plenty to spare.

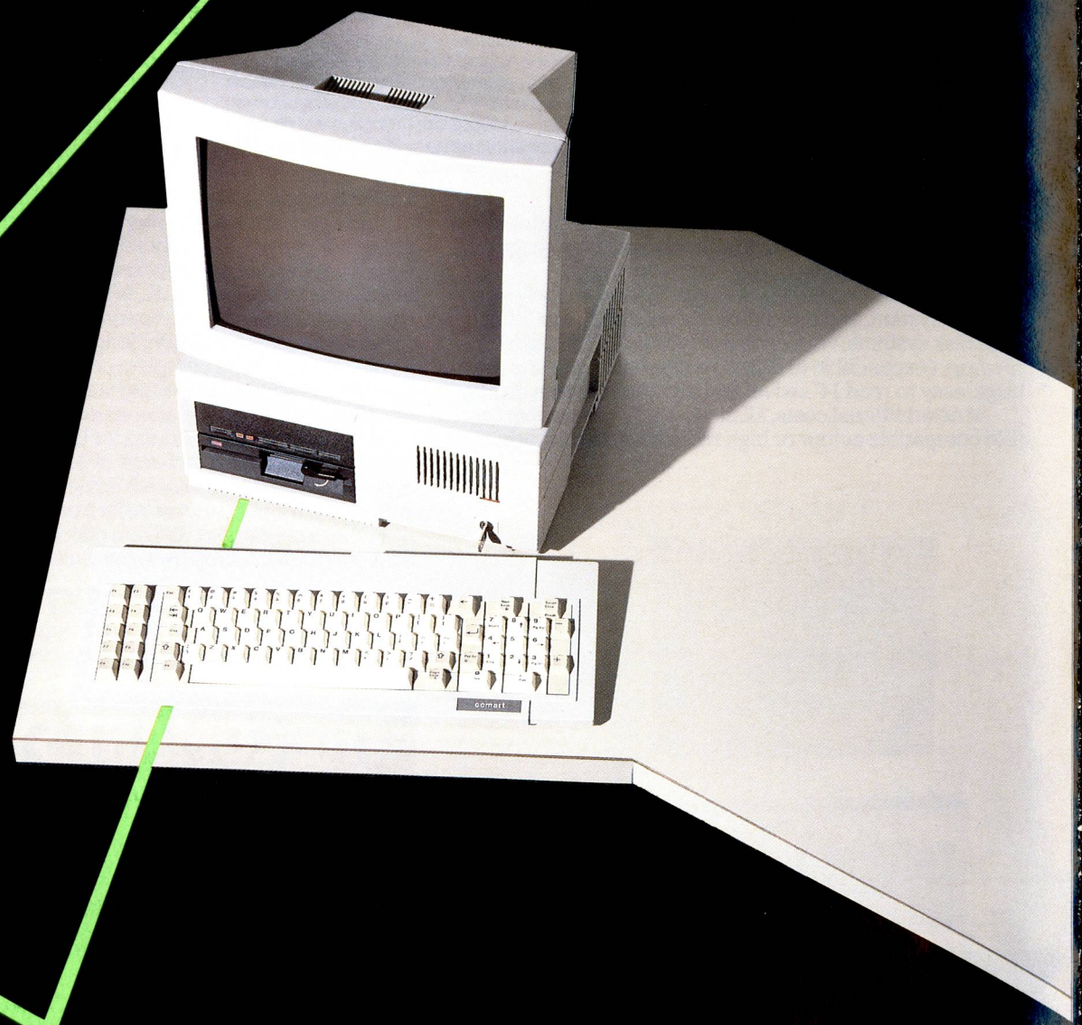
This same speed/power capability makes the CP2000 series ideal for integrated business and commercial software plus all the popular applications such as word-processing, database management and spreadsheets, within a multi-user environment.

Each of the Comart 1000 series and 2000 series computers can be readily added to, expanded or updated by slotting in new or extra cards.

Add on sub-systems include 8" floppy disks, cartridge tape



WORKSTATION





RT SYSTEM GROWS



back-up and hard disk storage of up to 40 Mb. All sub-systems are styled in half height compatible cabinets. For users requiring extra large databases, the CP 2000 series can accommodate up to 200 Mb of on-line data storage!

Security back-up from hard disks can be a long and tedious business. The Comart CB 240 cartridge tape unit will copy 40 Mb of data in just 10 minutes.

