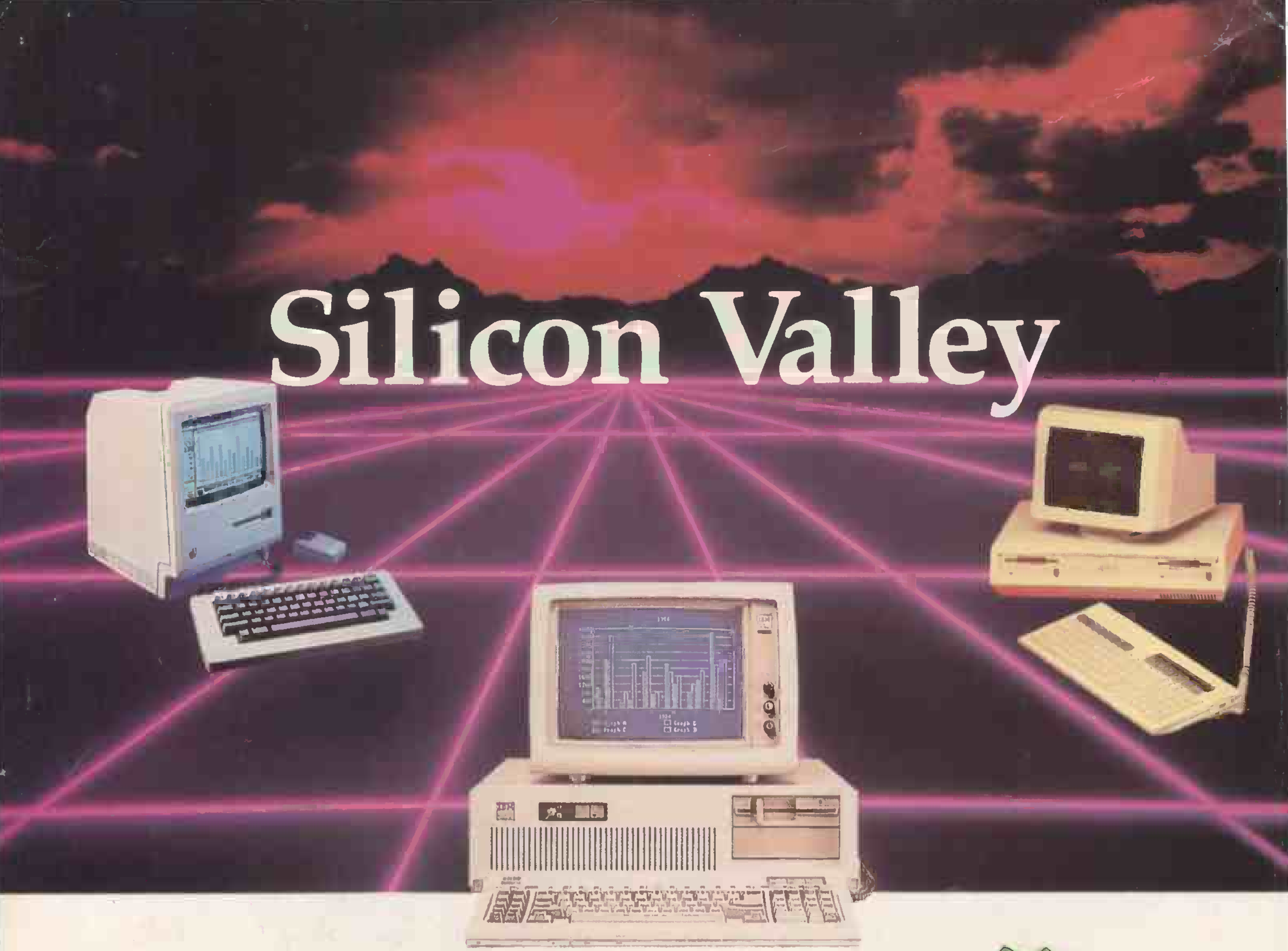
Personal Computer World

US $2.50/FF 18.50/SFr 7.30/IR £1.41/BFr 99.00/
Lire 5,700/DKr 27.00/DM 9.5
May 1985 95p

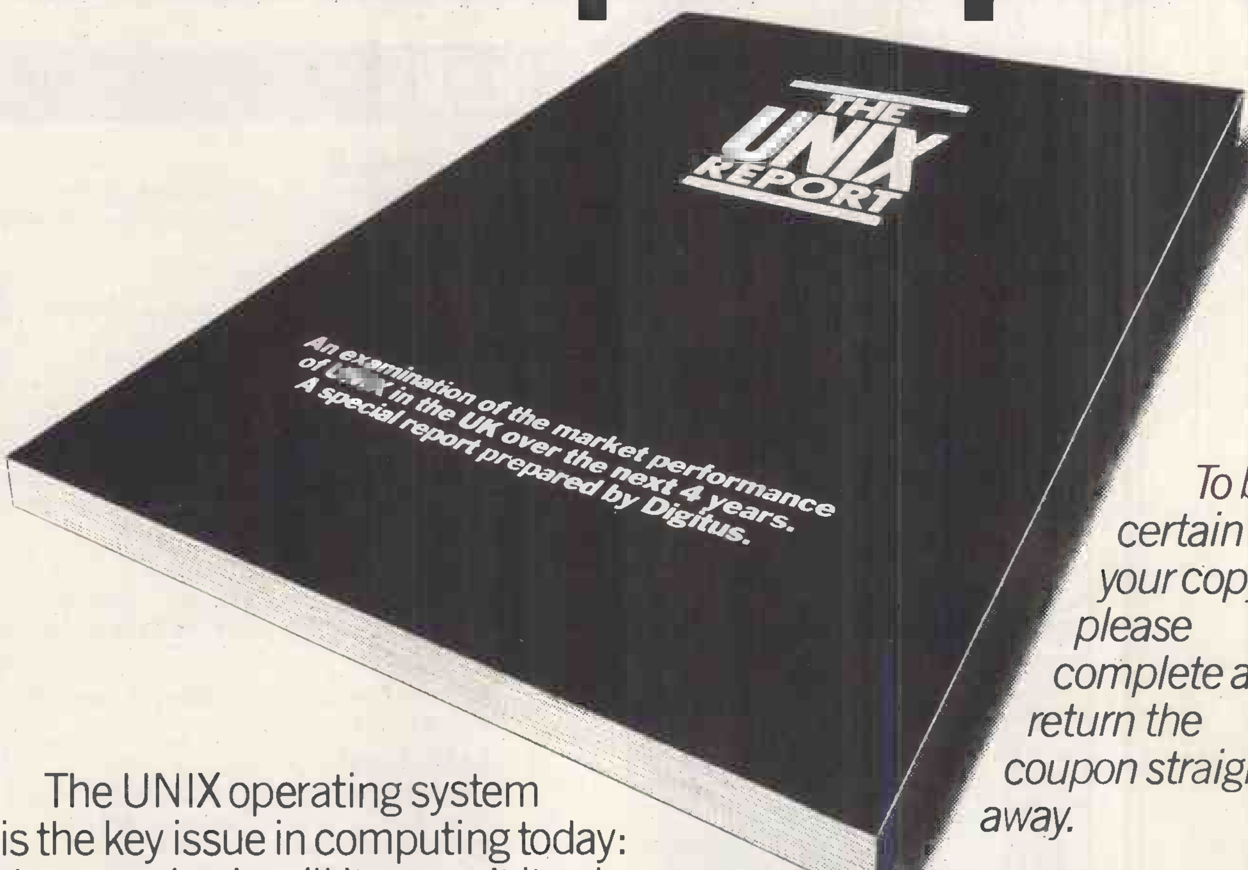
Commodore chases IBM

BRITAIN'S BIGGEST MICROCOMPUTER MAGAZINE

Breaking through the price barrier
NEW AMSTRAD REVEALED


Silicon Valley

Without any question, you need to send for this unique report.



To be certain of your copy, please complete and return the coupon straight away.

The UNIX operating system is the key issue in computing today: the question is, will it, or won't it, rule the multi-user world of the future?

If your company or organisation uses micro, mini or mainframe computers you cannot afford to be wrong about UNIX.

This exclusive report — based on unique information gathered from manufacturers and users alike — predicts the course of UNIX in the U.K. market over the next four, momentous years.

Please send me a copy of The UNIX Report.
I enclose a cheque for £95, or debit my Access/Visa, account no. ________

Name ________
Company/organisation ________
Position ________
Address ________

Post to: The UNIX Report, Digitus, 10-14 Bedford Street, Covent Garden, London WC2E 9HE. Tel. (01) 379 6968.

Digitus

UNIX YES OR NO?

PCW/5/85

CONTENTS

Vol 8 No 5 May 1985 95p

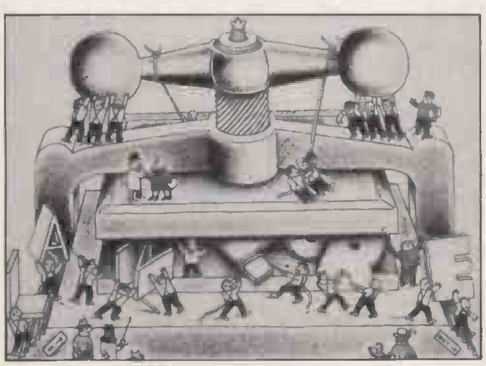
Cover story begins page 110
Photograph by Crispin Thomas

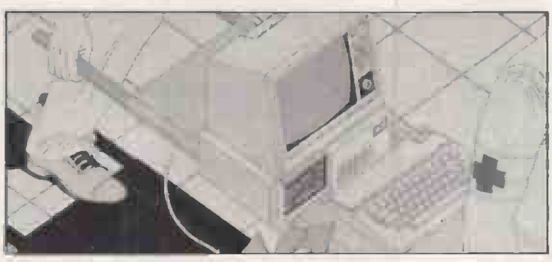
REGULARS

Founder Angelo Zgorelec **Editor** Graham Cunningham **Production Editor** Ginny Conran **Acting Production Editor** Kirstie Rogers **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 **Art Director** 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** Duncan Brown **Advertisement Manager** Bettina Williams **Assistant Advertisement Manager** Claire Rowbottom **Sales Executives** Janette Pitt, Claire Barnes, Steve Corrick, Jeska Harrington, Tony Keefe, Christian McCarthy, Anita Stokes, Isabel Middleton **Advertisement Assistant** Julia Vale **Advertisement Production** Gerry O'Sullivan **Production Assistant** Howard Carter

BENCHTESTS & REVIEWS

FEATURES





PCW Subscription Enquiries Stuart Cruickshank Subscription Rates UK: £15, Overseas £40 Subscription and mail order address 53 Frith Street, London W1A 2HG, tel: 01-439 4242 telex 23918 VNUG © Computing Publications Ltd. 1985. Editorial and advertising address 62 Oxford Street, London W1A 2HG, tel: 01-636 6890. No material may be reproduced in whole or in part without written consent from the copyright holders. Printed by Chase Web Offset, St Austell, Cornwall. Distributed by Seymour Press, 334 Brixton Road, London SW9, tel: 01-733 4444.

Now available for Rental

IBM+ACT WITH EXTRAS

- ✻ Accurate analysis of your requirements
- ✻ Highly competitive pricing
- ✻ Wide range of compatible software
- ✻ Staff training facility
- ✻ Rentals service available
- ✻ Try before you buy – we refund 95% of your rental if you purchase within first month of rental
- ✻ Trade-in on existing systems
- ✻ Expert installation service
- ✻ Micro data-transfer service

We specialise in networking your IBM PC's and Apricots together using the manufacturers' related products. These include IBM networking and clustering hardware and software and also the Point 7 and Point 32 from ACT.

IBM Personal Computer
IBM Authorised Dealer

As well as hardware from the leading manufacturers, you'll get friendly help and advice from 01 Computers, one of Britain's acknowledged experts.

And since we also handle the New Innovative Smart Integrated Business software package, we can really help you turn your personal computer into a powerful business tool.

Send in the coupon and find out how.

01 COMPUTERS LTD.

Southampton House, 192-206 York Road, London SW11 3SA

Telephone for a FREE demonstration Tel:- 01-228 2207 Telex 8954575 CTC LDN

Fill in this coupon and send it to us at the address below. It's an important first step to answering all your business computing needs.

Name ______________________

Address ______________________

______________________ Tel No: ______________

Occupation ______________________

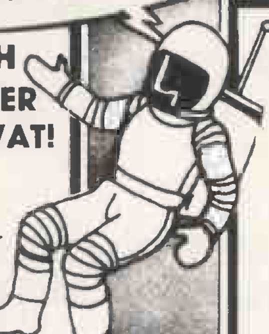
Southampton House, 192-206 York Road, London SW11 3SA

WEST ONE GALAXY

BUSINESS SYSTEMS LTD

230 Tottenham Court Road, London W1P 9AE. Telephone: 01-636 7142/4102

Looking for a business system? Let us help you. Come to the first floor for expert advice and unbeatable price.



apricot XI10 WITH 10MB WINCHESTER ONLY £1995 +VAT!

PLUS

- *FREE* Monitor
- *FREE* Wordprocessor (Superwriter)
- *FREE* Spreadsheet (Supercalc)
- *FREE* Super Planner

INTEGRATED ACCOUNTS PACKAGE

- *FREE* Invoicing
- *FREE* Stock Control
- *FREE* Sales Ledger
- *FREE* Purchase Ledger
- *FREE* Nominal Ledger
- *FREE* Payroll
- *FREE* Mailing List

SPECIAL

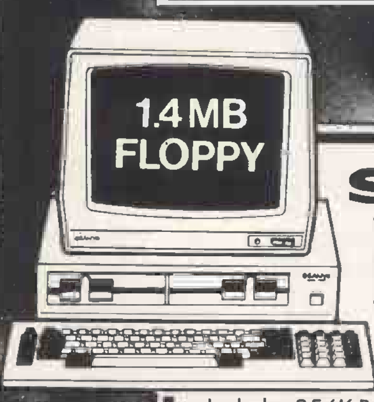
IBM COMPATIBLE SANYO 550.

IBM COMPATIBLE 550

Features dual 360K disk drive, 256K Ram.
Full IBM Colour Grahpics, (including IBM Compatible Video Board and GW Basic).
MSDOS 2.11. Wordstar and Calcstar.
FREE Hi-Res Green Monitor
Runs Lotus 123 etc

£995VAT

Limited stock.
Offer applicable only while stocks last.



SANYO 550 WITH 2×800KB FLOPPY DISC ONLY £995 +VAT!

PLUS

Includes 256K Ram and MSDOS 2.11

- *FREE* Monitor (Philips V7001)
- *FREE* Wordprocessor (Wordstar)
- *FREE* Spreadsheet (Calcstar)
- *FREE* Invoicing
- *FREE* Stock Control
- *FREE* Sales Ledger
- *FREE* Purchase Ledger
- *FREE* Nominal Ledger
- *FREE* Payroll
- *FREE* Mailing List

Integrated Accounts Package

GALAXY BARGAINS

SANYO with 10MB Winchester 360K floppy, 256K Ram, MSDOS 2.11, Wordstar & Calcstar and Monochrome Monitor
£1995 +VAT

SANYO 775/10MX SPECIAL OFFER
The portable Sanyo with 10MB Winchester disk.
Twin 360K floppies, 256K Ram, MSDOS 2.11, Integral 9 train, FREE SOFTWARE, FREE COLOUR PRINTER
£2795 VAT

PLUS FREE INTEGRATED ACCOUNTS PACKAGE WITH THESE SYSTEMS

TRAINING CAN BE PROVIDED ON ALL SYSTEMS SUPPLIED

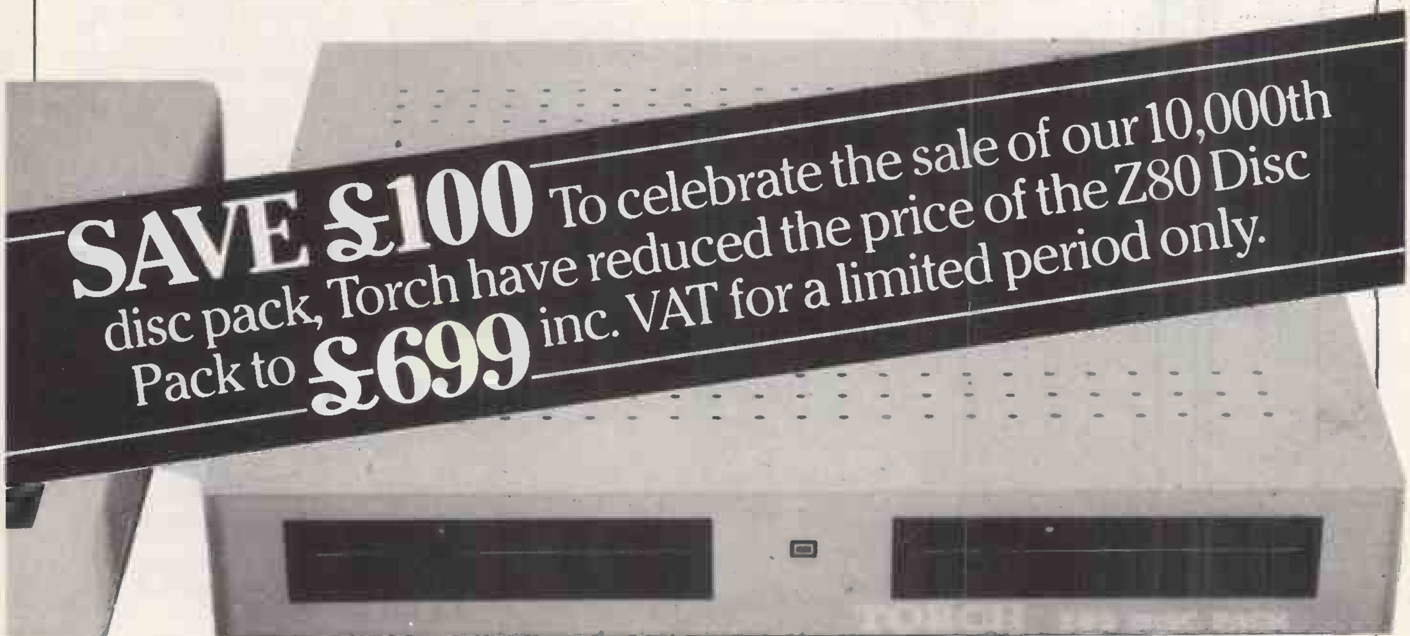
We also stock a wide range of Printers, Monitors, Disc Drives and Software Packages, plus many other Computer Systems at bargain prices.

1 YEAR WARRANTY & MAINTENANCE CONTRACTS AVAILABLE

OPENING HOURS MON-SAT 9AM-6PM

MAIL ORDERS TO: West One Galaxy Business Systems Ltd, 230 Tottenham Court Road, London, W1.
Cheques payable to: West One Galaxy Business Systems Ltd.

The best thing next to a BBC micro.



The BBC Model B Microcomputer is widely recognised as an impressive first computer for the home or the school, but its capabilities are restricted by its lack of data storage and the limitations of Basic for serious programming. For the user who needs more from this computer the Torch Z80 Disc Pack is a gateway to the world of advanced computing.

Model B's fitted with disc interface can be upgraded to full business machines by the Torch Z80 Disc Pack thereby offering the use of more powerful and flexible languages such as Fortran, Pascal, BCPL and Cobol while twin 400K disc drives provide a massive storehouse for information and rapid data transfer from disc to processor.

The Torch Z80 Disc Pack is the proven upgrade for the BBC Model B microcomputer. It provides 800K of disc storage plus a Z80 second processor with 64K RAM running TORCH's own CP/M® compatible operating system based in ROM.

This advanced design means that almost all of the 64K RAM provided by the Z80 board is available for programming use – an advantage no other BBC micro upgrade can offer.

If your BBC micro has the Econet® option, there is a further benefit the Torch Z80 Disc Pack can offer. TORCHNET can link together up to 254 upgraded Model B's on a local area network, so for enthusiasts, clubs, schools and businesses it is a simple and low-cost way to achieve networking facilities.

The discs can be used for storage under the Acorn DFS system or for CP/M® programs and data.

A comprehensive software package is provided which includes word and data processing and a spreadsheet program, along with utility programs and manuals.

The Torch Z80 Disc Pack is recommended by the CCTA for government use and our customers include hospitals, universities, private businesses, the Government and schools.

If you are ready to take a step into the world of serious computing simply clip the coupon below.

Technical Specification.
Processor – 4 MHz Z80A. **Memory** – 64K RAM Accessible from the Z80. **Firmware** – 8K CCCP ROM on ZEP100 card – 16K MCP ROM for BBC board. **Discs** – Twin 400K 5¼" floppy disc drives. **Software provided** – TORCH CPN CP/M® compatible O/S – Disc Utilities – Music System – Misc. Utilities – PERFECT® SOFTWARE comprising – Perfect Writer – Word Processor. Perfect Speller – Spelling Checker. Perfect Calc – Spreadsheet. Perfect Filer – Database.
Other Operating Systems Available – UCSD p-System.

TORCH COMPUTERS
Lighting the way ahead.

To: Torch Computers Limited, Abberley House, Great Shelford, Cambridge CB2 5LQ. Telephone: Cambridge (0223) 841000.
Please send further details of the Torch Z80 Disc Pack.

Name ______________________

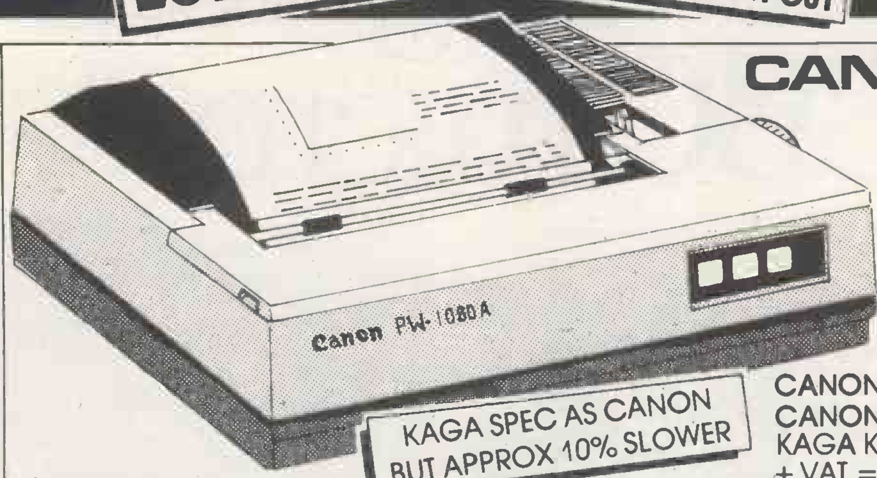
Address ______________________

____

____

QUALITY IN PRINT

Low Prices — **RING FOR SAMPLE PRINT OUT** — **Top Service**



CANON PW-1080A

OR KAGA PAXAN KP810
NEAR LETTER QUALITY PRINTER

NLQ Mode 23 x 18 Matrix: 27 cps
Draft Mode 11 x 9 Matrix: 160 cps
Full range of Epson FX 80 Print Codes
Friction & Tractor Feed
Centronics Interface Standard
CANON PW-1156A Available
(Accepts 17" Paper)

CANON PW-1080A £278.26 + VAT = £320.00
CANON PW-1156A £360.00 + VAT = £414.00
KAGA KP810 £260.87 + VAT = £300.00

See below for Printerpack prices

KAGA SPEC AS CANON BUT APPROX 10% SLOWER

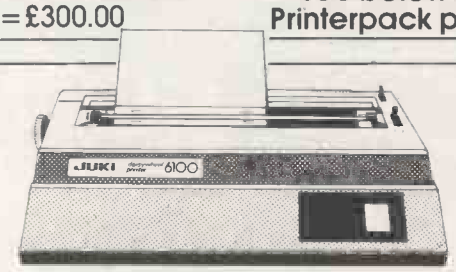
C.J.E. MICRO'S BBC PRINTERPACKS

CJE MICRO'S BBC PRINTERPACKS

For Star, Canon & Juki Printers include:

1. The Printer
2. Next Working Day Delivery
3. Cable to the BBC 1.25 Metres
4. Screen Dump Program (M/C Source)
5. Text Dump Program
6. Function Key set up Program. For use with WORDWISE
7. Function Key Label Printing Program. For use with above.
8. VIEW Printer Driver
9. 100 Sheets of Paper
10. Mains Plug with 3 Amp Fuse
11. Booklet giving details of using the printer with a BBC.
12. Character Defining Program for Downloadable-character-set

CANON PW-1080A C.J.E. PRINTER PACK £345 Inc. VAT
CANON PW-1156A C.J.E. PRINTER PACK £439 Inc. VAT
KAGA KP810 CJE PRINTER PACK £325 Inc. VAT
JUKI 6100 CJE PRINTER PACK £400 Inc. VAT
STAR SG10 CJE PRINTER PACK £275 Inc. VAT



JUKI 6100

One Year Warranty
20 CPS: BiDirectional & Logic Seeking
10, 12, 15 & Proportional Spacing
Wordstar Compatible
2K Buffer: 13 Inch Platen
Underline: Backspace + Lots more
Centronics Interface Standard
RS 232 Interface £54.00 + VAT Extra
Tractor Feed £119 + VAT Extra
Single Sheet Feeder £199 + VAT Extra
JUKI 6100 £330.43 + VAT = £380.00
See left for Printerpack prices

JUKI 6300: 40CPS: NOW IN STOCK

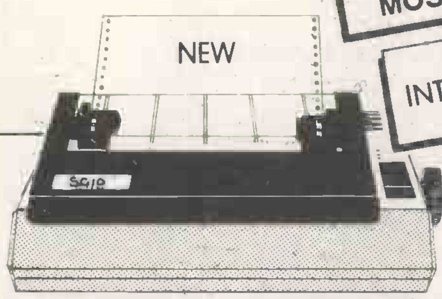
PRINTER CABLES/INTERFACES FOR MOST COMPUTERS STOCKED

SPECIAL RS 232 PRINTER BARGAIN

STAR DP8480 (8" Printing) £187.00 Inc VAT
Ideal for BBC/Newbrain/HX20 & Spectrum Int. 1
Phone for full specification

NEW

SPECIAL INTRODUCTORY PRICE



STAR SG10

NEAR LETTER QUALITY

NLQ Mode 17 x 11 Matrix
True Descenders 9 x 9 Matrix
120 CPS Bidirectional & Logic Seeking
40, 48, 68, 80, 96, 136 cpl
Italics, Emphasized, Double strike
Super & Sub Scripts
Downloadable Character Set
Hi-Resolution & Block Graphics
Friction or Tractor Feed
10" Carriage
See above for Printerpack prices

Centronics Interface Standard
RS232 Int. £52.00 + VAT Extra
STAR SG10 £250.00 Inc. VAT

STAR DELTA 10

160CPS: 8K BUFFER
CENTRONICS + RS232 INT'S STD
RING FOR SPECIAL PRICE

OFFICIAL ACORN APPROVED DEALER

PRINTAID

Powerful UTILITY for BBC word processors.
Mail Merging.
Easy entry of printer control codes.
Capability for proportional spacing with right-hand justification on Juki 6100
40 or 80 track. £16.00
Send or ring for details.

EXPORT ORDERS WELCOME

VAT INCLUDED WHERE APPLICABLE
PHONE/CREDIT CARD ORDERS WELCOME
Postage 50p per order or as stated
Next day Delivery for Printers/Disk Drives £8.00
FULL RANGE OF CONNECTORS & CABLES AVAILABLE
PRICE LIST ON REQUEST

RING FOR SAMPLE PRINTOUT, FULL SPECIFICATIONS & LATEST PRICES

CJE micro's

Dept PCW5 , 78 Brighton Road, Worthing
W. Sussex BN11 2EN (0903) 213900

Tasha Business Systems.
Your first choice for Microcomputers

OLIVETTI PC

M24: dual 320kb disk drive; 128kb RAM, keyboard monitor and MS DOS .... £call
M24: 10Mb Integral hard disk, 1 × 320kb disk drive, 128k RAM, keyboard, monitor and MS DOS .... £call

PORTABLE COMPUTER
M21: dual 320kb disk drive monitor .... £call

IBM SOFTWARE

WordStar Prof pack	£299
Lotus 1-2-3	£349
Symphony	£399
Framework	£call
Wordcraft	£call
Sage Accounts	£call
Pegasus Accounts	£call

We carry a large range of games for IBM PC

ADVENTURE
BUSINESS
STRATEGY

HEWLETT PACKARD

HP-150: dual 270kb 3½" disc drive 256kb RAM, keyboard, High resolution (512×390) monitor £1,999
HP-150: dual 720kb 3½" disk drive 256kb RAM, keyboard, High resolution (512×390) monitor .... £call
HP-150: 15Mb hard disk, 1×720 kb disk drive; 256kb RAM; keyboard, High resolution monitor .... £call

WORDSTAR **WORDCRAFT**
LOTUS 1-2-3 **MEMOMAKER**
MULTIPLAN **VISICALC**
DELTA 2 **PEAGUSUS**
ACCOUNTANCY

HEWLETT PACKARD HP110

The Portable HP 110: 272kb RAM 384kb ROM, 16 lines by 80 col LCD Lotus 1-2-3 Memomaker .... £call
Thinkjet Printer: portable £399
Portable disc drive 720k .... £call

GRAPHIC PLOTTER

HP 7470A	£1,099
HP 7475A	£1,637
Epson Plotter	£399
Apple Plotter	£399

HEWLETT PACKARD CALCULATORS

HP 11C	£54	HP 12C	£call
HP 15C	£call	HP 16C	£call
HP 75C	£599	HP 71B	£call
Visical pack	£119	Data Com Pac	£144
Text Formatter	£78		
HP 41C	£129	HP 41CV	£call
HP 41CV	£149	HP 41CX	£221
Card Reader	£145		
Printer	£call		
Cassette Drive	£call		

HITACHI PC

HITACHI PC: dual 320kb floppies 128kb RAM; keyboard; colour monitor, nucleus generator, MS DOS £1,249

MACINTOSH

IMacintosh 128kb RAM	£call
IMacintosh 512kb RAM	£call
External disk drive	£349
Image Writer Printer 10"	£385
Image Writer Printer 15"	£call

Multiplan	£190	TK Solver	£189
Chart	£145	Word	£179
Basic	£145	OMNIS1	£149
Lotus Jazz	£call	OMNIS2	£295
Copy-Mac	£call	OMNIS3	£399
MacPlot	£99	PFS: FILE	£call
		DFS: REPORT	£call
Clickart	£call	Macforth	£call
Mac the knife	£call	MacPascal	£99
Millionaire	£51	MacProject	£99
Zork I	£36	Macterminal	£call
Zork II	£42	Macdraw	£call
Zork III	£42	Deadline	£call
Witness	£call		

Hitchhiker's Guide to Galaxy £34

Music Composer	£69	MacCalender	£call
Frogger	£34	Trivia	£34
Lode Runner	£call	Funpack	£34
MacGammon	£call	Penstale	£call
Sargon III	£42	Payroll	£call

APPLE IIC PACKAGE

Apple IIC
Monitor IIC
Monitor Stand IIC
£999

APPLE IIe PACKAGE

Apple IIe 64k disk drive with controller
£599

EX-DEMO APPLE II

Silentype Printer III	£99
Apple Business Basic III	£49
VisiCalc III	£89
Apple Writer III	£99
Mail List Manager	£40

APPLE III PACKAGE

256k RAM Computer
5mbyte Hard disk
£1,999

SONY MODEL 10

WORD PROCESSOR

THINK JET PRINTER

150cps
£425

LASER JET

LaserJet Printer
£3,595

LETTER QUALITY PRINTERS

SILVER REED

EXP 500 Parallel/Serial	£270/310
EXP 550 Parallel/Serial	£360/399

BROTHER

HR-15 13cps (Diablo)	£389
HR-35 36cps (Diablo)	£call
Lazerjet Printer 300cps	£3,595

DOT MATRIX PRINTERS

Canon PW 1080A (160cps) 27cps NLQ £289
EPSON JX80 colour printer .... £call

LQ 1500	£call	RX80	£200
RX80 FT	£239	Plotter	£400
FX80	£call	P40	£87
FX100	£call	PX80	£160

HEWLETT PACKARD
Thinkjet Printer (150cps) £3,595

EPSON HX-20

£398

FREE INTEXT WORD PROCESSOR

EPSON HX20 EXECUTIVE

EPSON PX-8

FREE WORDSTAR SPREAD SHEET

£795

MSX COMPUTERS

SONY

HIT BIT 64k RAM	£260
Disk drive	£299

SANYO

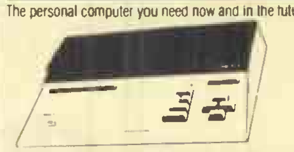
MPC 100 64k RAM	£221
Joysticks (two Ports)	£13
Light pen	£call

JVC
HC-7GB 64k RAM £225

PANASONIC

SHARP MZ 700

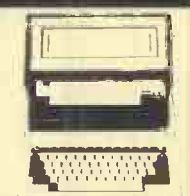
The personal computer you need now and in the future



MX 700 64kb RAM

£99

EX-DEMO SHARP PC5000



128kb Ram; 64kb Rom, 128 Bubble memory
Printer
Super Writer
Super Calc
Super con disk
M.R.P. £2,224 .... £1,699

COMMODORE

Commodore 64	£156
MSP801 Printer	£174
C2N Cassette	£39
Plus 4 Computer	£244
C2N Cassette	£39
1541 Disk Drive	£174

BBC MICRO

BBC Model B
£299

CASIO POCKET COMPUTERS

FX 720P	£49
FX 750P	£89
PB 410	£49
PB 110	£39
Ram Card RC2	£19
Ram Card RC4	£29
FP 200 Computer	£299
FP 1011 Printer	£169
FA20 Interface	£79
FA10 Interface	£179
CM1 Cassette	£59
FA4 Interface	£44

Tasha
Business Systems

Authorised Dealer
APPLE — COMMODORE — HEWLETT PACKARD — EPSON — SONY — OLIVETTI

01-937 8529
Monday to Saturday 9.30-6.30pm

- TBS reserves the right to change advertised prices
- Add 15% VAT
- Goods subject to availability

191 Kensington High Street, London W8   Tel: 01-937 7896 01-937 3366   Telex: 946240 (CWEASY G)   MBX No. 19001120

BBC MICRO COMPUTER SYSTEM

BBC Computers

Model B	£299 (a)	6502 Second Processor	£175 (a)
Model B + NFS	£335 (a)	Acorn IEEE Interface	£280 (a)
Model B + DFS	£346 (a)	Z80 2nd Proc. + Software	£348 (a)
Model B + DFS + NFS	£399 (a)	Bitstick + graphics Software	£325 (a)

TORCH UNICORN PRODUCTS:

ZEP100 Z80 Card with 64K Ram + Free Software Package	£275 (a)
ZDP240 Z80 Card with 2 × 400K Dual Drive + Software	£625 (a)
HDP68K + UNIX 68000 with Z80B & UNIX OS	£3495 (a)
GS800 GRADUATE 8086 + 256K RAM + Dual Drive + Xchange Software	£945 (a)

In addition to above we carry a very wide range of BBC firmware & software packages. Please write for further details.

SANYO COMPUTER SYSTEM

SANYO's MBC 555 Series featuring 16 bit 8088 CPU with powerful MS-DOS operating system. 256K on board ram with a dual drive system offering 360K or 720K storage capacity. Detachable keyboard with 81 keys including 5 user definable function keys. RGB/Composite Video with hi res 640 × 200 8 colour display. Centronics port as standard. Supplied with Systems dics, Sanyo BASIC and utility software which includes Professional WORDStar, DATAStar, SUPERSORT and CALCStar.

SANYO MBC 555-2 360K Drive	£1099 (a+b)
SANYO MBC 555-2 720K Drive	£1199 (a+b)

FREE SANYO Hi Res GREEN SCREEN MONITOR WITH THE COMPUTER

PRINTERS

EPSON

RX80FT 220(a) RX100 £345(a) FX80 £315(a) FX100 £430(a) H180 Plotter £399(a)

KAGA TAXAN NLQ Printers
KP810 £225(a) KP910 £349(a)

DAISY WHEELS
JUKI 6100 £325(a) BROTHER HR15 £325(a)

PRINTER ACCESSORIES

EPSON

Serial Interface: 8143 £28(b);
8148 with 2K buffer £59(b).
32K Parallel Buffer £99(b)

Paper Roll Holder £17(b);
FX80 tractor Attachment £37(b)
Ribbons: MX/RX/FX 80 £5(c);
MX/RX/FX 100 £10(c).
Dust Covers: RX/FX 80 £4.50(c);
RX/FX100 £6.50(c).
KAGA Serial I/face with 2K Buffer £65(c)
Ribbon £6(c)

JUKI Serial I/Face with 2K Buffer £60(b);
Ribbon £2.50(d).
JUKI Sheet Feeder £182(a);
Tractor Feed £129(a).
BROTHER HR15 Sheet Feeder £199(a);
Tractor Feed £99(a).
2000 Fanfold sheets with extra fine perforations
9.5" × 11" £13.50(b); 14.5" × 11" £17.50(b).
Self Adhesive Labels 3½" per 1000.
Single Row £5.25(d); Triple Row £5(d).
Parallel Leads: IBM £18(c); BBC £7(c).

ALL PRICES EXCLUDE VAT
Please add carriage 50p unless indicated as follows
(a) £8 (b) £2.50 (c) £1.50 (d) £1.00

MODEMS

— All modems listed below are BT approved

MIRACLE WS2000:
The ultimate world standard modem covers all common BELL and CCITT standards up to 1200 Baud. Allows communication with virtually any computer system in the world. The optional AUTO DIAL and AUTO ANSWER boards enhance the considerable facilities already provided on the modem. Mains powered £129(b). Auto dial Board/Auto Answer Board £30(c) each awaiting BT approval. Software lead £4.50.

TELEMOD 2:
Complies with CCITT V233 1200/5 Duplex and 1200/1200 half Duplex standards that allow communications with VIEWDATA services like PRESTEL, MICRONET etc, as well as user to user communications. Mains powered £64(b).

BUZZ BOX:
This pocket sized modem complies with V21 300/300 Baud and provides an ideal solution for communications between users, with main frame computers and bulletin boards at a very economic cost. Battery or mains operated, £62(c). Mains adaptor £8(d).

BBC to Modem data lead £7.

We also stock a full range of TTLs CMOS, CPU's, RAMs, EPROMS. Please write for our catalogue.

EPROM PROGRAMMERS

Industrial Programmer P8000	£695(a)
Industrial Prod. Programmer P9010	£795(a)
Industrial Prod. Programmer P9020	£995(a)
Industrial Prod. Programmer P9030	£1295(a)
GANG OF EIGHT PRODUCTION POROGRAMMER	£395(a)

UV ERASERS:

UV1B 6 Eprons	£47(b)
UV1T with timer 6 Eproms	£59(b)
UV140 14 Eproms	£71(b)
UV141 with timer 14 Eproms	£88(b)

DISC DRIVES

BBC compatible disc drives, fully cased and supplied complete with cables, manual and formatting disc for operation with the BBC micro. These drives can operate in both single and double density modes and are suitable for use with any micro with Shuggart A400 interface. Mechanisms available separately.

Single Drives:		
1 × 100K 40T SS	TS100 £85(b)	PS100 with psu £125(b)
1 × 400K 80/40T DS	TS400 £125(b)	PS400 with psu £149(b)
Dual Drives: Stacked Version:		
2 × 100K 40T SS	TD200 £175(a)	PD200 with psu £200(a)
2 × 400K 80/40 DS	TD800 £275(a)	PD800 with psu £300(a)
Plinth Version:		
2 × 40T 100K SS	TD200P £195(a)	PD200P with psu £200(a)
2 × 400K 80T DS	TD800P £295(a)	PD800P with psu £315(a)

3M FLOPPY DISCS

Authorised Distributor
Data Recording Products

3M

Industry standard high quality discs with guaranteed error free performance for life.
Discs in packs of 10:

40T SSDD £15(c)	40T DSDD £18(c)
80T SSDD £22(c)	80T DSDD £24(c)

MONITORS

All monitors supplied with BBC lead

MICROVITEC 14" RGB

1431 Standard Resolution	£165(a)
1451 Medium Resolution	£240(a)
1441 Hi Resolution	£389(a)

MICROVITEC 14" RGB with PAL & Audio

1431 AP Standard Resolution	£205(a)
1451 AP Medium Resolution	£280(a)

KAGA TAXAN 12" RGB

VISION II Hi Res	£225(a)
VISION III Super Hi Res	£325(a)

MONOCHROME MONITORS:

SANYO DM8112CX Hi Res 12" Green Screen	£90(a)
KAGA KX1201G Hi Res 12" Etched Green Screen	£99(a)
KAGA KX1202A Hi Res 12" Etched Amber Screen	£105(a)
ZENITH 123 Hi Res 12" Green Screen	£70(a)
ZENITH 122 Hi Res 12" Amber Screen	£70(a)

DRIVE ACCESSORIES

FLOPPICLENE Disc Head Cleaning Kit with 20 disposable cleaning discs ensures continued optimum performance of the drives. £14.50(c)

Single Disc Cable	£6(d)	Dual Disc Cable	£8.50(c)
10 Disc Library Case	£1.80(d)	30 Disc Storage Box	£6(c)
40 Disc Lockable Box	£14(c)	100 Disc Lockable Box	£19(b)

PRINTER SHARER/BUFFER

A unique printer sharer/buffer that provides a simple way to improve the utilisation of the installed equipment by reducing the waiting time for printing documents.

- STANDARD Centronics Interface with 3 inputs
- EACH input port scanned every 5 secs to check for data. Switching between ports completely automatic.
- Data Input rate 4800 bytes/sec
- LED Bargraph indicates percentage memory used.
- COPY key allows current document to be reprinted.
- Internal check to prove the data integrity.
- PAUSE switch allows printing to be stopped temporarily to allow paper change, adjust form feed etc. or allows temporary storage for large number of small files which can all be printed together.
- RESET allows all buffer memory to be cleared without having to hard break on the computer.
- 64K buffer capacity.
- Mains powered
- Compact 7cm × 17cm × 24cm

TSB 64 Buffer/Sharer £245(a)
Cable Set £30

PRINTER/COMPUTER SHARERS

Three computers to one printer (Centronics — 26 pin) £65(b)
External power pack £6.50

Cable Set (ea 1m long) £25(d)
Three computers to one printer (Serial) £75(b)

CONNECTOR SYSTEMS

I D CONNECTORS

	Headers	*Receptacles*	*Edge Conns*	*Grey Cable/m*
10 Way	90p	85p	120p	40p
20 Way	145p	125p	195p	85p
26 Way	175p	150p	240p	120p
34 Way	200p	160p	320p	160p
40 Way	220p	190p	340p	180p
50 Way	235p	200p	390p	200p

AMPHENOL CONNECTORS

	Solder	*IDC*
36 Way Centronics Plug	500p	475p
36 Way Centronics Socket	550p	500p
24 Way IEEE Plug	475p	475p
24 Way IEEE Socket	500p	500p

PCB Mtg Skt
Ang. Pin 36 Way 750p 24 Way 700p

RS 232 JUMPER LEADS WITH 25 WAY CONNECTORS

24" Single end Male	£5.00
24" Single end Female	£5.25
24" Male to Male	£8.25
24" Female to Female	£9.50
24" Male to Female	£9.00

Other lengths available

TEXTOOL ZIF SOCKETS

24 pin	£5.75
28 pin	£8
40 pin	£9.75

GENDER CHANGERS

25 Way D type

Male to Male	£10
Female to Female	£10
Male to Female	£10

D CONNECTORS

	No of Ways 9	15	25	37
Male				
Solder	60p	85p	125p	170p
Angled Pins	120p	180p	240p	350p
IDC	175p	275p	325p	—
Female				
Solder	90p	130p	195p	290p
Angled Pins	160p	210p	290p	440p
IDC	195p	325p	375p	—
Hoods	90p	95p	100p	120p
Screwlock Hood	130p	150p	175p	—

TECHNOMATIC LTD

MAIL ORDERS TO: 17 BURNLEY ROAD, LONDON NW10 1ED
SHOPS AT: 17 BURNLEY ROAD, LONDON NW10
(Tel: 01-208 1177 (4 lines) Telex: 922800)
305 EDGWARE ROAD, LONDON W2

PLEASE ADD 50p p&p & 15% VAT
(Export: no VAT, p&P at Cost)
Orders from Government Depts. & Colleges etc. welcome.
Minimum Telephone Order £5.
Detailed Price List on request.
Stock items are normally by return of post.

FREE! £400

worth of Mac-Software or Mac-Hardware when you

buy

128K RAM

from Tasha

To qualify for this offer, please hand in this advertisement when you make your purchase. Offer ends on 31st May 1985.

Tasha e.
Business Systems

Authorised Dealer

191 Kensington High Street,
London W8

Phone: 01-937 8529
01-937 3366

Telex: 946240 (CWEASY G)
MBX No. 19001120

640K Upgrade Free

With IBM-PC, XT And Compaq Complete Systems

EXAMPLE PRICE

64K PC	1139
Keyboard	185
Second Drive	297
Mono Adapter	181
Mono Display	186
DOS 2.1	59

Upgrade to 640K FREE

TOTAL COST £ 2047

Phone for your configuration quote

LIMITED OFFER!

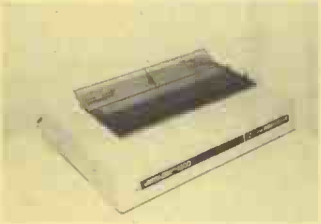
Please Phone Your Nearest Branch

NORTH LONDON 637, HOLLOWAY ROAD LONDON N19 5SS 01-281 2431
SOUTH LONDON 67, WESTOW STREET, UPPER NORWOOD LONDON SE19 3RW 01-771 6373
MIDLANDS 14, CHARLES STREET, HANLEY STOKE-ON-TRENT ST1 3AR (0782) 269 883

MICROWARE

IBM Authorised Dealer

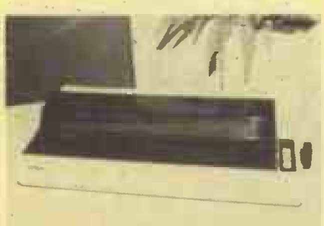
PRINTERS



JUKI PRINTERS

An exceptional range of high quality, low cost daisywheel printers.

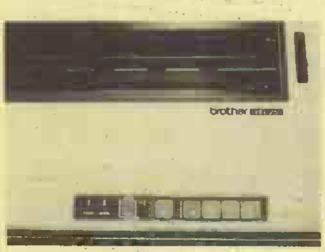
- Juki 6300 .... £699
- Tractor Feed £135
- Juki 6100 .... £350
- Tractor Feed £125
- Serial Int £50
- 2200 + Keyboard £245



EPSON PRINTERS

Market leaders in dot matrix printers, including the new JX80 colour printer and H180 plotter.

- FX100 + ... £495
- RX100 .... £399
- FX80 + ... £399
- RX80 FT + ... £255
- JX80 Colour £445
- H180 Plotter £399
- HP Int. for H180 .... £99
- LQ 1500 .... £995
- Feeder for LQ1500 .... £365
- Tractor for LQ1500 .... £52
- Tractor for FX80 .... £38



BROTHER PRINTERS

Highest quality medium speed daisywheel printers. Complete range of accessories. Superb letter quality on new 2024 NLQ dot matrix.

- HR15 Daisywheel £399
- HR25 Daisywheel £675
- HR35 Daisywheel £999
- Sheetfeeders £220
- Tractors £99
- 2024 Letter Quality £999

CANNON PRINTERS

Value for money dot matrix NLQ printers. Feature reverse feed tractor for labels and forms.