THE COMART WORKSTATION

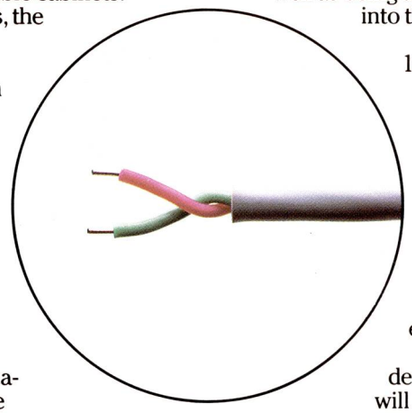
The new Comart workstation is like a well adjusted personality – happy and able to work on its own, and yet prepared to work with others, sharing and contributing as a member of the team!

It is a high performance, high specification microcomputer designed to fulfil the needs of the individual user – within an overall Comart system capable of sharing data and resources. Much more than a personal computer the Comart workstation has full graphics and communications facilities with a choice of sophisticated management tools and built-in networking.

The sleek new design has a space-saving footprint of less than one square foot, and a low profile multi-language IBM compatible keyboard.

There are three models. A single high capacity floppy diskette system, and the choice of dual diskette or 10 Mb hard disk systems. With each workstation, a 256 kbyte memory (expandable to 512 kb) is standard; so too is the large, easy to read 14″ swivel and tilt monochrome display.

At no additional costs, all models will fully support an IBM compatible colour or high resolution display, printers (either serial or parallel) and support mouse data entry – as well as being able to connect both to a modem and into the Comart Local Area Network.



Using a low-cost twisted pair network cable (easily installed with junction boxes and interface cables) Comart Workstations can be joined together to communicate and share information without further modification or addition. All told, the Comart network can accommodate up to 255 computers or workstations!

The use of an Intel 80186 advanced 16-bit processor ensures ample power to perform multi-tasking (essential for successful network use and window display software). Extra data storage and processing capacity can be obtained by using the Comart CP series as file servers on the network.

Concurrent DOS also provides GSX graphics display facilities, DR-NET and PC-MODE. MICROSOFT MS-DOS is an optional operating environment.

Under MS-DOS and PC-MODE, well designed software written for the IBM-PC will operate on the workstation including full colour graphics.

COMART – THE COMPANY

Since 1977, Comart has been a major force in microcomputer development in the U.K., earning a reputation for the kind of innovation which meets genuine customer needs.

Now part of the Kode International PLC microcomputer group our record of quality, reliability and service has few equals (as the owners of thousands of Comart systems installed not only in the U.K., but worldwide, will testify). Our growth rate and success ensures that our company will remain a vital market leader long into the future – in other words, you can have complete confidence in the fact that Comart will always be there to support your current installation and provide after-sales service and training.

Another important reason for Comart's world-wide success is our superb network of dealers and specialist suppliers available to give full advice and after-sales support. And you can never be far from Microserve, Comart's own customer-service division offering maintenance and field-service for Comart systems nationwide.

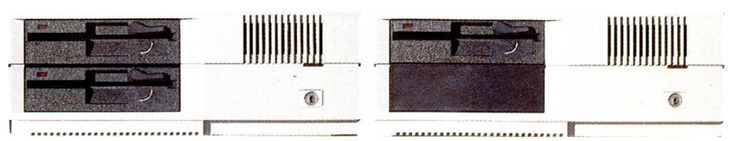
WHAT NEXT?

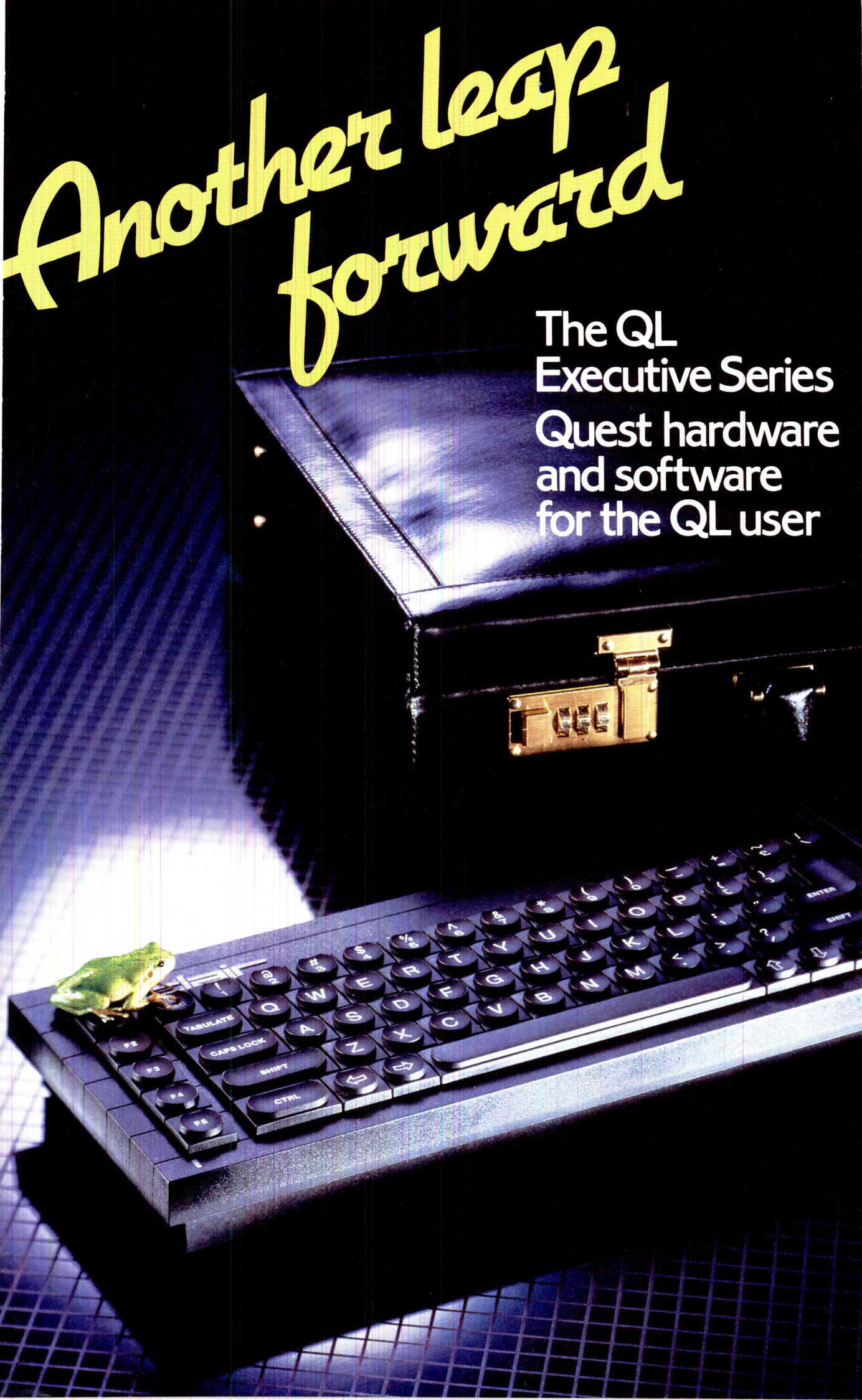
For more information or for an opportunity to see the Comart System for yourself, please complete and return the coupon overleaf.

THE COMART SYSTEM.

All working together.

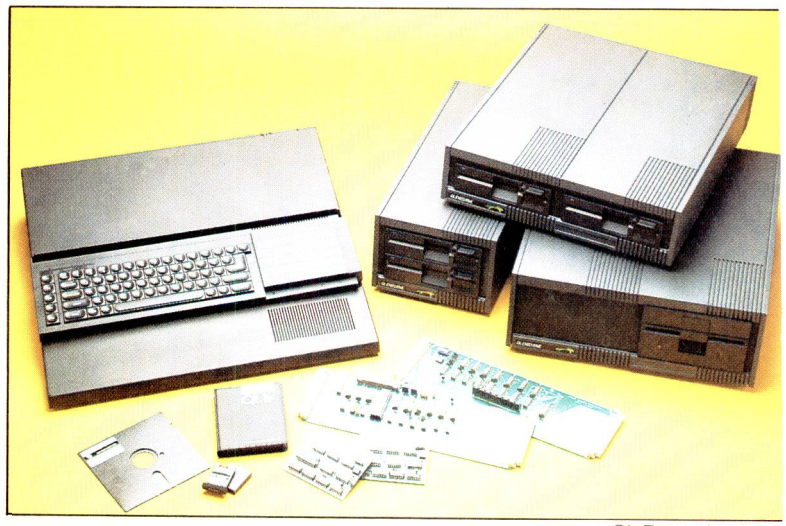





Another leap forward
The QL Executive Series
Quest hardware and software for the QL user

The full potential of the QL can now be realised: Quest's QL Executive Series of quality peripherals and software enables the QL effortlessly to bridge the gap between the home and professional computer.