- 156 Column £359
- 80 Column £299

NEC PRINTERS

Top of the range hard wearing printers, suitable for long periods of continuous use.

- 3550 IBM Comp £1,199
- 7700 High Speed £1,595
- 8800 IBM Comp £1,795
- T Switch £79
- Printer Cables £25

Full range of ribbons and wheels stocked. Ask about our unique genuine A4 continuous stationery.

SOFTWARE

WORD PROCESSING

Increase the efficiency and productivity of your paper flow. Standard letters, multilingual, multiple copy, spell checkers and address merging.

- Wordstar £245
- Mailmerge £125
- Spellstar £125
- Microsoft Word £245
- Mouse for above £175
- Wordcraft £399
- Disp/Write 1 .... £82
- Disp/Write 2 .... £250
- Writing Assistant £95
- Easy Writer £95
- Multimate £375
- Perfect Writer £45
- Typing Tutor £49

DATA BASES

Increase the accuracy and speed with which you can find facts, records and figures. We specialise in modifying DBASE to provide you with up to the minute management reports and information at the touch of a button.

- DBASE II £295
- DBASE III £450
- DBASE Programs .... Call
- Delta £455
- DMS £175
- DGRAPH III £295
- Cardbox Plus £295
- Filing Assistant £95
- Everyman £395

PROJECT MANAGEMENT

Produce resource scheduling/project plans. Create GHANT and PERT diagrams, critical path, cashflow forecasts and completion dates.

- Pertmaster 1000 .... £525
- Pertmaster 2000 .... £999
- Hornet 4000 .... £2,500

SPREADSHEETS

Produce financial reports and forecasts with graphical presentation, including 'What If' calculations and models. Full management accounts and statistical models can be compiled to your specification. A large range of standard models kept in stock.

- Lotus 123 .... £345
- Multiplan £137
- SuperCalc III £295
- FT Moneywise £325

MULTIPURPOSE

Combine graphics, database, word-processing, spreadsheet and communications all in one program.

- Framework £450
- Symphony £450
- Open Access £395

ACCOUNTING

Pegasus Single/Multi-User

Market leaders in accounting software. This product is well proven with thousands of installations nationwide. All modules can be integrated for accuracy and time saving. A file tansfer utility allows you to use data from your accounts in a spreadsheet in order to create up to the minute forecasts and reports.

- Sales £295
- Purchase £295
- Nominal £295
- Invoicing £295
- Payroll £295
- Jobcosting £295
- Bill of Material £295
- Stock Control £295

Discounts for more than one module purchased at a time.

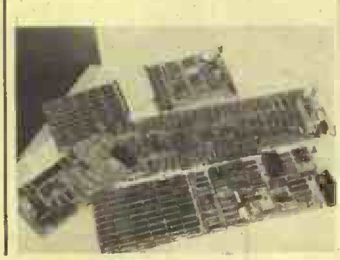
UTILITIES

For communications or file handling:

- Sidekick £69
- Xenocopy £149
- Apple T/O £249
- Crosstalk £129
- Norton Utilities £89

We stock hundreds of different software products in each of our stores. Demonstrations available by appointment our premises or yours.

ADD ONS



MULTIFUNCTION CARDS

Increase the power of your system with the latest state of the art hardware upgrades.

- 64K RAM Upgrade £45
- Serial/Parallel Int £87
- 384K RAM Card includes Clock, Battery + 64K £249
- MAXI CARD includes Clock, Battery, Calendar, Games Port, 2 Serial + 1 Parallel Port, Spooler and Silicon Disk £275

GRAPHICS

Use graphics in monochrome, or view Lotus/Symphony graphs before printing.

- Hercules Card £350
- High Graph Card £299
- Amber Mono Display £225

For high resolution colour (640×400) pixels.

- Tecmar Card £695
- Dazzler Card £745
- Quadram Monitor £769
- Microvitec Monitor £640

DISK UPGRADES

Upgrade your PC Instead of replacing your system. All prices include fitting.

- Dual 360K Half HT £295
- Dual 820K Half HT £395
- 10 MB + Controller £899
- 20 MB + Controller £999
- 45 MB Tape backup £1,495

NETWORKING

Your stand alone systems can be networked to share data, programs and resources.

- IBM Cluster/Stn £399
- PC Net/Stn £450

MODEMS

- Pace Multifunction £137
- Datacom £295
- Telebox £1,295
- Braid System £1,595

ORDERING INFO:

PLEASE SEND ME INFORMATION ON

- SYSTEMS ☐
- PRINTERS ☐
- SOFTWARE ☐
- ADD ONS ☐

Name________________

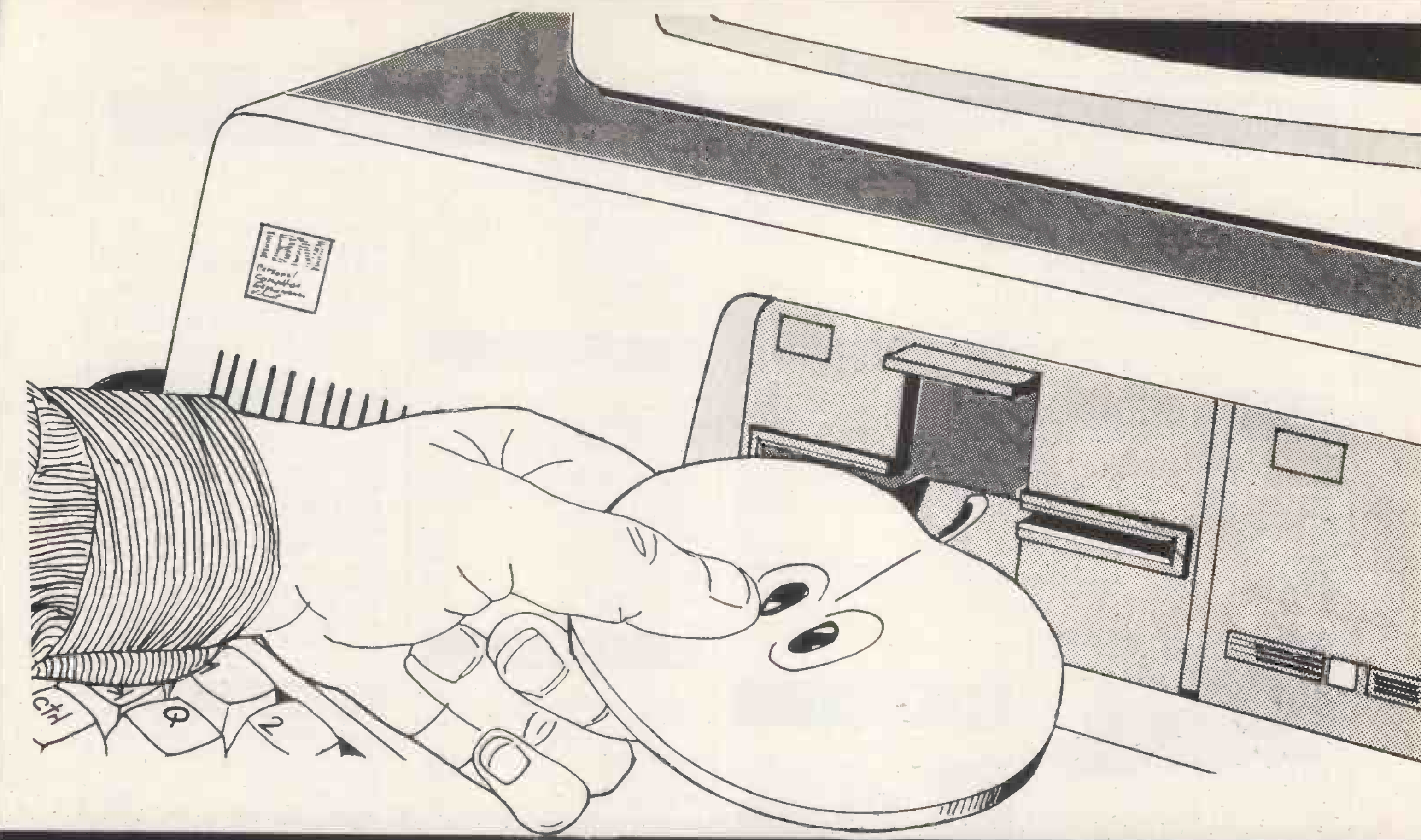
Address________________

Tel:________________

Midlands
14 Charles Street, Hanley
Stoke-on-Trent
(0782) 269883

North London
637 Holloway Road
London N19 5SS
01-281 2431

South London
67 Westow Street
Upper Norwood
London SE19
01-771 6373



UDM makes it possible!

READ, WRITE, and FORMAT APPLE disks in the IBM PC

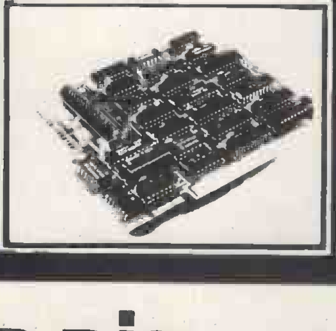
No modems. No serial links. No hassles. Say Goodbye to the TOWER OF BABEL.

READ, WRITE, and FORMAT APPLEDOS 3.3 and APPLE CP/M disks in your IBM-PC/XT or compatible. Transfer files to an APPLE disk and take your work home (when you need to) and then transfer the updated files back to an MS-DOS disk. Quickly, accurately, and effortlessly. Serial-file transfer methods can take hours. APPLE-TURNOVER takes only minutes.

All you need is the APPLE disk. All transfers are accomplished on the host computer. No need for modems, cables, or expensive down-loading services. The included software is menu-driven and easy to use. Options allow complete flexibility. Installation of the APPLE-TURNOVER printed circuit card takes just a few minutes and will not interfere with normal computer activities.

Make your APPLE deliciously more useful and a productive partner to your PC. Quick and easy file transfers will open a new world of productive applications. Finally, computer incompatibility can be a thing of the past. The Tower of Babel-like scenario that has plagued the microcomputer industry for so long can be conquered with the product you hold in your hands... APPLE-TURNOVER.

REQUIREMENTS: IBM-PC/XT and compatibles need **128K** of memory and two disk drives (hard disk OK) running PC or MS-DOS with one expansion slot for installation of the APPLE-TURNOVER half-size board.

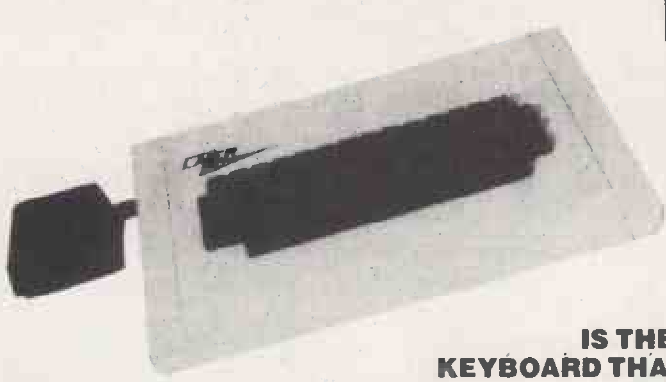


APPLE TURNOVER™

UNITED DISK MEMORIES **01-281 2438**

STANHOPE HOUSE
FAIRBRIDGE ROAD, LONDON N19 3HP

DESIGNS THAT DELIVER UDM



IS THE KEYBOARD ON YOUR ZX HOLDING YOU BACK?

HERE IS THE ANSWER

THE LAZER 62

IS THE ONLY FULLY FUNCTIONABLE 62 KEY/ KEYBOARD THAT WILL TRANSFORM YOUR SPECTRUM INTO A PROFESSIONAL USER COMPUTER LOOK AT SOME OF ITS FEATURES

THE LAZER 62

62 Full Travel Gold contact keys laid out to "Qwerty" standard for serious use by typists and programmers.

22 Keys are autoshifted giving single entry to Edit-Delete-Caps lock etc. No more using 2 or 3 fingers.

Strong attractive low profile case actually houses the Spectrum PCB with built in on/off switch.

Compatibility with Interface 1 and Microdrive maintained.

Easy to assemble — no soldering.

FROM

MICROBOARD INTERNATIONAL

TELEPHONE
0483-38006 (SALES)
04862-24567 (TECHNICAL)

TRADE ENQUIRIES
WELOME

NOW £59.95

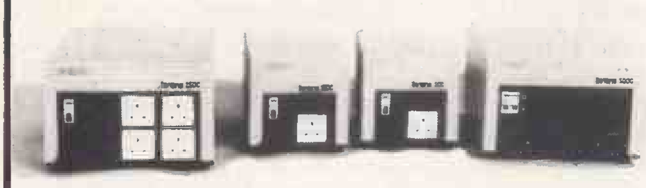
(INC VAT)

Please send me .... Lazer 62 Keyboard(s)
@ £59.95 + P&P (UK £2.25-Europe £6.75-World £12.00
I ENCLOSE CHEQUE/VISA NO________

TO MICROBOARD INTERNATIONAL
SALES OFFICE, 12C WORPLESDON ROAD
GUILDFORD SURREY GU2 6RW
ENGLAND

Data Corruption?

Voltage surges, sags, spikes, glitches, R.F. and other mains interference can corrupt vital data, a nightmare for many people reading this ad. Banish the nightmares with a Sentinel Line Conditioner.



- ★ Inexpensive to run, being 97% efficient.
- ★ Wide input voltage capability + 20% to −28%.
- ★ Up to 5KVA loading.
- ★ 115V, 220V, 240V options.
- ★ European or U.K. standard socket options.
- ★ 50 or 60Hz option.
- ★ R.F./Noise isolation:- >100db @ <100KHz
  > 60db @ >100KHz

The Solution

Two decades of design and manufacture enable us to offer:-

- ★ Office UPS systems from 250VA to 20KVA.
- ★ Industrial UPS systems 500VA to 400KVA.
- ★ Microprocessor controlled line conditioners 500VA to 5KVA.
- ★ Ferroresonant line conditioners 5KVA to 135KVA.
- ★ Mains filters/Spike catchers up to 750VA.
- ★ Frequency changers up to 135KVA.
- ★ Inverters up to 135KVA.
- ★ Customised and Military Spec., (05-21) specials.

G&R ELECTRONICS LTD

THE WORLD OF POWER

Brunel Rd, Salisbury, Wilts, SP2 7PT Telex 477064 Telephone (0722) 28801 A member of the DOWTY Group.

NOBODY KNOWS AS MUCH ABOUT COMMUNICATIONS AS THE BYTE SHOP

Communication is something The Byte Shop is quite expert at. Communication between person and person. Machine and machine. Man and machine.

More companies recognise this today which is why fewer and fewer are investing in 'stand-alone' computer systems.

Now the emphasis is on networking capabilities. It's an aspect that gives more people more access to computers so they can interchange ideas and information.

The Byte Shop has the expertise to provide objective advice on networking as well as a broad spectrum of computer related topics.

We will assess your current needs and future requirements. We can also install and commission your complete system. Help you make the right choice of application software. Train your staff and supply that all important service and technical back-up.

At The Byte Shop you'll get a system that suits your needs and your budget. Send for our free brochure, 'Where can you count on getting the right Business Computer?', simply complete and post the coupon.

Authorised Dealers of IBM PC, Comart, Compaq and Data General.

The BYTE SHOP BUSINESS COMPUTER CENTRES

KI A Kode International plc Company

Head Office: The Byte Shop Limited, Grove House, Little Paxton, Cambs. PE19 4EL. Telephone: 0480 218812. Telex: 32514G

To: The Byte Shop Head Office, FREEPOST, Grove House, Little Paxton, Cambs. PE19 4BR (No stamp required)

Please send me .... copies of your brochure

Name ....

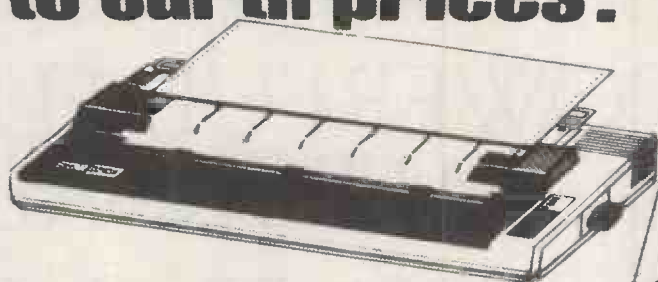
Company ....

Position .... Tel ....

Address ....

.... PCW

BYTE SHOP NATIONWIDE BUSINESS CENTRES: LONDON (01) 387 0505 · BIRMINGHAM (021) 622 3165 · GLASGOW (041) 221 8202 MANCHESTER (061) 236 4737 · NOTTINGHAM (0602) 470576 · SOUTHAMPTON (0703) 334711



Word-Bird

is not **"user friendly"** it is *easy* and *natural* to use.

No commands, no keying-in sequences, no "easy" reference cards.

Can be used immediately, mastered in days.

Labels, letters and fully-formatted books are typed direct to the screen, as they will look on paper, with all the emphasis and special characters your printer is capable of.

Easy, natural multi-lingual use.

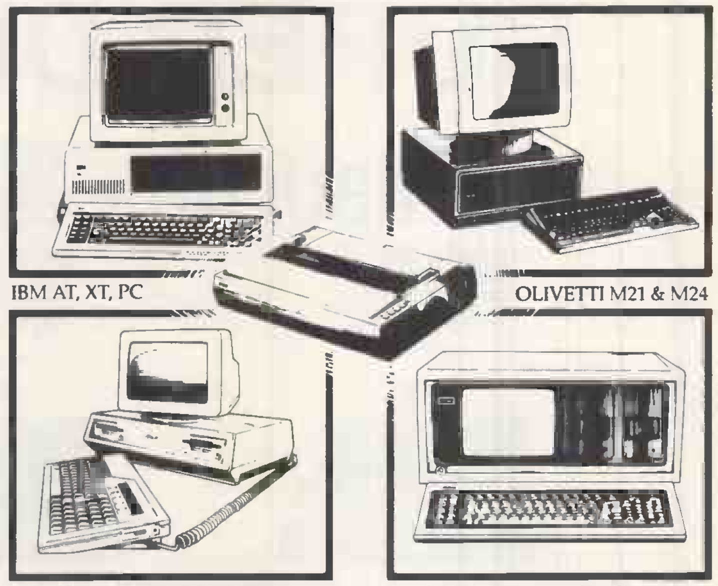
Full wordprocessing power at your fingertips.

*Phone for your **FREE** copy of the* Word-Bird Book of Wordprocessing *now!*

LEABUS
Legal & Business Software

114 Brandon Street
London SE17 1AL
Telephone: 01-708 2756

If in doubt, try renting first...



with the best — Silicon Valley

If you're not sure whether to computerise or what hardware to choose, or where to go for the best advice and service — come to Silicon Valley.

We are one of London's largest micro dealers with over 7 years trading experience behind us. And we intend trading for many years to come, which means we are not the cheapest.

We offer you unrivalled service and value for money. We supply hardware, software, training and insurance with full back-up support and maintenance.

As authorised dealers for ACT, Apple, Compaq, Olivetti and of course IBM, we have a reputation to protect. So we don't cut corners — in fact you will be surprised at how much extra you get with Silicon Valley.

To find out more about renting the Silicon Valley way, please telephone or send off the coupon below using the FREEPOST address (Silicon Valley will pay the postage — you do not need a stamp).

silicon valley
COMPUTER CENTRE

164 Grays Inn Road, London FREEPOST WC1X 8BR
Tel: 01-833-3391 Telex No 8813271 GECOMS G

For further details and a full 100% rebate on our rental scheme, complete this coupon and return.

Name ______________________

Position ______________________

Company ______________________

Address ______________________

______________________ Postcode ____________

Telephone No: ______________________ PCW/5/85

Softlife

A LOW COST EPROM PROGRAMMER FOR THE BBC MICRO

- Programs 2764, 27128, 2764A and 27128A Eproms
- Only connection to User Port on BBC
- Operating software supplied in Eprom – no tape loading problems
- ROM format command allows Basic programs and other files to reside in Eprom
- Fast error-free programming
- Zero insertion-force socket for ease of use
- Compact, sturdy construction
- Comprehensive documentation

- Proven in Scientific, Educational and Industrial environments

£67.00+VAT (inc.p&p)

For technical information contact:
Alastair France B.A.
Softlife Ltd 7 Rose Crescent
Cambridge CB2 3LL

KIRKLANDS MICRO-WAVE LTD

PRINTER

SUPER DEAL

Simply the lowest price printer suppliers anywhere in the UK

The FABULOUS star PRINTERS

Gemini-10X	**£215.00**	Delta-10X	**£343.00**	Radix-10X	**£448.00**
Gemini-15X (136 Column)	**£310.00**	Delta 15X (136 Column)	**£437.00**	Radix-15X (136 Column)	**£549.00**

IBM versions of Gemini and Delta in stock — please phone

Star Printers are Epson Compatible

EPSON Price Breakthrough

RX80	**£210.00**	FX80	**£360.00**	DX100 (Daisy)	**£410.00**
RX80FT	**£245.00**	FX100	**£465.00**	LQ1500	**£920.00**
RX100	**£375.00**	JX80 (New 4-Colour)	**£483.00**	HI80 Plotter	**£350.00**

We also stock all printer peripherals — call us for the best prices in the UK

Beautiful BROTHER Printers

HR5	**£148.35**	HR35	**£793.50**	New 2024 NLQ Printer	**£900.00**
HR15	**£378.35**	New M1009	**£178.25**		
HR25	**£631.35**	EP44	**£212.75**		

We can now offer the fabulous TEC Disk Drives, suitable for the BBC Micro (including leads + format + manual) 100K **£125.00**

Ring for other details

All prices include VAT. P&P Next day: £10.00 or £5.00 for normal service. Educational orders welcome

All products carry a FULL 1 YEAR WARRANTY. Shop hours: 9.00-5.30 Mon-Sat

KIRKLANDS BUSINESS SYSTEMS LTD

KIRKLAND HOUSE, 27 CITY ROAD, STOKE

Tel: 0782 414333

KIRKLANDS BUSINESS MACHINES

PRESENTS

THE KBM CANARY SYSTEM FIVE

THE FIRST FULLY IBM-COMPATIBLE THAT YOU CAN AFFORD

★ Price of the KBM Canary System Five (including a FREE disk operating system is only £1650.00 OR less than £10.00 per week (subject to approval).

★ Guaranteed FULLY compatible with the IBM-PC-&-XT. (Optional 10Mb Winchester hard disk at only £995.00 extra installed).

★ Works with ALL KNOWN IBM cards and software (except of course IBM-basic) so no problems with service!

★ Runs Concurrent PC-DOS 3.1 & 3.3 & MS & PC-DOS.

★★ BONUS 2 STAR EXTRAS AS STANDARD

★★ Colour Card

★★ Multi I/O Card

★★ 512K RAM Card

★★ Assync Comms Port

★★ 128K RAM on board

★★ Free DOS

★★ FULL 1 YEAR WARRANTY

We carry a full range of IBM-Compatible peripherals and cards at better than competitive prices usually available ex-stock. Phone for details.

We accept Educational orders on receipt of an official order. All prices exclude VAT and carriage is £20.00 for next day service in the UK mainland. Check for other areas. Access and Barclaycard welcome.

CONTACT

KIRKLANDS BUSINESS SYSTEMS LTD.
KIRKLAND HOUSE, 27 CITY ROAD,
STOKE-ON-TRENT ST4 1DH

OR WRITE TO

KIRKLANDS BUSINESS SYSTEMS
FREEPOST, STOKE-ON-TRENT ST4 1BR
Telephone: (0782) 414333 or 415787 now

Please send me a free information pack.
INTERGALACTIC ROBOTS LTD., UNIT 208, HIGHBURY WORKSHOP, 22 HIGHBURY GROVE, LONDON N.5.

Name ____________________

Address ____________________

____________________ PCW1

THE PRICE IS RIGHT!

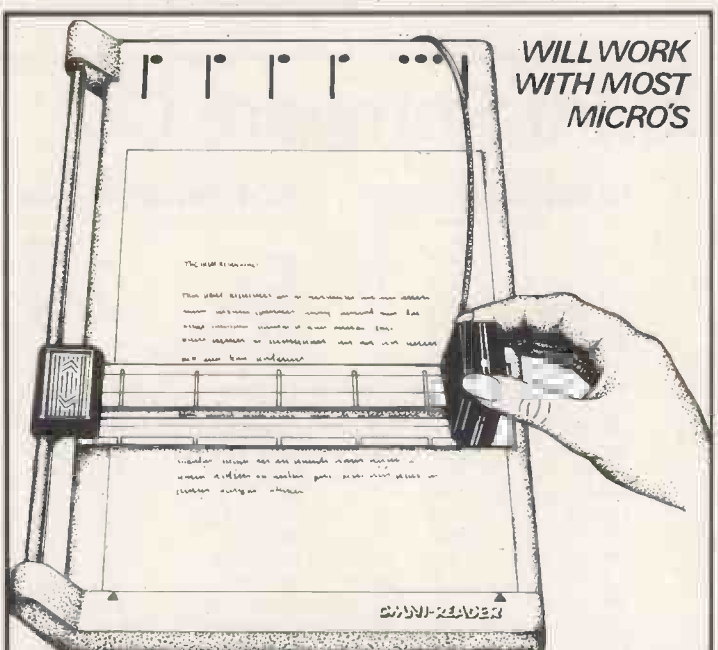
Look at this list of machines – all ex-demo stock. Mostly unmarked and in mint condition – AND THEY MUST BE CLEARED!!

Equipment	Qty.	RRP	
COMMOOORE			
64 Computer	– 2 only –	199.13	144.00
1540 Disk Drive	– 1 only –	199.13	152.00
MPS 801 Printer	– 2 only –	200.00	149.00
MCS 801 Col. Printer	– 2 only –	346.00	299.00
8096-SK Computer	– 1 only –	795.00	630.00
8296 Computer	– 1 only –	795.00	670.00
8050 1 MB Dual Drive	– 1 only –	895.00	600.00
8250 2 MB Dual Drive	– 1 only –	895.00	750.00
8027 Printer	– 1 only –	850.00	395.00
3022 Matrix Printer	– 2 only –	395.00	149.00
2023 Matrix Printer	– 2 only –	395.00	125.00
9090 Hard Disk	– 1 only –	2495.00	1395.00
APRICOT			
256k × 630k & Monitor	– 1 only –	1795.00	1390.00
F1 256K × 720K	– 1 only –	1095.00	875.00

Equipment	Qty	RRP	
SANYO			
MBC 555 128k & Mon.	– 1 only –	999.00	798.00
TIGER			
264K × 2Mb & Colour & Monitor + Software	– 1 only –	2700.00	1995.00 (or sensible offer)
EPSON			
PX-8 Portable	– 1 only –	798.00	598.50
SIRIUS 1			
128K × 1.2Mb & Monitor	– 1 only –	2195.00	1550.00
OTHER PRINTERS			
Centronics 737	– 1 only –	399.00	200.00
GP700A 4 Colour Matrix	– 1 only –	495.00	300.00
Smith-Corona Daisywheel	– 1 only –	395.00	199.00
Centronics 779	– 1 only –	795.00	200.00

MANY OTHERS – PHONE & ASK!

STOP PRESS! PLUS 4 ONLY £130.42! SX-64 ONLY £499.99!



A REVOLUTION IN TAKING WORDS FROM PAGE TO COMPUTER

The OMNI-READER can read text into most word processors, micro and personal computers. It attaches through a Serial RS232C interface as easily as a modem.

The OMNI-READER comes pre-programmed to recognise the most commonly used typefaces.

APPLICATIONS

- Word processor input – entering existing documents.
- Transferring text between incompatible computer/ word processor systems without the need for re-typing.
- Inputting tables of data, or new data into spreadsheet or database programmes.
- Entering text for electronic mail.
- Storing and editing documents for electronic filing.

AND IT ONLY COSTS £399!

EASYLINK WORLDWIDE LOW COST TELEX DIRECT FROM YOUR DESK!
THE MOST EFFECTIVE WAY TO BETTER BUSINESS COMMUNICATIONS. Allows you to connect to UK & INTERNATIONAL TELEX networks using your existing MICRO, with Hardware & Software ... Enables you to start from as little as £100!

We carry a wide range of SOFTWARE for all our machines, including WORDPROCESSING packages and SPREADSHEETS.
Most SOFTWARE is available ex-stock.
Specialist applications and bespoke programs also catered for.
Call us for info on our Cash Book and Bar Stock Records programs!

ALL PRICES EXCLUDE VAT

One of Commodore's top UK dealers!

L & J COMPUTERS

192 HONEYPOT LANE, QUEENSBURY, STANMORE, MIDDX. HA7 1EE. 01-204 7525

PERSONAL SHOPPERS WELCOME
Phone & Mail Orders accepted

ALL GOODS SENT SAME DAY WHEREVER POSSIBLE LARGE S.A.E. FOR LISTS ETC.

Access BARCLAYCARD VISA

Project Planners. Whatever the problem, put your finger on it.

When you get your finger (let alone your hands) on the Macintosh computer and MICRO PLANNER, remarkable things will happen.

Even if the nearest you've previously been to a computer is a space invader, you'll find yourself immediately in control.

The Macintosh is designed for people who simply want to get on with their work - instead of constantly prodding the computer to find out how it works. In fact it's so user-friendly that many people call it "user-cuddly".

MICRO PLANNER helps you get on with managing projects in a way that'll have you uttering words like "magic", and your boss wanting one too. It tightens control of every aspect of project co-ordination: defining feasible deadlines and showing how to meet them; establishing overall costs and indicating the effect of delays; controlling the use of available resources and smoothing out workloads for maximum efficiency.

The "mouse" on the Macintosh means that most of these functions can be carried out simply by pointing a finger. Whatever aspect of project management you deal with, the results are insanely great!

Point yourself in the right direction immediately by phoning Sarah. If you can contain your excitement, ask her in as calm a voice as possible to rush you full information on MICRO PLANNER and give you up-to-the- minute reports on where to put your fingers on it.

MPS
MICRO PLANNING SOFTWARE LIMITED

34 High Street, Westbury-on-Trym, Bristol BS9 3DZ. England.
Tel: 0272 509417 Telex: 44220 Comtel Ref. 349

Projects flow better with Micro Planner

Crestmatt challenge you to find a better deal.

Apricot F1 £1095+VAT
256k business system
1×720k double-sided d/d
FREE 12" monitor
FREE SC Fastext 80 printer
FREE tractor feed/cable
SuperWriter w/processor
SuperCalc spreadsheet
SuperPlanner
GSX graphics utility
ACT Diary
ACT Sketch

Apricot PC £1595+VAT
256k business system
2×315k disc drive
FREE 9" ACT monitor
FREE MT80+ printer/cable
SuperWriter w/processor
SuperCalc spreadsheet
SuperPlanner
FREE 10 blank discs
FREE box of paper

Olivetti M24 £1939+VAT
128k business system
fully IBM compatible
12" mono display,
keyboard and MSDOS
2×320k d/drive
FREE MT80+ printer & cable
FREE 128k expansion
FREE 10 discs
FREE box of paper

Compaq Portable £2195+VAT
256k business system
fully IBM compatible
2×320 k disc drives
FREE Lotus 123 s/sheet

authorized software dealers for AshtonTate, SageSoft Pegasus, CashLink, Anagram, SAM, MicroPro, & CompSoft.

PC £1795+VAT
256k business system
2x720k double-sided d/d
FREE 9" Apricot monitor
FREE Epson RX80FT printer
FREE printer cable
SuperWriter w/processor
SuperCalc spreadsheet
SuperPlanner
manuals/documentation for MSDOS, MSBASIC plus standard utilities
FREE 10 blank discs
FREE box of paper

printers

call for latest bargains
Printers: dot matrix
Mannesmann Tally MT80+
Shinwa CPA80 100cps (p) 2k
Epson RX80FT 100cps
Epson FX80 160cps
MP 165cps 72 corresp
Kaga Texan 160cps 27nlq
Canon PW1080 160cps
Canon PW1156 160cps
SmithCorona D200 160cps
SmithCorona D300 wide
SmithCorona FASTEXT 80cps

daisywheel
Juki 6100 20cps
QuenData 20cps
Brother HR15 13cps
Brother HR25 25cps
Brother HR35 35cps

ITT XTRA
STC authorised dealer

ACT
authorised dealer

COMPAQ
authorised dealer

apricot
approved microdealer DRG

Crestmatt packages may be reconfigured to suit individual business needs. We provide **demonstration, support** and **training** with on-site maintenance contracts available.

Crestmatt Limited
67a York Street (Baker St ⊖)
London W1H 1PQ
01.402 1254/5
01.723 4699

telex 265871 (MONREF G)
quote ref81:DRG015
export and mail order enquiries welcome
MonFri 9.30-7;
Saturday 10.30-4

offers strictly one month prices subject to change without notice; goods subject to availability

add VAT at 15% to all prices

OVER 140 AMSTRAD CASSETTE TITLES IN STOCK

OVER 90 *NOW* AVAILABLE ON DISK

CPM SOFTWARE

Macro 80, Microsoft Basic, Microsoft Basic Compiler, Turbo Pascal, BBC Basic (Z80), Purchase Ledger, Payroll, Database, other titles on request.

● TAPE TO DISC TRANSFERS ●

HARDWARE

Printers, Speech Synthesisers, CPC464 3″ Disc, Timatic 5¼″ 2nd Disc Drive also available.

RS232 INTERFACES INCLUDE

Sideways Rom's, Optional upgrades to BBC Compatible User port. Also available Arnors Maxam Assembler and Quma's Assembler.

Mail order welcome. Please send sae for full list to:

TIMATIC SYSTEMS LTD

Registered Office:
NEWGATE LANE
FAREHAM, HANTS PO14 1AN
Tel: FAREHAM (0329) 239953

Sales and Repairs:
FAREHAM MARKET
FAREHAM, HANTS
Tel: FAREHAM (0329) 236727

Organised by The Association of London Computer Clubs

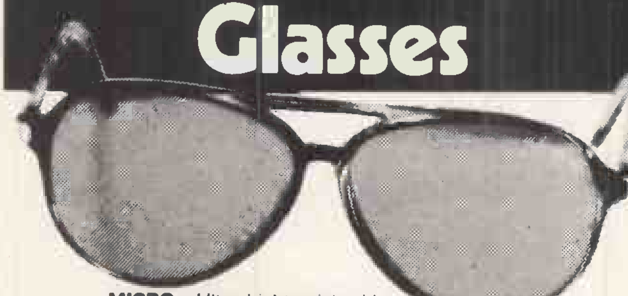
COMPUTING FOR LONDON.

Software, Hardware, Peripherals and bits for all micros. Free unbiased advice from the club stands. Bring-and-Buy Sale on the Saturday. *Plus Other Features* Robotics Conference, Network Features, Community Computing. Admission Adults £2.50 Under 12's £1.50

For stand information and availability contact Patricia Spilsbury 01-303 8849

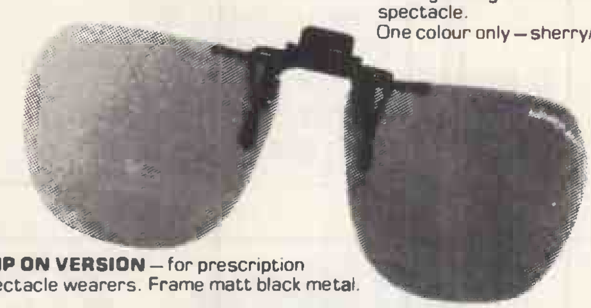
The Personal Computer Show For Everyone

The unique bollé IREX 90+VDU Glasses



MICRO – Ultra Lightweight, blue, burgundy, tortoiseshell

STYLUS – New lightweight ladies fashion spectacle. One colour only – sherry/gold



CLIP ON VERSION – for prescription spectacle wearers. Frame matt black metal.

PRICES £22·94 (VAT included). Products individually boxed and supplied with soft carrying case.

The leaders in eye wear technology are now first in the field with the unique Bolle IREX 90 plus VDU glasses, designed specifically to improve the resolution of screen images received by the eye and to increase efficiency.

bollé

BOLLE UK LTD

Brunel Close, Ebblake Industrial Estate, Verwood, Wimborne, Dorset BH21 6BA
Telephone: (0202) 824535/6 Telex: 418224 AvonG

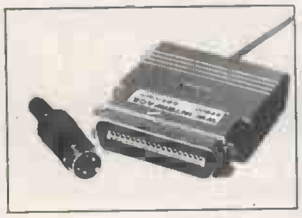
Please indicate model, colour and quantity:

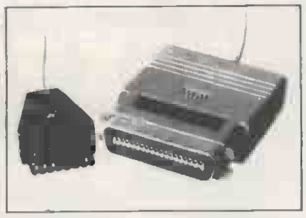
I wish to pay by Access/Barclaycard. Please charge to my account.
My card number is: Cheques accepted.

SIGNATURE
NAME
(BLOCK CAPITALS)
ADDRESS

EXPIRY DATE

Interface-Problems ? ? ?





We are manufacturing a complete range of interfaces and buffers. Low prices and professional quality are standard.

Examples:
Interfaces Atari/Centronics, C64/Centronics Centronics/C64, Centronics/V24, IEEE/Centronics, IEEE/V24, IEEE/C64, V24/Centronics. . .
Buffers Centronics/Centronics, IEEE/Centronics, IEEE/IEEE, V24/V24 . . . (32-128Kbytes)

UK dealer wanted!

MIKROCOMPUTERTECHNIK
Winchenbachstr. 3a
POB 201 605
D-5600 Wuppertal 2, West Germany
Tel: 202/505077
Telex: 859 16 56

apes

Augmented Prolog Expert Systems

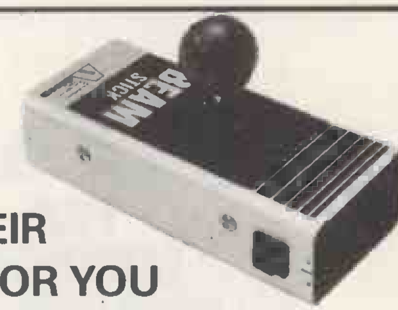
apes is a suite of modules implemented in the logic programming language micro-PROLOG. By combining these modules a range of logic programming environments can be constructed. In particular, **apes** can be used to construct logic based **expert systems.** More generally, **apes** is a tool for developing **logic programs.**

Designed for a comprehensive range of micro-computers, including the ACT Apricot, **apes** and micro-PROLOG, a product of Logic Programming Associates Ltd, are available at **£240** + VAT individually or **£395** + VAT for a joint package.

For further information and a copy of the explanatory brochure, contact: *pcw*

LOGIC BASED SYSTEMS LTD
40 Beaumont Avenue, Richmond, Surrey, TW9 2HE England

MICRO LINK



PROUDLY PRESENT THEIR EXCITING NEW PRODUCTS FOR YOU THE MSX USER

HARDWARE

QUICK DISK DRIVE . . . £
The first real alternative to Micro-Cassettes.................................**138.00**
(Software now being developed for this Quick Access Drive).

PRINTERS . . . £
J.P. 100a (100CPS-80COL) **199.00**
J.P. 130a (130CPS-80COL) **229.00**
J.P. 136a (130CPS-136COL) **389.00**
M.C.P. 80 (4 Colour Printer Plotter) **179.00**

Hardware prices are exclusive of VAT

Software prices are inclusive of VAT

Please tick the MSX Software required.

SOFTWARE

TITLES . . .	(incl. VAT) £
☐ ERIC & THE FLOATERS	5.95
☐ DRILLER TANKS	8.95
☐ BINARY LAND	8.95
☐ BEAN RIDER	11.99
☐ GHOSTBUSTERS	11.99
☐ MANIC MINER	7.95
☐ STOP THE EXPRESS	6.95
☐ DOG FIGHTER	6.95
☐ NINJA	6.95
☐ JET SET WILLY	6.95
☐ ANT ATTACK	7.95
☐ HYPER VIPER	7.95
☐ SUPER DOORS	8.95
☐ NUTS & MILK	8.95
☐ MAH NONG CRAZE	8.95
☐ FIRE RESCUE	7.95
☐ SUBMARINE SHOOTER	8.95

PICK *ANY* 4 TITLES AND GET *1* **FREE**

TITLE FREE £
☐ ______________ No charge

BEAMSTICK £
FED UP WITH SPAGHETTI JUNCTION COMING OUT OF YOUR MSX? **MICRO LINK** HAS SOLVED YOUR PROBLEM WITH THIS REVOLUTIONARY FAST ACTION, TWIN FIRE, INFRA-RED JOYSTICK ....Circa! **39.95**
ONLY
JOYCARD.................................**8.95**

☐ **ORDER** **ENQUIRY** ☐
Name: ______________
Address: ______________
____
Telephone: ______________
Cheque/Postal Order made payable to: MICRO LINK
Software £1.00 p&p (Total) £...................
Hardware £3.00 p&p (Total) £...................

"BOWYERS", STEEP MARSH LISS, HANTS. GU32 2BJ

Write programs to unlock the multitasking power of your QL!

Use Metacomco's much acclaimed ***Development Kits*** *to create the software for your QL: Use* ***Assembler*** *for its speed, and for access to the QL's many features; use* ***BCPL*** *for systems programming; writing games, utilities, and applications packages; use* ***LISP*** *for manipulating data structures, and for exploring the world of artificial intelligence.*

RELEASE THE POWER OF THE QL

ASSEMBLER £39.95 INC. VAT + P&P

> Standard Motorola 68000 mnemonics.
> English error messages.
> Produces code which can be EXECed, and run as a concurrent job.
> External references allow linkage to high level languages.
> Integral linker allows assembler programs to be linked together.
> Macro expansions.
> Position independent, absolute or relocatable code can be produced.
> Conditional assembly.
> Large range of directives.
> Fully formatted listings.
> 30 character variable names and 32-bit values.

ENHANCED! NOW INCLUDES ASSEMBLER LINKER* AND NEW LOW PRICE £39.95

BCPL £59.95 INC. VAT + P&P

> True compiler.
> Multiple BCPL programs can run concurrently.
> Full runtime library includes interfaces to QDOS graphics, file operations, window handling, etc.
> Exception handling provides diagnostics for debugging.
> Link loader allows linkage of separately compiled segments.
> Assembler and BCPL modules can be linked together.
> 32-bit variables use the full QL address space.

Each language is supplied as a complete Development Kit which includes the software (on a Microdrive Cartridge), Metacomco's popular full screen editor, and user manual.

LISP £59.95 INC. VAT + P&P

> Full support of QL features including window graphics, and screen handling.
> Compatible with Acornsoft Lisp for the BBC micro.
> Interpreter.
> Turtle graphics.
> Structure editor allows alteration of data structures.
> Prettyprinter displays programs in structured format.
> Tracer to aid in debugging.
> Garbage collector automatically recovers spare memory space.
> 28-bit integers and 250-character names.

The Metacomco Development Kits are available from HMV, Menzies and many other leading retailers, or direct from Metacomco.

METACOMCO
26 Portland Square, Bristol BS2 8RZ.
Tel: Bristol (0272) 428781

*Existing registered users can obtain an upgrade. Contact Metacomco for details.

QL & QDOS are the trade names of Sinclair Research Ltd.

Phone today, or post this coupon to: Metacomco, 26 Portland Square, Bristol BS2 8RZ.
Please send me:
The Assembler Development Kit at £39.95 ______
The BCPL Development Kit at £59.95 ______
The LISP Development Kit at £59.95 ______
I enclose a cheque for £ ______ or debit my ACCESS/VISA Account No.
[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
Card expiry date: ______

NAME ______
ADDRESS ______
______
POSTCODE ______
TEL. NO. ______
SIGNATURE ______

Price includes VAT, postage and packing UK mainland only. Delivery allow up to 28 days. PCW7

Get soft with your micro...

and make the best of it with Brainpower

SEND FOR MORE BRAINPOWER TODAY.

Are you really making the best of your micro – are you still using too much of your own brainpower?

We at Collins Soft have some very good news, six simple to use software packages called Brainpower that puts you firmly in control and helps you realise your own full potential.

skills that will help you make decisions

skills that help you plan ahead

skills which can help your business

skills to discover the universe and skills which will organise your work.

With Collins range of Brainpower software you have a Teaching program and Book which show you how easy Brainpower is to use on your BBC, Commodore 64 & Spectrum plus the main applications program itself.

Discover Brainpower at WH Smith, Boots, Menzies and all good Computer Shops or simply post the coupon for information – today.

NOMINATED FOR MICRO COMPUTING BRITISH AWARDS 1985

Read what they say about Brainpower.

ENTREPRENEUR

If you intend to go into business, Entrepreneur is an essential investment – Practical Computing.

PROJECT PLANNER

The manual has a simplicity that is endearing – Mike Grace Commodore Horizon.

STAR WATCHER

The best star-gazing program so far available on microcomputer – John Walker – leading software writer.

FORECASTER

I found the theories of Prediction fascinating – Commodore Horizons.

DECISION MAKER

In many ways it has succeeded in an area that few other programs have even attempted – using the computer to educate adults – Popular Computing Weekly.

Please send me my Collins Soft Brainpower brochure ☐ (please tick)

Name

Address

Post Code

WM 5/85

BRAINPOWER

Application through learning

Collins Soft, FREEPOST 30, London W1E 7JZ

COLLINS SOFT

DISK DRIVES

LOW COST FLOPPIES

80 Track DSDD 1.0Mb	£135
40 Track DSDD 0.5Mb	£135

WINCHESTERS

15 Mb half Height	£600
27 Mb Full Height	£750
SASI Controllers	£335

CP/M PLUS

Includes RMAC, MAC and LINK etc plus full documentation

Now only £199

Full software support for Map 80, Gemini and Nascom computers

PCB'S

8×8 NAS-BUS Compatible

Z80 CPU + 64K RAM	£230
Video/Floppy Cont	£199
64K RAM Card	£150
256K RAM Card	£285
Floppy/SASI/Serial	£185
Serial/Parallel I/O	£175
Real Time Clock	£35
Kits available	P.O.A

NEW! NEW! NEW!

8088 CPU + 256K RAM	£525

Concurrent PC-DOS soon available for NAS-BUS

SYSTEMS

MAPCOM CP/M System	£1760
RACPAK Dev. Pack	£1995

Various configurations

MAP 80 SYSTEMS LTD

ACCESS AND BARCLAYCARD ACCEPTED.
ALL PRICES EXCLUDE VAT AND P&P.
SPECIAL OFFERS WHILE STOCKS LAST.
CALLERS WELCOME BY APPOINTMENT.
RING FOR FURTHER INFORMATION

UNIT 2, STONEYLANDS ROAD, EGHAM, SURREY. TEL: 0784 37674

NEW LOW PRICES

WHY PAY MORE

NEW LOW PRICES

CUMANA DS/DD DISCS IN THEIR OWN LIBRARY BOX

Cumana discs are top quality DS/DD 96 TPI discs in Cumana's own packaging. This includes a Plastic Flip-Top Library Box. These discs are suitable for all makes of disc drive including single sided ones.