By providing industry standard operating systems and storage devices, Quest have opened up the way for the adoption of the QL by not only the serious home user but also by the business user.



QL Executive Serie



CP/M 68K

CP/M - 68K

The Easy Route to Industry-Standard Applications Packages

Quest has the exclusive rights, worldwide, to CP/M 68K for the QL and has converted this industry standard operating system to run on the machine. The world's most widely used operating system, CP/M offers a proven and familiar environment in which to develop applications software.

- Co-resides with QDOS
- Users can switch between Operating Systems
- Includes Assembler and C Compiler
- Supplied on microdrive cartridges or floppy disk
- Supports 3", 3½", 5¼" and 8" floppy disks

N.B. CP/M requires either an Executive Series floppy disk system or an OScard to be present.

CP/M on Floppy Disk £59.50
CP/M on Microdrive £99.50

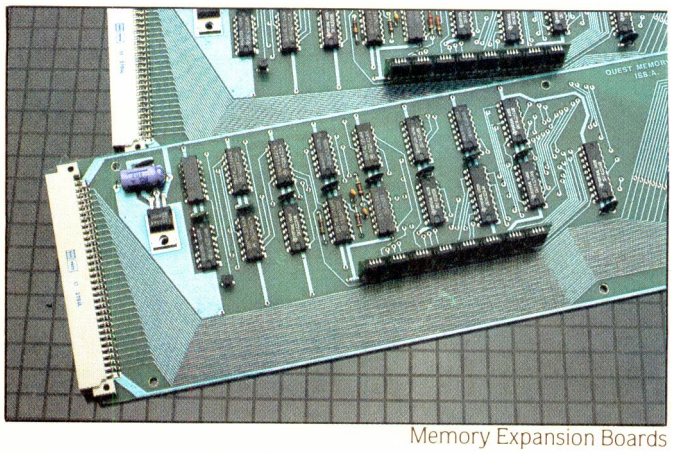
Memory Expansion Boards

The QL's standard 128K RAM is impressive, but because of the possibilities the machine offers, the programs used will frequently require additional capacity. Consequently, Quest has designed and produced a range of memory expansion cards to suit any requirement.

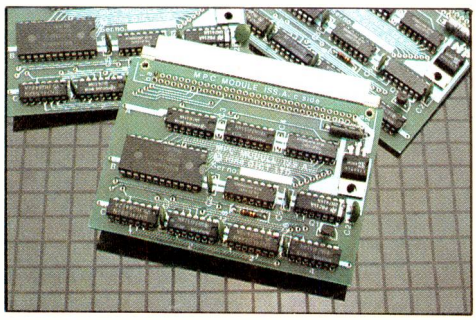
- Based on the latest 64K D RAM Modules
- Fully buffered
- Automatic refresh
- 150ns access to RAM contents
- Fit the standard QL and Quest's Expansion Console

The 64K unit can easily be powered by the QL's internal power source: larger units may need external power and provision for this has been made in their design.