PRICES INCLUDE DELIVERY

1-5 BOXES DS/DD 96 TPI	£17.50 + VAT
6-10 BOXES DS/DD 96 TPI	£17.00 + VAT
10- BOXES DS/DD 96 TPI	£16.50 + VAT

48 HOUR DELIVERY SERVICE

VISA

PLEASE SEND PAYMENT OR PHONE TO USE CREDIT CARD
LARGE QUANTITY AND EDUCATION DISCOUNTS GIVEN

Access

Micro Resources Limited

Southfield House, 11 Liverpool Gardens, Worthing, Sussex BN11 1RY
Telephone: Worthing (0903) 213174

LOGICSOFT LTD

TEL: (09904) 4919
or (0860) 315172

FRAMEWORK	321.75	CROSSTALK	123.75
FRIDAY	146.25	HARVARD PROJECT MANAGER	281.25
DBASE 11	237.25	MICROSOFT PROJECT	176.25
DBASE 111	321.75	THINK TANK	123.00
DBASE MANAGER	183.75	SPOTLIGHT	78.75
LOTUS 1–2–3	276.50	SUPERCALC 2	136.50
SYMPHONY	385.00	SUPERCALC 3	206.50
ELECTRIC DESK	213.75	ALPHA APPLE/IBM CONNECTION	146.25
WARNER DESK ORGANIZER	161.25	OPEN ACCESS	315.00
SIDEKICK	42.47	R. BASE 4000	321.00
IBM PC MOUSE/S'WARE	157.50	CLOUT	112.50
MICROSOFT WORD/MOUSE	329.00	NORTON UTILITES (VER. 3)	68.70
MULTIMATE	318.50	FLASHCALC	66.75
WORDSTAR PROFESSIONAL	296.25	OZ	255.00
WORDSTAR 2000	330.00	FLIGHT SIMULATOR	38.50
VOLKSWRITER	123.00	DAZZLE DRAW	35.00
VOLKSWRITER DELUXE	185.25	BRODERBUND ARCADE	35.00
BANKSTREET WRITER	43.50	TYPING TUTOR 111	29.40

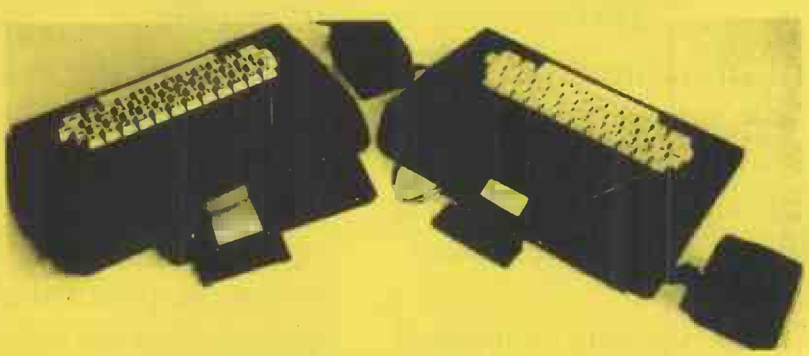
your user friendly supplier

ALL PRICES EXCLUSIVE OF VAT, BUT INCLUDE FREE DELIVERY

* PRICES AND AVAILABILITY SUBJECT TO CHANGE WITHOUT NOTICE
* RING US FOR THE LOWEST PRICE POSSIBLE ON MANY OTHER PROGRAMS
* WE WILL ENDEAVOUR TO BEAT ANY PRICE QUOTED

P.O. BOX 210, VIRGINIA WATER, SURREY, GU25 4QJ. TEL: (09904) 4919 or (0860) 315172 TELEX: 858623

FDS for ZX SPECTRUM *Executive*



★ The FDS EXECUTIVE uses high quality, gold plated, mechanical switches. It does not use a membrane pad like some other keyboards and so provides and so provides a positive tactile feedback.

★ The FDS EXECUTIVE has been designed to allow the user to plug the ZX Spectrum straight in without first removing it from its case.

★ Additional work has been carried out to provide the user with all the necessary cut-outs for the fitting of Interface 1 and Microdrives. Assembly is extremely simple requiring the use of only a Posidrive screwdriver and a sharp knife.

★ The FDS EXECUTIVE has, in addition to the standard 40 keys of the Spectrum, a further 11 keys providing the following single key functions:

- Full size Typewriter SPACE BAR
- Four CURSOR Control keys
- Single key FULL STOP and COMA keys
- E-MODE key; no more three finger contortions, for example; Press and release for PEEK press and hold for OUT
- DELETE key
- BREAK key
- Additional SHIFT key

★ The FDS EXECUTIVE is priced at £59.95 and is available from most good computer shops. It can be obtained Mail Order from Nordic Keyboards UK (please include £2.50 p&p).

NORDIC KEYBOARDS UK

Tarren Way East, Tarran Industrial Estate, Moredon, Wirral L46 4TT
Telephone: 051 606 9300

Not another new company with a personal computer.

Most new business software is being written for one computer system.

So, it's hardly surprising that many new companies are cashing-in with so-called 'compatibles'.

Sadly, their lack of experience shows.

Quite apart from the fact that these machines are only partly compatible, they often come with little or no service back-up.

The ITT XTRA personal computer has achieved full operational compatibility with the IBM PC/XT (the highest compatibility level, yet achieved).

And it comes from two long established and respected companies.

It was developed by ITT – world leaders in IBM plug compatible workstations.

And it's supplied by STC – which Fortune 500 lists as one of the world's largest industrial corporations.

With over 30,000 employees STC also enjoys its position among the top 10 British electronics companies.

So, not surprisingly the ITT XTRA comes with all the back-up you'll ever need.

The Compatible Personal Computer.

We offer excellent training and we operate through a nationwide network of carefully selected dealers to ensure really prompt, efficient installation as well as highly expert after-sales service.

ITT XTRA's User Manuals are among the clearest and most practical yet written.

So, if you're looking for a really compatible personal computer to suit your company, you can rely on the security of ours.

For further details, simply telephone 01-441-6303 .

ITT XTRA
Personal Computer.

STC BUSINESS SYSTEMS LTD., BUSINESS MICROCOMPUTERS, MAIDSTONE ROAD, FOOTS CRAY, SIDCUP, KENT DA14 5HT.


STC

For every business problem we've got a digital solution

ACT Sirius 1 available from £1799.

Fortune available from £4070.

Apricot available from £1790.

From the smallest to the largest application our knowledgeable staff will provide the most efficient and cost-effective solution from our comprehensive range of six computers, fifty makes of printer and several hundred software packages.

Our leasing schemes save the burden of capital cost and our new interest-free credit plan offers even greater savings.

Call us today for advice – or send for our price list. You will find the service you expect from a leading computer company.

Digital Solutions Limited
The Coach House, The Broadway, St Ives
Cambs PE17 4BX
Telephone Huntingdon (0480) 300728

digital solutions

digital™ IBM FORTUNE FUTURE

Demonstrations available on new Apricot range

printer?
PRINTER?
printer?
PRINTER?
printer?
PRINTER?

You need an

EPSON

Always in stock for next day delivery

RX-80
RX-80 F/T
FX-80
FX-100
LQ-1500
JX-80

Mail order by ALL major credit cards.
IBS will match any legitimate competitor's price advertised in this publication for the above products. Please quote page number and advertisement reference when placing your order.

to order PHONE (0908) 568192

IBS

Immediate Business Systems plc
3 Clarendon Drive, Wymbush, Milton Keynes
Buckinghamshire. MK8 8DA England

AMERICAN & BRITISH COMPUTER BOOKS & MAGAZINES

We offer a World-Wide service for books from all publishers and more than 50 magazines.
Please fill in the coupon and ask for monthly listing of NEW books and magazines. You may also subscribe to the following popular magazines starting from the current issues.

	Europe	Other
AMSTRAD CPC 464 USER	£19	£27
BYTE	£26	£32
COMMODORE USER	£18	£28
MSX COMPUTING	£18	£28
MSX USER	£18	£28
PERSONAL COMPUTER WORLD	£19	£28
QL USER	£18	£28
SINCLAIR PROGRAMS	£18	£28
SINCLAIR USER	£19	£29
YOUR COMPUTER	£21	£32

These are SPECIAL 6 months Trial Offer Prices.
Please fill the coupon and send it with your cheque to:

COMPUTER BOOKS AND MAGAZINES — HAULSTERM LTD
91 Exeter House, Putney Heath, London SW15
Tel: 01-788 8746

Name.. Tel:..................
Address...
....
I wish to subscribe for 6 months to the following magazines:
1 .... £ ....
2 .... £ ....
3 .... £ ....
Enclosed please find a cheque for Total £ ....
Please send me list of books and other magazines.

EUROPE'S BEST SOFTWARE PRICES?

- ★ Overseas and trade enquiries welcome. Our enquiry desk handles calls in Arabic, French, Italian and Spanish.
- ★ Over 400 leading software packages for Apple, Apricot, DEC Rainbow, IBM, Macintosh and Sirius. Volume discounts available.
- ★ We supply UK Government, local authorities, educational establishments, etc . . . on receipt of official orders.

WORDSTAR 2000 £299
DBASE II £250
LOTUS 1-2-3 £275

Symphony	385	Knowledge Man	299
Xchange/Open Access	395	Fortran 77	219
Framework/dBase III	320	DR Level II Cobol	580
Multiplan	130	Pascal MT+	290
Supercalc 3	199	Basic Compiler	350
Starlink Multi-user	1600	Spotlight	78
Crosstalk XVI	123	Electric Desk	225
BSTMA	145	Concurrent PC-DOS	189
Multimate	259	GSX Prog. Toolkit	219
Word W/Mouse	400	Infostar Plus	400
Friday!	149	Dataplot Plus	190
DMS-Delta 2	375	Presentation Master	1800

DEMO DISKS AND LITERATURE ARE AVAILABLE FOR MANY OF THESE PRODUCTS. PLEASE SEND SAE FOR FULL LIST

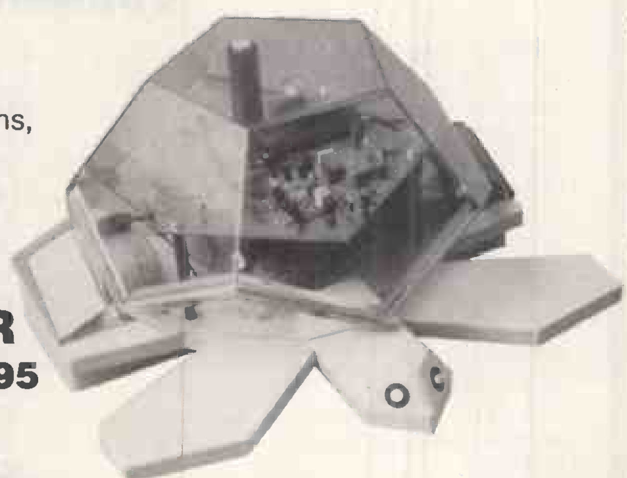
MAIL ORDER ONLY
When ordering, please state micro type, operating system, disk format and add 15% for VAT (in UK only). Software sent post free by registered post. Prices are subject to change. Please confirm prices when placing your order.

SANISOFT
EXPORT SPECIALISTS
5 KINGS MANSIONS, LAWRENCE STREET, LONDON SW3 5ND
Tel: 01-352 3700
Telex No: 297606 POLYIS G

PCW SPECIAL OFFER

HAVE YOU MET MYRTLE THE TURTLE?

She's quite a mover



Myrtle is the Valiant Turtle, she's a smooth robotic lady, when programmed in Logo your wish is her command.

Let her teach you all she knows about programming, maths, geometry, . . . she'll even teach you to dance!!

She knows all the big boys, BBC, Spectrum, Commodore 64, Apple, IBM, RML and many others. She has all the assets of the modern lady: remote control, rechargeable batteries, recharger and documentation etc.

MYRTLE IS ALL YOURS FOR

Turtle only £149.95
Save £30
Turtle plus BBC Logtron standard (LCSI) Logo £179.95
Save £70
Turtle plus Commodore 64 Logo ... £159.95
Save £50

Add £5 p&p — **All prices do not include VAT**

Send Cheque to:
VALIANT DESIGNS LTD
140 Battersea Park Road, Battersea, London SW11 4NB
Allow 28 days for delivery

Please send me
Turtle only ☐
for
Computer
Turtle and BBC Logo ☐
Turtle and Commodore 64 Logo ☐

NO COMPUTER IS HAPPY WITHOUT ME!

COMPUTERINE

- SEAT HEIGHT AUTOMATICALLY ADJUSTABLE
- COMPRESSED AIR ACTION
- BACK REST ADJUSTABLE, BOTH IN HEIGHT AND ANGLE
- EASY SPRING ACTION

£115

plus postage and packing

ITALIAN FURNITURE

GAGLIARDI

GT Britain - Switzerland - Italy - U.S.

509 KINGS ROAD, CHELSEA
LONDON SW10 0TX
Tel: 01-352 3663
Telex: 888142

VISA

NAME ____________________
ADDRESS ____________________
____
TEL: ____________________

I.S.C. Offer the UK's lowest prices on computer systems

APRICOT TWIN 315K and monitor	£1,350
APRICOT TWIN 720K and monitor	£1,500
APRICOT XI 5MB and monitor	£2,000
APRICOT XI 10MB and monitor	£2,150
APRICOT F1 720K Excl monitor	£850
COMPAQ PORTABLE	£1,870
EPSON RX80 F/T	£210
EPSON RX80 F/T	£210
EPSON FX80	£310
EPSON RX100	£330
EPSON FX100	£400
EPSON DX100	£340
WORDSTAR	£190
LOTUS 1-2-3	£250
DMS DELTA	£375
D-BASE II	£225
PEGASUS	£175

All products carry 12 months full guarantee, with **HOTLINE** phone support.
Prices exclude only VAT and delivery.
We **GUARANTEE*** the lowest prices!

COMPANY SERVICES INCLUDE:

CUSTOMISED DATABASE SYSTEMS, MAINTENANCE CONTRACTS, INSTALLATION CONTRACTS, NETWORK SYSTEMS, MULTI-USER SYSTEMS.

FINANCING:

CASH, LEASE-RENTAL, LEASE-PURCHASE, SHORT-TERM RENTAL, HIRE-PURCHASE, PERSONAL LOANS, INSTANT CREDIT (subject to status).

** Provide a currently advertised lower price within 7 days of purchase and difference will be refunded.*

Call for IBM prices.

I.S.C. LIMITED

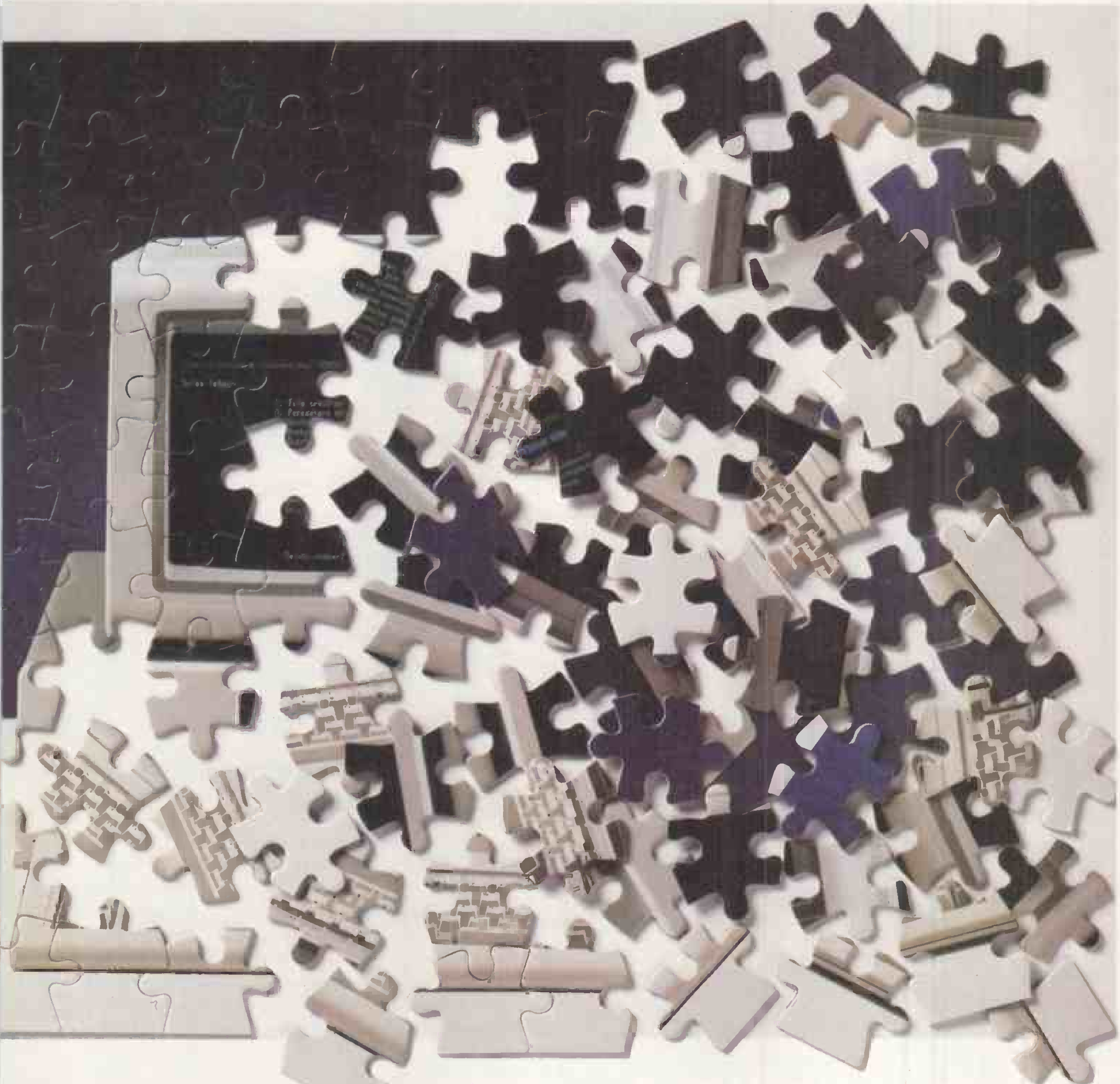
GRAPHIC HOUSE, 88 WAVENEY ROAD
ST IVES, CAMBS PE17 4FW
TEL: 0480 300533

THE NEW SHARP MZ5600.

Set the new Sharp MZ5600 alongside any of its competitors and, for performance, you'll find there's no contest.

The MZ5600 has the flexibility to grow, as your needs grow. Advanced features for software, including a multi-window function, giving up to four different sets of information on-screen simultaneously. High resolution graphics capability.

Optional 'mouse' device for applications of a graphical, drawing or menu-driven nature.
True 16-bit 8086 (8MHz), allowing large capacity, high speed processing.



IT MAKES THE COMPETITION LOOK POSITIVELY UNTOGETHER.

What's more, the MZ 5600 is compatible with virtually all standard business software. And comes with free 12 months' on-site maintenance.

The new MZ 5600 series. An outstanding performer.

From Sharp.

SHARP

INTEGRATED BUSINESS SYSTEMS

Sharp Electronics (UK) Ltd, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. Tel: 061-205 2333.

Sharp Electronics (UK) Ltd, Business Equipment Division, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. Telephone: 061-205 2333.

Please tick as appropriate for further details:

☐ Computers ☐ Electronic Typewriters ☐ Copiers

☐ Facsimiles ☐ Calculators

Name: __________________

Company: __________________

Position: __________________

Address: __________________

Tel. No: __________________ PCW/5600/4

What is NetWare?

NetWare is the most comprehensive network operating system on the market, containing all the features a true multi-user operating system of high quality requires.

How does it work?

NetWare resides on the network hard disk, coordinating all calls made by individual workstations via an interpretive shell. This frees DOS to handle local processing quickly and efficiently.

How can NetWare help my business?

With **NetWare's** capability to run on all major networks, and it's ability to control different microcomputers, investing in a network or upgrading your present system will allow sharing of hardware, software and data — whilst protecting your past investments instead of making them redundant.

How can I learn more?

Please phone our office and speak to our staff. We can answer general or specific questions and send you literature. Alternatively you can arrange for a demonstration either in your office, ours, or with one of our dealers, whichever is more convenient.

NOVELL Novell Data Systems Ltd

78-82 St John's Road,
Tunbridge Wells,
Kent TN4 9PH
Telephone 0892 47833

CAMEL PRODUCTS

PRINT-SP · ROM 81 · PROMER 81 S · MULTEPROM · BLOPROM-SP · DHOBI

PROMER 81 · P10 81 · NIKE · P10 SP · MEMIC · CRAMIC-SP · ROM SP · CRAMIC 81 · POLYPRINT · PROMER SP

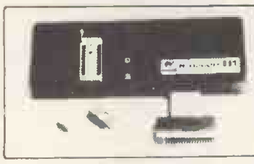
NEW POLYPRINT for Spectrum

. . . The interface which likes to say . . . Ja and Oui and Si and of course YES! A Spectrum Centronics interface unit with up to 8 sets of characters displayed on screen, as per international set in EPSON FX80 printer. Printer driver also in EPROM.

POLYPRINT from Silicon City £44.95

EPROM PROGRAMMERS

BLOPROM-SP A uniquely sophisticated EPROM PROGRAMMER



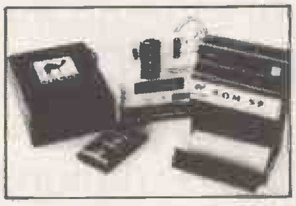
STATUS NO OF SYSTEM --HEX
EPROM TYPE --27128
RAM START ADDR --4000
EPROM ST ADDR --0000
JOB LENGTH --4000
TASK --CHECK

WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO RAM
Y) BLOW AN EPROM WITH DATA FROM RAM
Z) VERIFY THAT EPROM DATA IS THE SAME AS IN RAM
Q TO QUIT R TO RESTART

FAST CODES AVAILABLE
D H POR WXYZ

Eprom programmer for the 2516, 2716/32/32A/64/64A/28/128A, yes even the 64A/128A from Intel. Check, Read, Program & Verify all or part of Eprom. So immensely user friendly you'll hardly need the manual. Designed for the beginner but includes a single key entry route for the professional. Supplied as firmware, the m/c driver routine alone is worth more than the price of BLOPROM-SP. No Personality Cards, or other additions, just a Spectrum. Several inbuilt safety features. On-board Vpp generation. 28pin ZIF socket. Cabled connector and extender plug. ABS case. **£89.95**

AT LAST! for the Spectrum user. Put your programs, utilities. Assemblers into EPROMS for instant load from the unique ROM-SP



ROM-SP — for Spectrum
Ingenious unit for Spectrum, with 2×28 pin sockets and a Reset button allows up to 16K of Basic or M/C program to RUN or LOAD instantly from EPROMS. Cabled connector and full extender card. NOTE: Does not disable Sinclair ROM. **£29.95**
2764's at £5.50, 27128's at £8.50 × VAT

PROMER-SP — for Spectrum
A brand new Spectrum programmer for 2764/128. Zero insertion force socket & software on tape. **£29.96**

PROMER 81-S — for Spectrum
The very popular PROMER-81 for the ZX81 has been adapted to the Spectrum and the price kept low. **£24.95**

ROM-81
Provides two 24 pin sockets for up to 8K of EPROM memory in the 8-16K area. Can use 2516/32 or 2716/32 **£14.95**

PROMER-81
A low cost reliable programmer for 2516/32, 2716/32 EPROMS. Requires 4×PP3 batteries **£24.95**

DHOBI 1 — UV ERASER
Compact. Mains powered. Safe. Fully cased. Up to 3 EPROMS **£18.95**

DHOBI 2 With automatic timer **£22.95**

CRAMIC-SP NEW — for Spectrum
Ingenious software paged 16K non-volatile CMOS RAM to co-exist in the same area as Spectrum ROM. Easy storage and retrieval of BASIC, M/C or DATA on a 48K Spectrum **£89.95**

PRINT-SP — for Spectrum
Centronics Interface with standard centronics Cable. Software on tape. See also Polyprint **£31.25**

NIKE POWER BUFFERS

for Spectrum, Atmos, ZX81 **£17.35**

DREAM-81 — ZX81
64K Rampack with link options to disable 0-8-16K. Plus a 28 pin EPROM socket for 2716, 2732/2764 and 27128. **£59.95**

MEMIC-81 — for ZX81
4K CMOS RAM with lithium battery. Easy SAVEing, 10yr storage and instant retrieval of programs. **£29.95**

UK. VAT extra. No VAT on exports P+P UK Free
Europe +5% — Overseas +10% TLX 81574 CML
Cambridge Microelectronics. One Milton Road.

Cambridge Microelectronics Ltd. One Milton Rd. Cambridge CB4 1UY. Tel: (0223) 314814

Computer Enterprises

APRICOT/IBM ... CALL US LAST WITH YOUR BEST QUOTES (PC, Xi, F1, Portable, Point 7, Point 32)/(PC, XT, AT)

OLIVETTI
OLIVETTI M24/21/Portable ..... Ring for the BEST PRICES

SIRIUS/VICTOR
VICTOR 1.2Mb + 256k/2.4Mb + 256k RAM £1695/£2050
VICTOR 10Mb HARD DISK + 1.2Mb DRIVE + 256k RAM £2990
VICKY (Portable) 2.4Mb drives + 256k RAM £1950
PC Card (Makes Sirius IBM-Compatible) £950

SANYO
SANYO 775 Colour with free software ..... 'NEW' £1990
SANYO MBC 2×720k DRIVES + monitor + Free Software £990
SANYO MBC 10Mb HARD DISK + Monitor + Free Software £1990
SANYO 555 With £1000 worth software £790
SANYO 550-2/555-2 £1000 worth software ... £799/£1159

COLOMBIA
COLOMBIA Twin Disks, mono, bundled software/Colour £1799/£1895
COLOMBIA 10Mb + 320k disk + £1000 software/Colour £2850/£2940
COLOMBIA VP PORTABLE 128k RAM/256k RAM + Software ..... £1790/£1850

MACINTOSH Macwrite + Macpaint/Apple IIe/IIc £1499/£495/£799

COMPAQ
COMPAQ 256k RAM, 2 DRIVES + MS-DOS £1850
COMPAQ 256k RAM, 10Mb HARD DISK + DRIVE £3150
DESKPRO MOD2/DESKPRO MOD4 .... £2100/£4490

TELEVIDEO
TELEVIDEO TELE-PC 1605 ..... £1695
TELEVIDEO TPC-II PORTABLE £1750

ZENITH
Desk Top Twin 320/360kB Drives IBM Comp/Portable £1795/£1699
Desk Top 10Mb Hard Disk & Drive £2790

COMMOOORE
COMMODORE PC 256k RAM, 12" MONO, DOUBLE DRIVES £1600
COMMODORE 8296, £1000 worth free software £1490

EPSON
EPSON QX10 192k RAM, Dual DD, Free Software .. £1495
EPSON PX-8 64k, CP/M, Basic, Wordstar/120k RAM PACK ..... £699/£859

KAYPRO
KAYPRO 2 Twin single sided & free Soft £895
KAYPRO 4 Twin double sided & free Soft £1275
KAYPRO 10 with 10Mb HD and Free software £1995

NEC
NEC APC Mono, Dual drive, 128k, 2Mb disks/Colour £1890/£2190
NEC PORTABLE PC8201+ £200 Free software £290
NEC SPECIAL BUNDLE — Ring to find out this AMAZING DEAL
CANON A200M/A200C, 256k RAM, Twin Drives £1390/£1450
HEWLETT PACKARD HP 150 ..... £2195
HYPERION 256k, Ram disk, 2 drives, Free software £1995
WREN with built-in modem £995
EINSTEIN Colour, Twin DD £499
SINCLAIR QL/DISK INTERFACE ..... £320/£149
BBC B With DFS £399. COMMODORE 64 £179. ELECTRON £199

MULTI-USER COMPUTERS
NORTHSTAR DIMENSION 15Mb HD, 2 User/each user £4995/£1295
PERSONAL MINI (IBM PC-Compatible Multi user system) £9750
ALTOS Xenix, MPM86, 1 to 8 Users, Ethernet .... POA
TELEVIDEO 8 or 16 bit, 80Mb, 2 to 32 users .... POA
OLIVETTI 3B2 Unix V and UNIX SOFTWARE .... RING

PRINTERS

DOT MATRIX
Smith Corona FT80 D100/D200/0300 New LOW PRICES ..... RING
Canon PW1080A/1156A (NLQ) £285/£350
Canon PJ1080A (Ink Jet) £389
Kaga Taxan KP810/910 (NLQ) £289/£399
Panasonic NLQ 80/136 ...... £275/£375
Riteman III NLQ £299
MP165 NLQ/165cps £279
Citizen 160cps/40cps NLQ £399
Honeywell 32/38 ..... £499/£1110
Dataproducts 8050/8070 ..... CALL
Dataproducts 8010/8020 ..... CALL
Brother EP44 KSR/HR5 ..... £195/£129
Brother M1009/TC600 ..... £189/395
Brother 2024 NLQ £850
Panasonic KX-1091 120cps/LQ ... £265
Epson P40/P80 ..... £95/£150
Epson JX80 Colour £499
Epson RX80FT+ £239
Epson FX80 ..... £359
Epson RX100FT/FX100FT ... £359/£459
Epson LQ1500 ..... £895
Fujitsu P1340/1351 (24 pin) ..... CALL
Shinwa CPA80/CPB80 ..... £179/£199
Shinwa CPB 136P £350
NEC P2/P3 ..... £650/£795
Prism 132S (Colour) £999
Microprism FT (S&P) £299
Mannesmann Tally MT80 ..... £180
Mannesmann Tally MT160 ..... £350
Mannesmann Tally MT180 ..... £530
Seikosha GP700A (Colour) £349
Seikosha GP250X £199
Seikosha GP550A £219
Seikosha GP100A £149
Seikosha BP5420 420cps £590
Microline 82A/92P ..... £239/£360
Microline 83P/93P ..... £468/£599
Microline 84P £659
Microline 2410P £1590
Star Gemini 10X/15X ..... £219/£299
Star Delta 10X/15X ..... £335/£429
Star Radix 10X/15X ..... £470/£595
Toshiba 2100H (LQ) £1349
Texas Instruments 810 LQ £995
Texas instruments 855/LQ £695
Anadex DP9725 (240cps) £1195
Anadex Wp6000 (330cps) £1795
Anadex DP6500 (500cps) £1990
DRE-Newbury DRI 8925 240cps £1445
Newbury Data 8931 240cps + LQ £1750
Newbury Data 8950 480cps £1990
Hermes 612B £1690
Anadex DP9500 (180cps) £850
Anadex DP9620 (240cps) £985
Philips Mullard GP300 ...... from £1900
Siemens PT88 & PT89 (Ink Jet) ... £399
Diablo 150C Colour Ink Jet £890
Canon Laser Printer £2900

DAISYWHEEL PRINTERS
Brother HR1/HR15 ..... £290/£349
Brother HR25/35 ..... £595/£799
Juki 6100/6300 ..... £299/£750
Juki 2200 ..... £249
Quen-Data £219
Daisystep 2000 ..... £269
Qume Letter-Pro 20 ..... £446
Qume 9/45-55 ..... £1595/£2150
Qume 11/40-55 ..... £1195/£1379
NEC 3510 (S or P) £1015
NEC 2010 (S or P) £539
NEC 2050 (for IBM) £699
Diablo 620 RO £695
Diablo 630 API £1299
Ricoh 1200/1300 ..... £495/£795
Ricoh 1600 ..... £1375
TEC F10-40/50 ..... £995/£1250
Smith Corona TP1/L100 ..... £189/£249
Silver Reed EXP 'NEW' ..... CALL
Brother EM101 KSR £799
HP 2225 Thinkjet £399

AUTO SHEET FEEDERS
Genesis (Juki/TEC/NEC/Ricoh/Diablo) £299
Rutishauser Mechanical £395
Rutishauser Electro Mechanical ... £479
Tractor Feeds £159
Acoustic Hoods/with SSF ... £250/£375
Printer Stand for any printer £79

MONITORS

MONOCHROME
Roland MB121 Green/Amber £120
Sanyo DM8112 CX (18mhz) £89
Sanyo DM9112 12" (20mhz) £110
Philips 12" (Green) £79
Kaga 12G (Green) ..... £98/£110
BMC 12" Green £79
BMC 12" High Res £99
Zenith 12" Green/Amber £95
Yanjen (Green/Amber/tilt/Sw) £99
Swivel & Tilt Monitor Stand £28

COLOUR
Roland CC-141 14" (640×200) ... £395
Kaga K12R1 ..... £199
Kaga K12R1X RGB/PAL £249
Sinclair Vision QL £235
Novex 14" RGB £239
Luxor 14" (Super Res, 800 dot) ... £495
Dyneer 14CMI 640×200 ..... £399
Dyneer 14CHI 720×350 ..... £575
Sanyo CD3117M (620 dot) £295
Sanyo CD3115H (720 dot) £399
Fidelity CM14 12mhz, RGB & COMP £185
Microvitec monitors ..... POA
Princeton RGB Hi-Res £427

TERMINALS
Qume QVT 102 ..... £455
Qume QVT 108 ..... £590
Qume QVT 211GX (Tektronics) £856
Qume QVT 103 (DEC VT100) £595
Kokasi ICL 12" £350
Televideo 924/925/950 .... Best Price
Zentec (Various Emulations) £495
Hazeltine Esprit I £495
Hazeltine Esprit II £495
Hazeltine Esprit III (TVI 950) £655
Tatung VT4200 ..... £499
Wyse WY50/WY75 ..... £595/£699

PLOTTERS & DIGITISERS
Roland DXY800 (8 Pen/A3) £495
Roland DXY880 (HP Compatible) £600
HP 7470/7475 ..... £895/£1390
Watanabe MP1000 ..... £699
Watanabe WX4636 ..... £2165
MT Pixy Plotter (with SF) £495
ACT Writer 80/81 ..... £528/695
Epson H180 Expansion RAM £365/£75
Gould Bryans DP7 ..... £1255
Houston DMP40 (2 Pen) £699
Strobe 8 Pen drum plotter £655

SOFTWARE

(New LOWER PRICES on all software)
Lotus 123/Symphony (IBM, DEC, Wang) ..... £279/£399
Open Access (IBM/Apricot) £350
Framework/Friday ..... £350/£175
dBase II/III ..... £250/£325
Exchange (4 Int Package) £395
Card-Box/Plus ..... £139/£295
Files & Folders/Offix ..... £250/£450
Volkswriter Deluxe £195
PFS: Report/File/Write/Graph £350
File Transfer IBM/Apricot/Sirius £95
Autocad (2 01m CAD Package) £650
Doodle (CAO Package for IBM/Apricot) £695
Cadplan (CAD with Autodimensioning) £1500
Smartwork (Circuit-Board-Oesign) £895
QEO+/Main Street Filer ..... £290/£150
Sage Accounts/Plus ..... £295/£590
Easy Junior £395
Pulsar/Pegasus ..... £250/£275
Microsoft Project £375
Pertmaster/Milestone .... £650/£295
Harward Project Manager/Hornet £379/£2150
Omnis III/Datamaster ..... £399/£380
Everyman/Knowledgeman .. £379/£395
Concurrent CP/M86 with windows £175
Wordstar Professional £250
Multi Tool Word w/Mouse £275
Multimate/Wordperfect ..... £250/£399
Wordcraft/Samna+ ..... £299/£500
Arabic Word Processor/Conversion £550/£500
Perfect II (Writer/Calc/Filer) £395
Filevision (Mac) MacCash/MacLedger £140/£295
Jazz/Desq ..... £395/£290
Energraphics £290
Crosstalk/Sidekick ..... £129/£49
Human Edge Software .... Each £195
Expert Ease/Mind Proper ..... £650/£29
Superwriter VI. 10 ..... £150
Supercalc 2/3 ..... £195/£235
Multiplan/Trigger ..... £150/£450
Delta 4/Retrieve II ..... £395/£350
Micromodeller £595
Copy II Plus (IBM/Apple) £39
Think Tank/TKI Solver .... £125/£190
Jane (Apple)/Spotlight (IBM/Mac) £179/£195
Sargon II/III ..... £22/£29
Millionaire (Stock Market simulation) £39
Prokey (IBM/Frogger/Pinnball) £95/£25/£29
Spotlight £99
Management Training Series £350
Backgammon/Checkers/Chess/Odin each £39
Flight Simulator £39
Turbo Pascal/(With 8087 Support) £49/£85
News Agents System £500
Integrated Travel Agents System £750

COMMUNICATION

Acoustic Couplers (CX21/KN) £160/£130
Buzzbox Modem/V21 Auto Answer £90/£139
Portman V2123/V2123AA .. £125/£170
Telemod V21AA/V2123AA .. £130/£150
Minor Miracles V21/V22 ..... £120
Steebek SB1212/V22 (With autodial) £450/£650
Micom Borer M4012/V22(AA) £600
Micom Borer M3012/V21V23(AA) £250
Master Systems V2123/2123AD £235/£300
Dacom V2123AD/2123GT .. £330/£450
Braid Telex System £1750
Telexbox II/Mytelex .... £1250/£1750
Communique (Sirius/Apricot) £350
Telecom Gold/Easylink/One to One POA
Sage Communication Pack £350
IBM Internal Modem V2123AD £290

ADD-ONS and ACCESSORIES

AST/MST/Quad Cards for IBM PC/XT RING
Keytronics IBM Keyboard ... £175/£250
Roland Synthesisers (Juno-106/JX-3P) POA
Musical Instrument Digital Interfaces POA
Cumana Disks for BBC at best prices RING
Each 64k RAM for IBM or Como £76
IBM Joystick/Trackball ..... £45-£39
Apple/IBM/C64/Atari Joystick £39
Mouse (IBM/Apricot S or P) £125
Hercules Grf Card £290
Plus-5 10Mb HD for IBM, Sanyo etc £1125
Power Bank (For power cuts) £590
Multi User PC Expansion ... from £1050

COMPUTER ENTERPRISES INTERNATIONAL LTD
Tel: 01-543 6866/542 4850. Telex: 946240 CWEASY G (Quote: 19005565)
EASYLINK MAILBOX NO: 19005565
SHOWROOM (OPEN Mon-Sat 9 to 5):
85-85A QUICKS ROAD, WIMBLEDON, LONDON SW19 1EX
Export. Educational. Dealer. Governmental. Lease. Rent. Consultant ENQUIRIES WELCOME. All items new and carry manufacturers guarantee. Prices are exclusive of installation. Training. Delivery and subject to change without notice. Delivery £10 for each item in UK.

Serious Software

55 East Road, London N1 6AH
Telephone 01 · 253 2287
Fax 01 · 253 8196

SERIOUS SOFTWARE *can:*

★ Help you use your personal computer to convert copy into typesetting material at no extra cost — only your time.

★ Provide service converting computer storage media from one format to another. For example IBM PC to WANG 01S.

★ Provide an efficient, fast, 24 hour service nationwide.

We currently provide a personal service to a wide range of companies. Whatever size you are, we can help you.

The following are some of the diskettes, etc, which we process. Please contact for full details.

3½inch diskettes
Apricot

5¼inch diskettes
AES, BBC, Burroughs B20, Hewlett Packard, NCR, Philips, Sharp, Wicat, DEC

8inch diskettes
CPT, IBM, Systime. Wang, ICL, Olivetti, Tandy, Wordplex, Zerox

Magnetic tape: 1600 or 800bpi, 9-track, Phase Encoded ASCII or EBCDK

IBM Magnetic Cards

To: Operations Manager
Serious Software Ltd
55 East Road
LONDON N1 6AH

From: ____________________

____

____

____

Requirement: ☐ Literature ☐ Written Quotation ☐ Media Conversion ☐ Computerised Typesetting

ANCHORLORD LTD.

10 C5's TO BE WON!
GAMES + GAMES + GAMES !!

FOR EVERY £30 YOU SPEND WITH US,
YOU HAVE THE CHANCE TO WIN
A SINCLAIR C5!!*
Every 100th customer drawn from our hat will win a Sinclair C5. All runners up will receive a free game!

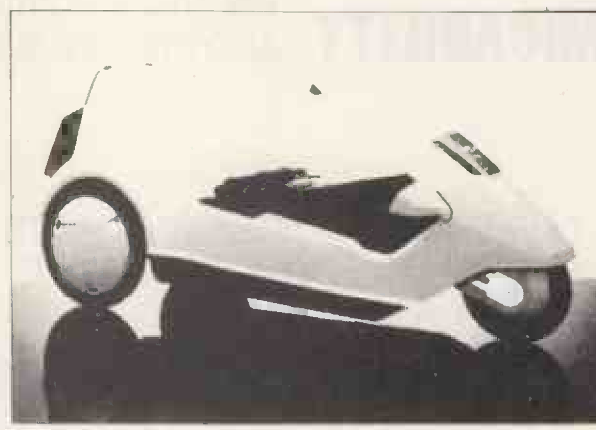
* Spend £150 and have 5 chances to win. Spend £300 and you have 10 chances to win!

MICROS

SINCLAIR SPECTRUM	£125
COMMODORE 64	£245
ACORN BBC B	£125
AMSTRAD CPC 464	£245
MSX GOLDSTAR	£250
SANYO MSX	£250

MONITORS

QL	£220
PHILIPS	£74
COMMODORE	£200



PRINTERS

EPSON RX80 F/T	£240
BROTHER EP44	£220
STAR GEMINI 10X	P.O.A.
COMMODORE	£300

PERIPHERALS

SPECTRAVIDEO'S QUICKSHOT JOYSTICK	£10
KEMPSTON PRO JOYSTICK	£10
SINCLAIR INTERFACE	£45

SOFTWARE

CBS IMPOSSIBLE MISSION	£8
FLIGHT SIMULATOR II	£10
DARK STAR	£8
BOULDER DASH	£8
TASWORD II	£12
FOOTBALL MANAGER	£8
INTERNATIONAL SOCCER	£8
POLE POSITION	£8

ANCHORLORD LTD.

OVERSEAS ENQUIRIES WELCOMED

THE INTERNATIONAL BUSINESS CENTRE, 29 GLASSHOUSE STREET, LONDON W1
OR TELEPHONE: 01-734 6080

Discount Micros!

SAVE HUNDREDS OF £££s

on the BEST RANGE OF MICROCOMPUTERS at the BEST PRICES!

IBM PC – Full system

64K System Unit
2 x 320K Drives
Keyboard
High Res. Monitor

~~£2000~~

£1598*

COMPAQ™

(Fully IBM compatible portable computer)

– Full System

256K System Unit
2 x 320K Drives
Colour interface
Keyboard
High Res. Monitor

~~£2200~~

£1698*

apricot – Full system

256K System Unit
2 x 315K Drives
Keyboard
High Res. Monitor

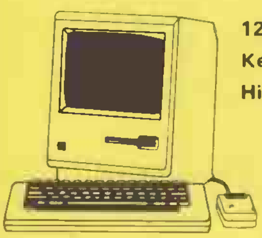
~~£1800~~

including a range of software FREE

£1398*

Macintosh

128K
Keyboard
High Res. Monitor

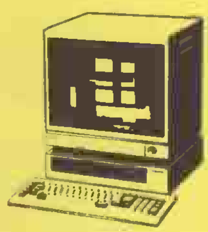


~~£1800~~

£1398*

SANYO MBC 550

128K System Unit
1 x 160K Drive
Keyboard
Spread Sheet
Wordstar



~~£800~~

£598*

SIRIUS 1 – Full system

128K System Unit
2 x 600K Drives
Keyboard
High Res. Monitor

~~£2200~~

£1598*

PRINTERS PERIPHERALS SOFTWARE

APRICOT

XI 256K 10MB + Mon	£2388
XI 256K 5MB + Mon	£2148
PC 256K, 2 x 720K + Mon.	£1598
PC 256K, 2 x 315K + Mon.	£1398
FI 256K, 1 x 720K + Mon	£1098
FIe 128K, 1 x 315K + Mon.	£998

SIRIUS

256K, 10MB	£2998
256K, 2 x 1.2MB	£2198
128K, 2 x 600K	£1598

IBM PC

128K 'XT' 10MB	£2998
128K 'XT' 10MB Colour	£3298
64K 'PC', 2 x 320K	£1598
64K 'PC', 2 x 320K Colour	£1898

COMPAQ

256K, 10MB	£2999
256K, 2 x 320K	£1698
Deskpro 2	£2095

APPLE

Macintosh 128K Inc. Mon.	£1398
Macintosh 512K inc. Mon	£2199
IIe 64K + Mon	£599

SANYO

MBC 550 (128K, 1 x 160K)	£598
MBC 555 (128K, 2 x 160K)	£798
MBC 550 (1 x 360K)	£798
MBC 555 (2 x 360K)	£1098

SPECIAL!

olivetti
authorised dealer

~~£1889~~ **£1498***

Other machines on request.
Plus a whole range of software & peripherals.

To place your order for IMMEDIATE DELIVERY, call Vanessa on

01-938 2151 (20 lines)

*Offer lasts for limited period only and is subject to VAT and change without notice!

Discount Micros Ltd.
7 Kensington High Street, London W.8.

Please send me

☐ Quote on ☐ Information on ☐ Ring me ☐ Urgent

Name ____ Title ____
Company ____
Address ____
____ Postcode ____
Phone ____ Extension ____

PCW/5/85

EXPORT SPECIALISTS

HISOFT

NOMINATED FOR

1985

HISOFT

We are delighted to announce that both **HiSoft** C and **HiSoft Devpac** have been nominated in the Home Software category of the British Microcomputing Awards.

These nominations are particularly pleasing since they mean that the computer industry is recognising what our customers have been saying for years: HiSoft produces high quality utility and language software at realistic prices with full technical support, a rare bonus in the home software jungle.

We have been crafting programming tools for many years and we can now offer an unrivalled set of development packages on the popular home microcomputers. The Product Availability Table below shows our current range together with UK inclusive prices; please feel free to write for technical details of any product or for export information. Our friendly technical and sales team are always happy to answer any telephone enquiries on (0582) 696421.

Product Price Availability Table

Machine \ Product	Pascal	Devpac	C	Ultrakit	Font 464
ZX Spectrum	25-00	14-00	25-00	9-45	
Amstrad CPC464	29-95	21-95	*		7-95
MSX	29-95	19-95			
CP/M-80	39-95	39-95	*		
Sharp	39-95	25-00			
Sinclair QL		19-95 (MON QL)			

*Available soon. All prices in £ sterling.

HISOFT

High Quality Microcomputer Software

for CP/M

Devpac80

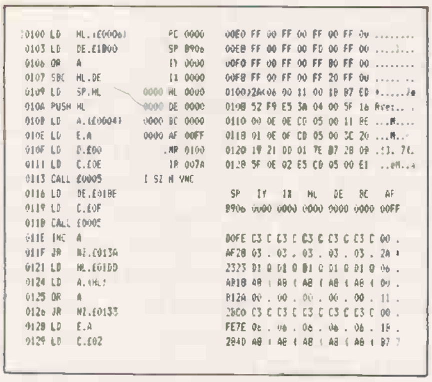
THE NEW STANDARD

£39.95

a sparkling full screen editor

```
HISOFT.ED80     LINE:12  COL:34  [DEL]  INSERT   Go to line: 2275
                                                       40 page manual
ED80 the full-screen editor

                Flexible read/write (Disk,Printer or CP/M logical device)

                               ED80 the side-scrolling editor
      Cut-and-Paste editing
                        Recover deleted lines and blocks

 All commands user-definable with the powerful INSTALL program

                              EEEE DDD     88    00      Dynamic tab-handling
                              E    D  D   8  8  0  0
 Convenient auto-indent switch EEE D  D    88   0  0
                              E    D  D   8  8  0  0
                              EEEE DDD     88    00
 Wild-card find and substitute
                         Internal disk handling (Directory, File-delete, etc)

                            GOTO line for speedy error correction

               Easy-to-follow introductory tutorial
 FREE:43713  #Find HiSoft ED80              #Substitute fast, powerful editing
```

a glittering macro assembler



a brilliant front panel debugger

Get these three programs for your Z80 CP/M computer. Only £39.95 direct from HiSoft (UK inclusive). Write for export prices or for full technical information.

HISOFT

180 High Street North,
Dunstable, Beds. LU6 1AT
Telephone (0582) 696421

THE UNIQUE MSX SYSTEM

Buy an MSX computer and you'll invest in the future system of home computing. MSX is the standard operating system that offers complete compatibility between the best names in computer hardware and software. As technology advances, MSX will be the computer link that keeps you right in touch.

Five page feature...

SONY®

As Sony continue to develop the latest in high technology products for your home, they have chosen MSX as the operating system for all their home computing products. They believe that any product which relies on software (record players, tape recorders, video recorders and computers) should, in the interests of both the consumer and the manufacturer, utilise the best system as the industry standard.

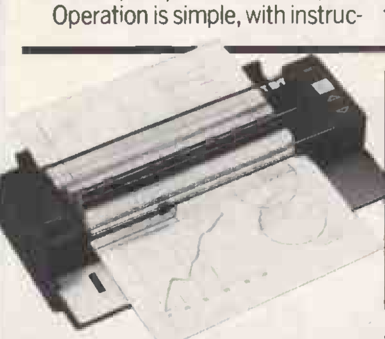
THE SENSATIONAL SONY HIT BIT

A 64K MSX Computer with an exclusive, built-in Personal Data Bank (firmware). This handy facility enables you to enter, store, recall and up-date all kinds of personal information such as appointments, addresses, telephone numbers, etc. Operation is simple, with instructions appearing on the screen every step of the process. **£299.95**

KV1430 14" MONITOR STYLE, PUSH BUTTON CONTROL TRINITRON COLOUR TELEVISION with front mounted RF terminal. **£239.95**

JS 75 REMOTE CONTROL JOYSTICK Play fast-action games from a distance without the encumbrance of cables with this quick-response remote control joystick. **£64.95**

HBD50 MICRO FLOPPY-DISK UNIT stores up to 360K bytes of information on a 3½" disk. Easily connected to the Hit Bit by using one of the expansion ports. **£349.95**



PRN-C41 PLOTTER/PRINTER This Plotter/Printer produces red, green, blue and black images and characters. Pen replacement is easy and it takes a wide choice of paper sizes. Including FREE 'greetings pack' software. **£249.95**

TCM737 DATA RECORDER A mains or battery operated recorder ideal for use with your home computer. **£39.95**

DISK DRIVE OPTION

Upgrade any MSX computer for business applications with the addition of the Sony Disk Drive. Store up to 360k of information on each 3.5 inch disk and realise the fantastic potential of your MSX with this high speed data access facility.

£349.95

Data from the Personal Data Bank can be saved on any data storage facility including the **UNIQUE HB155 RAM CARTRIDGE**, available for **£39.95**

JS55 JOYSTICK £19.95

PRICES SHOWN INCLUDE VAT AND ARE CORRECT AT TIME OF GOING TO PRESS. E. & O.E.

OR DETAILS OF YOUR NEAREST STOCKISTS AND OTHER MSX PRODUCTS, SEE FOLLOWING PAGES.

AXIS

AT HOME WITH TECHNOLOGY

THE UNIQUE MSX SYSTEM ...unbeatable

The MSX system has been universally adopted by the major home electronics manufacturers. With the rapidly growing interest in the use of computers, each one

SANYO

With direct involvement in the growing use of computers in industry, Sanyo recognise the fantastic potential of the computer in the home.

Drawing on their vast experience in the provision of popular home electronic products, Sanyo have selected the MSX system as the new standard and immediately taken advantage of the superb graphics capabilities with the introduction of their unique light pen option.

THE SUPERB MPC 100

This sophisticated piece of equipment offers all the advantages of 64K MSX computing. (Complete with 4 programme starter pack.) **£299.99**

Plus a unique optional feature –

MLT001 LIGHT PEN This provides you with unlimited flair and flexibility in colour graphics design. This feature comes complete with a software package containing some intriguing graphic facilities. **£89.99**

CTP 4132 16" TELETEXT COLOUR TV MONITOR
Advanced features include: black matrix 90° deflection tube, 30-function I.R. Remote Control, 8 programme tuning, AV terminals and Automatic Fine Tuning. **£349.99**

DR202 DATA RECORDER
Top of the range machine offering a host of high technology features. **£44.99**

DR101 RECORDER Specifically designed for use with personal computers, with phase shift switch, speaker monitor and AC/DC operation. **£34.99**

DR201 DATA RECORDER An AC only recorder styled for computer use with all controls conveniently placed on top of the machine for ease of use. **£34.99**

JOYSTICK MJY 002 £12.99

SPECIAL OFFER!

SLIM 11 DATA RECORDER
MJY 002 JOYSTICK

Plus special software pack.
Total value over: **£50.00**

FREE!

When you purchase the Sanyo MPC 100 Computer.

PRICES SHOWN INCLUDE VAT AND ARE CORRECT AT TIME OF GOING TO PRESS. E. & O.E.

FOR DETAILS OF YOUR NEAREST STOCKISTS AND OTHER MSX PRODUCTS, SEE FOLLOWING PAGES.

THE UNIQUE MSX SYSTEM ...unbeatable

The MSX System allows the experienced computer user to select, from a wide range of peripherals, all they need for any particular

SAVE OVER £100**

AXIS COMPLETE COMPUTING PACKAGE*

- SANYO MPC 100 Computer
- SANYO SLIM 10 Data Recorder
- SANYO MJY 002 Joystick
- SAMSUNG BT309K B/W TV Monitor

PLUS £35 worth of software

ONLY £324.95

Normal Axis price £425.75

*Offers available only while stocks last ** Axis Saving refers to previous advertised prices or recommended retail prices.

JVC

JVC invented the 'VHS' format for video recorders, so are well aware of the advantages of standardization.

They forecast MSX as the worldwide home computing standard and they see the video compatibility of their MSX as a key development path into the future.

THE SPECTACULAR HC-7GB

FREE! JVC SOFTWARE PAC WHEN YOU PURCHAS THE AMAZING HC-7GE COMPUTE

The HC-7GB personal computer from JVC is a new MSX machine designed for total compatibility between other MSX machines and all MSX software. A highly advanced 64K machine, the HC-7GB has three display modes offering RF, composite video and RGB outputs.

The HC-7GB MSX personal computer from JVC is the final word in home entertainment. £279.00

7255 GB 14" COLOUR TV MONITOR A fully remote controlled TV, ideal as a computer monitor or alone as a second TV. £259.00

HCJ 615 JOYSTICK £12.95

HC-R105 DATA RECORDER The stylish designed HC-R105 data recorder is an example of a machine produced to offer superb user convenience, exceptional performance parameters and reliable data transfer. The HC-R105 is a high speed machine giving very short access times to data. £89.00

"SPECIAL FOR VIDEO ENTHUSIASTS"

Add your own titles to your video films with the Character Generator included in the JVC free software pack.

PRICES SHOWN INCLUDE VAT AND ARE CORRECT AT TIME OF GOING TO PRESS. E. & O.E.

FOR DETAILS OF YOUR NEAREST STOCKISTS AND OTHER MSX PRODUCTS, SEE PREVIOUS AND FACING PAGES.

application. But, in order to help those starting a new system, Axis have put together a special range of "Complete Package Deals" that contain everything needed to start in computing.

These "Complete Package Deals" are available to you at exclusive and unbeatable Axis prices.

package deals

SAVE OVER £115**

AXIS COMPLETE COLOUR PACKAGE*

- TOSHIBA HX10 Computer
- TOSHIBA 140E Colour TV Monitor
- TOSHIBA HX-J400 Joystick
- SANYO SLIM 10 Data Recorder

PLUS Assorted Software (value **£9.95**)

*Offers available only while stocks last
**Saving refers to previous Axis advertised prices or recommended retail prices.

ONLY £399.95

Normal Axis price £517.75

AXIS BRINGS A GREAT DEAL TO THE INDEPENDENT DEALER

Axis is an organisation that brings you the best deals through your existing High Street dealer.

With an established reputation for personal service and care for their customers, Axis recommended dealers now bring you deals that no multiple can match.

Axis provide the resources to research and select high quality products and to make them available through the independent at unbeatable prices.

For "Exclusive Axis Deals" and the "Greatest Ever Care and Service", your nearest Axis recommended dealer is:

AVON

BRISTOL C.J. FREEMAN & CO. LTD. 47, High St., Portishead Tel: 0272 848180

BEDFORDSHIRE

BEDFORD TAVISTOCK HI-FI LTD. 21, The Broadway Tel: 0234 56323

BERKSHIRE

SLOUGH C.F. LAKE LTD. 37, Stoke Road Tel: 0753 38287

READING SEWARDS 130-131, Friar Street Tel: 0734 599527

BRACKNELL SEWARDS 54, The Broadway Tel: 0344 52255

WINDSOR SONICS HI-FI LTD. 58 Grove Road Tel: 07535 60716

BUCKINGHAMSHIRE

CHESHAM D.L. CHITTENDEN LTD. 59-61, The Broadway Tel: 0494 784441

HIGH WYCOMBE C.F. LAKE LTD. 117/118 Oxford Road Tel: 0494 28605

CHESHIRE

NORTHWICH NORDIS LTD. 39, Chester Way Tel: 0606 3691

CREWE ROY TOWNSEND SOUND & VIDEO 2-4 Victoria Street Tel: 0270 213276

CLEVELAND

STOCKTON N TEES MCKENNA & BROWN LTD. 81, High Street Tel: 0642 679995

DERBYSHIRE

DERBY STUART WESTMORELAND 67, St. Peter's Street Tel: 0332 367546

DURHAM

DARLINGTON MCKENNA & BROWN LTD. 102, Bondgate Tel: 0325 59744

EAST SUSSEX

EASTBOURNE CLEARVIEW RENTAL 215, Seaside Tel: 0323 21646

SEAFORD CLEARVIEW RENTAL 34-40, High Street Tel: 0323 898989

ESSEX

GRAYS A.C.L. RADIO SERVICES LTD. 1, Northmall Tel: 0375 4666

ILFORD D. WOOLFMAN LTD. 76, Ilford Lane Tel: 01-478 1307

SOUTH BENFLEET HODGES & JOHNSON LTD. 285, High Road Tel: 037 45 58725

WESTCLIFF HODGES & JOHNSON LTD. 96-98, Hamlet Court Road Tel: 0702 334488

CHELMSFORD RUSH HI FI 5-6, Cornhill Tel: 0245 57593

GRAMPIAN REGION

ABERDEEN A & G KNIGHT 108, Rosemount Place Tel: 0224 630526

GREATER LONDON

CROYDON J & T ROBINSON LTD. 20, Norfolk House, George Street Tel: 01-681 2800

SUTTON LANDAU RADIO LTD. 195-197, High Street Tel: 01-643 0027

HAMPSHIRE

BASINGSTOKE SEWARDS 18, Paddington House, Bedford Walk Tel: 0256 465665

KENT

GRAVESEND BENNETT & BROWN 181-183, Windmill Street Tel: 0474 52919

SHEERNESS BRITTAIN & HOBBS. LTD. 22-24, High Street Tel: 0795 665551

LANCASHIRE

PRESTON GOODRIGHTS LTD. 1, Friargate Tel: 0772 57528

BARNOLDSWICK HARRY GARLICK (TV CENTRE) 1, Church Street Tel. 0282 813309

BURNLEY HARRY GARLICK (TV CENTRE) 10, Howe Walk Tel: 0282 37118

LEICESTERSHIRE

WIGSTON A.G. KEMBLE LTD. 63, Leicester Road Tel: 0533 881557

LOUGHBOROUGH STUART WESTMORELAND 33, Cattlemarket Tel: 0509 230465

LINCOLNSHIRE

GRANTHAM STUART WESTMORELAND 49, High Street Tel: 0476 78108

NORFOLK

NORWICH HUGHES TV & AUDIO 17-21, White Lion Street Tel: 0603 60935

NORTHERN IRELAND

NORTH BELFAST THE GRAMOPHONE SHOP 16 Donegall Square N Tel: 0232 240046

NORTH YORKSHIRE

YORK CUSSINS & LIGHT LTD. Kings Square Tel: 0904 55666

NOTTINGHAMSHIRE

NOTTINGHAM E.N.L. AUDIOVISUAL 116-118, Alfreton Road Tel: 0602 784015

STAFFORDSHIRE

STOKE-ON-TRENT ROY TOWNSEND SOUND & VIDEO 10, Trinity Street, Hanley Tel: 0782 289114

STRATHCLYDE REGION

SALTCOATS HARRIS OF SALTCOATS 104-106, Dockhead Street Tel: 0294 64330

SUFFOLK

IPSWICH HUGHES TV & AUDIO 42, Buttermarket Tel: 0473 215093

LOWESTOFT HUGHES TV & AUDIO 62, London Road North Tel: 0502 85611

SURREY

DORKING DORKING AUDIO SYSTEMS 23, South Street Tel: 0306 882897

W. GLAMORGAN

SWANSEA RADIO SUPPLIES SWANSEA LTD. 80 Gower Road, Sketty Tel: 0792 204140

WEST YORKSHIRE

HOLMFIRTH FRANK PLATT ELECTRICAL Victoria House, 24, Victoria Street Tel: 0484 682036

HALIFAX FRED MOORE LTD. 15-17, Southgate Tel: 0422 67763

BINGLEY SPENCER & HILL LTD. 133, Main Street Tel: 0274 565161

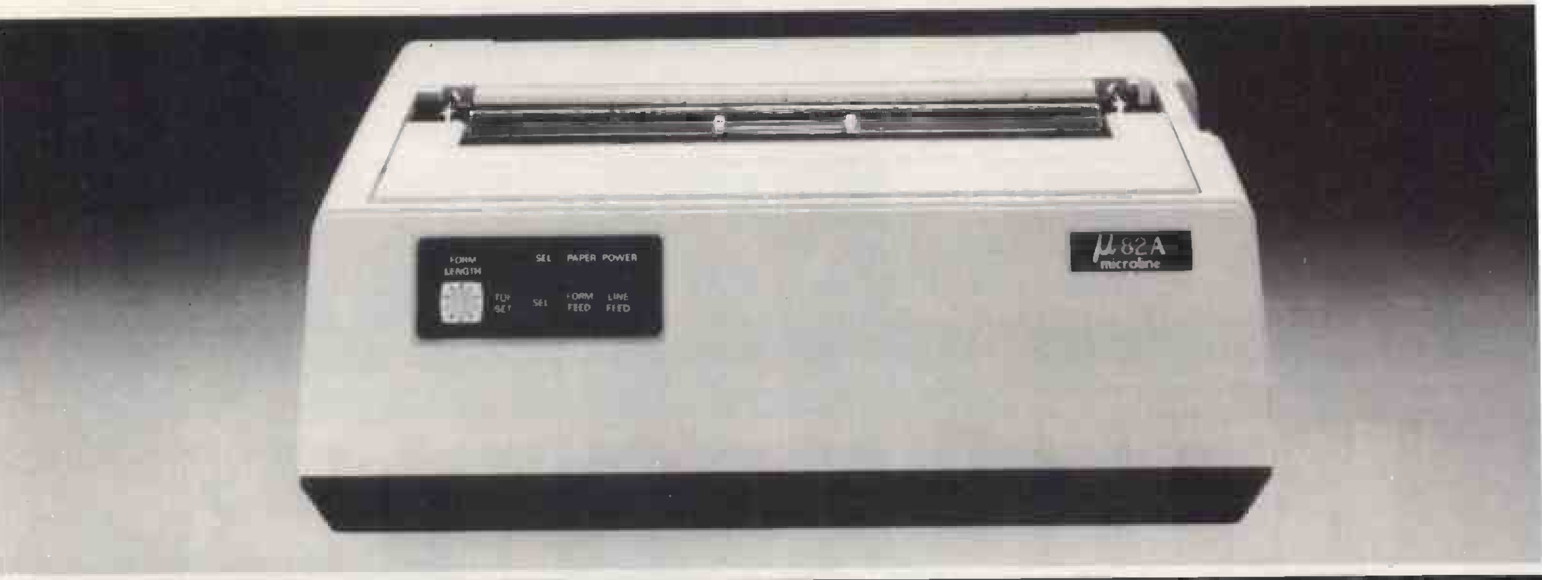
Demand for some MSX products means supplies are limited. Please phone your dealer to check that he has stock available.

Note: For your local stockists of particular products in this advertisement,

Ring Teledata 01-200 0200

AXIS
AT HOME WITH TECHNOLOGY

DON'T FORGET TO ASK YOUR DEALER FOR DETAILS OF CREDIT FACILITIES, EXTENDED GUARANTEES, ETC. AVAILABLE ON CERTAIN ITEMS.



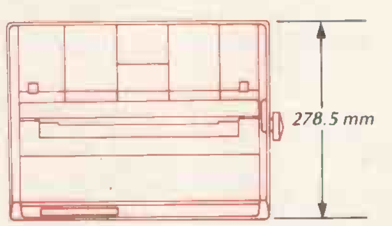
The MICROLINE 82A

FROM EXCELLENCE

THE NEW OKI

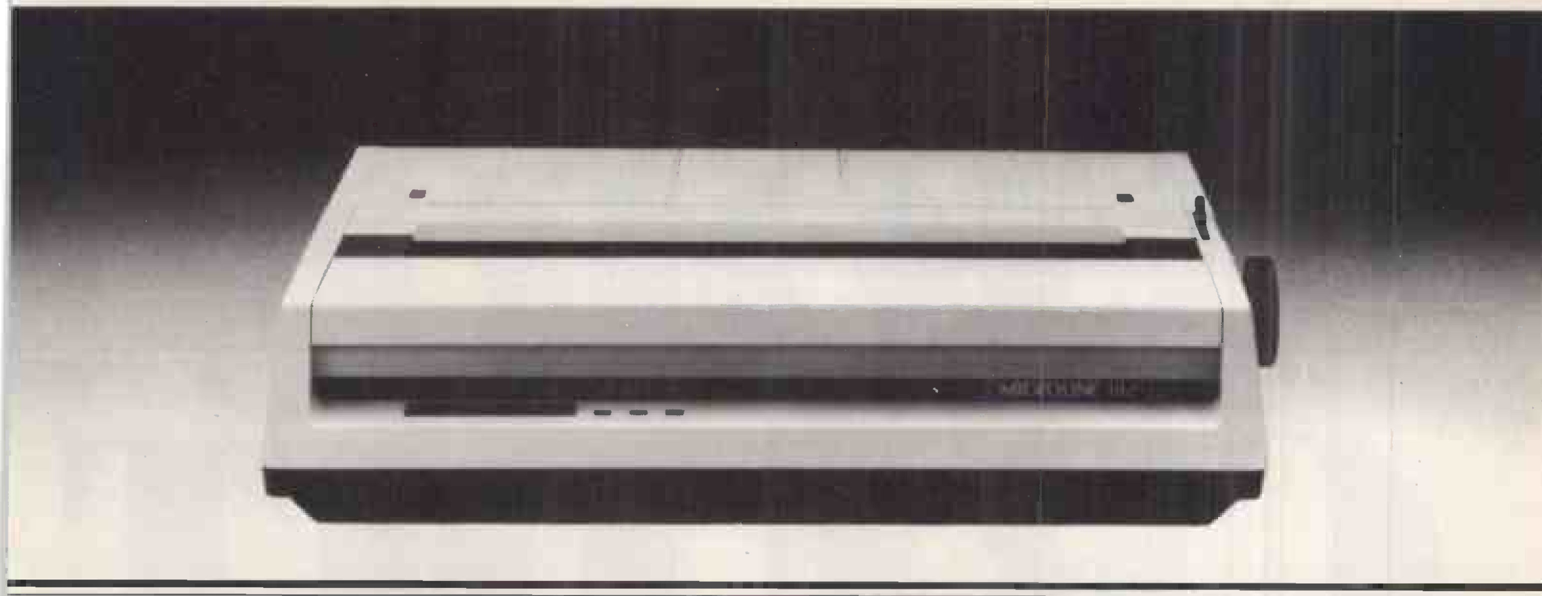
Above we show you two printers (to the same scale). On the left is the OKI MICROLINE 82A - one of the most successful standard dot matrix printers ever manufactured. On the right is the printer that will become the NEW standard for dot matrix printers - the new MICROLINE 182 - from OKI.

In the past OKI have always achieved excellence in their printer products - now we believe they've reached perfection! OKI's revolutionary design concept for the new Microlines sets hitherto unparalled standards of performance, styling - and price.



The dimensions of the larger Microline 193 are, length 524 mm, width 278.5 mm and height 128 mm. These dimensions do not include the platen and tractor unit.

The new MICROLINE 182 is the first of a whole new range of printers from OKI which fulfil all the requirements of today's printing needs. With operating noise level reduced to an almost unbelievable 58dB. and a print speed of 120 characters/second, listings, invoices and many other applications are all handled quietly, with upmost speed and efficiency. If your requirement is for high resolution computer graphics, the MICROLINE 182 will reproduce your screen images with a degree of accuracy never before seen from a matrix printer. True underlining, superscript and subscript are



The new MICROLINE 182 to the same scale as the 82A

TO PERFECTION

MICROLINES

OKI IS O.K.

also incorporated as standard. In addition a new concept in ribbon design, allows a single action 'clean hands' operation.

But that's not all - complementing the new styling and incorporating even more features are the MICROLINE 192 and 193. Both have the same incredibly high specification as the 182 - PLUS

- Even faster throughput (160 cps)
- Correspondence quality printing
- Down line loadable character font memory - with battery back-up
- Operator selectable default settings.

OKI

X-DATA

A Subsidiary of Dyneer Corporation

X-DATA Ltd. 750/751 Deal Avenue
Slough Trading Estate Berks SL1 4SH
Tel: Slough, (0753) 72331 Tlx. 847728

The reputation of OKI MICROLINE printers was built on excellence of quality and reliability. The new Microlines are no exception - even higher quality, greater reliability and performance bring the new generation of OKI MICROLINE printers - to near perfection.

Contact your local dealer for more details of the new generation from OKI or contact us directly at the address below. Insist on perfection.... insist on OKI.

MORE CREDIT.

When you're choosing an accounting/book-keeping program, it pays to balance cost against performance.

On the credit side, Sage can offer the only fully integrated one diskette program on the market for £375. Easy-to-learn and easy-to-use, it provides the simple, efficient and inexpensive solution to small business accounting problems.

What's more, Sage Accounts now has even more functions than before • Sales and Purchase Ledgers • Nominal Ledger • Cash Book • Journal Entries • Trial Balance • VAT Return • Monthly and Annual Accounts • Age Analyses • Statements • Budget Variance Reports • Credit Control Features • Audit Trail – all together in one compact and comprehensive package.

In addition, Sage Plus provides invoice production linked to stock files and integrated with the sales and nominal ledgers.

Operational problems? Forget them. Sage is suitable for use on most business micros and is fully automatic – which means no shuffling through a pile of disks to find the program you need. It's also complete and self-contained – no expensive modules to buy every time you need a new function.

Would you like to have Power?

While all the rest are in the dark.

Meet the **POWER BANKS**

THE UNINTERRUPTIBLE POWER SUPPLY systems

that are the complete answer to ALL of your problems!

With the POWER BANK "BLACK OUTS" will not affect the operation of your computer system.
Micro Systems, Networks, Hard Disks, Printers, Telephone Exchange, Data Transmissions etc.

* Output derived constantly from self contained sealed for life batteries.
* Sine wave shaped output – voltage and frequency closely regulated.
* Genuine "NO BREAK" unit with continuous output ratings of 500-250 & 120VA.
* Much more than a "spike and surge" suppressor.
* Far superior to a voltage stabilizer.
* Overload and short circuit (output) indication and protection.
* Bench or rack mounting (500VA).
* Battery level monitored – mains on – mains off indication.

could you bank on that much power?

MANUFACTURED BY: **POWER TESTING (UPS) LIMITED**
23 Tallon Road, Hutton, Brentwood, Essex CM13 1TE Tel: Brentwood (0277) 233188. Telex 24224 MONREF 586

THOUGHTS & CROSSES

37 MARKET STREET, HECKMONDWIKE, WEST YORKS

COMPUTERS

Apricot F1E 128K + 315K disck drive	£795
Apricot F1 256K + 720K disk drive + (With FREE software incl Superwriter, Supercalc Superplanner)	£1150
BBC Microcomputer Model B (With FREE Software worth £80	£399
BBC Microcomputer Model B (Computer trade in + £80 FREE Software)	£350
BBC Model B with DFS	£469
BBC Model B with Econet	£446
BBC Model B with DFS and 200K Disc Drive	£570
Electron	£129
ZX Spectrum Plus 48K	£129
Memotech 512	£265
Comodore 64	£189
Apple IIe (With 2 disk drives and controller)	£985
Amstrad CPC464 (Green) + £100 FREE Software	£239
(Colour Monitor) + £100 FREE Software	£349
Sinclair QL	£389

PRINTERS

Canon PW1080A with NLQ	£315
Canon PW1080A + Sinclair QL interface	£353
Canon PW1156A with NLQ	£425
Epson P40	£95
Epson RX80	£259
Epson RX80 F T	£289
Epson FX80	£375
Epson FX100	£520
Brother HR5 (Centronics or RS232)	£155
Brother HR15 (Centronics or RS232)	£375
Brother Cut Sheet Feeder	£220
Brother Keyboard	£150
Brother EP44	£235
Brother 1009 (Centronics)	£189
Juki 6100 (Centronics Daisy Wheel)	£370
Juki 2200 (Typewriter Daisy Wheel Printer Cent Ser)	£270
Juki Tractor Feeder	£103
Juki Sheet Feeder	£248
Daisy Step 2000 (Centronics Daisy Wheel)	£250
Shinwa CPA80 (Centronics)	£215
Shinwa CPA80 (RS232)	£236
Mannesman Tally MT80 Plus (Centronics)	P.O.A.
Shinwa CP80 (Centronics)	£199
Commodore 1520 4 Colour Printer Plotter	£95
Alphacom 32 (Spectrum ZX81 model)	£69
CCP 40	£105

PRINTER INTERFACE

Epson RS232 Interface	£29
Epson RS232 Interface with 2K Buffer	£65
QL Centronics Interface	£40
Canon RS232 interface	£80
Shinwa RS232 Interface with 2K Buffer	£60
MT80 RS232 Interface	£25
MT80 2K Buffer	£10
Juki RS232 Interface	£60
Stack RS232 Interface for Commodore VIC20 64	£30
Stack Centronics Interface for Commodore VIC20 64	£20
IEEE to Centronics Interface for Commodore 4032 8096	£70
CBM64 to Parallel	£60
Tripler Centronics Interface for Commodore VIC20 64	£50
Apple IIE Centronics Interface	£69
Apple IIE Serial Interface Card	£69
Electron Plus 1.	£58

PRINTER RIBBONS

Epson MX FX RX80	£5
Epson MX FX100	£8
Seikosha GP100	£4.50
Seikosha GP80	£4.90
Microline	£2 30
Anadex	£12 50
MPS 801	£6 50
NEC 8023	£7
Canon PW1080A	£11
Canon PW1156A	£11
Epson 100 Refill	£3.30
Shinwa CP80 CPA80	£6 50
Mannesman Tally MT80	£6 50
Riteman A1	£7
Panasonic KX-P110 (MTX)	£9
Qume MS	£4.30
Qume nylon	£6 50
Diablo MS	£5
Diablo nylon	£4
Diablo S S	£3
Juki 6100 SS	£2
Juki 6100 MS	£5
Brother EP44 or HR5	£2 30
Brother M1009	£3 80
Brother Singlestrike HR15 25	£3
Brother Correctstrike HR15 25	£3
Brother Multistrike HR15 25	£6

Others available Please Ask.
PRINT WHEELS also available. Please Ask.

PRINTER PAPER

1000 Sheets of perforated tractor feed paper	£9
Alphacom Roll (Black)	£1.40

MONITORS

Microvitec 1431 MS (Standard res suitable for BBC etc)	£199
Microvitec 1451 MS (Medium res suitable for BBC etc)	£290
Microvitec 2031 20	£299
Microvitec 1431 MZ (Spectrum)	£245
Microvitec 1451 MQ	£275
Philips 7502 anti-glare green screen monitor (20MHz)	£78
Commodore 1702	£210
Fidelity TV Monitor	£210
Fidelity CM14	£179
Fidelity QL Monitor (Std Res)	£199

DISK DRIVES

Torch Disk Pack	£800
Memotech (Single)	£410
Memotech (Dual)	£600
Amstrad 3" Drive	£190
Electron Plus 3	£210
Commodore 1541 + Easy Script + 6 Programs	£210
CUMANA	
Single without PSU	
CSX 100 100K 40T	£116
CSX 200 200K 80T	£155
CSX 200D 200K 40T DS	£163
CSX 400 400K 40 80T DS	£181
Single with PSU	
CSX 100 100K 40T	£149
CSX 200 200K 80T	£181
CSX 200D 200K 40T DS	£190
CSX 400 400K 40 80T DS	£206
Twin Drives with PSU	
CSX 200 2 x 200K 40T	£268
CSX 400D 2 x 200K 40T DS	£361
CSX 400S 2 x 200K 40 80T	£339
CSX 800S 2 x 400K 40 80T DS	£402
OPUS	
Single without PSU	
5401 100K 40T	£118
5402 200K 40T DS	£155
5802 400K 40 80T DS	£180
Single with PSU	
5401P 100K 40T	£145
5402P 200K 40T DS	£183
5802P 400K 40 80T DS	£208
Twin Drives with PSU	
5401D 2 x 100K 40T	£265
5402D 2 x 200K 40T DS	£349
5802D 2 x 400K 40 80T DS	£399
3" 100K 40T	£125

DISKETTES
Wabash, 3M Scotch, Control Data

S S S D 40T 10 for	£16
S S D D 40T 10 for	£16
D S S D 40T 10 for	£20
D S S D 80T 10 for	£26

DYSAN DISKETTES

104 1D S S D D 40T 10 for	£20
104 2D D S D D 40T 10 for	£29
204 2D D S D D 80T 10 for	£35
3" Maxell Diskettes Single	£4.50
3 5" Hewlett Packard Single	£5.50
3 5 Hewlett Packard Double	£5 50

PVC COVERS

BBC	£3 99
Microvitec 14	£4 80
Acorn Electron	£2 99
BBC Cassette Recorder	£2.99
ZX Spectrum	£1 99
ZX Spectrum Plus	£2 99
Saga Keyboard	£4.95
Sinclair QL	£3.99
VIC 20 64	£2.99
Dragon 32 64	£3 99
Amstrad CPC464	£3.99
Amstrad Monitor (Green)	£3.99
Amstrad Monitor (Colour)	£4 80
Canon PW1080A	£4 80
Epson FX80	£4 80
Epson RX80 F T	£4 30
Epson RX80	£4 30
Shinwa CP80	£4.30
Brother HR15	£5 60
Apple IIE	£4.50
Apple IIE and Monitor	£5.75
Seikosha GP80	£3.50
Seikosha GP100	£3.75
Juki 6100	£5.60

Over 40 different covers available for various equipment. Phone for availability and price.

COMPUTER LEADS

BBC Parallel Printer Lead	£10
BBC Serial Printer Lead	£10
RS423 5 Pin DIN to 5 Pin DIN	£4 50
RS232 D to D'	£13 50
Memotech Parallel Printer Lead	£10
Dragon Parallel Printer Lead	£13.50
Oric Parallel Printer Lead	£13 50
Amstrad Parallel Printer Lead	£10
Centronics to Centronics Lead	£15
QL to RS232 Lead	£14.95
7 Pin DIN to 5 Pin DIN & 2 5mm Jack Plug	£2 40
7 Pin DIN to 3 Jack Plugs	£2.40
5 Pin DIN to 5 Pin DIN & 2 5mm Jack Plug	£2.40
ZX Spectrum Cassette Lead	£1 80
RGB Monitor Lead (6 Pin to 6 Pin)	£3 20
ZX Interface 1 to RS232	£13.50
The Plug suppressor & RFI Filter	£16

SPECTRUM PERIPHERALS

ZX Microdrive	£45
ZX Interface 1	£45
ZX Expansion System (Includes Microdrive Interface 1 Tasword Two Masterfile Ant Attack Games Designer)	£95
Spectrados DDOS (Disk Drive Prices as per BBC with PSU)	
Kempston Interface E (Rom for Spectrum-Centronics Printer)	£40
Kempston Interface-S (Cassette Based Interface as above)	£30
Tasman Interface (Cassette Based Interface as above).	£35
Light Writer	£18
Games Board	£3 95
Spectrum Keyboard	£37
3 Channel Sound	£28
Saga Keyboard	£48
Extension to Keyway (Ribbon)	£12
Microdrive Cartridge	£1 99
Pack of 4 Cartridges	£7.95
Currah Microspeech	£20
Vox Box	£33
Wafer Drive	£99
Wafer Cartridges	£3.50
VTX 5000 Modem	£65

COMMODORE PERIPHERALS

Microspeech (Currah)	£20
Commversa	£18
Music Maker	£28
Modem 1000	£125
Koala Pad (cass + Disc)	£75
Simon's Basic	£45
Logo	£32
Disk Utilities	£13.50
Wordcraft (Cartridge)	£85
Commodore Cassette Recorder	£40

BBC PERIPHERALS

Acorn DNFS 1 2	£95
Opus DDOS Interface	£110
LVL DDOS Interface	£110
The Music System	£22 50
The Key (Disk)	£11 50
Replica II (Disk)	£10 50
Replica II (3 Disk)	£13
Graphkey (Tape)	£8
Grafdisk (Disk)	£11.50
Beta-Base (Disk)	£22
Beta-Base (3 Disk)	£22
Wordwise (ROM)	£40
Wordwise Plus (ROM)	£60
Disk Doctor (ROM)	£30
Gremlin (ROM)	£30
Caretaker (ROM)	£30
Acorn Speech ROM	£54
View 2 (ROM)	£55
View Printer Driver	£8 95
6502 Second Processor	£199
Z80 Second Processor + FREE Software	£367
LVL ROM Extension Board	£40
AMX Mouse	£85

JOYSTICKS & INTERFACES

Quickshot II Joystick	£11
Sure Shot Joystick	£15
Kempston Joystick	£15
Zip Stick + Interface for ELECTRON	£28
Vulcan Joysticks (Pair of proportinal Joysticks for the BBC)	£20
Sure Shot for C16	£15
Zip Stick for C16	£14 95
Sure Shot Joystick for DRAGON	£15
SPECTRUM	
Kempston Interface	£11
DK Tronics Dual Port Interface	£12
Datel Electronics Interface	£9
Budd Interface (+ Reset Switch)	£12 95
Cambridge Programmable Joystick + Interface + Program	£29
DK Tronics Programmable Interface	£22

COMPUTER SOFTWARE

SPECTRUM Titles (approx)	480
COMMODORE Titles (approx)	280
AMSTRAD Titles (approx)	120
ELECTRON Titles (approx)	100
BBC Titles (approx)	180
MEMOTECH Titles (approx)	40

All our Software is discounted by 10%
Please send for software lists

Tel: (0924) 402337 for General Enquiries.
ALL PRICES INCLUDE VAT + CARRIAGE

Open 9-5pm Mon-Sat

Tel: (0924) 409753 for Credit Card Orders only.
EXPORT ORDERS WELCOME

Clearing Business Hurdles

In the sprint for business efficiency no doubt you're finding plenty of obstacles, backlogs of paperwork, communications problems and the like.

In such circumstances it's well worth evaluating SILVER-REED'S range of bi-directional daisywheel printers. They'll deal with mailings, lists, labels, reports and generally enhance your office capability, with a clear, letter quality presentation that protects your company image.

They clear the technology hurdle – they're developed with SILVER-REED'S renowned R & D expertise. They clear the presentation hurdle – using the same unmistakable clear, letter quality print as on SILVER-REED'S EX55 electronic typewriter, the "Silver Fox". They clear the efficiency hurdle – as part of a complete system for word processing applications, all are centronics or RS232C compatible.

Take some positive steps towards clearing your business hurdles – ask for more details of SILVER- REED'S range of computer peripherals. Contact your local dealer or clip this coupon.

SILVER REED

SILVER-REED (U.K.) LTD.
SILVER SEIKO HOUSE, 19-23 EXCHANGE ROAD.
WATFORD, HERTFORDSHIRE WD1 7EB
TEL: WATFORD (0923) 45976 & 35616
TELEX: 923029 (SILVER G)
FACSIMILE: (0923) 27693

Please send me details EXP 400☐ EXP 500☐ EXP 550☐ EXP 770☐

Company Name ....

Company Address .... Post Code ....

Name .... Position .... Tel no. ....

FREEPOST No Stamp required PCW/5/85

Some people choose a particular computer because it's a safe choice.

A choice that no-one is likely to query.

Which is not a bad criterion as long as you don't mind a computer that works at half the speed of the Wang.

Or a computer that takes up half your desk. Or one that hasn't a 'help' key like the Wang.

Playing it safe may also appeal to the odd person who prefers to memorise cryptic commands, rather than choose from a menu.

It may even find favour with the more dextrous who, when the occasion demands,

are happy pressing several keys to select a single function.

But choosing a computer should be based on more than the first name that pops into your head.

Because in computers, as in everything, the biggest tend not to be the quickest.

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

*Practical Computing 'Benchmarks' (Jan 1984)

WANG

The office automation computer people.

WANG (UK) LTD., 661 LONDON ROAD, ISLEWORTH, MIDDX.

MM

APRICOT PC
£1295
Incl. Monitor

MORE MASSIVE SAVINGS

PC COMPATIBLES
PC's AND
SOFTWARE
AT HUGE
SAVINGS

APRICOT
PORTABLE
£1295

MATRIX PRINTERS

	Ex Vat.
ANADEX DP-6500 500cps	£2295
ANADEX WP-6000	£1995
BROTHER HR5	POA
BROTHER M1009 50cps (IBM)	POA
BROTHER 2024L (190 cps) NLQ	POA
CANON PW1080A 160cps (NLQ)	£299
CANON PW1156A 160cps (NLQ)	£379
DATAPRODUCTS 8070 400 cps	£1640
EPSON RX 80T 100cps	POA
EPSON RX80F/T 100cps	POA
EPSON FX 80 160cps	POA
EPSON FX 100 F/T 160cps	POA
EPSON LQ 1500 200cps (NLQ)	POA
HONEYWELL From	£375
MANNESMANN MT80 + 100 cps	£189
MANNESMANN MT180 160cps (NLQ)	£549
NEC PINWRITER P2(P)(NLQ)	£535
NEC PINWRITER P3(P)(NLQ)	£595
NEWBURY DRE 8850 300lpm	£2065
NEWBURY DRE 8925 240cps	£1385
OKI 84A 200cps	£645
OKI 92P 160cps	£375
OKI 2410P 350cps	£1535
OLI 2350 (P)	£1435
OLIVETTI DM4100E 120cps	£520
OLIVETTI DM5300E (P) 220cps	£985
PANASONIC KX-P1091 (120 cps) NLQ	£269
SHINWA CPA 80 100 cps	£189
STAR DELTA 10 160cps	£299
STAR DELTA 15 160cps	£399
STAR GEMINI 15X 120cps	£269
STAR RADIX 15 200cps (NLQ)	£525
TOSHIBA TH2100H 192cps	£1350
TREND 930 200cps (NLQ) 80cps	£1350

SOFTWARE

	Ex Vat.
CAXTON BRAINSTORM	£245
CAXTON CARDBOX	£165
DBASE II	£265
DBASE III	£325
DMS DELTA 4	£375
DMS +	£155
DR FORTRAN 77	£235
DR PASCAL MT +	£250
DR ASSEMBLER Plus Tools	£125
FRAMEWORK	£345
FRIDAY	£135
KNOWLEDGEMAN	£380
LOTUS 1 2 3	£345
MICROSOFT WORD	£240
MULTIMATE V 3.2	£315
MULTIPLAN	£145
MULTIUSER ACCOUNTS per Module	£295
OPEN ACCESS	£345
PEACHTREE 5 Ledger Pack	£499
PEGASUS LEDGER MODULE	£200
PERFECT WRITER	£129
R. BASE 4000	£295
SAGE ACCOUNTS	£250
SAPPHIRE DATAMASTER	£395
SELECT WORDPROCESSING	£175
SMART SOFTWARE SYSTEM	£490
SYMPHONY	£425
TK SOLVER	£245
VOLKSWRITER DELUXE	£235
WORDSTAR	£195
WORDSTAR MAILMERGE	£95
SPELLSTAR FOR WORDSTAR	£95
WORDSTAR PROFESSIONAL	£260
WORDSTAR 2000	£295

COMPUTERS

	Ex Vat.
APRICOT F1 256K	£895
APRICOT PORTABLE 256K 1x720K Drive	£1295
APRICOT 256K 2x720K Drives & Monitor	£1545
APRICOT Xi 256K 10MB & Monitor	£2195
APRICOT Xi 512K 20MB + Monitor	POA
CIFER 9000 Multi User 21MB	£5095
COMPAQ 2 2x360K drives	£1795
COMPAQ PLUS 10MB	£3195
ERICSSON 256K 2 x 360K	£1645
IBM PC 256K 2x360K Mono	£1958
IBM PORTABLE 256K	£1999
IBM XT 256K Colour	£3375
IBM XT 256K Mono	£3099
MACINTOSH	£1445
OLIVETTI M24 256KB 2x360KB Drives	£1690
OLIVETTI M24 256KB 10MB	£2810
OLIVETTI M21 256KB 2x360KB Drives	£1590
OLIVETTI M21 256KB 2x720KB Drives	£1810
SANYO MBC 555 128K 2x160K Drives	£795
SANYO 775 256K COLOUR PORTABLE	£1795
SIRIUS/VICTOR 256K 10MB	£2550
SIRIUS/VICTOR 256K 2.4MB	£1935
SIRIUS/VICTOR 128K 1.2MB	£1645

DAISYWHEEL PRINTERS

	Ex Vat.
BROTHER HR15	POA
BROTHER HR15 Keyboard	POA
BROTHER HR15 Sheetfeeder	POA
BROTHER HR25	POA
DAISYSTEP 2000 20cps	£219
DIABLO 630 API	POA
DIABLO Sheetfeeder	£490
FUJITSU SP320 48cps	POA
JUKI 6100 18cps	£319
JUKI 6300	£699
NEC 2030 Parallel 120cps	£545
NEC 3530 Parallel 35cps	£1049
NEC 7730 Parallel 55cps	£1440
OLIVETTI DY450 45cps	£880
QUME 11/40 RO + I/Face	£1345
QUME 11/55 RO + I/Face	£1745
QUME LETTERPRO 12/20	£475
RICOH RP1300S FLOWRITER 46K IBM PC	£995
RICOH RP1600S FLOWRITER 46K IBM PC	£1349
RICOH RP1600S Sheetfeeder	£459
RICOH RP1600S Tractor	£138
TEC STARWRITER F1040 40cps	£840
TEC STARWRITER F1055 55cps	£1195
TEC Sheetfeeder	£459
TEC Tractor	£138

EXTERNAL STORAGE

	Ex Vat.
PLUS 5 20MB + 5MB CARTRIDGE	£2325
PLUS 5 30MB + 5MB CARTRIDGE	£2845
PLUS 5 40MB + 5MB CARTRIDGE	£3059
CIPHER CARTRIDGE TAPE STREAMER	£795

IBM BOARDS

	Ex Vat.
64K MEMORY EXPANSION	£150
128K MEMORY EXPANSION	£190
256K MEMORY EXPANSION	£249
PC NET STARTER KIT	£795

VDU's & TERMINALS

	Ex Vat.
CIFER T4	£760
HAZELTINE ESPRIT Fixed Keyboard	£395
QUME QVT 103 (VT100 VT131)	£695
TELEVIDEO 910	£489

COMMODORE
SALE
MANY ITEMS
AT TRADE
PRICES: Including
C16 PLUS 4
Cassettes
Disk Drives
Printers

FULL MANUFACTURERS WARRANTY

MOST ITEMS EX STOCK

NEXT DAY INSURED COURIER DELIVERY AVAILABLE

MAYFAIR MICROS

BLENHEIM HOUSE, PODMORE ROAD,
LONDON SW18 1AJ

TEL: 01-870 3255 / 871 2555

We accept official orders from UK Government and Educational Establishments. Mail Order and Export Enquiries welcome. Callers by appointment.

Laskys: The

The best name for micros – now in a high street near you.

If you're buying a micro you need someone who can cut through the confusing mass of information and give you some authoritative advice, on a system that best meets your needs. The best place to get that advice is Laskys– the Data Base where we sell micro hardware and software at bargain prices.

We have one of the broadest Hardware ranges anywhere in the U.K., including the following top brand names: Acorn, Atari, Apple, Brother, Cumana, JVC, Microvitec, Sinclair and Sony, to name a few.

We also have an impressive range of Software packages for Games, Education and Business use. And, of course, we also supply monitors, disk drives, printers, modems, and all the peripherals

All credit offers subject to acceptance by Laskys credit brokers. Ask for written details. Typical APR 33.7% subject to status. Prices correct at time of going to press and include VAT at 15% but may be subject to variation. All offers subject to availability. *Two year guarantee on parts and labour, Hi-Fi and television. For VCR's, portable equipment, video cameras, computers and peripherals, one year. Hi-Fi and micro sundries 6 months. Optional 5 year guarantee. These are in addition to your statutory rights.

It Reads, Writes and
It Paints in 3-D, Keeps
and Talks to

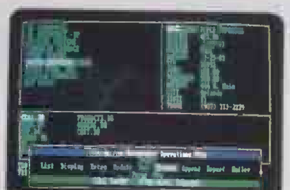
It's called "OPEN ACCESS," and it's the result of 60 man-years of effort to create a truly do-it-all, super-program—one that can perform virtually every task you're ever likely to encounter.

The beauty of it is, all that capability resides on a single program. You don't have to re-enter data. Or spend time trying to get unmatched programs to work together.

OPEN ACCESS takes its name from the source of its power—a relational data-base manager that gives you access to more data in more ways than any comparable software.

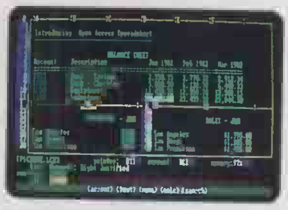
OPEN ACCESS includes an electronic spreadsheet, 3-D graphics, word processor, appointment scheduler and telecommunications module—all revolving around the powerful information manager.

1



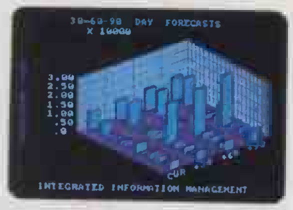
INFORMATION MANAGEMENT—THE MASTERMIND. This advanced data-base manager stores and retrieves multiple files quickly, easily and reliably. What's more, it shares all information with the other programs, so you never have to re-enter the same data twice.

2



ELECTRONIC SPREADSHEET—NUMBER CRUNCHING AND GOAL SEEKING. It helps you produce forecasts, cost estimates and "break-even" points—in seconds, instead of hours or days. Best of all, it allows "goal seeking." Ask, for example, "What sales must I have the rest of the year to net $1 million?," and OPEN ACCESS will figure it out!

3



3-D GRAPHICS—NOT JUST PRETTY PICTURES. These graphics distill raw data into trends that can be instantly visualized, helping you discern the important facts from a wealth of information.

does Arithmetic.
Your Appointments
the World.

Because they do not have a dedicated relational data-base manager that can quickly direct massive amounts of data, other programs simply can't do what OPEN ACCESS can. Some don't have a communications program, others no dedicated word processor. None have a time management program.