64K RAM £115.00 256K RAM £349.00
128K RAM £185.00 512K RAM £579.00



Memory Expansion Boards



OScard

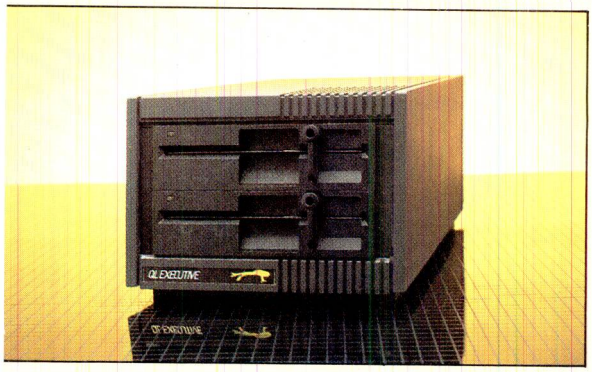
OScard

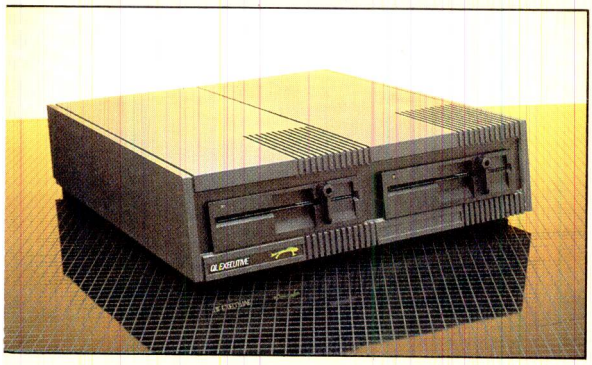
To enable microdrive or floppy disk versions to be used without the QL Executive Series floppy disk controller, this circuit board provides the necessary memory switch and RAM capacity. A full years warranty. OScard £49.50

Power Supply Unit

Specially designed to power Quest's memory expansion cards and the Expansion Console, this plug-in, stand-alone unit is covered by a full year's warranty.

Power Supply Unit £64.50





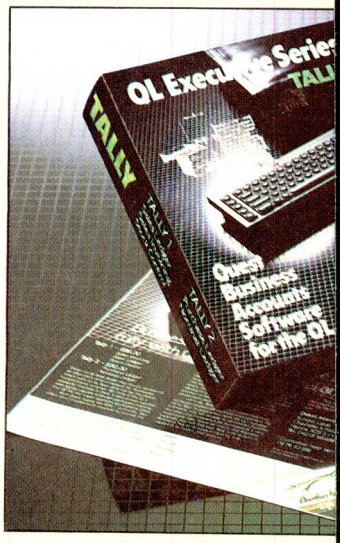
Disk Drives

With years of experience in disk drive tec have been able to harness their technical commercial purchasing power to offer Q capacity and reliability of disk storage at prices.

Complete with disk interface controller/i unit, power supply and cables – no hidde attractively styled and using state-of-the the Executive Series of disk drives brings professional mass storage to the QL.

- Latest half-height technology
- All necessary equipment included
- Operate under CP/M and QDOS
- Full year's warranty cover

200K Floppy Drive* £295
400K Floppy Drive £419
800K Floppy Drive £499
2 x 200K Floppy Drives £469
2 x 400K Floppy Drives £579
2 x 800K Floppy Drives £695
*Full height technology



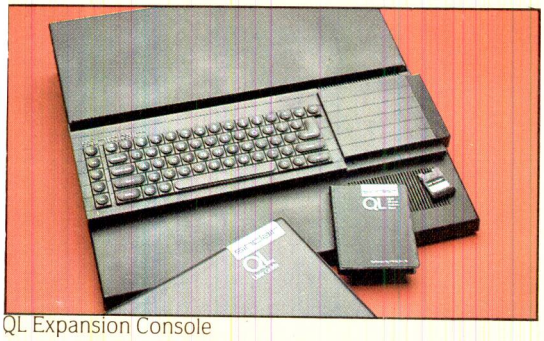
Tally

Business Accounts Software

Double Integration is the key to Tally, for the accounts modules contained in it link not only with each other but also with the four Psion packages – Quill, Archive, Easel and Abacus – supplied with the QL.

Tally I, comprises Sales Invoicing, Sales Ledger and Stock Control and Tally II consists of Purchase and Nominal Ledgers. These Quest programs enable the user to integrate, for example, Sales Ledger and Quill to produce standard letters without re-entering any data, or to use Easel to display in graphic form the data entered under Tally's Stock Control module.

Tally I £115.00
Tally II £59.50

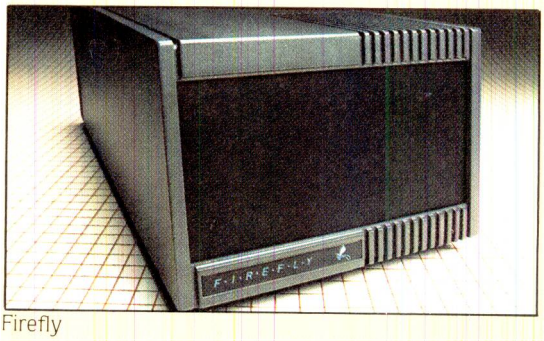

QL Expansion Console

Expansion Console

The Professional Desk Top System

Your QL and extra expansion cards can be con stylishly housed in the QL Executive Expansion also serves as an ergonomically designed mon wrist-rest. Made of durable and attractive bla the console is available simply as the housing u module ready to take cards and including a cal

Expansion Console £139
Monitor Stand/Handrest £69.50



Firefly

Firefly QL

The Firefly QL Winchester disk offers a full 7.5 mb of data and program storage with extremely fast access times. Ideal for large databases such as stock and customer lists, these products represent true value for money – larger capacities coming.