There's just one conclusion: OPEN ACCESS can do more for you than any other comparable business program on the market. Bar none. But the only way for you to be convinced is for you to see OPEN ACCESS work its magic on your work load. So call your local software dealer today, or call us at SPI,

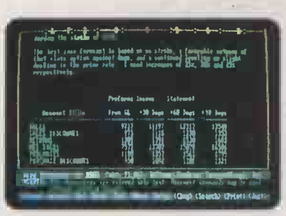
Time Management
Spreadsheet
Information Management
3-D Graphics
Communications
Word Processing

SPI

SOFTWARE PRODUCTS INTERNATIONAL

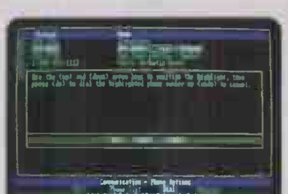
13 Horseshoe Park, Pangbourne
Berkshire RG8 7JN
Tel. (07357) 4081

4



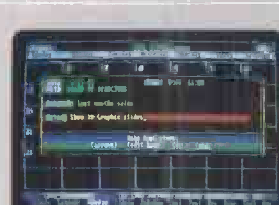
WORD PROCESSING—EDITOR EXTRAORDINAIRE! Superior word processors make it easy to correct typos, change words, shuffle paragraphs and format documents. This is one of that breed. Use it to write efficient memos, letters, proposals and reports.

5



TELECOMMUNICATIONS—YOUR LINK WITH THE WORLD. This program gives you access to virtually any other computer system in the world. Not only can you transmit and receive reports from your colleagues, you can also subscribe to special data banks that know everything from GM's stock price to the relative humidity in Genoa. Now that's power!

6



TIME MANAGEMENT—CONSERVING YOUR MOST PRECIOUS RESOURCE. This module helps you keep track of all your appointments, hour by hour, day in and day out. It alerts you to standing obligations, automatically coordinates meeting times with other busy professionals, and lists all your associates on a Rolodex™-like file.

Cash & Carry COMPUTERS at HI-VOLTAGE

Croydon's New 13,000 sq ft Computer Discount Centre

Expert Staff • Free Advice • Everything on Demonstration • Open 9am-6pm Monday-Saturday • Access & Visa cards accepted

UK's Best Printer Prices

London's Largest Range of Printers on Demonstration

DOT MATRIX PRINTERS

Brother HR5	£129.90 + VAT =	£149.38
Brother M1009	£169.90 + VAT =	£195.38
Brother 2024L NLQ	£899.90 + VAT =	£1034.88
Epson P40 Thermal AC/DC	£81.90 + VAT =	£94.18
Epson RX80	£199.90 + VAT =	£229.88
Epson RX80FT+	£225.90 + VAT =	£259.78
Epson FX80	£329.90 + VAT =	£379.38
Epson RX100FT	£349.90 + VAT =	£402.38
Epson FX100	£449.90 + VAT =	£517.38
Epson LQ1500 NLQ	£895.90 + VAT =	£1030.28
Epson JX80 Colour	£499.90 + VAT =	£574.88
Canon PW1080A NLQ	£289.90 + VAT =	£333.39
Canon PW1156A NLQ	£389.90 + VAT =	£448.38
Canon PJ1080A Colour	£479.90 + VAT =	£551.88
Panasonic KP1091 (IBM) NLQ	£279.90 + VAT =	£321.88
Shinwa CPA80	£199.90 + VAT =	£229.88
Anadex	POA	
Data Prods. Paper Tiger	POA	
Newbury	POA	
Oki	POA	
NEC	POA	
Tec	POA	
Seikosha GP50S (Sinclair Spectrum)	£79.90 + VAT =	£91.88
Seikosha GP500A	£113.90 + VAT =	£130.98
Smith Corona Fastext 80	POA	
Smith Corona D100	POA	
Smith Corona D200 NLQ	POA	
Kaga Taxan KP810 NLQ	£289.90 + VAT =	£333.39
Kaga Taxan KP910 NLQ	£379.90 + VAT =	£436.89
Commodore MPS801	£139.90 + VAT =	£160.89

DAISYWHEEL PRINTERS

Brother HR15	£329.90 + VAT =	£379.39
Brother HR25	£589.90 + VAT =	£678.39
Brother HR35	£749.90 + VAT =	£862.39
Daisystep 2000	£239.90 + VAT =	£275.89
Diablo 630	POA	
Silver Reed	POA	
Juki 6100	£349.90 + VAT =	£402.39
Juki 6300	£779.90 + VAT =	£896.89
NEC	POA	
Qume	POA	
Ricoh	POA	
Tec	POA	
Epson DX100	£389.90 + VAT =	£448.39
Commodore DPS1101	£309.90 + VAT =	£356.39

PRINTER/TYPEWRITERS

Brother EP22	£109.90 + VAT =	£126.39
Brother EP44	£189.90 + VAT =	£218.39
Brother TC600	£373.50 + VAT =	£429.53
Brother FB100 Disk Drive for TC600	£161.50 + VAT =	£185.73
Juki 2200 Daisywheel (P or S)	£259.90 + VAT =	£298.89

All popular interfaces, cables, etc. available from stock. Custom cables made to order.

Let our experts match your computer to the printer of your choice.

Printers — All models parallel-centronics interface Serial RS232C available at same or slightly higher prices.

Prices correct at copy date. Subject to change without notice due to currency fluctuations etc. E. & O.E.

MONITORS

Microvitec Colour		
1431 DS STD RES RGB	£169.90 + VAT =	£195.39
1431 DZ STD RES Spectrum	£199.90 + VAT =	£229.89
1451 DS MED RES RGB	£229.90 + VAT =	£264.39
1451 DQ MED RES QL	£229.90 + VAT =	£264.39
1451 APDS MED RES RGB/Composite	£289.90 + VAT =	£333.39
1441 DS High RES RGB	£389.90 + VAT =	£448.39
1446 LI MED RES IBM PC	£439.90 + VAT =	£505.89
Fidelity CM14 STD RES RGB/Composite	£159.90 + VAT =	£183.89
Commodore 1702 STD RES Composite	£173.00 + VAT =	£198.95
Sinclair/Kaga QL Vision RGB	£249.90 + VAT =	£287.39
Sanyo 3125 STD RES RGB	£172.90 + VAT =	£198.84
Sanyo 3117 MED RES RGB	£284.90 + VAT =	£327.64
Sanyo 3115 High RES RGB	£399.90 + VAT =	£459.89
Sanyo 2112 Green SCRN MED RES	£65.00 + VAT =	£74.75
Sanyo 8112 Green SCRN High RES	£88.00 + VAT =	£101.20
Sanyo CRT36 Green SCRN High RES	£118.90 + VAT =	£136.74

CASH & CARRY COMPUTERS
53-59 High Street,
Croydon, Surrey CR0 1QD.

COMPUTERS

Apricot	POA	Sanyo	POA
Commodore	POA	Canon	POA

SUPERDISKS Prices per box of ten ex VAT

	SSDD 40TR	DSDD 40TR	SS96TP1 80TR	DS96TP1 80TR
BASF 5¼"	£10.95	£18.20	£19.80	£22.50
3M 5¼"	£13.55	£19.50	£20.05	£24.00
VERBATIM 5¼"	£14.50	£19.50	£19.50	£25.50
DYSAN 5¼"	£16.80	£24.90	£24.90	£32.00
TDK 5¼"	£17.50	£17.35*	—	£33.00
3M/BASF 3½"	£34.90			

*Exclusive offer

Add 70p for P&P per order of Disks or Ribbons

PRINTER RIBBONS (Ex-VAT Prices)

Single prices, deduct 10% for 5+

Brother HR15 Corr.	£2.65	Epson 80 Series	
Brother HR15 MS.	£4.95	Epson 100 Series	£6.00
Brother HR5	£2.70	Juki 6100 SS.	£1.80
Brother EP44	£2.50	Juki 6100 MS.	£3.50
Brother M1009	£3.60	Juki 2200	£3.50
Canon PW1080A	£9.50	Kaga KP810	£9.50
CBM 801	£6.50	Mannesman MT80	£5.90
CBM 802/1526	£5.90	Seikosha GP50	£6.50
CBM 1525	£4.00	Seikosha GP100	£4.00
CBM DPS1101 MS.	£3.50	Seikosha GP500	£6.50
Daisystep 2000	£3.50	Seikosha GP700	£18.50
		Shinwa CP80	£5.90

Also in stock Diablo, Anadex, Qume, NEC, Ricoh & OKI Ribbons.

Mail Order + Export + Trade
Hot Line Phone 01-686 6362

Delivery by Securicor (3 day) please add £5.00 + VAT per item.
Delivery by T.N.T. (overnight) please add £9.50 + VAT per item.

Send off the coupon or order by 'phone quoting your Access, Barclaycard No. 'Phone 01-686 6362. Immediate despatch on receipt of order or cheque clearance.

Or you can Telex your order on: 946240 Attn 19001335

We accept official orders from PLC's, Government Departments and Educational establishments.

These prices correct until superceeded by next advertisement

To Cash & Carry Computers, 53-59 High Street, Croydon, Surrey CR0 1QD

Please supply ______

I enclose my cheque for £ ______ including delivery by Securicor/T N T*

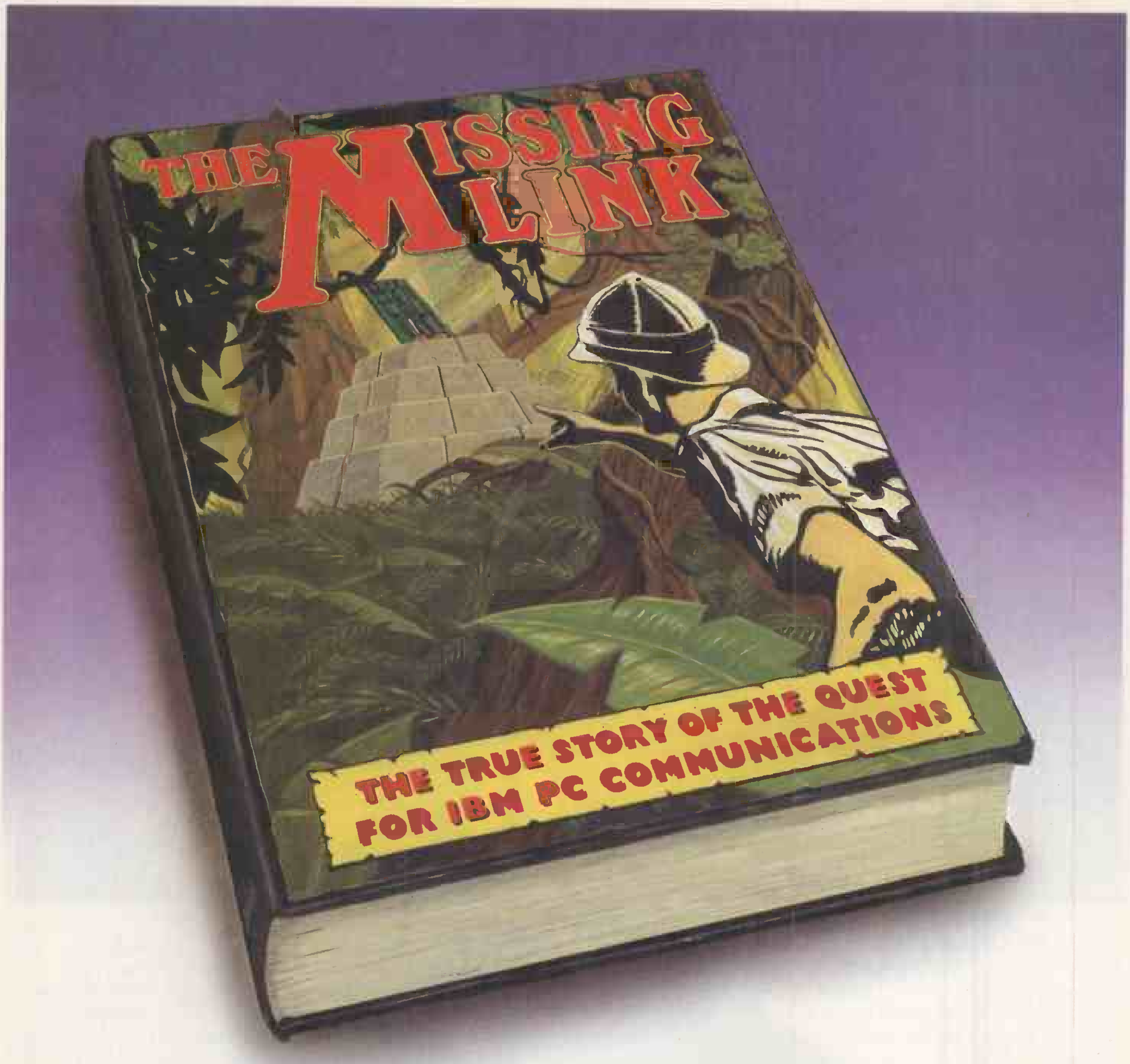
or charge my Access/Barclaycard No ______

Name ______ Signature ______

Address ______

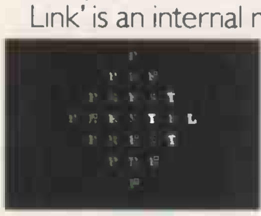
PC 5

*Please Delete



The search is over.

At last, the only complete, BABT approved communication's package for IBM®PC, XT, AT and compatible micros. 'The Missing Link' is an internal modem which comes complete with a menu driven software package allowing auto-dial/auto-answer access to private and public VIEWDATA and DATEL services such as PRESTEL®, TELECOM GOLD®, PSS, ONE TO ONE and many more.



APPROVED for use with telecommunication systems run by British Telecommunications in accordance with the conditions in the instructions for use.

The British designed ⅔ size card plugs into any of the expansion slots and offers CCITT V.21 300/300 and V.23 1200/75, 75/1200 full duplex with selectable error detection and correction protocols.

The Missing Link is available from Jaguar Communications (0727 32983), Interface (0256 461191), K.P.G. Hardware (01 995 3573), First Computer (01 499 3046), and IBM Dealers at a price of £499 + VAT.

For further information contact PC Communications Ltd., Business and Technology Centre, Bessemer Drive, Stevenage, Herts. SG1 2DX. Tel: Stevenage (0438) 316561. Telex 825824

PC COMMUNICATIONS

IBM is a registered trademark of International Business Machines.
Prestel and Telecom Gold are trademarks of British Telecommunications.

WIN A SAFARI TO KENYA

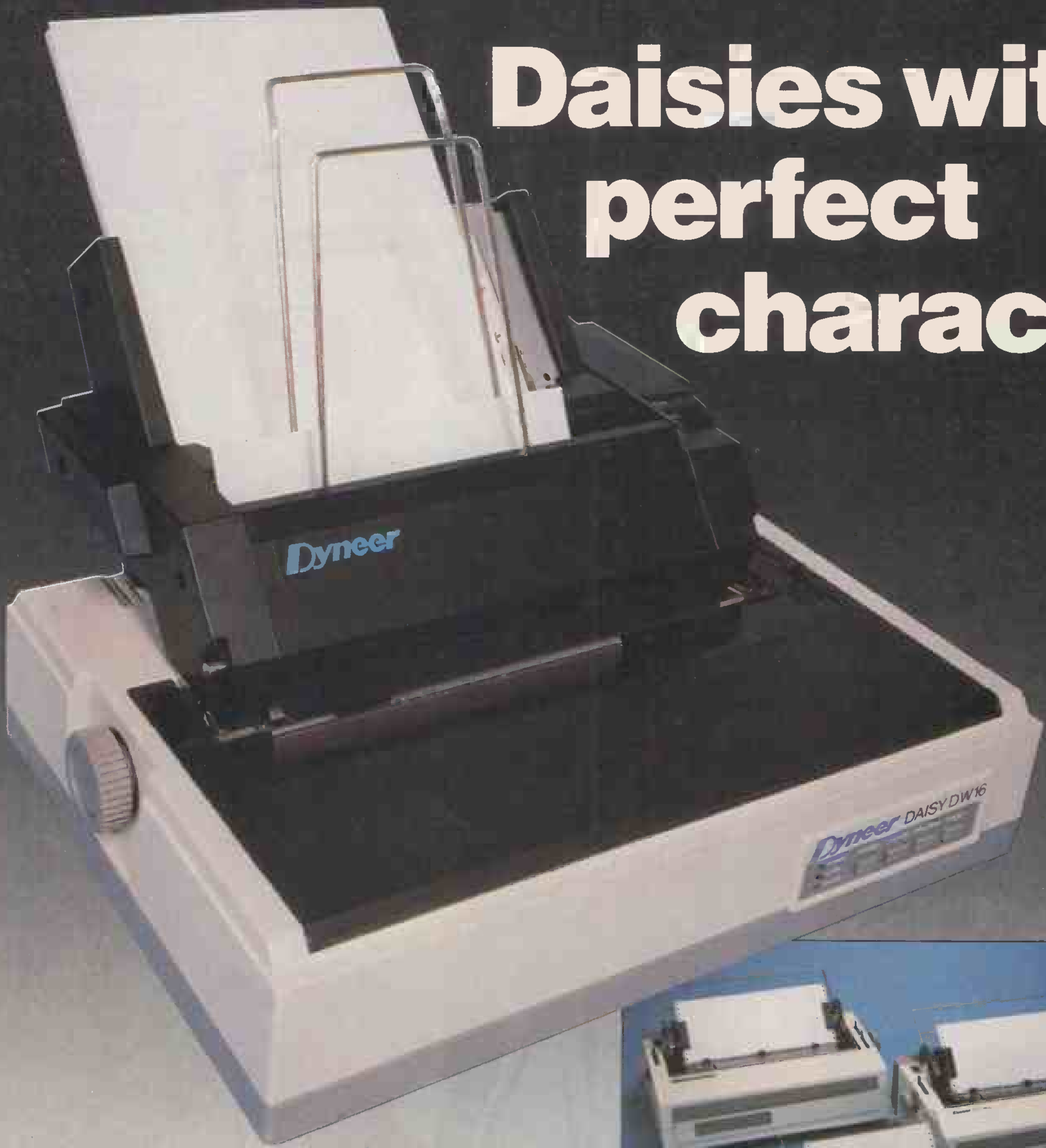
An opportunity to win a super ELEPHANT Safari for two persons – luxury accommodation, travel and all expenses paid – with every purchase of a 10-disk ELEPHANT pack made between 1st April and 30th June 1985!
Look for your participating ELEPHANT Dealer's special Competition Display and pick up a simple puzzle card with your purchase. Send it to us with an ELEPHANT 10-pack top to receive, completely free, an ELEPHANT 'T' shirt and an opportunity in this exciting competition. Each subsequent 10-pack purchase and completed puzzle card gives you another opportunity – there's no limit!
Should you have difficulty in obtaining ELEPHANT products, phone or write for details of your nearest Dealer.

Dennison

ELEPHANT NEVER FORGETS

Dennison Manufacturing Co. Ltd.
Colonial Way, Watford, Herts WD2 4JY, Tel: Watford (0923) 41244, Telex: 923321
France: Soroclass, 45, rue de l'Est - 92100, Boulogne.
Tel. Réseau de Distribution: 605.98.99, Administration des Ventes: 605.70.78, Telex: EMS 206 436 E
Germany: Marcom Computerzubehör GmbH, Podbielskistr. 321, 3000 Hannover 61, Tel: (0511) 647420, Telex: 923818
Other Countries: Dennison International Company, 4006 Erkrath 1, Matthias-Claudius-Strasse 9, Telex: 858 6600

Daisies with perfect characters



THE DYNEER DW16 – pictured above – offers Daisy-Wheel-Perfect print at a price you'll find difficult to believe.

With a print speed of 16 cps (Shannon Text at 14 cps), the DW16 features bi-directional printing up to 10 inches wide on 12 inch (max) paper, and offers a choice of tractor or friction feed systems.

If you need higher performance, the DW20 and DW36 offer maximum print speeds of 20 cps and 36 cps respectively, printing up to 13.2 inches wide on 17 inch (max) paper.

And all models are available with optional automatic cut-sheet feeders for users needing maximum correspondence throughput.

But whatever the print speed, every Dyneer Daisy is built to the most stringent engineering standards and is compatible with most popular word-processing packages. And all feature the Dyneer Hallmarks: Quality, Reliability and Unbeatable Price/Performance.

Ring us for details and you'll have to agree we're right. Printers of perfect characters – and at prices you'll hardly credit.

X-DATA

THE NAME BEHIND
THE PRODUCTS IN FRONT

X-DATA LIMITED, 750 DEAL AVENUE, SLOUGH TRADING ESTATE, SLOUGH, BERKS SL1 4SH. TEL: SLOUGH (0753) 72331

a Dyneer subsidiary

DYNEER DAISYWHEEL PRINTERS AUTHORISED DEALERS

STOCKPORT	Alpha Business Computers Ltd St Christopher House Wellington Road South STOCKPORT Cheshire SK2 6NL 061 477 7799
DROITWICH	Bulldog Computer Services Boot House, 2-4 Colman Road DROITWICH Worcester 0905 772602
HARROW	Comco Engineers Ltd Biro House, Stanley Road HARROW Middlesex 01 423 1933
GATESHEAD	Croft Computers Ltd Saltwell House, Lobley Hill Road GATESHEAD Tyne and Wear 0632 600414
PORTSMOUTH	Datawork Computer Services Silvestor House, Silvestor Road Cowplain PORTSMOUTH 0705 265211
WOKINGHAM	Dean Peripherals Ltd Lakeside House, 70A Waterloo Road WOKINGHAM Berkshire 0734 781317
BRISTOL	Dewco Management Engineering Computer Services Ltd 20/22 Park Street BRISTOL 0272 277480
ILFORD	Gamma Computers 742 High Road, Goodmayes ILFORD Essex 597 3500
CAMBRIDGE	GCC (Cambridge) Ltd 66 High Street, Sawston CAMBRIDGE CB2 4BG 0223 835330
PANGBOURNE	Micro General Unit 25, Horseshoe Park PANGBOURNE Reading, Berks 07357 4466
MACCLESFIELD	Micropute Catherine Street MACCLESFIELD Cheshire 0625 615384
BRENTFORD	Pony Micros Suite 40/41, Strand House Great West Road BRENTFORD Middlesex 01 560 4191
LONDON	Sensory Information Systems 2B Englands Lane LONDON NW3 01 586 4128
LONDON	Technical Software Services 77 Seafield Road LONDON N11 01 368 5192

X-DATA

THE NAME BEHIND
THE PRODUCTS IN FRONT

X-DATA LIMITED,
750 DEAL AVENUE, SLOUGH TRADING ESTATE
SLOUGH, BERKS SL1 4SH
TELEPHONE: SLOUGH (0753) 72331

a Dyneer subsidiary

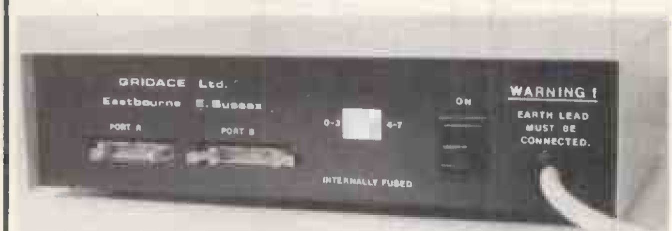
MAINS CONTROL INTERFACE FOR THE BBC MICROCOMPUTER

- ★ Connects to user-port
- ★ 4 independent outputs — rated at 3 amps each
- ★ Solid state, zero-switching, noise free
- ★ All outputs individually fused
- ★ Feed-through connector for access to unused lines
- ★ Two units may be used on one port
- ★ Rugged steel casing — ideal for laboratory use
- ★ Fail-safe operation
- ★ Demonstration software supplied on tape

Details and orders:

Circuit Enterprises Ltd
Durnsford Industrial Estate
46 Weir Road, Wimbledon
London SW19 8UG
Tel: 01-946 9770

Price £98
inc carriage
plus VAT
Official Orders
Accepted



LUTTERWORTH SOFTWARE

THE NUTCRACKER SUITE

Why use a sledgehammer to crack a nut? Most word-processors are too powerful, too complex and too expensive. The Nutcracker Suite's three programs are really easy to use. You can even print text as you enter it. Has word-wrap and paragraph reforming, plus line and page editing functions using every key in the most natural way. Reads and unscrambles Wordstar files. Saves and prints in 100% ASCII format. Special printer control program also included.

Winner C.T.A. Award Best Business Program 1984

THE ULTIMATE DIARY

Event based diary for every professional. Events can be entered with a frequency tag (e.g. every two weeks, every three months, annually, even every second Tuesday!), and will re-appear in all future reports. Reports for today's events, this week's events, this month's events. Calendar for any month up to 2083. Simple search routine (any field) with wild cards. Up to 5000 separate entries, which can easily be amended or deleted.

MICROFILE

Powerful flat form database. User can set field lengths and labels for any number of separate databases. Up to 16 fields and 32,767 records. Search or sort on any field. Print format options, allowing mail-merge, on both automatic and inspection basis. Superbly easy to use with all prompts on screen.

EACH PROGRAM IS ONLY £43 + VAT (£49.45)

FORMATS: IBM PC DOS/APRICOT MS DOS

Ask your dealer for a demo, or send cheque to:

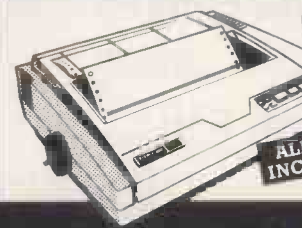
LUTTERWORTH SOFTWARE,
126 NEW WALK, LEICESTER LE1 7JA (Tel. 0533 550822)

Disk Storage No.1

This diskette storage box holds 70 diskettes
Our **Super Low** price
£14.95 including VAT
(B)

Dot Matrix Printers

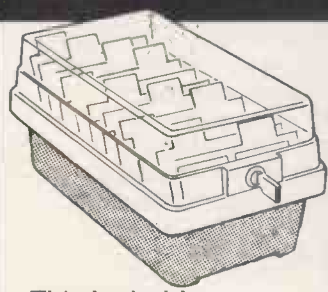
(C)



ALL PRICES INCLUDE VAT

Taxan Kaga KP810	£297
Canon PW1080A	£297
Epson RX80/FT	£277
Epson FX80	£396
Shinwa CPA80 (100cps)	£227
Mannesmann Tally MT80	£217

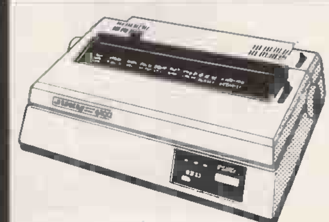
Disk Storage No.2



This lockable diskette box holds 90 diskettes
(B)
Our **Super Low** price
£14.85 inc.VAT

COMPUTER PERIPHERALS the best service the best value from Viglen

Daisy Wheel Printers



Juki 6100	£377
Quen Data	£263

(C)

FREE

Parallel Centronics Cables for the following computers. Please specify when ordering. BBC, IBM-PC and compatible computers, Apricot, Sirius, Amstrad, MSX.

Printer Interface and Cable for the following printers:-

Apple II	£50
Sinclair Spectrum	£39
Sinclair QL	£25

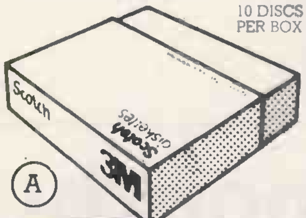
All prices INCLUDE VAT

Please add for carriage:-
A - £2. B - £3. C - £8.

3M Scotch Discs

(Lifetime guarantee)

10 DISCS PER BOX



(A)

ALL PRICES INCLUDE VAT

5¼" diskettes double density

	1-2 boxes	3-9 boxes	10+ boxes
SS 40 TRACK	£15.00	£13.50	£13.00
DS 40 TRACK	£20.00	£18.40	£17.70
SS 80 TRACK	£23.00	£20.70	£20.00
DS 80 TRACK	£26.70	£24.00	£23.00

SHOWROOM OPEN

Weekdays 9.30 - 6pm
Saturdays 9.30 - 4pm

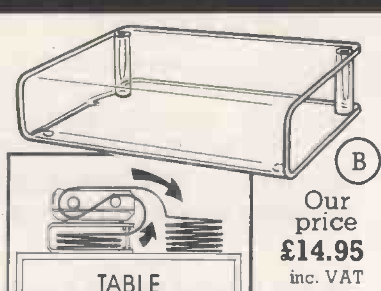
Money-Back Guarantee
If not entirely satisfied with your purchase, simply return to us within 7 days in perfect condition and in original packing including a note stating reason(s) for return.

Printer Stand

- 80 column dot matrix printers
- Raises printer high enough to put continuous stationery underneath
- Beautifully finished in clear perspex
- Viglen quality every time
- Will accept paper up to 12½" wide
- Non-slip rubber pads

Dimensions:
15" (380mm) wide
12½" (320mm) deep
4" (90mm) high

Also available 136 column printer stand **£27.00**



(B)

Our price **£14.95** inc. VAT

Viglen are also major suppliers to educational and government establishments and welcome further enquiries and orders.

ORDERS are usually despatched within 24 hours

Post to: Viglen Computer Supplies.
Unit 7, Trumpers Way, Hanwell W7 2QA.
Credit Card Holders may order by phone. 01-843 9903.

Please send me ______________________

I enclose Cheque/P.O. for £ ____________ Incl. carriage.
Cheques payable to Viglen Computer Supplies.

Name ______________________

Address ______________________

PCW5/85

I prefer to pay by ACCESS/BARCLAYCARD
(Delete whichever is not applicable)

Card No. ______________________

Credit Cards valid only if signed by card holder. Address must be the same as card holder

Signature ______________________

VISA

Prices correct at time of printing and offers subject to availability.

Is the Information Revolution Passing You By?

If you use an Apple, IBM, BBC or ACT micro then you could be missing out on the information revolution of the decade. Today there are literally hundreds of databases worldwide, which can be accessed by a microcomputer fitted with a Nightingale modem and using appropriate software. These data bases include Prestel, Micronet, Homelink, Telecom Gold, various 'Bulletin Boards' and massive American Databases such as 'DIALOG' and 'The Source'. Micros can also be used to send telex messages.

A world of information is available to you now when you install the Nightingale modem from Pace. There are hundreds of thousands of 'pages' of data available on Prestel, free computer software on Micronet, homebanking facilities available with Homelink, Company facts, Educational information, magazine and news articles available with Knowledge Index and the ability to communicate with other micro users direct, or via 'bulletin boards'.

The Nightingale modem is only £136.85 inc. VAT. If you do not already have suitable communications software Pace can supply this complete with a manual and full installation instructions.

NIGHTINGALE - The Modem

By far the most versatile modem available, at the price, for either home or business use, Nightingale will enable your micro computer to send and receive data utilising an ordinary P.O. Telephone Line. It offers Prestel/Viewdata baud rates (1200/75 & 75/1200) alongside 300/300 baud full duplex for communication between computers.

The state-of-the-art modem chip technology employed in Nightingale requires minimum support circuitry resulting in low power consumption, low cost, high quality and extreme reliability. It also features a simple self test facility for easy installation.

Nightingale complies with the vigorous specifications laid down by British Telecom and is fully BABT approved.

SPECIAL INTRODUCTORY OFFER

For a limited period, when you order the Nightingale modem you will receive discount vouchers entitling you to the following:-

KNOWLEDGE INDEX

20% discount off standard enrolment fee (normally £25)

This remarkable collection of databases includes over 22,000,000 items covering Agriculture, Books, Business, Electronics and Computing, Corporate and Company News, Education, Engineering, Government Publications, Legal Information, Magazine Articles, Mathematics, Medicine and News/Current Affairs (The enrolment fee also includes 2 hours of free access time).

ONE TO ONE

50% discount off standard enrolment fee (normally £50)-

One to one is an electronic message service designed to give you the communications capabilities of a telex at much lower cost. By using your micro fitted with a Nightingale modem you can produce telexes, letters, reports and contracts, and send them in seconds to any destination. Courier delivery, priority mail and radio paging are also included in this highly efficient communications service.

To Pace Ltd., 92 New Cross Street, Bradford BD5 8BS

Please supply:

- ☐ modems at £136.85 inc. VAT & carriage
- ☐ modems & software pack for BBC micro at £159, inc. VAT & carriage
- ☐ modems & software pack for Apple II/IIe at £279 inc. VAT & carriage
- ☐ modems & software pack for IBM PC* at £269 inc. VAT & carriage
- ☐ modems & software pack for ACT at £269 inc. VAT & carriage

Name .... PCW. 5/85

Address ....

Cheque enclosed £ ...... or please debit my Access ☐ ____________

Barclaycard ☐ ____________ (Please tick)

If you require further information on the above communications products for other computer systems, please write enclosing a stamped addressed envelope.

*Assumes IBM micro fitted with RS 232 interface. Please allow up to 28 days delivery.

PACE

"Bringing tomorrow a little closer"

PACE SOFTWARE LTD.
92 NEW CROSS STREET,
BRADFORD. BD5 8BS
Tel. (0274) 729306
Telex 51564


PHILIPS
For a demonstration post coupon now!
Personal Computer Division
30, Guildford Street, Chertsey, Surrey.
(or phone 09328-68911)
Name:
Address:
Tel.:
PCW 5·85
P2000 C
Philips Portable Computer
The affordable portable.

Herbie Briggs has just destroyed the myth that all floppy discs are created equal.

They seem equal. Until you look at the seams.

That's where equality ends.

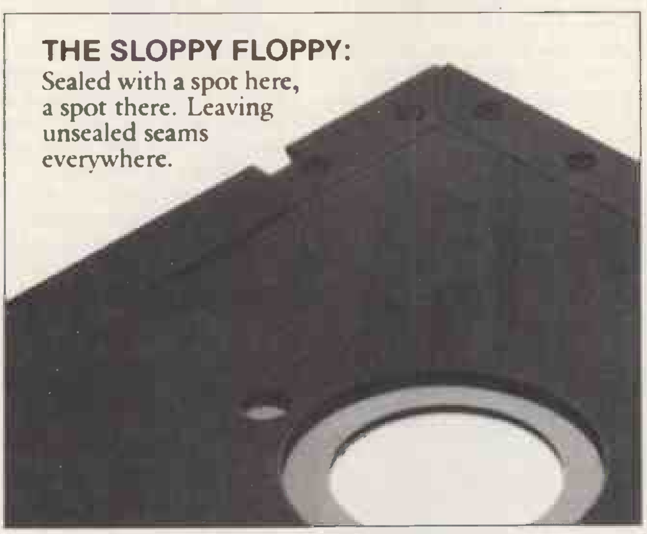
Most companies seal their discs with a spot here, a spot there. Leaving most of each seam not sealed at all.

Sooner or later, the seams might do what comes naturally: they bulge. Warp. Pucker. Open up.

Pens, pencils, fingernails—even a four-year-old's, like Herbie—can catch and snag in those wide open spaces.

That's sloppy. And dangerous. Because if you put a sloppy floppy into your disc drive, it can jam your drive. Ruin your drive head. Lose your data.

So much for their seams. Ours are different.

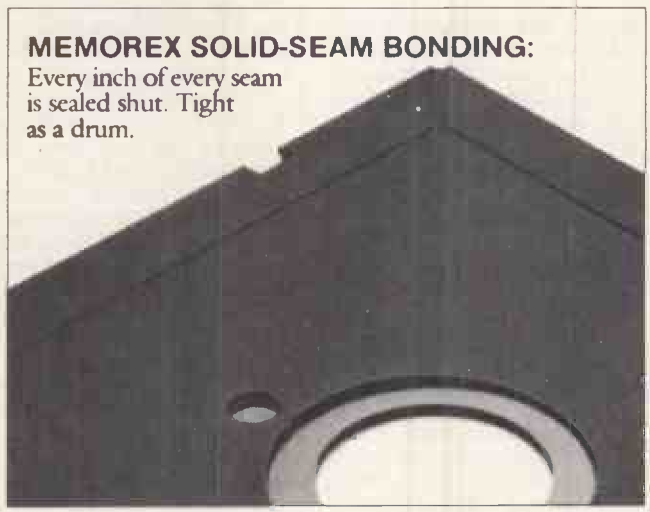


THE SLOPPY FLOPPY: Sealed with a spot here, a spot there. Leaving unsealed seams everywhere.

Memorex uses a process we developed, called Solid-Seam Bonding.

Solid-Seam Bonding seals shut every inch of every seam of every Memorex* floppy disc. Tight as a drum. That makes the Memorex floppy stiffer. Stronger. And your data safer.

To resist bulging, warping, puckering, or opening up.



MEMOREX SOLID-SEAM BONDING: Every inch of every seam is sealed shut. Tight as a drum.

To resist all the things that can jam your drive, ruin your drive head, or lose your data.

Which proves that a Memorex floppy disc isn't equal to all the others. It's better.

Solid-Seam Bonding is just one example of the extra care that goes into every Memorex floppy disc. Be it 8," 5¼" or the new 3½." Extra care that lets us guarantee every Memorex disc to be 100% error-free.

The next time you're buying a floppy disc—or a few hundred of them—just remember this:

It's always better to be safe than sloppy.

For more information on the full line of Memorex quality computer media products, including computer tape, call Memorex U.K. Ltd., 96-104 Church Street, Staines, Middlesex. Tel: 0784 51488

Your Data. When it matters, make it Memorex.™

MEMOREX

Don't forget you read it here first — the latest Amstrad machine takes pride of place as Guy Kewney keeps track of manoeuvres in the micro market.

Spicing up the Amstrad

Exactly one year ago, *PCW* reviewed a new micro from the home electronics group Amstrad. This machine, the CPC 464, was very well received due to its complete system approach and value for money. In accordance with Amstrad's hi-fi tradition, the machine included a built-in cassette recorder and a monitor, all driven from a single mains plug. Furthermore, the machine was well designed with all the features necessary to make it a strong competitor in the home computer field.

The machine has indeed sold well and occupies the number three slot in many home computer sales charts. Amstrad has also introduced a dot-matrix printer, a fair amount of commissioned software and, most important, a 3in disk drive. Now, after a year of Amstrad telling off journalists for calling the machine just 'The Amstrad', the company has proved its point by releasing its latest micro, the CPC 664.

Essentially the machine is a CPC 464, but a 3in disk drive replaces the cassette deck on the right-hand side. The system consists of two boxes — an integral computer-disk drive-keyboard unit and a colour or monochrome monitor. The long, slim external drive has been included in the main unit by placing the electronics that drive the disk alongside the physical drive, which makes the unit noticeably longer. The disk drive is also higher than the main keyboard, which gives the machine a bulbous right-hand end. Two power supplies are provided from the monitor, 5 volts for the computer and 12 volts for the disk drive, thus keeping the one-plug design of the 464. A useful optional extra is the TV modulator: you could buy the monochrome system for use in the office and then take it home to play games on a colour TV.

A few cosmetic changes to the keyboard have been included. The grey/red/blue/green colour scheme has been replaced by a grey/blue one, with all the control keys in blue. The cursor control keys have been enlarged to form an MSX-like diamond.

One of the few criticisms of the CPC 464 was its supposed lack of function keys; in fact, the numeric keypad also acted as 10 function keys. To emphasise this point, Amstrad has now labelled the keys f0 to f9 while retaining the numeric keypad layout. This might prevent you from using it for number entry, though with time you'd get used to it.

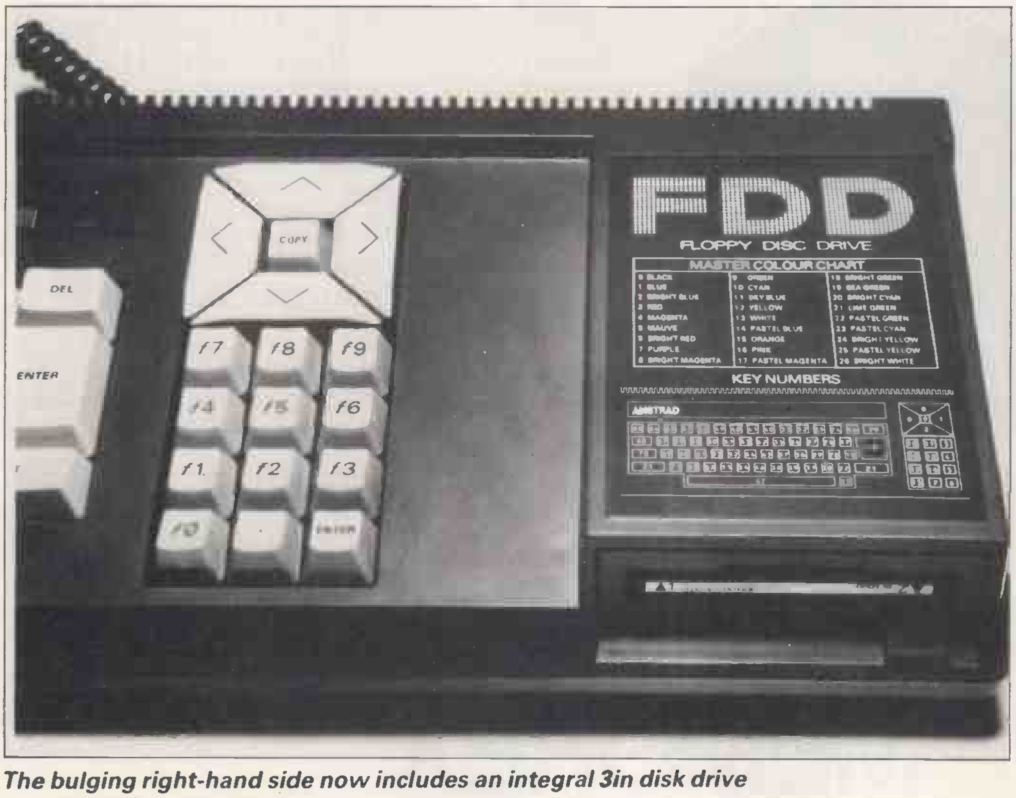
Along the back of the machine there are ports for the RGB monitor, second disk interface, printer port, joystick and external cassette recorder.

The CPC 664 has the same fast Locomotive Basic and powerful graphics, sound and interrupt commands as the 464 (see Benchtest, *PCW*, May 1984). In response to user suggestions Amstrad has, however, updated the system ROM to include some extra facilities. Two areas have been enhanced with this new ROM — graphics and error detection. On the graphics front, there is now a command FILL n which will fill an enclosed area with the colour specified by n. Line drawing commands have also been souped up: the command MASK allows you to specify which pixels of a contiguous block of eight are on or off. This pattern is then continued for the length of the line, so creating a dotted line. An extra parameter for the line-drawing commands stops double-plotting of end points. Anyone who has plotted lines using a logical function such as exclusive OR will appreciate the value of this in preventing the appearance of unwanted dots. GRAPHICS PAPER and GRAPHICS PEN work as on the Sinclair Spectrum and now include the 'transparent' colour, previously only available for text.

Amstrad has always maintained that Locomotive Basic is fast enough to write arcade-quality games. The command FRAME enhances this ability by waiting for frame flyback on the monitor before showing any graphics changes. This makes scrolling smoother, picture-drawing neater, and can also be used to create spectacular instant colour-changing effects.

There is a command to read a character from the screen, and an extra parameter to the MOVE command which allows colour change.

There is only one error that can occur when using tape, and that's a read error which is always fatal. Correspondingly, the Amstrad CPC 464 was designed to treat this as fatal and abort the tape-reading procedure. With disks there is a wide variety of errors, such as directory full or bad sector, so the error/break handling has to be extended to give the user a chance to retry, or perform any other option, according to the needs of the program. From Basic, after discovering a disk error with



The bulging right-hand side now includes an integral 3in disk drive

the usual ON ERROR construct, you can now continue to discover the nature of the disk error with the DERR function and act accordingly.

Amstrad has also extended the ON BREAK. This normally takes one press to stop execution and two to return to the system, but can now be ignored by using ON BREAK CONT. Once activated, there is no way to return to your program other than cold starting and reloading.

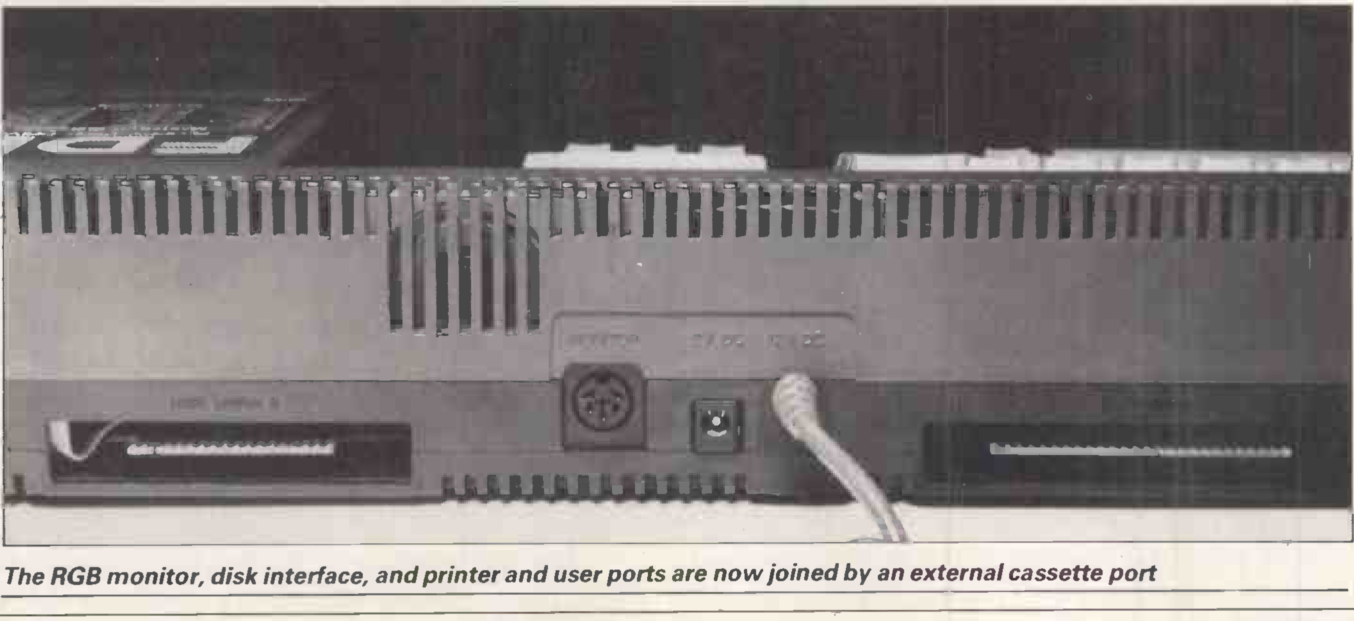
Included with the system is a disk containing CP/M and DR Logo. There are some problems with CP/M due to the small size of the transient program area (the memory available for application programs) which prevents certain CP/M applications from running. The second problem is that most CP/M programs are only available on 5in disk and not on the new 3in format. Having said that, there is a lot of software available on disk from Amstrad, and you can probably find a commercial company willing to transfer from 5in to 3in disks. Amstrad intends to make all its software available on disk, including small business software such as word processors and stock control systems, at prices starting from £9.95.

The CPC 664 will run all software designed for the CPC 464. For 464 owners, the addition of an external disk drive makes the machine very nearly a 664: certainly, all commercial software will be written for both machines. A few Basic programs using the new commands will not work, but most commands can be simulated by multiple Basic commands or, at worst, a call to one of the ROM routines. 464 owners who still feel they want to upgrade to the new ROM will be disappointed: Amstrad does not intend to sell an upgrade for the 464.

The CPC 664 incorporates the CPC 464 with Amstrad's disk drive in one unit

The CPC 664 system includes a hefty manual which isn't just the 464's manual and the disk drive manual thrown together. Although very similar, Amstrad has taken the opportunity to clarify some points from the old manual, such as the use of multiple colour planes to create sprite-like graphics, as well as explain the use of the new commands. The Amstrad documentation is excellent, although it tends to lean a little towards the reference side and needs to be complemented by a suitable book for out-and-out beginners.

By far the best feature of the Amstrad CPC 664 is its price. With a monochrome monitor the system costs £339, a colour monitor version will set you back £449. With built-in disk drive, CP/M and an 80-column screen, it represents excellent value for a small business that requires something cheap, or for serious home use. Compared with, say, the QL at £399 with Microdrives and no monitor, or the BBC at about £330 with no disk drive or monitor, it certainly seems good value. Admittedly the technology may not be the latest all-singing all-dancing wonder (a Z80 8-bit processor and CP/M) but it will be available at the end of April, while it's still a case of estimating the time of arrival of other more sophisticated machines.



The RGB monitor, disk interface, and printer and user ports are now joined by an external cassette port

Instead of computers catc
technology now has to ca

The way we see it, technology has suddenly got quite a race on its hands.

There's no other home computer in the world that's so expandable or so updatable as the new Enterprise 64.

And if you're wondering quite how we've managed that, kindly take a closer look at the outputs on our remarkable new machine.

You'll notice that amongst all the usual sockets and terminals, we've gone and incorporated a special 66-way expansion port.

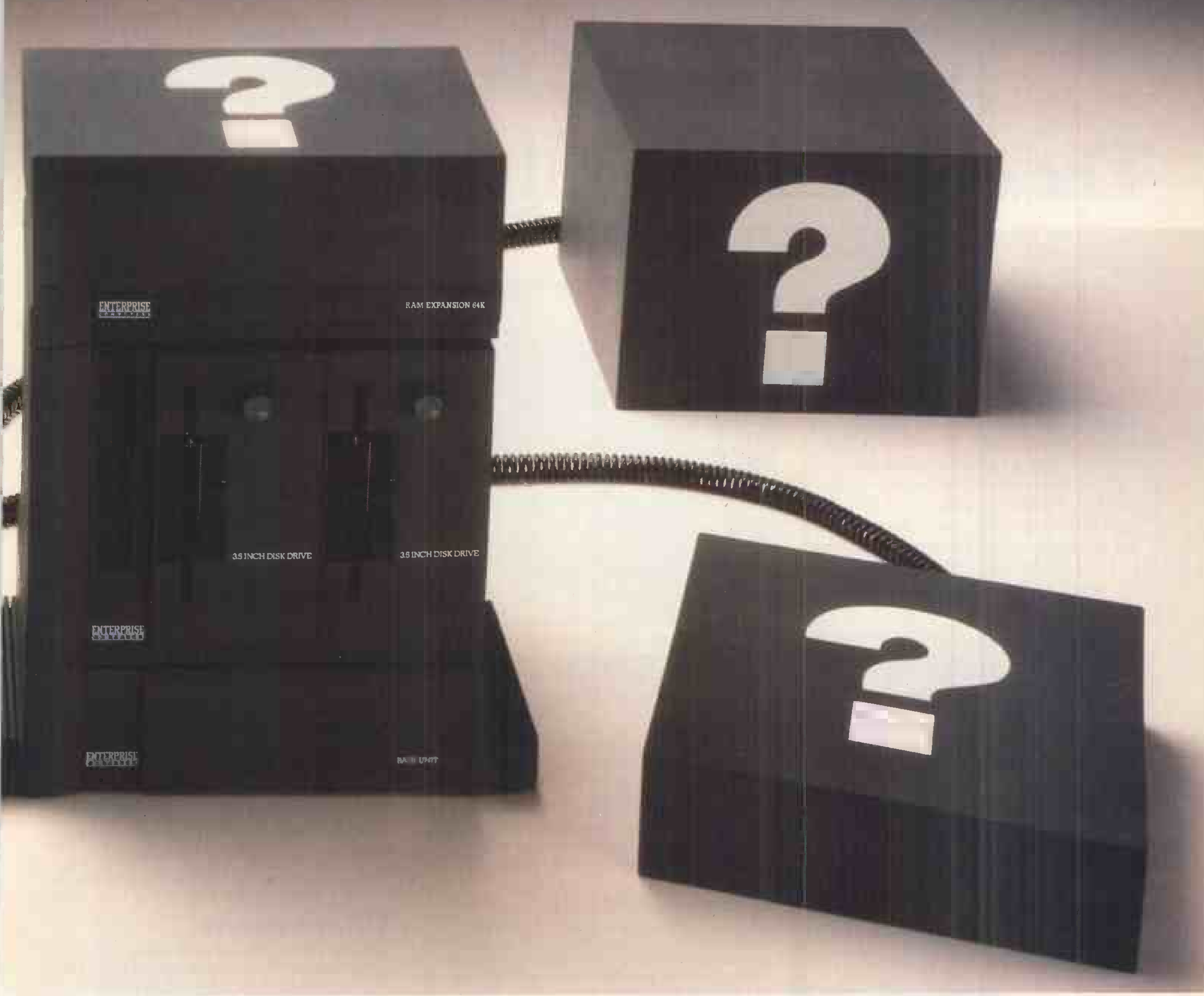
This will accept a whole range of new peripherals that are in the pipeline. Including those that are a mere twinkle in the eyes of our hardware designers.

We thought this expandability principle was such a good idea, we applied it to the Enterprise's memory, too.

Even in its most basic 64K form, this puts more user RAM at your disposal than almost any other competitor.

But plug in our special Rampacks to the base unit, and you can progressively increase that figure to a truly extraordinary 3,900K.

hing up with technology,
tch up with a computer.



Not that that's the only challenge we present to today's ambitious programmers.

With a screen resolution of up to 672 x 512 pixels, 256 colours and a high speed video processor, the Enterprise will outgun all but the highest quality TV monitors.

And the sophisticated sound chip generates no fewer than 4 voices across 8 octaves in full stereo.

Combine the two and you can create effects that leave today's games looking like pub video tennis of the mid-seventies.

For anyone with literary aspirations, the Enterprise also comes complete with an integrated word processor.

Whilst the really serious user will be delighted to discover analogue RGB and TV outputs, as well as parallel, RS423 serial and network ports.

Both Cobol and 'C' will be available with CP/M running, and you can even use Lisp, Forth and Z80 assembly language on cartridge without encroaching on user RAM.

The new Enterprise 64.

It hasn't just overtaken technology. It's left every other home computer straggling in the distance.

ENTERPRISE
C O M P U T E R S

WITH OBSOLESCENCE BUILT-OUT

Lease of life

You needn't expect anything about Acorn contained in this issue to be necessarily accurate by the time you read it — the speed at which decisions are being made in Cambridge makes that an impossible ambition.

However, it is worth noting that the Electron, now at a substantially reduced price, is selling 'as well as anything else' on the market. Different people have different 'informed' estimates about how micros are selling, but it looks impossible to escape a doldrums period of several months.

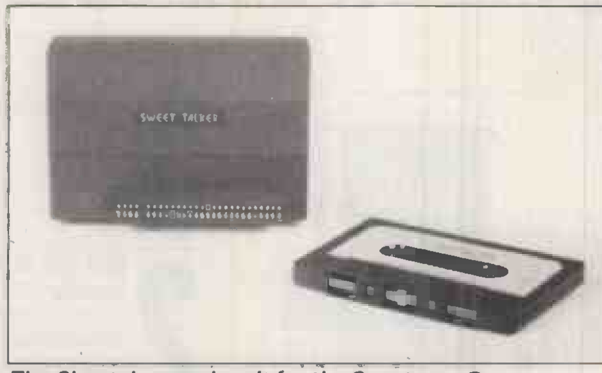
Two reasons: Atari and IBM. Atari (and, to a lesser extent, Commodore with the Amiga) are both grabbing the attention and imagination of prospective buyers with machines which look so much better than anything on the market, that people who really aren't going to spend anything like £800 are nonetheless waiting to see what they are like before buying a Spectrum (or Amstrad) anyway. And in the business arena, IBM's now strong rumours of the PC Two are putting a stranglehold on distribution. Big wholesalers are simply not prepared to stock up on lookalikes for the old version if the new version will be better.

That said, people are still buying micros, and I do expect the Amstrad announcement, in a month or two, to revitalise parts of the market.

But all the same, anyone who is expecting an avalanche of eager Electron buyers through the doors of his shop, had better not hold his breath.

Rumours and reports of the cancellation of the Electron as an Acorn product are premature, if not totally wrong. The stock of those machines is high, and at the current rate of sales it would be quite surprising if Acorn had to build any more before Christmas. But since no-one, inside Acorn or out, actually knows how many customers will show up between now and then, it would be a very strange thing if plans hadn't been made for two possibilities: one, that the Electron will never need to be built again; or the other, that Electrons will need to be made again in July (or whenever).

At the new price, the machine is an affordable starter machine, and I wish I could give it a better recommendation than that of one program junkie I know who called it 'a BBC with the nice bits left out', but I can't. Not even after the Consumers Association called it the 'best value for money in the home market'.



The Cheetah speech unit for the Spectrum, Sweet Talker, has been reduced to £25 including cassette software. The maker suggests that it can be used for 'warning of impending attack in games', which gives me nightmares. I still haven't recovered from the shock of playing a BBC game downloaded from Micronet, and hearing the thing suddenly address me in Kenneth Kendall's cultured tones, suggesting 'enter your name'.

Details on (01) 833 4909.

Why have I printed this picture of three Englishmen in front of Tyne Bridge, Newcastle, together with another pic of three Australians in front of Sydney Harbour Bridge? Is it because I don't often get interesting pics like this? Is it because the Englishmen, Claremont Controls, makers of the Hornet project management system, are fascinating folks? No, it's because the Australians have taken on the distribution of Hornet, and we have an Australian reader. I think.

Claremont is on (0669) 20181. Hornet Computer Systems is in Sydney, and I don't have an address. Ask Claremont.

The domino theory

The following is an example of the domino theory in action. Last November, *PCW* ran a story about a version of Intelligent Interfaces' Syscon 6 which lets BBC owners connect up to the Mator Shark hard disk drive.

This drive gives 10Mbytes of storage, with up to 1838 files, a figure I got wrong at the time of writing (about 3am, hence the error). I wrote a follow-up story, with the right figure, and also mentioned that other versions of the Syscon 6 allow BBC owners to use Commodore drives from the 2040 upwards. Not the fastest drives, but the idea is worth considering if you have any lying around.

However, the follow-up story never made it into print. Should this one be luckier, and the dominoes stop tumbling, then you may like to note Interface's phone number. It's (0789) 296879.

The fall and rise of Boddy

The man who founded Torch, Martin Vlieland-Boddy, has not disappeared into the wilderness licking his wounds after being ousted from that company, despite the popular myth. What he is doing is trying to confound orthodox financiers by setting up a trading group.

His own company is Active Technologies, which is the designer of Torch's latest product, the 8086 add-on, the Graduate, which turns a BBC Micro into an IBM-compatible system.

Active has just put 22 per cent of its share capital on the Unlisted Securities market, raising the relatively trivial amount of £200,000 'to establish a share price,' as the Boddy recently put it. His plan is to widen the scope of Active by acquiring, or merging, or setting up joint ventures with, a series of other technology-based businesses — but ensuring that most of them are outside the micro business.

'Groupings like Racal are our model,' he told me, 'where they have irons in several fires, and can reassure

MORSE: THE TOP TEN SYSTEMS

£ Value ? Advice Software Printers Support

1 **IBM Personal Computer.** The World's best selling Personal Computer, as well as ours. By buying in volume, Morse are now able to offer the IBM PC at a price that can't be touched by other dealers. This system has twin 360K disk drives, UK keyboard, monochrome display, printer adaptor and DOS 2.1 with all manuals and full warranty. **SAVE £540 ON LIST PRICE!** Ideal as the basis for word-processing or spreadsheet work. **£1500**

2 **IBM COLOUR PC.** Like the above system this IBM has two disk drives, keyboard, DOS 2.1, Basic and full warranty, but we've exchanged the IBM monochrome display for the colour display and graphics adaptor. For software like Lotus 1-2-3, Chart or Execuvision, colour output is essential, and at this price it's now affordable. Printer adaptor £87, extra memory, £70 each 64K. **This system normally over £2340! £1800**

3 **IBM XT.** The 10Mb Winchester version of the PC is still as popular as ever, and we suspect the shortage of AT's is the reason. Our 128K RAM, monochrome system with communication port is ideal for planning, database or accounts applications. **SAVE OVER £410!** IBM XT now: **£3190**

4 **COMPAQ DESKPRO.** This superfast machine is also benefitting from the lack of AT's, and with 640K, 10Mb hard disk PLUS internal tape backup, it's all you need. We supply it with **FRAMEWORK or SYMPHONY, fast NEC printer, disks, cable at NO EXTRA COST, SAVING £970! £5595**

5 **COMPAQ PLUS.** Compaq Portable + 10Mb Winchester = strength + value. This 256K computer has a reputation for being really tough and reliable. Morse stock this popular machine at nearly **10% below the list price,** so you can store more and pay less. **SAVE £355!** Only: **£3590**

6 **COMPAQ PORTABLE,** the No.2 PC in the U.S., and the best of all compatibles. With 256K, unique graphics and text display, dual 360K disk drives and of course, portability, the Compaq is great value. Now it's even better value because you **save £200** at Morse. Why pay any more? **£1990**

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 HR15** printer, cable and free word-processor and spreadsheet, etc. **saving £480.** 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. **SAVE £300!** High demand has allowed us to prune the prices to £1690 for twin 720K disks, and now on twin 315K disks: **£1490**

9 **APRICOT PORTABLE.** The computer you can talk to! Remarkable piece of technology with flat liquid crystal display and speech recognition. 256K as standard, 720K disk drive, loads of software, all in a 12lb. pack. Morse can supply it from stock. **With FREE £95 MOUSE! £1695**

10 **APRICOT F1.** Incredible value full specification business micro. Bright colour display, 256K memory, 720K disk drive, infra-red cordless keyboard. Bundled with word-processor and spreadsheet. In stock now. Mono display £200, Mouse £95 **£995**

SANYO SUPERDEALS!

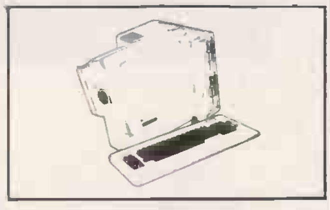
The Sanyo MBC 555 series has proved very popular. It's ideal as the basis of an office system. Now Morse have even better prices!
SANYO MBC 550, 160K disk drive, 128K RAM, WordStar & CalcStar, MSDOS, (RRP £795), now **£600**
MBC 555, 2 x 160K drives, 128K, Word-, Spell-, Info- & CalcStar, Mailmerge etc. (RRP £995), **£795**
MBC 555 (x2), as above, with twin 360K disk drives (£1395) **£995**
CRT 36 green monitor: **£127**
CRT 70 colour monitor: **£495**

MORSE HARDWARE

Digital Equipment make some of the finest wordprocessors, and the dedicated **DEC MATE II** can be found in many offices. Morse offer the DecMate II (list price £3049) at **£1790, saving over £1200! New products at Morse** include the Apricot colour board and Point 32 network. The IBM Wheelwriter and Quietwriter printers have arrived and have to be heard to be believed! Coming soon: Tapestry, IBM's network. You can link up with **£1500 IBM PC's** at Morse.

EPSON AT MORSE

Selling like hot cakes, the 64K **EPSON PX8.** Lap-held CP/M, with 80 column LC display, WordStar, CardBox, Calc, diary etc only **£795**
NOW IN STOCK: PF10 battery operated 360K disk drive, **£395.**
JX80 seven colour printer, **£560.**
CASIO FP200 portable computer. Basic, CETL etc, (list £299). With **FREE** £35 database and other software, at Morse only **£230.**
CASIO PB700 pocket computer with Basic & graphics (£110) **£86.** Plotter, tape, expansion, available.



TELEVIDEO TELE-PC

Completely IBM PC compatible computer with 128K memory, good-looking 14" graphics display, twin 360K disk drives. Runs Flight Simulator, Framework, 1-2-3 etc without any problems. List price £1990, unbeatable at **only £1390.**
NEW SOFTWARE AT MORSE. On our shelves now, WordStar 2000, Delta 4, largest, fastest spreadsheet ever: SuperCalc3 release 2.
Many more items too numerous too mention. All Morse prices are exclusive of VAT at 15%. E.& O.E.

MORSE

MORSE COMPUTERS 78 HIGH HOLBORN, LONDON WC1V 6LS. 01-831 0644. TELEX 916509.

the City that they aren't overexposed to any one risk market.'

People in the business of raising finance for micro companies should watch this venture closely.

Taking over

To my surprise, Americans are now taking very seriously the idea that the IBM PC Two, when it comes, will use a non-standard diskette of 3¼in diameter. This was the size chosen by Dysan for its bold attempt to take over the disk world by producing Apple-compatible 3¼in drives, disks and software which no-one wanted.

It seems unlikely, perhaps, that IBM might now want to adopt the same standard, but there are two possibly plausible arguments in favour. Firstly, there must be quite a few disks lying around at a nice price. And secondly, by taking that route, IBM would get software onto a format which no-one else could copy, so lookalike machines would be handicapped until they could catch up.

The chip inside the Two is looking more and more like the 80286. Confirmation from within ACT that 'we are tracking the Intel chip family' and hints from Roger Foster that he might 'have a machine of that performance available before IBM does' prove less than nothing.

I've heard rumours of a machine based on the 68000 chip from ACT, too. I don't believe them, but I have to admit that, if ACT *was* working on something like that, it would start off by hinting at a machine using the 80286.

Whether ACT follows or not, the new IBM machine would do very well with the 80286. It would make it around three times faster than the PC, and it is known to be very much prettier, with a footprint the size of the Junior's.

All we really want to know is 'when?', and, of course, IBM isn't going to help us with that one.

Anyone who went to the PC Trade Show (a nice, peaceful place, with pleasantly quiet corridors and no untidy clutter of exhibitors or visitors) will have remarked on the hype being given by IBM and Torus to a product called Tapestry — a network-managing 'icon'-based system.

The idea is to manage the highly complex network structure — disk and printing sharing, applications, communications and file management, electronic mail, phone directory, and online help — by nice, simple Macintosh-like (Small Talk-based) icons.

Do not be deceived, however, into supposing that the PC Network is: a) something you've heard of before; or b) IBM's network. It's yet another non-standard IBM network standard. Somewhat to their own embarrassment, IBM staff on the stand claimed that the network hadn't been officially announced yet, whereas Torus had its own network, Icon, for networking PCs, also on offer.

Confused? Consult Torus on (0223) 862131, and if you feel you understand it all, do let me know.

The Arabian link

Arabic capability on micros, I've learned through long experience, always intrigues a large number of readers. The latest Arabic-based system is on the IBM PC and XT, from Aptec (Appropriate Technology).

'Our approach provides a more comprehensive range of linguistic features than are inherently available under IBM's Arabic language utilities,' claims the company. The Aptec package of 13 different applications and programming packages supports, for example, the complete set of 'vocalisation signs' — the little slashes and dots above and below the words, which give vowel sounds.

Details on (01) 328 7272.

Easy screen

Data General (DG) has answered one of the two major objections people had to the DG One — that its enormous LCD screen was hard to read — by announcing a new one.

The new screen also has an improved tilt mechanism, says DG, which is about as far as we can expect the company to go in admitting that the old one wasn't much cop. It worked fine, if you had your head held in a clamp at a normal angle with the light behind you.

What is really nice, however, is that the new screen (with tilt feature) is available as a free upgrade — not only to new buyers, but to existing owners. All the company has to do now is to put some wellie into its drive to put software on the beast, and it might start to be irresistable.

Details from dealers, or from DG on (01) 572 7455.

Warming up

One of the most impressive word processors I've played with in some time is Microsoft's Word on the Macintosh (which will be reviewed next month). Anyone starting from scratch but anticipating that word processing will be their major activity should give this one a half-hour trial at least.

It is, like all Macintosh programs, entirely different from the version on the ordinary, user-proof previous generation machines, and the only thing it loses by the trade-off is WordStar function keys.

If I knew why computer designers won't give WordStar-trained people the old, familiar control-key operations which we can all do in our sleep, I'd rest easier at night. Why is 'cut text' CONTROL-X, ':copy text' CONTROL-C, and 'paste text' CONTROL V? All my computer life (well, sort of) CONTROL X has meant cursor down, and CONTROL C, page down.

The original answer, of course, was that 'Macintosh doesn't use cursor keys'. No, it doesn't, and don't ask me why not. The CONTROL key is there, and my reflexes are there. But Apple didn't invent WordStar keys, so we aren't allowed to use them.

The menu for character formats is CONTROL D. The menu for paragraph formats is, logically enough, CONTROL-M. Logically? No, of course it isn't: it's completely daft.

If Microsoft/Apple had to invent a whole new set of control-key standards, what was wrong with a logical set? Why not a mnemonic set? Aargh!

The thinking man's software

Caxton's Brainstorm, which was designed as an aid to thinking, has a sort-of rival in Living Videotext's Think Tank, which has now appeared in a version for the 512k Macintosh.

Brainstorm still has the edge over Think Tank in one important respect — it links ideas in the outline, so that your ideal model can have the same thought in two places and the system will link them together. The result is that Brainstorm can be used as a powerful indexing tool.

Think Tank, however, on the Macintosh, takes advantage of the obvious theory that the second step after a good deal of complex thinking is normally a good deal of heavy writing.

Having set up your 'outline' in Think Tank, all the headings and sub-headings can be viewed as the 'title' of a window, and that window can be up to 16k long. On Brainstorm, you have to print your processor out and try to work from the blueprint that gives you, which isn't as powerful as the linked idea display on the computer.

For a writer, Think Tank 512 is like working on a book with the entire structure always visible to you as you write. At any stage, you can close down one window and go back to a previous chapter to add a thought (or page, or whatever) which has just occurred to you.

As word processors go, it's OK, but limited by comparison with Macintosh processors. It gives you two sizes of type, and a rigidly-defined set of heading and footing options — but then, what other word processor will print out the contents page with numbers?

Coming soon — a version of Think Tank for IBM users, version 2. This will include the fascinating idea of 'clone' subjects, and involves taking the 'replicate' idea of spreadsheets and perverting it. Take a sequence of ideas and sub-ideas, for example, called 'product development', and clone them; you can then put clones into the outline for all the products you're planning.

Change one, and all the other clones will be changed, too. Apparently, this neat feature was an accident — it was meant to be just a duplicate function, but the link-back happened as a program bug. When the company fixed it, the test users complained that they'd liked it, it was the best thing in the package . . .

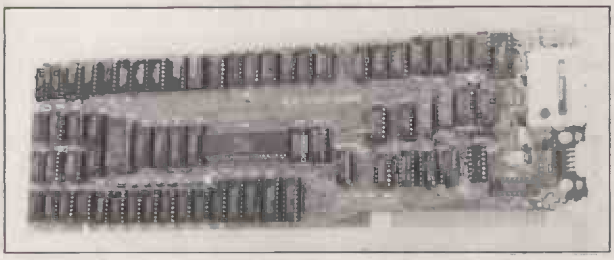
Think Tank in all its versions is distributed in the UK by Rapid Winners.

Anyone for second place?

The irony of the collapse of Peachtree, the micro subsidiary of the world's biggest software house (MSA) is that only the Peachtree Business Management System has been bought out.

Dick Moore, managing director of Peachtree, is now managing director of his own company, Plusmark, which bought the rights. Good luck to him in turning the 1000-odd Peachtree customers into Plusmark customers and building on the enhancements which he plans, but really, we could have done without yet another 'we'll take over the world' comment on the way.

'It is our intention to establish Plusmark as the market leaders in specific vertical areas,' he said. Funny — no-one you talk to ever plans to come second, third, fourth, fifth, or whatever, and yet out of the hundred or so people in any business, only one can be the leader. And then the 99 get annoyed with you for suggesting that they're indulging in hype.



Unfortunately untested at the time of writing, this board claims to provide 32 lines of text on the IBM mono monitor or video unit, even using WordStar.

It is actually a general-purpose video board, giving IBM users access to several types of display apart from the standard IBM colour and mono displays. You can also have projection TV output (PAL colour), or an ordinary RGB monitor like the one for the BBC, or even a standard British TV. I want to test it on Flight Simulator.

Details from the designers, a new company called DLM in Bucks. Phone (0753) 888852.

The second time around

A new Lynx, the details of which are still secret, is about to be re-launched by Anston Technology, which has bought the rights to this distinctly unusual micro.

The machine isn't new — it was launched around two years ago, based on the Zilog Z80, and with a colour display. It was never my favourite machine, taking 10 seconds or so for Basic to fill the screen with text, and not scrolling, but its user group has greeted the news of the revival with amazing enthusiasm.

They haven't yet overcome the problem of what to do when the screen is full of text — at the moment, it starts again at the top — but they tell me they've worked on the speed problem and have a screenfull of data down to less than a second.

The new Lynx starts with a 128k model, and can be expanded to 256k. This machine did actually appear before the company was wound up, but only a hundred or so were made and they were sold to European buyers.

Since the enthusiasts of this machine are so enthusiastic, I feel it only fair to publicise the user group orgainser. It is Bob Jones, of 209 Kenton Lane, Kenton, Harrow, Middx HA3 8TL, and his ever-busy phone number is (01) 907 3406.

International exchange

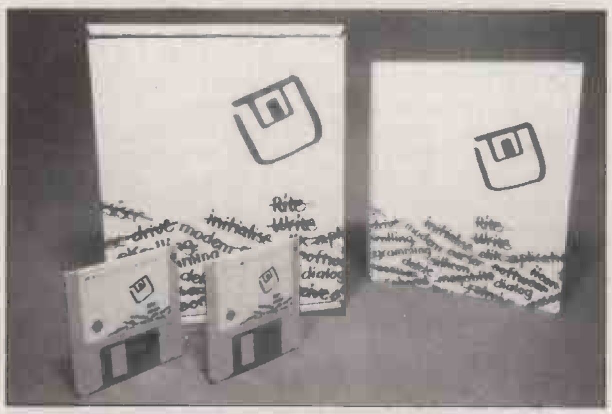
American communications software, with all its advantages over British varieties, is at last becoming available to British users.

The reason it hasn't been available before is simple. There was no such thing as a Hayes-compatible modem in Europe, and American software tends to assume you have one. Dowty, an engineering company which recently took over Steebek Systems, is now working on two Hayes-compatible modems. Rumour informs me that Dacom, an independent modem builder whose equipment wears Scicon and ACT labels (among others) is also working on this. And Anderson Jacobson is also supposed to be getting a model approved.

All will cost around £500, and the reason for the high price is that they have to have two types of data code.

To run standard 300 baud modems, you whistle two different notes. One note is a dot, the other is a dash — they are usually an octave apart. Two (different) return notes also signal dot and dash, or binary zero and one. The note shifts between the two frequencies, so the system is called Frequency Shift Keying, or FSK.

Prestel uses another frequency shift to transmit data from the host at 1200 baud, but receives it back



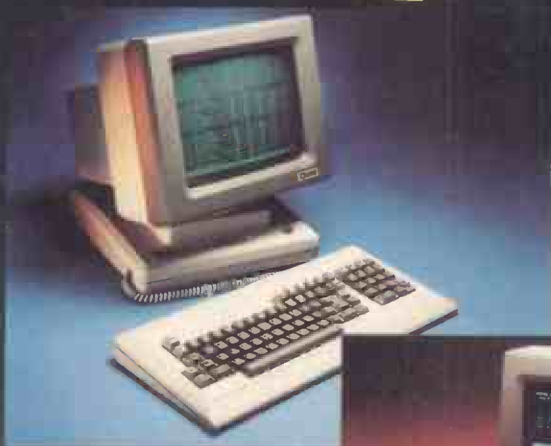
For an extra £109, you can add a new menu option to the Macintosh command bar, saying 'Spell'. The program which does this (to MacWrite) is called Mac Spell Right, and is produced by Assimilation Process. The company also does a RAM disk package for £30 for the Fat Mac, which works well enough as long as you don't use a hard disk (at which point, it goes crazy) or the new disk-based MacWrite, which ignores it.

Details from Pete and Pam on (0706) 217744.

QUME

remember Qume = Quality

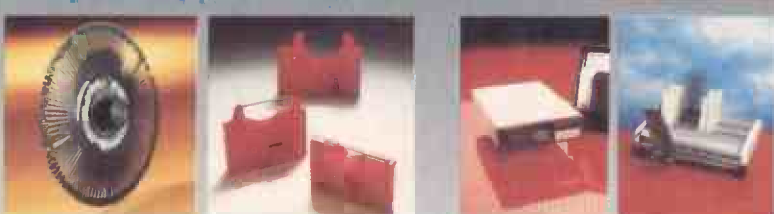
because it incorporates all the advantages of a world- wide organization – extensive technology resources, multi manufacturing facilities – and Qume (UK) a British company with customer service a priority.



a "wide" range of video terminals designed to satisfy virtually every application from word processing to advanced colour graphics.

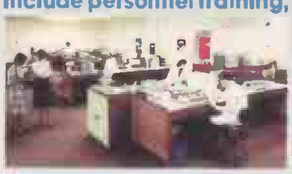
also a "wide" range of Daisywheel Printers from the Sprint 12/20 for Home and Personal Computer applications to the Sprint 11/90 "the world's fastest Daisywheel Printer", ideal for clustered systems and data processing applications.

The range of Computer supplies include–



Daisywheels, Ribbon Cassettes, add-on Disk Drives and Sheet Feeders
– all Qume original quality

a customer support organization with technical Hot-Line. Services also include personnel training, equipment maintenance and servicing.



Service Department

READING Facility

Sales and Marketing NEWBURY

a company serving British computer users directly and through a Nationwide network of appointed Distributors.

Qume®

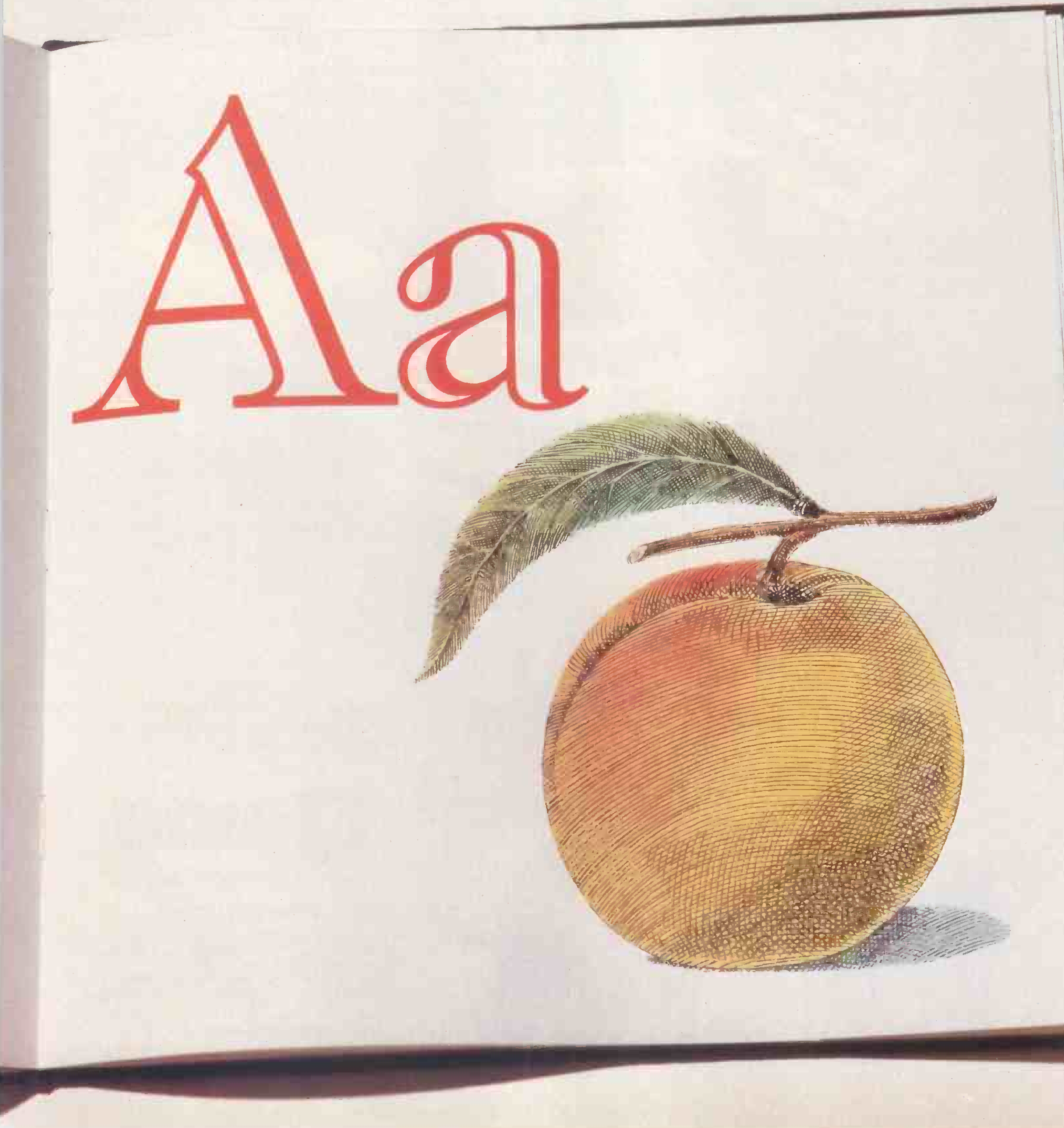
The Quality Peripheral People

Qume (UK) Limited,

Marketing and Sales	Service and Training Centre
Park Way, Newbury,	Bridgewater Close, Reading,
Berkshire RG13 1EE	Berkshire RG3 1JT
Telephone: (0635) 31400	Telephone: (0734) 584646
Telex: 846321	Telex: 849706

A British Company of ITT

A beginner's best in busine



guide to the ss computers.

The only lessons you need to learn when buying your first computer are that 'A' now stands for Apricot.

And that for first-time buyers there is none better than the Apricot F1.

This is no idle boast, we assure you.

For its price of £1,095* you literally get an unbeatable package.

PROOF THAT APRICOTS HAVE BETTER MEMORIES.

Our rivals' memories can be quickly forgotten.

Given our price, none can compare with the memory of the 16-bit Apricot F1.

Ours delivers a powerful 256k which can be easily upweighted to a truly massive 768k.

Not content with that, there's a huge 720k disc capacity and a range of add-ons to increase processing and storage.

If that sounds like gobbledegook to you, fear not. A tutorial is included in the free package of business software which explains all.

Suffice to say that the Apricot's memory can easily keep pace with your business growth and won't become quickly obsolete like so many of our competitors.

REMOTE CONTROL APRICOTS.

Even our keyboard beats the others hands down. We have 92 keys (our competitors short-change you with as few as 58) which includes a numeric pad for rapid calculations.

As yet further proof of our inventiveness, the keyboard is cordless as is our optional mouse.

These work on infra-red beams just like your telly's remote control so you don't have lots of wires getting in the way.

To home in on a particular part of the screen you simply point the mouse at your F1 and twiddle the control.

Yet another feature worth looking at is the fact that the Apricot F1 can drive either a colour or monochrome monitor, or even your TV set.

You can display up to 16 colours simultaneously or 16 levels of greyscale.

As your business develops you can plug the F1 into one of our new network systems which allows more than 30 computers to talk to each other.

DEALERS IN FRESH APRICOTS.

Our nationwide dealer network will help you pick the right Apricot for your needs. Our dealers will even train you on your own premises, if it suits you better.

They also act as a local back-up system should you ever need help.

Contact your nearest dealer, or regional distributor listed below and he'll point you exactly in the right direction.

Then you can call in and get to the root of all knowledge about the Apricot F1.

Computers & Communications Limited, Bradford. Tel: 0274 499122.

Microworld Distribution Division, Edinburgh. Tel: 031 557 4196/2087/3345.

Micro Systems (Distributors) Limited, Kettering, Northants. Tel: 0536 520910.

Hugh Symone Distribution Services Limited, Bournemouth. Tel: 0202 26535.

Quest International Computer Systems Limited, Chandler's Ford, Hampshire. Tel: 04215 66321.

apricot F1

*PRICE EXCLUDES MONITOR AND VAT.

ACT (UK) LTD., HALESOWEN, WEST MIDLANDS B63 3NT.

again at 75 baud.

To send and transmit at 1200 baud in this country, you have to turn to a different code — phase encoding. This has been explained to me often enough for me to realise that you can't explain it in a couple of paragraphs, but you can explain one thing — an FSK modem can't work on phase-encoded signals, nor *vice versa*. You need a different (complex) circuit.

In the States, where (Telecom people have been telling me for years) they have a far inferior system, they just happened to pick a set of FSK frequencies which allow them to have both 300 and 1200 baud in the same modem. Of course, they have to make do (poor dears) without Prestel's 75 baud.

You can't use an American modem for 1200 baud FSK full duplex in this country. If you do, you run the serious risk of interfering with the switching equipment in our exchanges, which use a very similar frequency.

The way round the problem in the UK is technology — a set of very powerful VLSI circuits developed by Rockwell are being built into these multi-standard modems. They will now, at last, behave like the Hayes standard modems which Americans have been using software to control for years.

American comms software is superior to most British comms programs for the simple reason that an American comms system uses Bell and we use BT. Bell phones can dial a number by 'touch-tone' techniques, known as multi-frequency (MF), in small fractions of a second. British phones have to go through a pulsed network, taking around 15 seconds to dial a number, especially if it's one of the new Telecom packet switched numbers with lots of zeros and nines and eights in it.

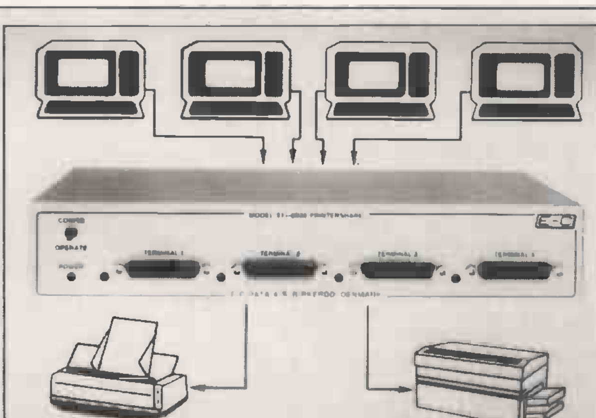
Bell phones, once they are dialled, are switched in small fractions of a second, unlike BT phones which can take up to 10 seconds to generate a ringing tone. And automatic phone answering machines respond instantly, unlike British ones which are required to wait for three rings. The result is that, in the States, you can pick up a Macintosh mouse, click it, and watch Dow Jones data scrolling down your screen at 1200 baud full duplex, inside three seconds.

In Britain, only today are we starting to see modems which can cope with 1200 baud full duplex and 300 baud full duplex in the same unit, and the same logon sequence would take around half a minute, assuming you didn't get the engaged signal.

American modems can detect engaged tones, unobtainable tones, and carriers. Ours can't. American phones can automatically redial if they find a number engaged. Ours are not permitted to redial more than so many times an hour, in case they jam our antiquated exchanges.

Of course, we are getting new exchanges. Plessey is, even now, putting the finishing touches to its 20-year-old project to design a world-beating System X digital exchange. This is something which was on the stocks before Concorde — by the time they get it debugged, it will be more obsolete than Concorde. Then they will start installing it, no doubt.

Stebeck is on (0635) 33009.



Up to eight computers can share one or two printers with this Danish device, the Printershare. The builder is E-C Data A/S of Birkerod, which claims that to the computers which use the shared printers, they look just like a printer with a buffer.

Details on the following phone number: +45 - 2 - 818191, from Niels J Bjergsrom, who promises a Centronics version some time before July.

With the portable Husky, you don't get a disk drive. Not to worry — find someone with a Sirius, and the Husky Sirius Comms Pack will let you treat it like a storage system, just like the PC pack they launched (though I didn't record it) last year. It costs £98 plus VAT.

Stuck in the mud

Robb Wilmot's announcement that he would become a director of Sinclair, and would be in charge of the first Metalab project to be announced, came as a surprise only to those who hadn't been paying attention for the last few years.

Wilmot and Sinclair have been personal friends from the days, way back when Sinclair Radionics was around, when Wilmot was selling Clive chips from Texas Instruments. Wilmot left Texas when it messed up its own personal computer effort (but before it was abandoned) to join Clive on the ZX80 — then he became boss of Texas UK, instead.

The other surprise was supposed to be the 'wafer scale integration' plans. This simply means using the chips on a silicon wafer, without chipping them off first. Normally, they are broken up into chips so that they can be tested and the useless ones thrown away. Sinclair has bought Ivor Catt's patents for a system which involves using self-testing chips, which link themselves together and ostracise the ones which can't test themselves, or can, but declare themselves unfit for work.

Now the really clever thing about Catt's patents is that his plans don't end with building a wafer-sized memory. His scheme proposed building memory, but only as a way of financing the plant in the first place. The real purpose of the system was to produce content-addressable memory.

The advantage of content addressable memory is that you don't have to know where you put the information in order to find it. The whole memory bank — as many gigabytes as you can afford — can be asked for responses to: 'Do you contain the name Smith? And is he mentioned in connection with this fingerprint pattern?', and each memory block instantly searches itself for the information. Only the correct location will respond, cutting a two-hour search (or more) down to milliseconds.

ICL rejected this approach seven years ago because 'there are so many powerful software tools for conventional mainframes, that it would be pointless to again start developing new tools for a new type of hardware'.

Ironically, last month Cincom announced that it was releasing Mantis (a type of database software) for ICL users 'because they are starved of good system software', of exactly the type which the company's R&D chiefs had insisted was too good to throw away.

It's funny, isn't it, how people you talk to are always good, thoughtful, intelligent and perceptive, with endless explanations of why something Not Invented Here is actually no good, and it isn't simple parochialism that makes them stick in the mud.

Castles in the air

Bets are being taken inside Commodore and Atari as to which of them will be first with a super-duper 68000 system to beat the Macintosh. Outside those companies, most money in the trade is going on Atari. This is due to Jack Tramiel and his remarkable publicity campaign.

The difference between Commodore under Tramiel and Commodore today was revealed most emphatically by the contortions of Atari, where Jack Tramiel is now in charge, last month. While Tramiel was on television, showing WH Smith his new SS500 and proclaiming that it would be announced at Hanover, plus joining in with Digital Research in announcing Gem software developments, Commodore was keeping quiet.

Then, two weeks later, it produced the PC clone, the Model 10, ready for shipment in April. 'We have them in the warehouse now,' Commodore said.

As little as two months ago, I was shaking my head and wagging my beard and saying that I didn't think it would be launched. OK, it may not be the right time to do anything as hohum as launch a PC clone, but Commodore has launched it. Staff there have painful memories of previous non-launches, and are determined to avoid over-hyping new products as much as possible.

So what of the Commodore Amiga?

Like the Atari, it has a 68000 inside it. Unlike the Atari, it also has extra hardware, with special chips to draw lines, file areas, compare memory blocks, and do a hundred odd little things that, in the Mac and the Atari, the central processor has to devote its whole attention to.

My contacts in the States are very excited about it because of the power it gives them to invent totally convincing games, which run a lot faster than anything they have ever dreamed of in the 8-bit world. And, they tell me, Commodore is shipping advance models for software developing to programmers.

In contrast, Atari is talking to the right people and convincing them that the ST is on the way, but isn't giving computers to software people. On the contrary — if you want the Atari, you will find that the company is offering to relieve you of a tidy couple of thousand pounds for the documentation, without which you cannot write a byte of code.

When Tramiel walked out of his GEM conference, his next act was to go to Atari's UK headquarters in Slough and announce that henceforward there was no need for the staff of Atarisoft.

For a radically new design of chair, you'd think Alternative Furnishing would provide: a) a product picture; or b) a vitally healthy-looking athlete using it. Instead, they provide a picture of Bob Dunne MP, Undersecretary of State for Science, wearing a jacket which completely hides the shin support pads of this remarkable stool. I've used one, and it really is different. Details on (0227) 60809 — that's in Canterbury.

For £250, the MacEnhancer from Microsoft would be expensive if all it did was 'allow Macintosh applications to use a wide range of IBM-compatible printers'. After all, most of us don't have a wide range, just one — and printer drivers for most popular computers are available from stores for £50 or less.

What this little box does to justify the extra money is provide four additional ports, allowing five peripherals to be connected. For anyone going for the network, this will be essential — you can't have spare disk, network, modem and printer all connected at once, otherwise.

The building, designed for 120 people, is now filled to bursting with 18, and most people in the business expect that it will be sold. Certainly, my information is that the company needs the money.

Commodore people aren't to be drawn on when the Amiga will be available, but they have their own opinions on when the Atari ST will be out and they aren't expecting it this year. It has to be said that, on track record, nothing in Tramiel's history convinces me that they are wrong. I've written too many stories about Commodore vapourware which refused to condense into products, or which took two years longer than predicted to appear. Jack Tramiel has the reputation of being the only person in the industry who could possibly get the 'Mac-basher' or 'Jackintosh' out by April, but no-one seriously expects this to happen — he also has the reputation of tailoring his promises to his listeners' desires, rather than to possibility.

Bigger and better

The new versions of Sinclair's free Quill software (by Psion) are not only improved in the obvious way of now fitting into memory: they also use QDOS. The first versions were written before QDOS existed, so Psion had to write its own input and output routines.

The new versions, able to leave that to the computer's firmware, don't have to constantly consult the microdrive cartridges for further instructions, and hence run very much faster — especially Quill, the word processor.

But more significantly, perhaps, because they use standard operating system calls, they can use the many disk drives now available on the market, too. The result is that on the Medic disk drive (including 512k of RAM for your £700 and the two floppies) the programs run quite normally.

The new versions also have the wonderful feature of letting you quit each module while watching the computer reset itself. This means that the Xchange overlay now becomes a possibility, as soon as enough QL buyers exist and have memory upgrades. Medic, by the way, sells a 512k upgrade for £200.

Consumer service

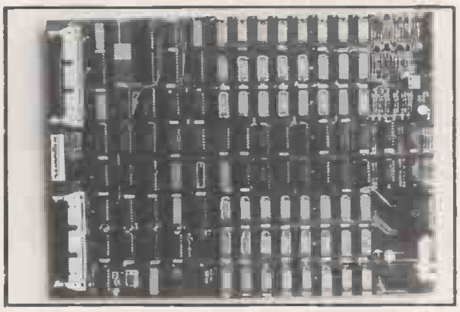
A money-back guarantee is good news for the name Currah, which went into a bit of a decline when the company went into receivership. The speech specialist has been getting a big boost from Welwyn Systems, where the Currah speech synthesis bits and pieces are being sold.

The company now has Steve Currah, founder and designer of Currah Components and its products, on the staff. Welwyn is not only putting out a lot of publicity effort in Currah's direction, but is also building the Microspeech and

GRAPHICS

DIGISOLVE offer you a way to increase your graphics speed and resolution. Using a high speed graphics processor, our cards draw lines and characters FAST. The graphics processor works in parallel to the host machine and gives you the power of using a co-processor specifically designed for graphics. With drawing rates of up to 1,500,000 pixels per second, lines appear instantly to speed up your plotting.

With the resolution, we offer new possibilities for software and systems, both in monochrome and colour on a large range of computers.