Firefly £1149.00

See the QL Executive Series on Stand Number 3311 at The Which Computer Show, NEC Birmingham, 15th-18th January 1985.

Executive Extras

As the major source of all QL related products, Quest is pleased to present a quality range from some of the world's leading manufacturers.

The Sinclair QL

Superb value for money, with 128k of user memory, 32 bit processor chip and 4 software packages (Word Processing, Spreadsheet, Graphics and Data base) included in the purchase price.

£399



Microvitec 1451/DQ3



Prism 14QL

Monitors

Microvitec 1451/DQ3

- 14" medium resolution colour monitor specifically designed for the QL
- 85 column text and outstanding graphics
- RGB TTL input

£274

Prism 14QL

- Portable, 85 column display
- Detachable anti-glare tinted glass
- Full A4 width on Quill
- Standard resolution for Easel graphics

£235

Printers

Brother HR-5

- Full 80 column printing
- Uses plain or thermal paper
- Compact and lightweight

£189

Brother HR-15

- Versatile daisy wheel printing
- Text re-printing
- Prints red and black
- Attachable cut sheet feeder

£519

Brother M-1009

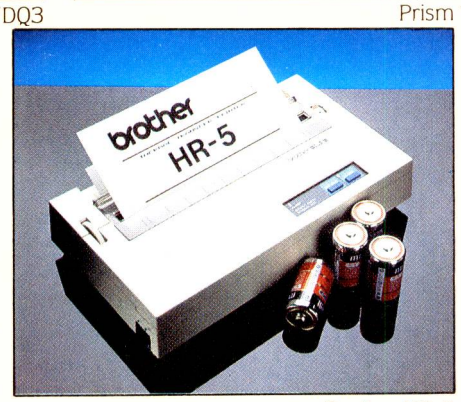
- Dot matrix printing at 50 cps
- Bi-directional, logic seeking printing
- Excellent value for business or home use

£224

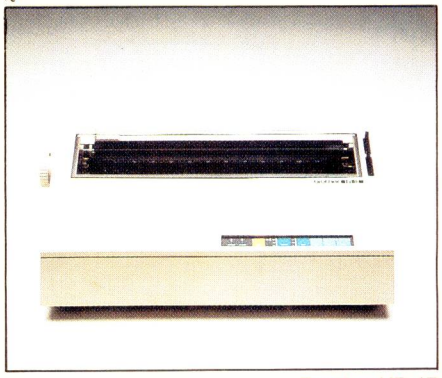
Epson RX-80 F/T

- 80 column printing at 100 cps
- Six user selectable graphics modes
- Six different densities
- Text and graphics on the same line

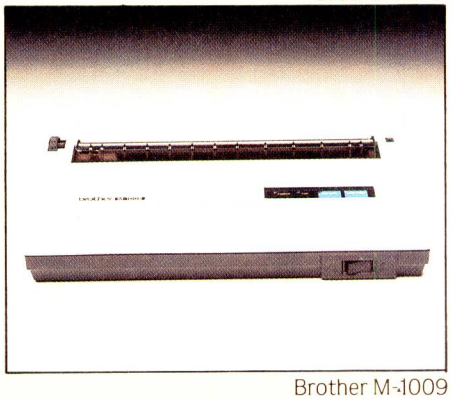
£334



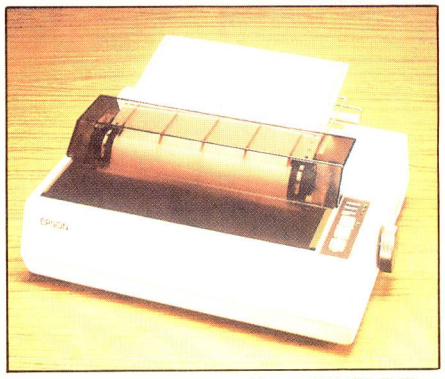
Brother HR-5



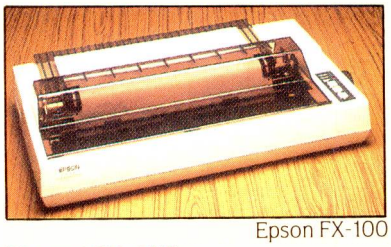
Brother HR-15



Brother M-1009



Epson RX-80 F/T



Epson FX-100

Epson FX-100

- High speed (160 cps) matrix printer
- 136 column capability
- Bi-directional, logic seeking printing

£664

Consumables

A full range of consumables is available for your business and personal use, from microdrive cartridges and floppy disks through line printers and personalised stationery to desks and chairs. Please phone for our 48 page catalogue.

TELEPHONE SALES DESK 04215 66488
ALL PRICES INCLUDE VAT, POSTAGE AND PACKING

CP/M is a registered trademark of Digital Research
QL is a registered trademark of Sinclair Research



A Quest Automation plc Group Company
School Lane, Chandler's Ford, Hants. SO5 3YY
Tel: 04215 66321 Telex: 47326

Affordable and reliable printers from Micro P give you more Quality CPS for your money



Even in today's high tech world, for most of us, the written word is still the least expensive means of sending and receiving information. If you own a microcomputer the chances are that sooner or later later you are probably going to need a printer.

Micro P – CPP40

A low cost 4 colour 40/80 column printer/plotter capable of printing text or graphics on plain paper. The CCP40 is an ideal companion for small and portable micro's, as it is fitted with re-chargeable batteries – perfect for beginners.

Micro P –SHINWA CPA80

With 100 cps quality printing, the CPA80 probably gives more cps/£ than any other printer available today. The CPA80 is packed with features you would normally find on a more expensive printer. With an optional RS232 version available (even for the QL) this Epson compatible printer will hook up to almost any micro.

See them at your local dealer today!

Micro P – MP165

Looking for a matrix printer as well as a daisywheel? Well, the MP165 combines all the attributes of these two technologies to give a matrix printer capable of printing at up to 165 cps, as well as providing crisp Near Letter Quality, (NLQ) print at 75 cps. Features include a 2k buffer as well as both friction and tractor feed, as standard. Ideally suited to most popular micro's, the MP165 is now available in a new RS232 QL compatible version.

Micro Peripherals ltd

'THE POWER BEHIND THE PRINTED WORD'

INTEC UNIT 3, HASSOCKS WOOD, WADE ROAD,
BASINGSTOKE, HANTS. ENGLAND, RG24 0NE.
Telephone: BASINGSTOKE (0256) 473232 (32 lines).
Telex: 859669 MICROP G Facsimile: 0256 461570

*Full 12 months warranty - RRP ex. VAT. QL is a registered Trade Mark of Sinclair Research.

Personal Computers Ltd.

Macintosh™ Centre

(first again)

Personal Computers Ltd, the U.K.'s first personal computer dealer has done it again! First in the U.K. with Apple Computers — first in the U.K. with Lotus 1:2:3 software — and now another first, the brand-new Macintosh Centre open in the heart of the City of London.

Macintosh is the new computer sensation from Apple, designed on the simple premise that a computer is a lot more use if its easy to use. Computers have little value if they require thirty manuals to figure out and a doctorate in mathematics to operate. Ideally, working with a computer should be like talking to a very bright friend who is eager to help get your work accomplished — and that's Macintosh.

With Macintosh you can write, analyse, organise, create and illustrate, often at the touch of a finger, by moving a 'mouse' on your desk to move a pointer on the screen. It can also help you prepare letters, reports, produce charts and presentation slides, store and retrieve information. And much more.

This doesn't just mean your work will be faster and more accurate — it will also be better. And remember the less time you spend shuffling papers — the more time you have available to exercise your creativity.

Macintosh takes over your deskwork, but not your desk. In fact it takes up an area as small as a standard sheet of paper.
Macintosh has a wide range of software available, and new packages are being added all the time. In addition to Mac's own software which includes MacPaint, MacWrite, MacDraw and MacProject, there's world-famous packages from Microsoft — like Multiplan, Chart, Word and File, and the best-selling Filevision — you'll find them all at the new Macintosh Centre.

Macintosh — recently voted best value personal computer by 'Which Computer' magazine, source: 'Which Computer' survey August 1984 who called it "an unbeatable buy".

Let us put a mouse in your hand, and show you the capabilities of this exciting new computer. Call in at the new Macintosh Centre, 218 Bishopsgate, London EC2M 4JS or for further information call the Mac Hotlines on 01-377 1200 today!



Personal Computers Ltd.

218 & 220-226 Bishopsgate, London EC2M.
Tel. 01-377 1200