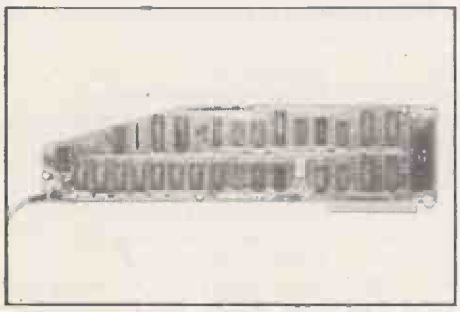
COLOUR GRAPHICS CONTROLLER

DIGISOLVE offer you high resolution colour graphics too. Designed to plug into any computer with a bus host adaptor. The VGP64 gives you 512 x 512 pixels in 64 colours. With its own vector processor and 384K bytes of memory, your computer can become a sophisticated grahics system. **64 COLOURS** or 8 if you insist, not many do! **4096 COLOURS** now you can really paint a picture. **384K BYTES of RAM** or 768K Bytes with 4096 displayed simultaneously. 2 **PICTURE BUFFERS** give you help with animation. **GREY SCALE OUTPUT. EXT VIDEO SYNC LOCK** available for making video tapes. **APPLE, SAGE, PET, IBM, S100, VME BUS, RS232,** centronics, all have interfaces available to make use of our fast hardware. New ones are coming along all the time so give us a ring if your requirement is not listed.

8 COLOURS £899, 64 COLOURS £999
4096 COLOURS £2000 + P&P + VAT

The above prices are box units including power supply but excluding computer interface.

SOFTWARE PACKAGES: Painting and Slide generation, Business graphics, Architectural 3D design.



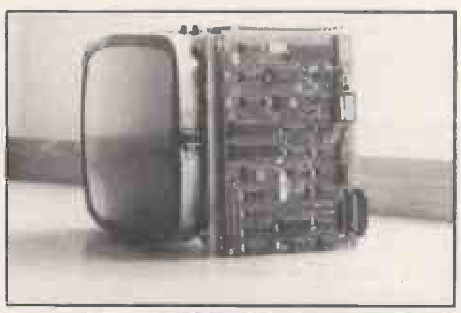
APPLE II

DIGISOLVE's Apple II High Resolution Vector Graphics Processor card quadruples the screen resolution and saves using up your Apple's memory. The enhanced Applesoft support disc supplied with our card provides powerful graphic functions and simplifies the conversion of existing software.

512 x 512 pixels resolution. **FAST** 1,500,000 pixels per second. **MEMORY** an extra **64K** on the card. **TEXT** to 85 characters by 57 lines. **CURSOR** drawing features. **SOFTWARE** 18 new functions are added to Applesoft and extra utilities too, all with source listing. **OUTPUT** to a dot matrix printer or save images on a disc. **PASCAL** and **TASC** Compiles supported too.

£399.00 + P&P + VAT

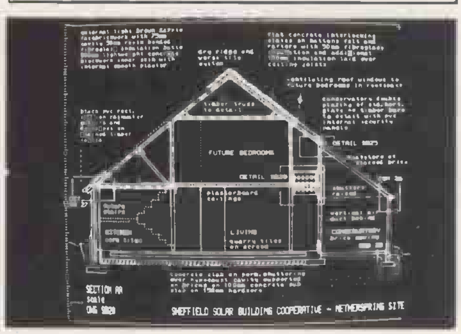
SOFTWARE PACKAGES: Art and Design, Business graphics, Painting, Slide generation packages. Architectural design and modelling, Kitchen design and Visicalc preboots.



VDU BOARD

DIGISOLVE offer you the cheapest way to make a scrolling VDU with our intelligent 80 x 24 VDU card. With over 50 control functions, the card works up to 19.2K baud.

80 x 24 DISPLAY optional 40 x 24 or 40 x 12.
TRUE DESCENDERS on properly formed characters in an 8 x 12 matrix.
BLOCK GRAPHICS
FULLY SCROLLING display
UP TO 19.2K BAUD via RS232 communications port.
KEYBOARD AND RS232 DATA INPUT
£180.00 (1 off) + P&P + VAT



COLOUR GRAPHICS TERMINAL

The new **FRONTIER** monochrome and colour high resolution graphics terminals are fully compatible with Tek 4014 terminals at an amazing price. The high line rate flicker free monitor and advanced electronics provide an exceptional graphic display terminal.

512 x 720 DISPLAY, 1K x 1K STORED PICTURE PAN, ZOOM & SCROLL to move the display about. **LOCAL EDITING** with macros and software definable character fonts.
PALLETTE OF 4096 COLOURS
FLICKER FREE DISPLAY due to high line rate monitor and advanced electronics working non-interlaced.
19" SCREEN OPTION AVAILABLE

PRICES FROM £1495.00 + P&P + VAT

CUSTOM DESIGNS

DIGISOLVE have staff dedicated to design consultancy and are helping many industrial users with custom design packages. Our experience in designing display equipment, character or graphic based, and microprocessor controllers may help you with your special projects. Please do not hesitate to contact us if you require further details.

Digisolve

DIGISOLVE LIMITED
AIRE & CALDER WORKS
CINDER LANE
CASTLEFORD
W. YORKS WF10 1LU
(0977) 513141 (6 lines in), 513382, 510511
TELEX 557661 AGRAM

Microslot for the ZX Spectrum and the Speech 64 for the Commodore machine.

And it isn't missing any opportunity to emphasise its own financial health. The latest announcement (of a money-back guarantee scheme) begins by describing Welwyn as 'a division of the £50million Crystalate Holdings' as a method of boosting buyer confidence.

The money-back offer, by the way, covers any faulty products from Currah.

Details on (0892) 42077.

PC Express

The PC Express board, which gives a speed-up to the IBM PC by plugging in a new 8086 processor, is now available in this country through ISG Data Sales. It costs £693, and details are on (02357) 66330.

Junior hits the deck

Last month I discussed the arguments against the PCjr being introduced in the UK. It's always nice to be partly right, so I'm pleased to pass on the news that the Junior has had its day.

An end has been called to production in the US, although IBM says it will still be supporting users and offering enhancements. Interpretations of what this means are wide-ranging, to say the least.

Some claim that IBM has pulled out of the American home market for good, others that it's just clearing the decks to come back with another stronger contender. Companies such as Apple aren't sure whether to celebrate or to start worrying even more about the future. IBM, as ever, isn't saying much on the subject.

Corporate Trio

A program which can take ordinary ASCII codes and turn it into files for Lotus 1-2-3 or dBaseII and dBaseIII, is of such obvious utility that the only real surprise is how few there are. Trio, from CDI Systems of Oak Brook, Illinois 60521, US, costs a thumping $395, a price which reflects a simple fact of life — that most buyers will be corporate data processing professionals.

Details on (312) 325 2430.

Show business

September may seem a long way off, but it's already time to start the ball rolling for this year's *PCW* Show.

We'll save the details of what's in store at the Show for later issues. For now, we're inviting companies to submit entries for The Standard 1985 Micro Business Awards for 'innovative hardware and software products which offer an outstanding contribution to business profit and efficiency'.

The Awards, sponsored by London's evening newspaper, *The Standard*, will once again be presented at the September *PCW* Show, but entries are open to the entire industry, not only companies taking part in the Show.

Now in their third year, the Awards have a track record of attracting entries both from established major names and some of the industry's newcomers. Last year's winner was ACT, for the Apricot Portable, and Torus Systems for the ICON PC network system, while other finalists included Apple's Macintosh, Amstrad's CPC 464, and three integrated business software products — Symphony from Lotus, Framework from Ashton Tate, and one of the British contenders, Psion's Xchange.

Entries will be judged by a team of experts, including Anthony Hilton, city editor of *The Standard*, and the editor of this magazine, Graham Cunningham.

The closing date for entries will be 31 July and entry forms will be available shortly from the organisers. Entries initially will take the form of written submissions which must cover these three points: application, contribution to profit and efficiency, and description in use. From these submissions a shortlist of finalists will be drawn up, which have to be demonstrated and presented to the judging panel on the eve of the Show.

The Awards are one of the highlights of the *PCW* Show, now in its eighth year and set to be by far the biggest ever at its new Olympia home.

Presentation of the awards takes place at an industry lunch on the opening day, and the winning products will be demonstrated at the Show.

Further details from: The Standard Micro Business Awards, 2nd floor, 8-10 Hallam Street, London W1N 5LF, or telephone Ken Welsby on (01) 636 3205.

Projects into print

The *PCW* publishing empire keeps on growing. This spring sees the launch of *Business Computing: the Survival Guide*, which will be followed in the early autumn by a handbook designed for users who've grown tired of zapping aliens.

There's a thousand other things that can be done with a micro — from robots to music, from speech to vision, from modems to mice; the aim is to cover them in this handbook.

And there's an opportunity for readers to contribute their own construction projects. If you've ever devised any projects and fancy writing them up, or if you've any ideas you think are worth pursuing, then the handbook's editor is waiting to hear from you.

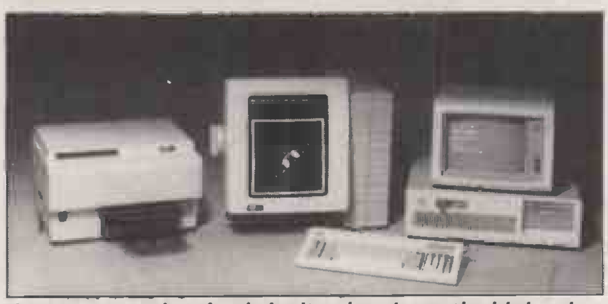
The man in charge is David Tebbutt — write to him c/o *PCW*, 62 Oxford St, London W1. He's up against deadlines already, so don't delay in writing to him.

Guy Kewney can be contacted on electronic mail. His numbers are Source TCK 106, and Telecom Gold 81: JDS018.

No, you haven't seen it before, and it isn't the Osborne Encore. It isn't even the Morrow Pivot. Well, it is, but it's got a new display. 'New display technology which makes it easy to read under any lighting conditions is now a standard feature,' comments George Morrow, one of the US suppliers of this machine.

The new display adds an extra $200 to the Pivot price, but so far, availability is restricted to the US.

Morrow is in California on (0101) 415 430 1970.



Just to prove that Apple isn't going down the high-price laser printer path all by itself, Corporate Data Sciences (CDS) has announced a largely similar machine at $12,000 including software and high-resolution display.

The point the company makes is that this brings Mac Laser printing ability to the IBM PC — but the way CDS does it, it clearly has some way to go. Firstly, CDS doesn't have the Mac's high-resolution screen, so it has to be provided separately. And secondly, the company doesn't include Mac's network, so you can't share the printer cheaply between five users. I also note that CDS concentrates on emulating rather coat-hangerish typefaces such as limitation daisywheel, whereas Apple opts for Times and Helvetica typeset-quality print.

Corporate Data is in San Jose, on (408) 980 9747.

David Ahl reports from the States on the software that's all the rage and exposes the myth of the true 'home' computer market.

The 'in' thing

The big rage in software in 1985 seems to be packages which help people make decisions — or at least ones that claim to help. Many of the packages I have seen are no more than a standard spreadsheet, database or graphics package, with a manual that leads you to believe it's a decision aid. For example, KnowledgeMan is a $500 decision support package that includes screen painting, business graphics and text processing, and supports a mouse.

Arborist Decision Tree for the IBM PC, TI Pro and other clones is a general-purpose program for modelling and analysing business situations. It uses graphics to display decision tree structures, makes use of windows, and automatically recalculates data.

Bottomline I from Ilar Systems is a quarterly financial planning, analysis and forecasting package which uses exponential smoothing to produce historical and projected financial statements.

It's for MS-DOS and CP/M systems, and costs $195.

Odesta has released Helix, a combination database and decision support system for the Fat Mac. It performs filing, sorting and retrieving functions on data files, and does complex modelling and analysis tasks. Its price is $395.

Actuarial Micro Software has released two packages for the IBM PC and Apple II computers. General Application Software System combines up to 10 variables in one algorithm to create a statistical model and to quantify risks; the price is $325. Monte Carlo Simulations combines statistical analysis and business forecasting using the Chi-square best-fit test to match data to a standard probability distribution; the price is $125.

Random bits

Remember when I reported that IBM was buying quantities of MSX systems? Apparently the reason is that Big Blue is developing an MSX machine of its own. It is to have two built-in disk drives and an interface to a laser disk unit (from Sony); the target retail price is $300 . . . Steve Wozniak, co-founder of Apple Computer, has left the company to pursue interests in the video entertainment industry. Inside resources say that as Jobs and Sculley moved Apple more toward business markets, Wozniak felt ignored and unwanted . . . In a recent Dataquest survey of non-owners of computers, 57 per cent said they didn't need one and 26 per cent said the price was too high. Other reasons for non-ownership included: Too complicated, I'm old-fashioned, and I'm too busy . . . Tallgrass Technologies is scrapping its current line of hard disk/tape drive units to make way for its new PC/T line of disk/tape systems. The PC/T line uses a 60Mbyte cartridge tape system for backup . . . Harris Corp has unveiled a local area network, HarrisNet, which can couple up to 250 IBM PCs or clones together into a cluster controller . . . As price competition on hardware hots up, more dealers look to software for their profits. Ask a Businessland salesman for a simple spreadsheet and word processor, and the chances are he'll sell you Lotus 1-2-3 and WordStar for over $1000 rather than a couple of $99 packages that would meet your needs just as well. I hear that some manufacturers of low-priced software plan to take action . . . DEC has halted production of its Rainbow personal computer; it plans to sell off an estimated 10,000 machines in inventory. Angering many dealers, DEC said it would not accept returns from dealers who opt to drop the line because the production halt is 'a temporary measure' and it is 'not abandoning the product'. Industry observers, customers and dealers all expressed scepticism at that statement and feel it is an attempt to ease out of the market gracefully . . . Shugart, one of the oldest floppy disk drive manufacturers, was acquired by Xerox for $41 million in 1977. However, Shugart missed the IBM PC bandwagon and the 5¼in manufacturing operations are being sold to Matsushita, a Japanese giant known outside of Japan as Panasonic and Technics. A spokesman said the other operations would be sold if possible, but it was more likely that they will just be shut down . . . Lotus has invested $1 million in Arity Corp, a 10-man firm looking into ways of adapting artificial intelligence to micro software. It's first product is an integrated package with an interface designed for inexperienced users.

Shattering illusions

'A lot of myths about computers were exposed in 1984,' says John Sculley, president of Apple Computer. 'One of them is that there is such a thing as a home computer market. It doesn't exist. People use computers in the home, of course, but for education and running a small business. There are not uses in the home itself.'

Trip Hawkins, president of Electronic Arts, agrees: 'No-one has yet figured how to make the computer part of the social fabric of the home.'

Three years ago in the heady days of 50 per cent growth in the personal computer industry, such talk would have been ludicrous. Everything was rosy, software companies were set up almost daily, and there were over 100 consumer computer magazines.

But today sales projections are being revised downward every few months, and manufacturers (and magazines) are dropping like flies.

Computer company executives and designers are still trying to make the computer as compelling an addition to the home as a television set or washing machine, but with little notable success. Coleco thought it had the answer with its all-in-one machine in a single box. The market thought otherwise. Commodore, Atari, TI, Mattel and Timex thought the answer was in mass merchandising, but only Commodore is around to tell the tale (although Atari is beginning to show some new life). The Japanese think they have the answer in MSX.

Dan Bricklin, inventor of VisiCalc, feels that 'what everyone is missing is that it (a home computer) has to be both convenient and cheap. You need the computer all over the house,' he said. 'You are not going to go upstairs just to type in a quick query and get back an answer.'

Many industry people today think that Alan Kay's Dynabook concept holds the most promise for success as a home computer. Dynabook was conceived as a portable, animated, interactive book. It would have all the functions of a desk-top micro, could be used as a sketchpad or music machine, and could serve as a remote terminal. When Alan Kay left Xerox (and the Dynabook project) three years ago, the machine was functional but it was still the size of a small desk. Insiders believe that if research was resumed today, then both the size and price could be dramatically reduced.

Predictions

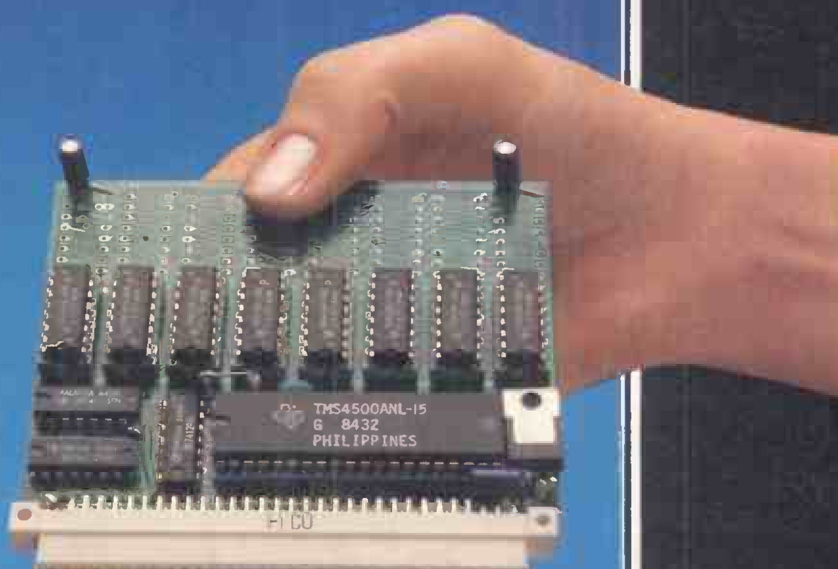
IBM's share of the office market, according to a study by Future Computing, increased from 18 per cent in 1982 to 41 per cent in 1984 while Apple's share dropped from 22 per cent to 11 per cent. Nevertheless, Apple remains firmly in second place, followed by Tandy (6.3 per cent), Compaq (4.5 per cent), Hewlett-Packard (3.9 per cent), DEC and Wang (3.7 per cent each), Zenith (3.2 per cent) and Kaypro (1.7 per cent). For home computers, the Electronics Industry Association projects sales of six million units in 1985 and 75 million software packages (86 per cent on floppy disk and 14 per cent on cartridge). And a research study by Business Communications indicates that the market for artificial intelligence hardware and software will grow by 50 per cent a year for the rest of the decade. END

More Memory to your QL

- **¼ MEGABYTE MORE.** This new memory Expansion Board from Simplex Data Ltd. gives your existing QL a further 256k worth of extra memory.
- **EVEN MORE EXPANSION.** In addition to the ever popular ¼ Megabyte board, you now have the unique opportunity to purchase a ½ Megabyte Memory Expansion board–512k! Even more memory for your QL
- **DESIGNED FOR THE SINCLAIR QL.** Most users of the QL will realise the limitations of a 128k system. Simplex Data have not only expanded the memory potential, but have given you, the user, a wider field of operation.
- **EASY TO USE.** Simply remove the port cover located at the end of the QL keyboard and slot in your NEW Simplex Memory Expansion board–It's as simple as that!
- **COMPACT SIZE.** There's nothing like it on the market. Measuring approximately 97mm x 77mm, this little board is a major advance in Micro technology.
- **HOW IS IT DONE?** Utilising the latest 256k x 1 bit Dynamic RAM'S.

Only £198.00*

Inc. VAT, postage and packing.
1 year warranty included. Please allow 28 days for delivery.



*This special offer price is guaranteed for a limited period only and ends the last day of April.

Exclusively available from

SDL Simplex Data Limited

432 Greenford Road, Greenford, Middlesex UB6 8SG. Tel: 01-575 7531

To: SIMPLEX DATA LIMITED, FREE POST, 432 GREENFORD RD, GREENFORD, MIDDLESEX UB6 8SG.

Please send me: ________ (Qty) Memory Expansion Boards at £198.00 (inc. VAT, Post and Packing).

I enclose Cheque/Postal Order for £ ________

Name: ________

Address: ________

____

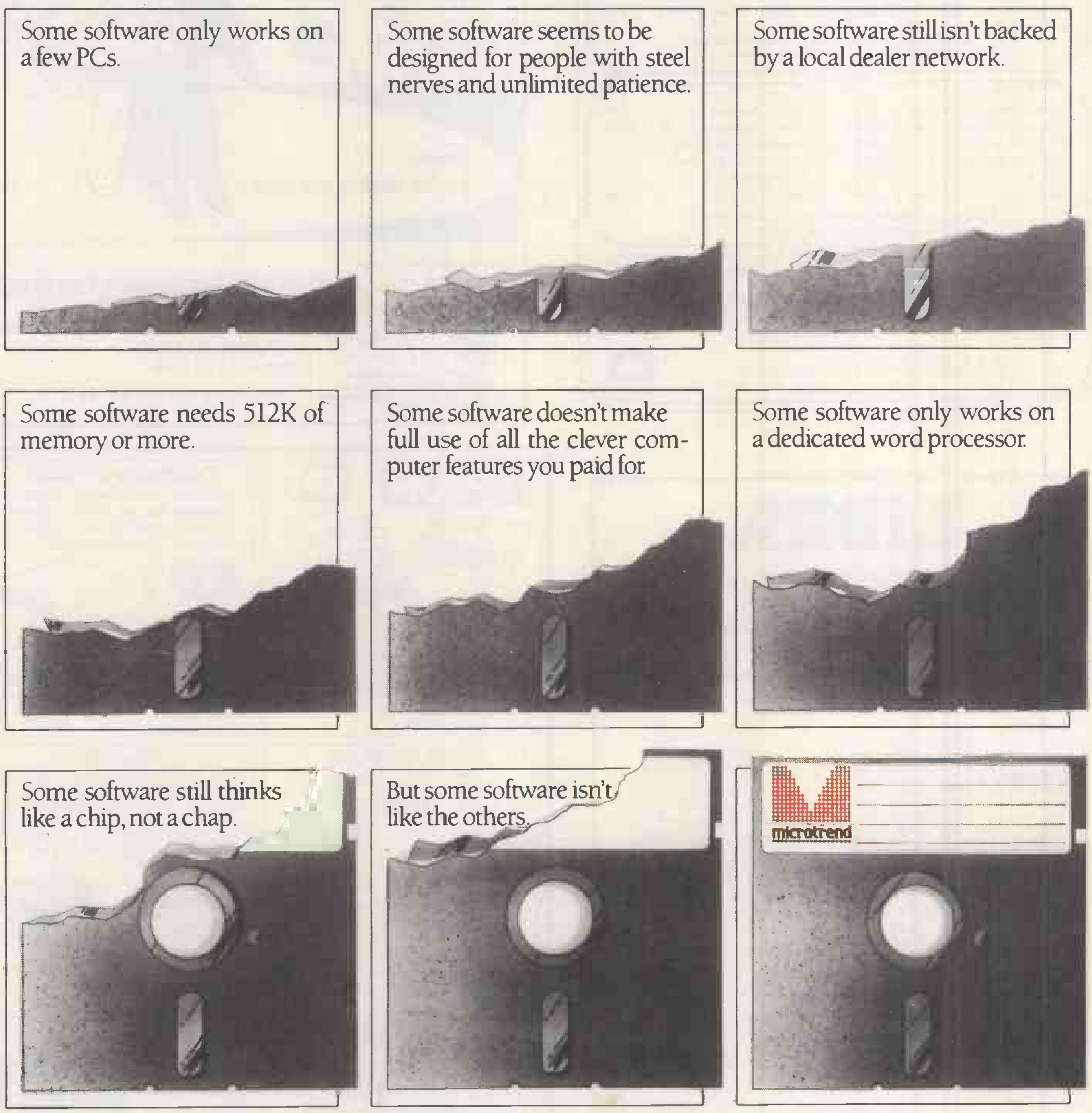
Telephone No.: ________

Payment by ACCESS or BARCLAYCARD phone: 01-575 7531

SORRY NIGEL!

We got it Wrong

SOME SOFTWARE STILL MISSES OUT.



MICROTREND SOFTWARE. GETS THE BEST OUT OF YOUR COMPUTER. AND YOU.

Microtrend Software is available in several European languages and can be used on most major microcomputers running PC-DOS, MS-DOS, CP/M80, CP/M86 and CCP/M86.
For further information contact: Microtrend UK, Council Chambers, King Street, Pateley Bridge, Harrogate, North Yorkshire HG3 5LE. Tel: 0423 711878. Telex: 57558 MICRUK G.

Looking for the best dBASE® II offer available

includes, ABSOLUTELY FREE, the SYBEX BOOK "Understanding dBASE II"

£279 Cash/Cheque with Order

OTHER SOFTWARE AVAILABLE

dUtil	£69	Friday	£175	Rescue III	£375
Expressbase II	£119	Compsoft DMS+	£195	dBase III (IBM PC)	£399
dGraph	£179	Autocode	£199	Retrieve II	£375
Quickcode	£179	dB/Compiler	£695	Delta 2 (IBM PC)	£495

Please add VAT to the above prices which include carriage stating Computer type and Format required.

BOOKS

Advanced dBase II Users Guide	£33.35	Everyman's Database Primer II	£16.50
Advanced Techniques in dBase II	£17.95	Everyman's Database Primer III	£16.50
DELTA, Data & You	£10.95	The Illustrated dBase II Book	£19.50
dBase II for Every Business	£16.50	Mastering dBase II Easy Way	£17.20
dBase II for First Time User	£16.95	Understanding dBase II	£18.95
dBase II Guide for Small Business	£20.95	Understanding dBase III	£20.95

E & O E

Please add 1.90 for single books towards packing & post (plus 0.60 for each additional book)

MAIL ORDER ONLY

Send for latest Price List stating type of Computer & specific interests.

PARKINS ASSOCIATES

PARKINS ASSOCIATES (PCW 5)
20 RIDGEWAY, RAYLEIGH
ESSEX SS6 7BJ
Tel: 0268 - 743928

Cash/Cheque with order or Access

Prices as at 25/3/85

---

tangolynk

APRICOT, SIRIUS, COMPAQ, HP150, FUTURE COMPUTERS, IBM PC, XT, AT. COMART, OLIVETTI M24, ORION, STC XTRA, WOROPLEX, LOGICA VITESSE, ALMARC, FERRANTI ARGUS PC

C 0 1 | C 0 2 | C 0 3

Darling, they're playing our tune

Dance with ICL at

Network Designers Limited

GOLD
This software package has been officially recognized by ACT for use with Apricot & Sirius personal Computers

The Old Berkshire Hunt Kennels
Kingston Bagpuize
Oxon OX13 5AP
Telephone (0865) 821177

LIBRA

Business Supplies Limited

Magnetic Media Specialists

Diskettes

			Per box of 10 1-9 boxes £	10 + boxes £
3" MAXELL CF2			46.00	36.00
3½" FUJI DS			47.00	47.00
5¼" **DYSAN**	SS/DD		20.50	16.10
	DS/DD	48 tpi	29.50	22.50
	SS/QD	96 tpi	29.50	22.50
	DS/QD	96 tpi	37.50	28.60
5¼" **NASHUA**	SS/SD		14.00	9.90
	SS/DD	48 tpi	16.60	12.60
	DS/DD	48 tpi	19.50	14.75
	SS/QD	96 tpi	21.50	15.50
	DS/QD	96 tpi	24.00	17.50

8", HARD SECTOR AND PREFORMATTED DISKETTES AVAILABLE.
ATHANA, 3M AND VERBATIM ALSO STOCKED P.O.A

DISC PACKS — MAGNETIC TAPE
DISK CARTRIDGES — TAPE CARTRIDGES
FAST DELIVERY — P.O.A.

DISKETTE DRIVE CLEANERS FD-05/FD-08	£12.00
CC1 ALL-PURPOSE COMPUTER CLEANER	3.50
CC7 LINT-FREE WIPERS	2.70

* PRICES EXCLUDE VAT/CARRIAGE *
* TRADE ENQUIRIES WELCOME *
* SEND FOR PRODUCT LIST *

ACOUSTIC HOODS	ANTI-GLARE SCREENS	LISTING PAPER
BURSTERS	FIREPROOF SAFES	LABELS
DECOLLATORS	RACKING	BINDERS
SHREDDERS	TRANSIT CASES	FILING SYSTEMS
WORK STATIONS	TELEX ROLLS	RIBBONS
VDU DESKS	CUSTOM PRINTING	PRINT WHEELS

** APPLY FOR ACCOUNT FACILITIES NOW **

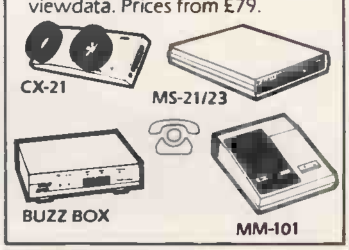
LIBRA
Business Supplies Limited
CHILTERNS, BATCHWORTH LANE, NORTHWOOD, MIDDX HA6 3HE
09274 (65 from London) 28598

EPSON

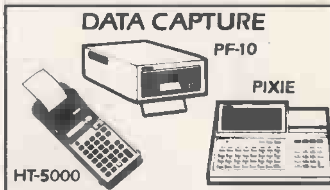
As one of EPSONs largest dealers we sell *service* and *support* their full range. For quality, style and reliability they are hard to match. Write for our full list and ex-demo and specials list.

COMMUNICATIONS

Acoustic and Direct Connect Modems for all asynch speeds including electronic mail and viewdata. Prices from £79.



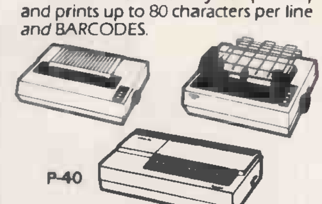
DATA CAPTURE



We have supplied many hundreds of terminals for data capture for sales men, shops or depots and can get your data into most micros, minis and mainframes over telephones. Call us to discuss your applications.

PRINTERS

We supply famous EPSON printers for all makes of computer. The LQ1500 for instance prints Near Letter Quality at 67cps and Draft at 200cps. The incredible P-40 costs only £87 (ex VAT) and prints up to 80 characters per line and BARCODES.



Introducing BARDEMON

Bardemon II is the first of a novel 'Concepts' series of software which is not only functional, but explains how to print all popular barcodes and enables you to modify it to your needs. Runs on all EPSON micros and RX, FX, LQ and P series. Only £99 (ex VAT).

ACTEL

The Computer Centre,
Bugbrooke Road, GAYTON,
NORTHAMPTON NN7 3EU.
TEL: (0604) 858011.

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

Ancient bugs

Dr F Marriott ('Letters', March 1985) may like to note that in the early 1870's Edison had a favourite expression: 'Well, boys, now let's find the bugs' (GG Bryan, *Edison* 1926). Can anyone point to an earlier use of the term, or is it (as I suspect) yet another of Edison's inventions?

Michael Behrend, Cambridge

No, Edison wasn't first to this one as the reader below points out . . .

More bugs

The term 'bug' goes back much further than your correspondent, Dr F Marriott, suggested in *PCW* March.

It is probably derived from the Welsh 'bwg', meaning a ghost. There is mention in *Coverdales Bible* which was therefore called the 'Bug Bible' of 1535 (Psalms XCI 5: 'Thou shalt not nede to be afrayed for eny buggles by night').

Shakespeare got into the act in the *Faerie Queen*: 'For all that here on earth we dreadfull hold. Be but as bugs to faeren babies withall', and in Henry IV: 'Warwick was a bug that feared us all'.

The word was later applied to a mischievous spirit, hence 'bogyman', and it was not a difficult transition to apply the term to computtttttttt. . . Damn.

Rod Paris, Caversham, Berks

Any other offers?

Fantastic NewBrain

We have just computerised our business, and now all our accounts and invoicing headaches are left to the computer to sort out which gives us more time to make money.

What's more, the whole lot (computer, printer, interfaces, software) cost less than £500. 'Pray tell the name of this machine?' I hear you all say. The answer is simple . . . a NewBrain of course!

Hudson Engineering Co Ltd, Workington, Cumbria

Congratulations — you've just managed to upset Amstrad, Commodore, Sinclair and Acorn, and all in less than 100 words. The NewBrain ranks among the unsung heroes.

Evaluating Logo

I have just read Julian Pixton's review of three BBC Logos (*PCW* February), and having used two out of the three Logos reviewed, I feel his review is critical in unimportant areas and uncritical in important areas.

I believe the Acornsoft version of Logo to be far superior to the Logotron version in most respects, and if I had to classify the two versions, the one from Logotron is aimed at children playing, whereas the Acornsoft version enables you to produce software to help young and old to learn.

When considering Logo (or any other software) you should think of the future. Having used Logo within varying teaching environments, I fear that arguments about the utility of Logo will be restricted to traditional Logo ideas concerning its use in primary schools. Logo is a fine language for teaching programming and mathematics to primary children with adequate software preparation, but I believe that, ultimately, Logo will be of equal use in the secondary and tertiary sectors.

At present I am working on a book aimed at Logo for young children on the BBC B. It concentrates on the use of Acornsoft Logo because this is the only version with sufficient facilities to provide a viable software base. I am using Acornsoft Logo as it provides the best development environment on the BBC B.

The power of Logo is not principally determined by the speed of its graphics or the speed of list processing. I am developing routines for use in secondary and tertiary education including, inter alia, matrix routines using Logo property lists — property lists are available on Acornsoft Logo, but are only promised for Logotron Logo.

I have already developed applications for calculating means and standard deviations, the correlation coefficient, and regression line. The routine was easy to write on the Commodore 64, has been implemented by RML for the 480Z (and thus can be implemented also for the Open University version of Logo), and has been adapted for Acornsoft Logo. The routines, as designed, could not be implemented in Logotron Logo because there is no Local facility.

For the production of software of any complexity in a structured language, the lack of Local is a telling blow.

The review of the BBC B Logos by Julian Pixton ignored both Locals and property lists, and one suspects that their utility was not recognised — perhaps this is because Julian is acknowledged in the Logoton manual?

Boris Allan, Stockport, Chesire

Relax. As Julian works on an educational Logo project he inevitably comes into contact with Logo developers — he's also acknowledged in the Acorn manual. Local and property lists are both available in Logotron's Logo extension, along with a lot of other things not available from Acorn.

The good old days

About three-score and 5-E10 'K' ago (or was it January '83) Bob Huckle got me, and I would guess many others, singing and dancing with his article in *PCW* on modifications within WordStar to change code outputs to an Epson via an Osborne and C/PM. Enlarged characters, proper underlines, and so on. Ah, the good old days!

How about he does something similar for Framework, Fred, Compaq and MS-DOS ? Only Epson still reigns supreme from the old trio of mine.

I haven't got a copy of a 'Programmers Guide to Framework', or whatever it is called; in any event, R Huckle Esq would be much more succinct and entertaining.

For his sins and others like him, I subscribed to *PCW* and after a shaky start they now seem to come on time.

Ben Duncan, Gerona, Spain

We'll pass the challenge on to readers as Bob's a busy man these days.

Computer Town

We have decided to form a Computer Town to run in conjunction with the computer class which we formed last year. We are in a Borders village and have had over 30 people coming to our classes each Monday evening. It was originally run from 7pm to 9pm, but due to the response we are now running two groups. One from 6pm to 7.15pm and then 7.30pm to 9pm. We have, at the moment, a ZX81, three Vic-20's and a Commodore 64, and also members bring along their computers so we do have a wide variety of machines for people to try. We have a session each meeting in which we teach a bit of programming to those who are interested in doing something more than playing games.

Every member so far has joined in; we provide refreshments and then have hands-on time, with help to those who need it or help to plan someone's programming, and so on. We feel the Computer Town could work well in conjunction with this, and we are always ready to help anyone who needs help at our premises so long as they give us a ring to arrange a mutually convenient time.

We are very concerned about computer literacy and feel we can help anyone who can get to us. We are in the process of having our outbuilding changed into a classroom so that we can hold training courses in computer appreciation, programming and applications. We are also doing residential weekends/ weeks for those who cannot get to our courses or who want a more intensive training program.

We seem to be the first Computer Town in Scotland, so please give us a plug and perhaps others here will follow suit.

John Schofield, Jaysoft Microdevelopments, Greenlaw, Berwickshire

The defence rests

I would like to set the record straight about the Sinclair QL. The problem seems to be that there have been no reviews of the production models now being supplied.

First the hardware. Since I have been using my QL (about 2 months) the hardware has behaved absolutely faultlessly. The keyboard, which has been heavily criticised, does not have the same feel as that of an IBM or Apricot but is very good to use nevertheless, once you're used to it. The microdrives have never failed or lost a program, and work very well. They are obviously not as good as disk drives — no-one disputes this — but there aren't any computers around at £400 with twin disk drives. We should be comparing microdrives with cassettes, to which they are infinitely preferable. Criticisms about the lack of a cassette interface seem daft when faced with the alternative of using microdrives or cassettes — I can't imagine anyone ever using cassettes.

The only valid criticism is the price of the blank cartridges, which must come down. People have complained about the picture going off the screen on their televisions or monitors, but I haven't found this to be the case on any of the three TVs I've used.

The Basic is excellent and far superior to any other Basic I have seen. Much has been made of the fact that SuperBasic is slower than BBC Basic or Amstrad's Basic, but it is so much more powerful and is still fast. Unfortunately, the Basic is let down by the user guide and poor error messages.

The bundled Psion programs are excellent, with the exception of the word processor which is far too slow to be of any practical use, so we'll have to wait for the promised Quill II.

Overall I really feel that the QL should be reassessed in perspective. It should be compared, not with Apricots and IBM PCs, but with other micros around the £400 mark.

N Alexander, Wolverhampton

Hot and cold

Without wanting to blow out of all proportion a very mundane problem (for most people anyway) of whether to put on the woollies or the short sleeves (I am by the way referring to the misprinted °F—°C conversion formulae which appeared in 'Letters', *PCW* February), it is true that quite a lot of people who have been brought up to think in terms of one temperature scale cannot so easily adapt to, or think in, the other. I have known people who have shivered at the thought of going for a swim at temperatures of around 30°, and I for one was shocked to find that people have a body temperature close to the boiling point of water.

To cut the story short, I have since worked out a quick way of converting temperatures by mental arithmetic:

$$°F = (°C \times 2) - 10\% (°C\times2) + 32$$

$$°C \simeq \frac{(°F-32)}{2} + 10\% \frac{(°F-32)}{2}$$

$\therefore 30°C = 60 - 6 + 32 = 86°F$
and $98°F \simeq 33 + 3.3 = 36.3\ °C$

This is good enough for everyday use.

FA Khatir, Dartmouth

The invisible man

In June 1984 I paid £10 to the Independent Sinclair User Group, 189 Rosehill Road, Burnley, Lancs, as my first annual membership fee. Within a few days I received the first newsletter. Since then, despite writing several letters, I have received nothing further, nor have I had a reply to my letters.

The ISUG seems to be nothing more than a sham. It is reputedly run by a man called Vic Webber. If Mr Webber is reading this letter I would invite him to justify his lack of action with money belonging to other people.

If any of your readers have had this problem, or indeed if they have had successful dealings with this group, I should be interested to hear from them. I am contemplating taking matters further but would welcome comments from other interested persons.

J Schofield, Blackburn, Lancs

Vic Webber is playing the 'invisible man' with unfortunate consequences. If you write to PCW *we'll pass on your letters.*

Big, bad IBM

I must take issue with Guy Kewney in his highly biased 'Newsprint' (*PCW* February) account of the arrival of Victor, the maker of Sirius computers, in the UK.

Guy chooses his words carefully, and so succeeds in conveying an impression that is neither accurate nor fair. This is 'underhand' journalism of a kind I am surprised and disappointed to find in *PCW*. Lotus 1-2-3 is readily available for the Sirius and I agree that the add-on board to make the Sirius IBM-compatible is expensive, but it is far more interesting to examine precisely why this board can be so essential.

Sadly here, as in the US, IBM has succeeded in dominating the computer market to the extent that many software packages are available only in IBM format. IBM has made many enemies in the past by what it has done to quell competition; it is restricted now by new anti-trust legislation, but has achieved the same objective — a stranglehold on the market, by an equally questionable method.

IBM took a standard operation system, MS-DOS, and changed it just enough to make its version, PC-DOS, incompatible. In fact, in doing so, IBM flew in the face of what is regarded as good software-writing practice by making the system 'hardware specific'. Herein lies the answer to the problems of software compatibility even between the IBM PCjr, PC, AT and XT. There is no advantage in making these changes, but the consequences for the other computers are all too apparent.

Any comparison between the Sirius and the IBM PC in terms of price/performance will show that the Sirius is superior. The IBM machine is overpriced, already outdated, and inferior to many other computers which will not receive the recognition or success they deserve purely as a result of IBM. I suggest that Guy, and *PCW* readers, take a long objective view of the computer industry to reach the same conclusion.

Simon Sheppard, Brighton, Sussex

'Underhand' seems to be an over-reaction to the piece, two of whose main points match yours — the PC-compatible board is expensive and Victor's market position is weak. This doesn't mean we're in favour of IBM's position, it's simply a fact which has to be kept in mind when assessing other companies. It's difficult to disagree with the overall feeling of your analysis of IBM. The fact that IBM is releasing its own applications software now, plus the fact that it looks likely to increase direct sales rather than going through dealers, and may even release a proprietary operating system for the AT, should give further pause for thought.

END

BLUDNERS

We'd like to make it clear that in November's 'Computer Answers', the opinions on the effects of TV/monitor use on eyesight were incorrectly attributed to the Institute of Ophthalmology. We regret any inconvenience caused to the Institute as a result.

March's Program of the Month wasn't helped by an illegible line at 1600. The line reads :AZ=AZ+(V*16^(DG-T1)). And the Atari Multi-mode Text listing is reprinted in full this month.

The RAF did not order any games for its pilot aptitude testing centre at Biggin Hill mentioned in April's 'ChipChat'. The press release we received on the subject was incorrectly amended.

Under pressure

The old adage 'Nothing lasts forever' bodes ill for Unix: other systems are threatening its position as a 'standard'. Martin Banks observes the moves.

If you look at the way the average company is organised, it's possible to state with a fair degree of theoretical certainty that there ought to be a good future for small multi-user computer systems. After all, the way they can provide small clusters of related workstations, coupled with the ability to network the clusters to build bigger systems, is a direct analogy of how most companies are departmentalised.

If this is the case, then it would seem reasonable at first glance to state that Unix is the operating system to go for and all else is dross.

However, it doesn't work out that way in practice. There are several different versions of Unix around, with even more Unix lookalike systems of varying degrees of compatibility. Although portability between machines is there in theory, in practice it just isn't that simple.

Despite this, it is still possible to suggest that Unix should become the dominant operating system for small to medium-sized business machines. Virtually any application that requires more than a solitary personal computer has to be a potential target for Unix-based applications.

One of the problems now facing the system is the publicity surrounding it. Having come from the rarefied air of AT&T's Bell Laboratories and the world's universities, it has been ill-equipped for the cut and thrust of the commercial world. In more practical terms, this has also meant that there have been few commercial applications packages available.

This might not have mattered too much it if hadn't been for IBM, which inconveniently introduced the PC just at the time when lots of micro manufacturers were looking closely at the potential market for supermicro machines running Unix.

The IBM machine, together with its host of clones and close compatibles, is the market for which the majority of the applications software has been written. Packages for Unix have, by comparison, tended to be fairly specialised and therefore expensive. Ironically, the world and its uncle has jumped on the IBM band-wagon; only Apple stands out as a major contender against the stream. Where Unix could have been a rallying point for all manufacturers wanting to get out from under IBM, it has suffered instead from everyone wanting to stay under the big blue umbrella.

The MS-DOS environment is now the *de facto* standard operating system for small micros — stand-alone machines at least. This still leaves some potential in the multi-user area, a potential that is not always satisfied by networking stand-alone machines together. They may appear to work well like that, but for many applications it will not be the best option.

Can Unix move in here? If it's going to then it has two years at most in which to achieve a worthwhile market-share. In that time, the fragmentation of the market for Unix systems must be cleared up. For example, although AT&T now claims that Unix System V is *the* standard, there is still a lot of System III around. At the same time, Microsoft's Xenix is claiming the lion's share of the low-end Unix market-place.

In this context it's not surprising then that Microsoft and AT&T have recently signed a deal to engineer a unified front, bringing Xenix and Unix into line with each other. Digital Research (DR), which recently completed a port of Unix onto the 80286 processor, has developed a library of 15 or more applications programs to run under the system. It has decided to drop the idea of marketing them, however, primarily because the fragmented state of the market makes the library's commercial viability suspect.

There will be some scope for more applications coming through as the 286 device becomes more prevalent. This may be helped by such things as language support for both Unix and the more prevalent IBM environment on the 286 processor. DR, for example, has a range of language products available for both the 286 and the Motorola 68000 that are source code-compatible with both Unix and its own Concurrent DOS. This, the company claims, will provide a funnel for software developers to go from one environment to the other.

But what is most likely to deal Unix its severest blow is the Apple Macintosh. This machine, with its fancy graphics, user interfacing, mouse *et al* has demonstrated that there is an alternative to the old character-based user interfaces typified by the dreaded A> prompt that we all know and love. Here is a machine that the non-expert can easily use because he can 'see' what he wants to do from the icons shown onscreen, and point the cursor quickly and directly at the action required.

Couple this approach with the move towards high-resolution colour graphics, and you have a powerful tool for software developers to make their products really user-friendly for the first time. This is, however, a software technology that demands a considerable amount of local processing power to make it work properly. Unix, being dedicated to multi-user operations, will not always be available on machines that pack enough power to provide this for a large number of users, especially at the low end of the market where competition from machines with such capabilities will be found.

Such facilities are already available for the IBM PC environment. DR has already announced its Graphics Environment Manager (GEM), while Microsoft has Windows due this summer. GEM is interesting in multi-user terms as well: it will be part of DR's Concurrent DOS 286 for the 80286 device, which is itself a multi-user operating system.

The key to developments, as usual, will be what IBM does. With Top View it has shown a direct interest in the systems software market; it is unlikely to have missed the point of the Macintosh, GEM or the upcoming Windows. If it does produce something graphical by the end of the year, it will not only be the leader, but will completely crush the opposition. If it doesn't, then GEM or Windows could become market leader.

Either way, the place of Unix at the small systems end (especially with the emergence of Concurrent DOS 286 with GEM an integral part) looks to be increasingly insecure. Despite all the fine words said about it, everyone is hedging their bets like mad on the subject of Unix. END

Illustration by Bill Sanderson

Wired for sound

MIDI can open up a new area of creative technology with its expanding musical capabilities. David Rosam and Ian Beynon take it from the top.

MIDI has been very much in the spotlight over the last few months, with many pieces of musical technology finding their way into the pages of computer magazines. But for those hoping to find some hard information in the heap of hype being piled up by manufacturers, there has only been disappointment — MIDI is both much misunderstood and underutilised.

Musical Instrument Digital Interface is of great interest to both musicians and computer enthusiasts. For those with suitable musical instruments, MIDI can open up many new possibilities. For the interested computer enthusiast, proper music is, at last, a possibility. Even micros with the most sophisticated sound chips, such as the BBC and Commodore 64, cannot approach the capabilities of the simplest synthesiser, But computer enthusiasts are faced with learning the language of musical instruments, and musicians are faced with learning about the mysterious terminology associated with computers. As a result, very few people are getting the most from MIDI.

'. . . computer enthusiasts are faced with learning the language of musical instruments, and musicians are faced with learning about the mysterious terminology of computers.'

Musical instruments

The technology behind modern electronic instruments is identical to that used in computers—the microchip is at the heart of both. All the instruments you can connect to MIDI can be termed 'synthesisers'. When synthesisers are mentioned, most people immediately think of the keyboard instruments which are, by far, the most common type of synthesiser.

A synthesiser is really just a box of electronics for producing sounds. It can be triggered by any kind of switch, or an analogue signal which has been digitised. There is no reason, in theory, why any kind of instrument cannot be used for triggering the electronics, but in practice, it's a slightly different story. The keyboard remains the most popular kind of synthesiser instrument as it is a very convenient way of triggering a synthesiser, and traditional keyboard instruments are widely taught. There are some guitar synthesisers on the market which are played exactly like a guitar.

Drum machines also come within the range of synthesisers. Drum machines, until recently, had a very characteristic sound, so any record made with a machine instead of a drummer was instantly recognisable. As technology advances, their sound is becoming more and more realistic. These machines allow anyone to set up even very complex rhythms. Most drum machines have some memory facilities which allow rhythms to be stored, as well as offering preset rhythms.

For the purposes of this article, a synthesiser means a keyboard device, as these are the cheapest kind and are more likely to be bought by a non-musician or beginner in electronic music. Modern synthesisers are extremely sophisticated devices. Instead of the limited number of notes which can be played on a computer, and the limited or non-existent enveloping facilities, typical synthesisers allow you to play chords of up to eight notes, and allow far more flexibility when shaping sounds.

Almost all synthesisers offer an array of preset sounds, so the sounds of a piano or a violin, for example, are available at the touch of a button — try doing that on a computer!

Now that both computers and musical instruments are employing the same kind of technology, it's relatively easy to send information from a computer to a musical instrument, or *vice versa*. This is what MIDI is all about.

An interface box will allow you to connect your computer to any piece of MIDI-compatible equipment. MIDI synthesisers, at present, start at about £350 for the Casio CZ 101, but prices are falling all the time. The situation is very like that for other types of computer peripherals — how many of us would have been considering the purchase of printers, colour monitors and disk drives, even two years ago? In the near future, a synthesiser will be comparable in price to these types of peripherals.

But even before prices fall for the rest of us, current owners of MIDI-compatible musical equipment will find that a home computer and interface is a very attractive proposition. With suitable software a whole range of possibilities are opened up, and any number of dedicated add-ons can be imitated at a fraction of the cost.

Communications

MIDI is a communications standard like Centronics or RS232, although, strictly, it is more akin to RS232 since it is serial and two-way. In this case, though, MIDI is used exclusively in sending musical codes between musical instruments. There have been previous attempts to impose a standard for communication between musical instruments — notably DCB, or Digital Communications Bus — which have failed to become generally accepted.

'The keyboard remains the most popular kind of synthesiser instrument as it is a very convenient way of triggering a synthesiser, and traditional keyboard instruments are widely taught.'

The story seems destined to be different for MIDI. The standard is set to be universally adopted by all manufacturers of electronic musical equipment and computer equipment which can be used with it — in fact, virtually every piece of serious electronic music-making equipment that has been recently released by every manufacturer is MIDI-compatible.

Yamaha has launched its CX5M MIDI computer, an MSX machine that has much circuitry in common with the company's synthesisers — so much so, that all you need add to the machine to obtain a top-flight musical instrument is a piano-type keyboard. But don't be misled, there is no need to sell existing computer equipment in order to use MIDI.

Each piece of MIDI-compatible equipment has three five-pin DIN sockets: these are labelled 'IN', 'OUT' and 'THRU'. IN allows the equipment to receive MIDI signals from another piece of MIDI equipment, OUT is simply the reverse, allowing one piece of MIDI equipment to send out MIDI signals to another piece of MIDI equipment, and THRU sends a direct copy of the incoming information on to another piece of MIDI equipment, as OUT can only drive one IN. In some cases, THRU is not included.

In use

MIDI has been around since 1982, although it has only just been brought to the attention of home computer owners. Musicians have been using MIDI to trigger one instrument from another. For example, two synthesisers can be set to produce different sounds, but can be played simultaneously from one keyboard by connecting the two instruments together via MIDI and playing the keyboard of one of the two instruments.

MIDI also allows a musician to connect a drum machine to a keyboard and synchronise a rhythm track with the melody. Other possibilities include connecting a sequencer: a sequencer is a device which remembers notes, ready for playback at any time. During playback, the music can be changed — tempo can be speeded up or slowed down, as well as the sound characteristics of the notes being changed. As an example, a tune could be played slowly with a sound like a flute. There are two types of sequencer — real time and step time. A real-time sequencer plays back exactly what the musician has played, whereas a step-time sequencer literally steps through the tune with the musician playing each note in turn, filling in individual slices of time until the tune is completed.

Computers

MIDI is much more than just a way of connecting synthesisers and drum machines, and its full potential can only be realised with a computer. The beauty of the system is that any cheap home computer can be used, provided that a MIDI interface is available for it. There is absolutely no advantage in using an expensive business micro, and there is no advantage in using a micro with more sophisticated onboard sound over one with crude onboard sound.

The sound capabilities of the chosen computer are not used at all when connected to MIDI — the sound is always generated by the synthesiser or drum machine — so there isn't any point in purchasing an expensive micro for use specifically with MIDI. Even the extra memory offered by a business machine is largely superfluous as any computer with a memory size of, say, 32k offers far more storage than almost any dedicated sequencer, for example.

Using a computer as a sequencer is one obvious application for a computer connected to MIDI. Using a computer has advantages over using a dedicated sequencer, such as those offered by the instrument manufacturers. Something like a 48k Spectrum or a Commodore 64 and an interface will cost about half the price of the sequencer itself: production on a mass scale and the competition in the computer market-place will probably mean that this will remain the case, too.

The computer isn't just limited to being used as a sequencer — there are many other possible applications, all hinging on the nature of the software that is being run. For example, a computer could be used to produce a graphics display which could aid in composition. The contents of the computer's memory can be saved to disk — very interesting, when you consider the popularity of digital sound recording when trying to ensure the highest standards of reproduction.

However, the range of software available is still restricted and comparatively high in price. Little or none has found its way into computer shops as yet, but the situation will change as more and more people want to use MIDI.

Nonetheless, even within the restricted software range, there is software which enables sequencers to be duplicated, multitrack music to be composed, and music edited. Although someone with a MIDI set-up may not be able to play a note on any musical instrument, it is perfectly possible to play music by composing on a computer monitor and sending the information to the musical instrument to be

Commodore 64 programs

```
READY.

10 POKE 56836,3: POKE 56836,86
15 REM *** TRIGGER NOTES ***
20 FOR N=1 TO 12:READ A:POKE 56837,A:NEXT N
30 FOR N=1 TO 400:NEXT N
35 REM *** RELEASE NOTES ***
40 FOR N=1 TO 12:READ A:POKE 56837,A NEXT N
50 FOR N=1 TO 400:NEXT N
60 GET A$:IF A$<>"" THEN STOP
70 RESTORE: GOTO 20
95 REM *** TRIGGER NOTES DATA ***
100 DATA 144,60,127
110 DATA 144,64,127
120 DATA 144,67,127
130 DATA 144,72,127
135 REM *** RELEASE NOTES DATA ***
140 DATA 128,60,0
150 DATA 128,64,0
160 DATA 128,67,0
170 DATA 128,72,0

READY.
```

Fig 1

```
READY.

10 POKE 56836,3: POKE 56836,86
20 FOR N=36 TO 96
30 POKE 56837,144
40 POKE 56837,N
50 POKE 56837,127
55 GET A$:IF A$="" THEN GOTO 55
60 POKE 56837,128
70 POKE 56837,N
80 POKE 56837,0
90 GET B$:IF B$=" " THEN STOP
100 NEXT N
110 GOTO 20

READY.
```

Fig 2

```
10 POKE 56836,3: POKE 56836,86
50 M$="OFF":S=30
90 PRINT ""
100 PRINT " MIDI STEP TIME SEQUENCER "
110 PRINT "1:- PLAY SEQUENCE"
120 PRINT "2:- EDIT SEQUENCE"
140 PRINT " REPEAT MODE ";M$;" "
150 PRINT " SPEED=";S;" "
200 GET A$
210 IF A$="1" THEN GOTO 500
220 IF A$="2" THEN PRINT "":LIST 1000-
230 IF A$="R" AND M$="OFF" THEN M$="ON":GOTO 100
240 IF A$="R" THEN M$="OFF":GOTO 100
250 IF A$="F" AND S<60 THEN S=S+1:GOTO 100
260 IF A$="S" AND S>1 THEN S=S-1:GOTO 100
270 GOTO 200
500 PRINT " PRESS ANY KEY TO STOP ":FOR N=1 TO 100:NEXT N
510 RESTORE: READ E
520 FOR N=1 TO E
530 READ A,B,C
540 POKE 56837,144:POKE 56837,A:POKE 56837,B
550 FOR Z=1 TO C*(60-S)+10*C*C
560 NEXT Z
570 POKE 56837,128:POKE 56837,A:POKE 56837,0
580 GET A$:IF A$<>"" THEN GOTO 90
590 NEXT N
600 IF M$="ON" THEN GOTO 510
610 GOTO 90

READY.
```

Fig 3

played. At the end of this article is some software which will allow you to do just this, although, for reasons of space, it is a little crude.

It has been predicted that some sheet music will be available on MIDI-coded EPROMs, so it will be possible to have either whole pieces of music which can be played back, a little like a record or tape, or to have backing tracks that you can play along with.

Codes

Anyone wishing to write MIDI software will have to know about MIDI codes. These are bytes of information which are sent down the MIDI bus in a standard format that a MIDI-compatible instrument will understand.

A note, for MIDI purposes, consists of two events — triggering and releasing. Triggering is what happens when a key is hit on a keyboard (or a string strummed); and releasing is what happens when the key is allowed to return to its usual position. One thing that always must be borne in mind when writing MIDI software for keyboard synthesisers is that for every triggering, there must be a corresponding release — this is one of the fundamentals of MIDI programming.

An interesting side issue is the question of sequencer specifications. Advertisements usually claim, for example, that a product has a capacity of 10,000 events. Each note consists of two events, so the sequencer will only store 5000 notes.

The number of notes which can be triggered at one time entirely depends on the synthesiser that is being used. Popular synthesisers vary greatly in this respect. For example, the Roland Juno synthesisers are six-voice polyphonic machines, which means that up to six notes can be played simultaneously. On the other hand, the Oscar synthesiser will only allow one note to be played at one time when in monophonic mode. At the very top of the scale, Yamaha DX synthesisers offer 16-note polyphony. If you try to trigger more notes than your synthesiser has voices, the last note will be totally ignored. If you fail to release notes, your synthesiser will simply carry on playing the same note all the time.

In order to trigger the note, three consecutive bytes need to be sent to a synthesiser. The three bytes should contain the following information:

(i) A header, or status information, to tell the synthesiser that what follows relates to the triggering of a note.
(ii) A MIDI channel number.
(iii) A pitch or note value.
(iv) A velocity value.

Some of these terms will need an explanation. A MIDI bus can contain information on up to 16 channels (think of them as being like TV channels). A number of instruments can 'tune in' to any particular channel, but there are only 16 programs (in the TV sense) to choose from. You must be sure that your synthesiser is working on the correct channel to receive the informaion that is being sent to it. Some older instruments will only operate on one particular MIDI channel.

The velocity value information only applies to touch-sensitive instruments — a touch-sensitive keyboard acts in the same way as a piano keyboard. If you hit a key hard, the note sounds loud; if you hit a key soft, the note sounds quiet. This information has to be sent even if your instrument is not touch-sensitive — the instrument will ignore the unwanted information.

> *'. . . synthesisers offer an array of preset sounds, so the sounds of a piano or a violin, for example, are available at the touch of a button — try doing that on a computer!'*

Returning to the four pieces of triggering information, the first two pieces make up the first byte as two four-bit codes. The binary number 1001 means 'trigger a note', and constitutes the high end of the byte — bits four to seven; the low bits constitute the channel number. Confusion could creep in here. As far as MIDI is concerned, these channels are numbered 0 to 15. You will find that musicians and instruments refer to them as 1 to 16, so don't forget to make the adjustment.

It will probably become clearer with an exampe. A byte that looks like this:
10010000
means 'trigger a note (1001) on channel zero (0000)'. In decimal, the byte has the value 144. Any synthesiser tuned into channel zero would prepare to receive a note.

There is no need to start off in binary and convert the codes to decimal every time, as there is a general formula which will help you calculate the first byte:
144+required MIDI channel-1
or, more simply:
143+required MIDI channel
10010000 is the binary equivalent of 144, and −1 makes the adjustment from 1 to 16 channel numbers into 0 to 15 channel numbers.

The second byte in the set of three contains a number in the range 1 to 127, and relates to the note you want to trigger. Notes are governed by a simple number system, with middle C at note number 60. Increasing the value by 1 will make the note increase in pitch by a semitone. Likewise, decreasing the value by 1 will lower the note by a semitone.

Notes 16 and 19 represent a minor third (or three semitones). Notes 30 and 42 are an octave apart — 12 semitones. If you have a knowledge of music you will see that this system is far easier to use than the old one volt per octave system, which was analogue as opposed to digital.

Although your instrument may only be able to be played through a keyboard, say, five octaves long, MIDI can trigger notes over more than 10 octaves. One interesting side-effect of this is that you can play music through MIDI that would be impossible to play directly from the keyboard. It depends

Spectrum programs

```
 10 OUT 159,3: OUT 159,86
 15 REM   Trigger notes
 20 FOR n=1 TO 12: READ a: OUT 191,a: NEXT n
 30 FOR n=1 TO 200: NEXT n
 35 REM   Release notes
 40 FOR n=1 TO 12: READ a: OUT 191,a: NEXT n
 50 FOR n=1 TO 200: NEXT n
 60 IF INKEY$<>"" THEN  STOP
 70 RESTORE : GO TO 20
 95 REM  Trigger notes data
100 DATA 144,60,127
110 DATA 144,64,127
120 DATA 144,67,127
130 DATA 144,72,127
135 REM  Release notes data
140 DATA 128,60,0
150 DATA 128,64,0
160 DATA 128,67,0
170 DATA 128,72,0
```

Fig 1

```
 10 OUT 159,3: OUT 159,86
 20 FOR n=36 TO 96
 30 OUT 191,144
 40 OUT 191,n
 50 OUT 191,127
 55 PAUSE 0
 60 OUT 191,128
 70 OUT 191,n
 80 OUT 191,0
 90 IF INKEY$=" " THEN  STOP
100 NEXT n
110 GO TO 20
```

Fig 2

Fig 3

```
  10 OUT 159,3: OUT 159,86
  20 POKE 23658,8
  50 LET M$="OFF": LET S=30
 100 BORDER 7; PAPER 7; INK 0: CLS ; BRIGHT 1
 110 PRINT AT 3,2;" MIDI STEP TIME SEQUENCER "
 120 PRINT AT 7,5;" 1:- PLAY SEQUENCE "
 130 PRINT AT 9,5;" 2:- EDIT SEQUENCE "
 140 BRIGHT 1: PRINT AT 14,6;" REPEAT MODE "; INVERSE 1;M$; INVERSE 0;" "; BRIGH
T 0;" "
 150 PRINT AT 16,9;" SPEED ";TAB 19-LEN STR$ S; INVERSE 1;S; INVERSE 0;" "
 180 BRIGHT 0
 200 PAUSE 0: LET A$=INKEY$
 210 IF A$="1" THEN  GO TO 500
 220 IF A$="2" THEN  CLS : LIST 1000: STOP
 230 IF A$="R" AND M$="OFF" THEN  LET M$="ON": GO TO 140
 240 IF A$="R" THEN  LET M$="OFF": GO TO 140
 250 IF A$="F" AND S<60 THEN  LET S=S+1: GO TO 140
 260 IF A$="S" AND S>1 THEN  LET S=S-1: GO TO 140
 270 GO TO 200
 500 PRINT  INVERSE 1; BRIGHT 1;AT 20,3;" PRESS ANY KEY TO STOP ": PAUSE 12
 510 RESTORE : READ E
 520 FOR N=1 TO E
 530 READ A,B,C
 540 OUT 191,144: OUT 191,A: OUT 191,B
 550 FOR Z=1 TO C*(20-S)+C*30
 560 NEXT Z
 570 OUT 191,128: OUT 191,A: OUT 191,0
 580 IF INKEY$<>"" THEN  GO TO 100
 590 NEXT N
 600 IF M$="ON" THEN  GO TO 510
 610 GO TO 100


1000 DATA 48
1010 DATA 53,120,2
1020 DATA 60,110,2
1030 DATA 65,110,2
1040 DATA 60,110,1
1050 DATA 53,115,2
1060 DATA 60,110,1
1070 DATA 65,110,1
1080 DATA 60,110,1
1090 DATA 53,115,1
1100 DATA 60,110,1
1110 DATA 65,110,1
1120 DATA 60,110,1
1130 DATA 49,120,2
1140 DATA 56,110,2
1150 DATA 61,110,2
1160 DATA 56.110,1
1170 DATA 49,115,2
1180 DATA 56,110,1
1190 DATA 61,110,1
1200 DATA 56,110,1
1210 DATA 49,115,1
1220 DATA 56,110,1
1230 DATA 61,110,1
1240 DATA 56,110,1
1250 DATA 51,120,2
1260 DATA 58,110,2
1270 DATA 63,110,2
1280 DATA 58,110,1
1290 DATA 51,115,2
1300 DATA 58,110,1
1310 DATA 63,110,1
1320 DATA 58,110,1
1330 DATA 51,115,1
1340 DATA 58,110,1
1350 DATA 63,110,1
1360 DATA 58,110,1
1370 DATA 48,120,2
1380 DATA 55,110,2
1390 DATA 60,110,2
1400 DATA 55,110,1
1410 DATA 48,115,2
1420 DATA 55,110,1
1430 DATA 60,110,1
1440 DATA 55,110,1
1450 DATA 48,115,1
1460 DATA 55,110,1
1470 DATA 60,110,1
1480 DATA 55,110,1
```

on the type of synthesiser you have, but it's certainly worth a try once you are happy with the system.

The third and final byte holds the velocity information; it should contain a value between 1 and 127. Most instruments, particularly those at the cheaper end of the market, will not be able to interpret this byte, but it should be there even if the instrument ignores it. A touch-sensitive synthesiser like the Roland JX8P, or the Yamaha DX7, will interpret higher numbers as harder hit keys. Thus, 127 will trigger the note with maximum velocity, while 20 will trigger a much quieter note. The exact result will also depend on how the synthesiser itself has been programmed.

An example of an event which will trigger a note could look like this:
144,64,100

These three bytes, when sent in succession, will trigger E above middle C on any keyboard 'listening' on channel 1, with almost maximum velocity.

Releasing a note is almost the same as triggering one, except that the code in the high bits of the first byte has to be changed. The formula calculating the value of the first byte in the case of releasing a note is:
127+MIDI channel number

The second byte holds the note number and follows the same conventions as for triggering a note.

The third byte has no real role to play in releasing the note, but is sent to preserve symmetry between triggering and releasing. You can send any value you wish, but conventionally, the byte is set to zero.

To release the E above middle C triggered in the above example, these three bytes would have to be transmitted:
128,64,0

Attempting to release an untriggered note will have no effect.

The programs

For those who already have MIDI equipment, here are three MIDI programs for you to try. The program explanations should make MIDI codes clear. Program 1 demonstrates how to trigger a chord of four notes and release them — you will need a polyphonic synthesiser for this one. Line 10 initialises the interface and prepares it to transmit data in MIDI format. Line 20 triggers the four notes by reading 12 bytes from the data statements in lines 100 to 130. These bytes are output consecutively through port 191 on the Spectrum and location 56837 on the Commodore 64. If you understand music you should be able to examine the data and work out that the chord is C major. In any case, you should see that the chord has been triggered with maximum velocity via MIDI channel 1. Line 30 is a delay loop and represents the sustain time — how long the notes are played for — before line 140 to 170, and releases the notes that have been triggered earlier.

Having released the notes, the computer's keyboard is checked for key presses. If no key is being pressed, line 70 restores the data pointer to the start of the data and the program runs again. If any key is being pressed, the program stops.

Running this program may result in a little disappointment! The notes do not trigger anywhere near simultaneously, owing to the time taken by a Basic program to output 12 bytes. It is an unfortunate fact that machine code will have to be used for any polyphonic work, but for clarity's sake the programs in this article have been written in Basic.

Before you finish with the program try altering the values in the data statements, and if you have a touch-sensitive keyboard try altering the velocity byte, currently set at the maximum value of 127.

Program 2 shows how to trigger a chromatic scale over a five-octave range from MIDI. The scale starts from two octaves below middle C — note number 36 — and the program triggers each number in turn. The key numbering system lends itself to using simple FOR/NEXT loops. The program's main loop runs between lines 20 and 100, and counts between 36 and 96 using the value assigned to the variable N as the

MIDI key number in triggering or releasing. Lines 30 to 50 transmit the three bytes of data needed to trigger a note. Line 55 waits for a key to be pressed — if you press the space bar the program will stop, but any other key will release the note. The releasing is done in lines 60 to 80. Line 90 is another check for pressing the space bar — if a different key is being pressed, the program loops back to play the next note in the scale.

Try substituting these alternative line 20s:
20 FOR n=96 TO 36 STEP −1
or
20 FOR n=36 TO 96 STEP 4
The first plays the scale backwards and the second plays every fourth note (intervals of major thirds).

If you want to see how many of the possible 10 1/2 octaves you can play on your synthesiser, try altering line 20 to:
20 FOR n=1 to 127
In some cases, you will be triggering sounds of just a few hertz (cycles per second), and you may be able to distinguish individual oscillations as a series of clicks.

It is relatively easy to extend the basic MIDI principles in order to write a piece of serious MIDI software. Program 3 is a simple but complete monophonic sequencer. As a monophonic program, it should work with any MIDI-compatible synthesiser.

After initialisation, lines 100 to 200 print the menu. Option 1 plays the stored sequence. Option 2 allows you to edit the sequence — when you have finished altering the sequence, you will need to run the program once more. Pressing R will set the computer in repeat play mode, and pressing R once more will switch off the option. Pressing F will make the sequence play faster, and pressing S will make the sequence play slower.

If you choose '1', the routine from line 500 to 610 is selected. This is the core of the program, triggering and releasing all the notes, and taking care of the timing which forms the rhythm.

The note data is in the lines from 1000 onwards. Some sample data has been given so that you can test the program, but by substituting your own data you will be able to create sequences.

Choosing option 2 will list the data lines; you can now use the Basic editor to edit the sequence. The first data line contains a single figure — this is the number of notes in the sequence. All the subsequent lines contain three pieces of data: the first is the MIDI note code (falling between 1 and 127); the second is the key velocity value (falling between 1 and 127, although if your synthesiser is not touch-sensitive, this value will have no effect); the third is a relative note length (a 4 will last twice as long as a 2). The third piece of data is only relative because F and S adjust the speed of playback.

The program suffers slightly from the limitations imposed by Basic. As you saw earlier, it is not really possible to write polyphonic programs because of the speed limitations of the language. You will also find that, at higher speeds, the timing becomes increasingly inaccurate. Writing the software in machine code will allow you a polyphonic synthesiser with correct timing, but will take considerably more effort to write.

'MIDI is an expanding system, with more codes being added to control different types of instruments, or features within instruments which are being added as technology advances.'

Conclusion

There is much, much more to MIDI than I can cover here. MIDI is an expanding system, with more codes being added to control different types of instruments, or features within instruments which are being added as technology advances.

At present, in addition to the information covered in this article, MIDI is able to transmit data relating to 'performance control'. Pitch bend is one example of this — most synthesisers allow the player to 'bend' the pitch of a note and create some of the effects heard in today's pop music. MIDI also enables the musician to select a different sound from the synthesiser's internal memory (assuming it is programmable). This feature is particularly useful when playing live by keeping both of the musician's hands free to play the instrument.

The other main area of MIDI concerns the so-called 'system exclusive' information; this is the non-standard part of MIDI. Each manufacturer of MIDI equipment has his own ID number, and if this ID byte is transmitted then the following information will only make sense to that particular manufacturer's equipment. The most common application of this feature is software which enables you to create sounds for your instrument from the computer keyboard.

This software was written using the SIEL MIDI computer interface, and will work on any system using port 159 on the Spectrum or location 56836 on the Commodore 64 for control, and port 191 on the Spectrum or location 56837 on the Commodore 64 for transmission.

If your interface does not use these ports or locations, you will have to modify the OUTs in the Spectrum program or the POKEs in the Commodore 64 program. Consult your manual for the correct values.

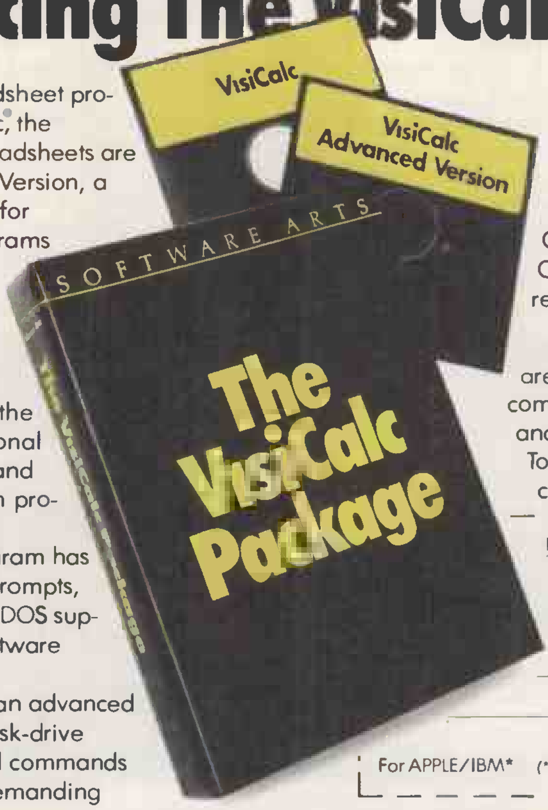
The three programs in this article are in Spectrum or Commodore 64 Basic, but should be fairly simple to convert to other computers if you read your interface manual carefully. END

'How do you change the program on your machine, Granny?'

FOR IBM and APPLE IIE/IIC

ONE SPREADSHEET TO START ON. ONE TO GROW ON.

Introducing The VisiCalc® Package.



Here are two powerful spreadsheet programs in one package—VisiCalc®, the standard by which all other spreadsheets are judged, and VisiCalc Advanced Version, a second generation spreadsheet for advanced users. These two programs allow you to begin with a basic spreadsheet program and later move on to a more advanced spreadsheet as your business and home needs grow.

VisiCalc is the perfect tool for the single disk-drive Apple //c personal computer. Six home budgeting and planning applications have been programmed into the spreadsheet.

This original spreadsheet program has been upgraded with Full Word Prompts, Variable Column Widths and ProDOS support to make the best known software program ever, even better.

VisiCalc Advanced Version is an advanced spreadsheet program for dual disk-drive systems. It contains sophisticated commands and functions to handle more demanding applications. Plus, an on line Introductory Guide to help you easily understand the program's capabilities.

Some of these advanced functions include Keystroke Memory,™ On line Context-Sensitive Help, and Print Commands for Presentation-Quality reports, among others.

And if two great spreadsheet programs aren't enough, The VisiCalc Package comes with comprehensive documentation and **The VisiCalc Book** by Donald H. Biel. To find out more simply clip the coupon.

Name

Address

Postcode

For APPLE/IBM* (*delete as necessary)

Software Arts™

43 Buttermarket, Ipswich, Suffolk, England, IP1 1BJ
Tel: Ipswich (0473) 221551/213187 Telex: 98501 SAINT G

Commodore PC

In an attempt to recapture its fading business interest, Commodore is launching the IBM PC-compatible Commodore PC. But is there room for yet another IBM clone in an already overcrowded market? Peter Bright finds out.

The Commodore PC's lightweight keyboard is similar in style to that of the IBM PC, but with some detail changes

Commodore Business Machines has a long and largely successful history of producing microcomputers. Its first micro was the highly successful Pet, and for a long time the Commodore Pet and the Apple II together ruled the micro market.

However, over the years Commodore has leaned more towards the home micro market than the business side. Its Vic-20 and Commodore 64 home games machines have been very successful, while its Pet-based business machines have fallen foul of IBM and the 16-bit revolution in the business race.

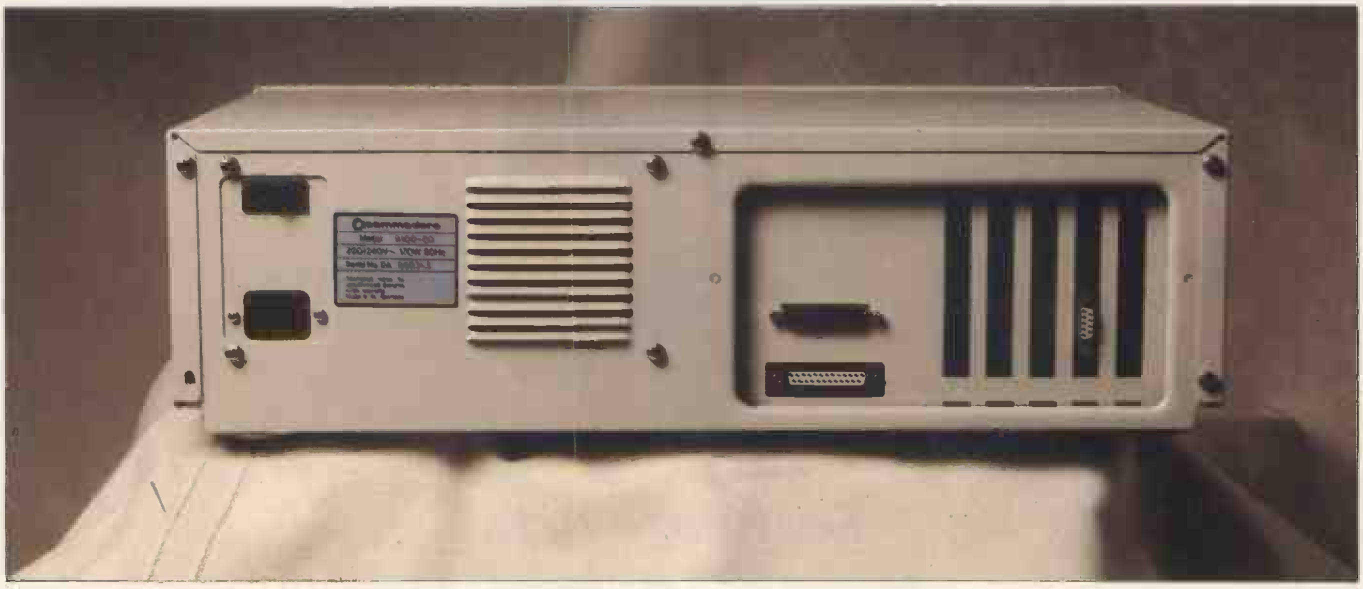
In an attempt to win back some of its old business market, Commodore has embarked on a program of launches which are designed to bring its machines up to date.

The first of these is a 16-bit IBM-compatible machine known as the Commodore PC. This is quite a departure for Commodore, which has something of a reputation in the industry for shying away from industry standards and going its own way.

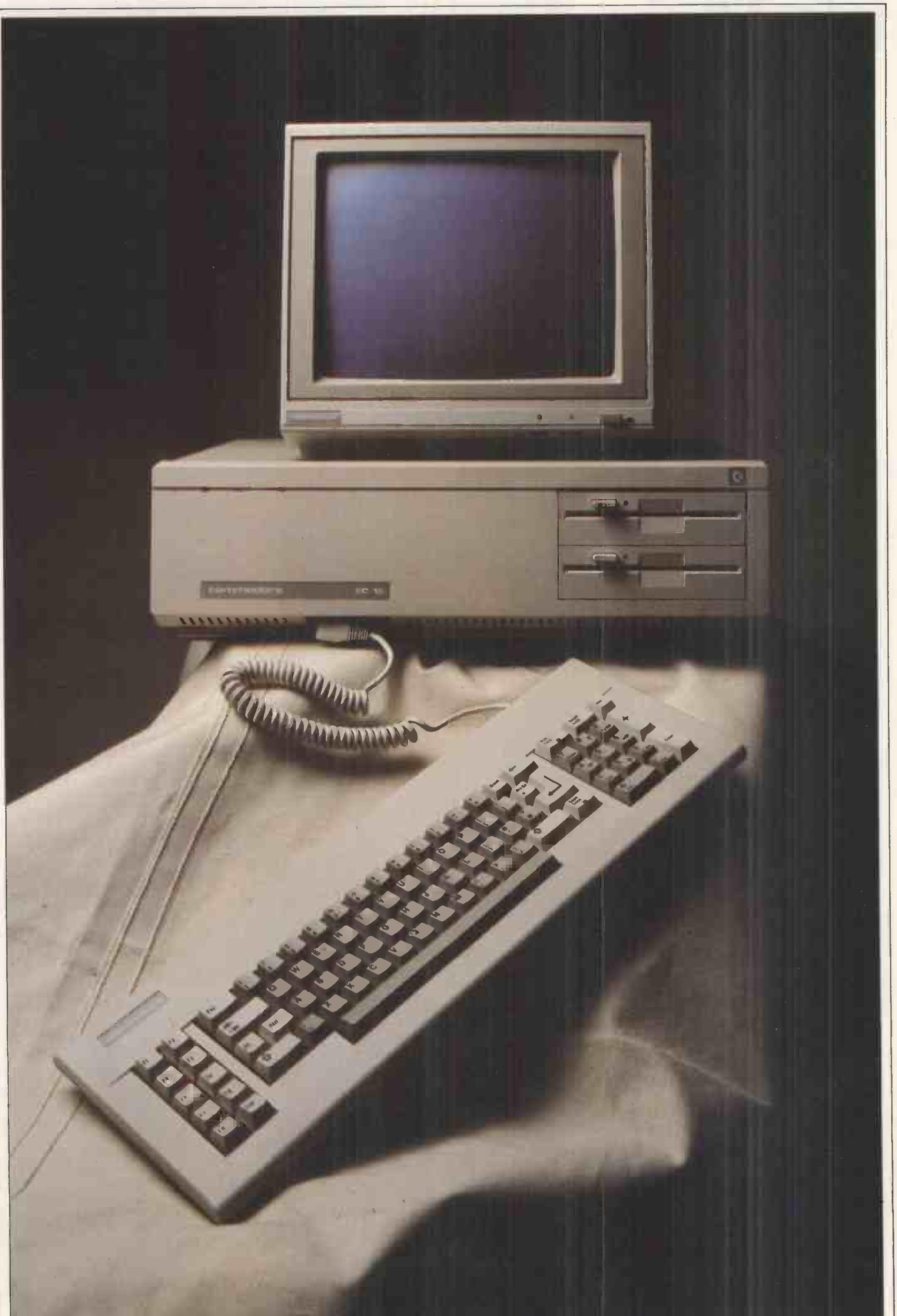
Interestingly the Commodore PC comes not from Commodore US but from Commodore Germany, where it was designed and will be built.

Hardware

Externally, the Commodore PC looks much like any other IBM PC-compatible machine. The overriding colour is cream rather than the grey of the IBM PC or the Olivetti M24. The whole unit



The back panel is constructed of metal and incorporates only the bare minimum of ports



comes in the traditional three-box design — main processor box, keyboard and monitor.

The majority of the casings are fabricated out of metal. Only the front panel is made of plastic, which tends to give the machine a very square, slab-like appearance.

At 5.75ins high by 19.5ins wide by 15ins deep, the main processor box of the Commodore PC is only a shade bigger than that of the IBM PC. However, because it has a very square front rather than the sloping panel of the IBM PC, the Commodore somehow manages to look much larger than the already grossly oversized IBM PC.

I found the size of the box rather intimidating when it was sitting on my desk, but unfortunately, the monitor and keyboard cables aren't long enough to allow you to put the main unit on the floor out of the way so there isn't any alternative.

The front panel of the Commodore is plain in the extreme. All there is to look at are the disk drives, a couple of LEDs and the Commodore badge.

The back panel isn't much more interesting. Instead of being fabricated out of plastic like the front panel, it is made out of metal with only the bare minimum of ports showing.

Running along the rear panel, to the left are the on/off switch, power input and the vents for the fan. To the right are an RS232 serial port, an IBM-style Centronics printer port with a 25-way D plug, and five blanking plates for the expansion cards. On the review machine one of these was used for monochrome video output.

Theoretically, getting inside the machine is very straightforward — you just slide off the lid *á la* IBM PC. But things weren't that simple on the review machine. The first step is to remove the seven screws which hold the lid on. The screw holes hadn't been drilled very accurately — one in particular took more force than usual to remove and was impossible to replace.

Once the screws have been removed, the lid slides off making such a graunching sound that you'd swear it was taking a quarter-inch off the PCBs inside. Putting the lid back on was even worse and required a fair application of brute force to make it fit. Not impressive.

The predominant feature of the inside of the casing is empty space. To the left are five full-length IBM-compatible

The basic green-screen monitor is comparatively small and out of proportion with the rest of the unit

expansion slots and to the right are the fully-cased power supply/fan and the disk drives. The fan is almost noiseless in operation so the machine is very quiet.

There is quite a large gap between the disk drives and the expansion slots which is presumably designed to take a hard disk drive.

The main PCB is very large and decidedly non-state-of-the-art. In fact, the main circuit board is so large that it is fabricated in two sections which are then joined inside the casing. Standard TTL chips are used throughout with no evidence of custom chips or ULA's. In general, chip spacing is on the generous side although the build quality is good.

'In an attempt to win back some of its old business market, Commodore has embarked on a program of launches which are designed to bring its machines up to date.'

The main processor in the Commodore PC is an Intel 8088 running at a sedate (and IBM-like) 4.7Mhz. I can't argue that this isn't IBM-compatible, but it's hardly adventurous. This is especially true of machines like the Olivetti M24, which use the full 16-bit 8086 running at 8Mhz while still remaining IBM-compatible.

The review machine was supplied with 256k of RAM; this is the least you will get on this machine. The Commodore PC can take a mixture of 128k and 256k bit chips up to a maximum of 640k. The review machine had one bank of nine 256k bit chips to give 256k with parity.

In addition to the main PCB, the review machine also came with a monochrome display card plugged into one of the expansion slots. Obviously if you want a colour system, a colour graphics card can be supplied.

The Commodore PC has a total of five IBM PC-compatible expansion slots, but the display card is probably the only one most people will need.

Unlike the IBM PC, the Commodore has most of its main functions included on the main PCB. This gives you an RS232 serial port and a Centronics printer as standard without the need to use an extra expansion card. It also allows you to upgrade the system to its maximum RAM capacity onboard, again without the need for extra cards.

The review machine was supplied with twin IBM-compatible 360k 5¼in disk drives. These were half-height units, so they could be stacked on top of each other instead of side-by-side as on the IBM PC. This is a much neater arrangement.

The drives themselves were made by BASF in Japan and seemed very reliable. My only quibble was that the locking mechanism requires that you push what looks like an eject button. Sometimes I forgot to push it and the disk wouldn't read.

The keyboard on the Commodore PC is cream, and it is attached to the main unit via a coiled cable and a DIN plug. Unlike the IBM PC, the socket for the keyboard is at the front of the main system box rather than at the back.

The DIN plug on the Commodore PC is exactly the same as on the IBM PC. Out of interest I plugged an IBM keyboard into the Commodore to see what would happen — it worked fine. Inspired by this success I then plugged the Commodore keyboard into the office IBM. It crashed. Unfortunately, at the time the IBM had 10 pages of unsaved WordStar text on it which promptly disappeared.

The first thing that struck me about the Commodore keyboard is that when you pick it up it's as light as a feather. This is in direct contrast to the IBM unit.

The keyboard contains a total of 85 keys which are arranged in the same general order as the IBM PC. The main qwerty typing area is in the centre of the keyboard with the 10 function keys to the left and the numeric keypad/editing keys to the right.

Although the Commodore keyboard is functionally the same as the IBM PC keyboard, a number of detail changes have been made to make it easier to use.

Due to the Commodore keyboard being slightly wider than its IBM counterpart, Commodore has been able to move the numeric keypad/editing keys slightly to the right so that they are separated from the main typing area. This makes the keyboard much less cluttered.

Commodore has also made the RETURN key much larger and easier to locate. The size of the RETURN key was the cause of many complaints about the IBM keyboard, so this version will undoubtedly find favour.

Benchmarks

BM1	1.3
BM2	4.8
BM3	10.3
BM4	10.7
BM5	11.7
BM6	20.8
BM7	32.2
BM8	34.2
Ave	15.75

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

Commodore has moved the CAPS LOCK and ALT keys away from the space bar so that they can't be hit by accident, and has included LEDs in the CAPS LOCK and NUM LOCK keys to indicate when they are selected.

I was very impressed with the improved layout of the keys on the Commodore PC. It seems to have cured most of the criticisms levelled at the original unit, but the Commodore does lose out to the original IBM keyboard in terms of feel. The great thing about the IBM keyboard is the solid, positive feel of the unit. The Commodore keyboard feels much lighter and more plastic by comparison.

'. . . the Commodore PC is decidedly old hat. The world has moved on since the IBM PC was launched, and even PC clones need to make some effort to keep up.'

The display of the Commodore could be mistaken for that of the IBM PC. The review machine was a base model black and white machine with Commodore's own monochrome display card installed in the main unit. The monitor supplied with the machine was a fairly basic green-screen unit, but it was comparatively small and looked out of proportion with the rest of the unit.

To test the display I ran Microsoft's Flight Simulator on the system. With the standard monochrome display adaptor, the machine refused to display anything. When I took the colour graphics adaptor out of the office IBM PC and fitted it into the Commodore, Flight Simulator ran quite happily in glorious technicolour. Indeed, the IBM colour graphics adaptor worked well in the Commodore in all cases bar one.

I did run into one problem with a small demonstration program which was designed to drive an Okimate colour printer. The software is supposed to produce colour pictures on the screen which can then be printed on the Okimate. The program worked fine on the PC and on an Olivetti M24 PC-compatible machine, but when I tried it on the Commodore with the IBM colour card, nothing happened.

Interestingly, I found that if I soft-reset the machine and then ran Flight Simulator, the picture would be briefly displayed as Flight Simulator accessed the colour card before being overwritten by the Flight Simulator display. Very strange.

This was the only piece of software I found that wouldn't work, but it does show that there is no such thing as a totally compatible PC clone.

System software

No software at all, not even system software, was supplied with the review machine. However, as it's a PC clone I would expect it to run MS-DOS version 2 or similar when it is shipped.

For the purpose of the review I used an IBM copy of PC-DOS version 2 on the Commodore along with a collection of Olivetti M24 utilities and an Ericsson version of GW-Basic. This led to the odd situation where at various times the Commodore would profess itself to be either an IBM PC, Olivetti M24 or Ericsson PC, but at no time did it actually think it was a Commodore!

I also had a go at booting up an IBM copy of Digital Research's Concurrent CP/M, which seemed to work OK.

Applications software

I tried a wide range of applications software on the Commodore and it ran all the packages I expected it to. You can trust most self-respecting IBM-compatibles to run the likes of Flight Simulator or Lotus 1-2-3.

The IBM PC diagnostics package didn't run, but this is no great problem as few PC-compatibles actually manage to run diagnostics.

The main problem area for IBM-compatible machines is Basic. The IBM PC uses IBM's own Basic-A which makes use of routines contained in the PC's ROM. The trouble is that these routines are copyright and IBM is quite happy to sue anyone who copies its routines.

The usual way around this is for compatible machines to use Microsoft's GW-Basic, which is much the same as Basic-A with the exception that it doesn't use the ROM routines.

The problems usually occur when an application program is written in Basic-A and is therefore looking for a program called Basic-A rather than GW-Basic, but this is easily overcome by changing the call or renaming GW-Basic.

Incidentally, one of the few problems I had with applications programs was when I Benchmarked the Commodore using Ericsson GW-Basic. The cursor disappeared whenever I called up Basic; this didn't seem to affect the running of programs, it just made editing difficult.

If you take a look at the Benchmark figures for the Commodore PC, you will see that it's speed is nothing to get excited about. But having said that, it is actually faster than the IBM PC which uses the same processor and the same clock speed.

Documentation

As is so often the case with new machines, one of the last jobs that manufacturers do is to write the documentation.

In this case the machine was supplied with an instruction booklet — the trouble was that it was written in German.

Prices

The review machine was the base model PC10. This comes with 256k of RAM, twin 360k disks, and a monochrome display card and monitor. It will retail for £1675 plus VAT. The hard disk version with 256k of RAM, one disk drive and a 10Mbyte Winchester will retail for £2795.

Technical specifications

Processor:	Intel 8088
ROM:	32k
RAM:	256k expandable to 640k onboard
Mass storage:	Twin 360k 5¼in BASF drives
Keyboard:	85-key IBM-compatible layout
Size:	5.75ins×19.5ins×15ins
I/O:	RS232, Centronics printer, five IBM slots
DOS:	MS-DOS version 2

In perspective

The IBM compatibles market needs another entrant like it needs a hole in the head. The market is full of machines that are either cheaper than the IBM, such as the Advance, or that offer more performance than the IBM, such as the Olivetti M24, or both.

The Commodore PC is certainly not a high-performance PC-compatible like the M24, so it follows that it will be trading on the back of its competitive pricing.

Commodore has good corporate awareness thanks to its home computer penetration. The problem is that recently, people have tended to forget about the company's business machines.

To try to counteract this, Commodore is beefing up its distribution channels and broadening it's dealer network in order to support the PC in the mass market. The company will also be embarking on a press-based advertising campaign to coincide with the launch of the PC.

Conclusion

What can you say about an 8088-based IBM clone that hasn't been said a hundred times before? Commodore is very excited about this machine, but I must admit I find it difficult to share the company's enthusiasm.

There isn't anything that is actually wrong with the machine. It worked reliably during the test and I'm sure it would give a long period of faithful service. The problem is that I can think of half a dozen other PC clones that will do exactly the same.

A fairly major disadvantage is that the machine is monochrome only, which means that you can't run Flight Simulator, produce graphics on Lotus 1-2-3, and so on. Other compatible machines such as the Olivetti M24 and the Compaq allow colour graphics software to run by using grey scaling.

To add to the problems, Commodore won't have a colour board or monitor ready until later this year. The only way I could get round this was to use an IBM colour card and monitor.

In terms of technology, the Commodore PC is decidedly old hat. The world has moved on since the IBM PC was launched, and even PC clones need to make some effort to keep up. Some now use the full 16-bit 8086 instead of the IBM's 8088; they also run at faster clock speeds to give the performance a boost. But the Commodore has none of this — it could have been designed four years ago. It follows, therefore, that if the machine isn't trading on technology, it has to sell on the basis of price and Commodore's name.

The base model price of £1675 for a complete system including 256k of RAM, twin disks and a monitor compares favourably with the recommended prices of most other compatibles. The problem is that a number of dealers are discounting machines like the Olivetti M24, Compaq and even the IBM PC itself to levels that are close to the price of the Commodore. This could lead to the Commodore being discounted virtually as soon as it hits the streets, just to keep it price-competitive.

The Commodore PC is a worthy machine, but ultimately it fails. If you are looking for the least expensive clone you can find, then some of the Taiwanese clones are cheaper. If you want an advanced clone, there are machines like the Olivetti M24 and the Compaq Deskpro. The Commodore sits uncomfortably somewhere in the middle. Too little, too late. END

Have you got the drive to succeed in business?

£199

DD1-1 disc drive (with CP/M* and DR. LOGO*) and interface.

£159

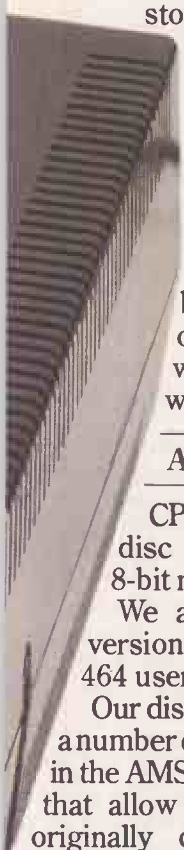
FD-1 additional disc drive.

Running any business successfully means first running it efficiently.

And no matter how business-like you think you are, you can't beat the power and convenience of a random access CP/M* disc system.

Now, with Amstrad's CPC 464 computer, you can enjoy all the advantages of a 3″ disc drive complete with an integral power supply and plug-in interface controller.

Naturally, you can add a second drive (FD-1) to double the on-line storage capacity, speed up copying files and producing back-up discs.



But of course, simply plugging a disc drive into a computer won't get you very far.

That's why Amsoft have produced a disc based software range of over 30 programs with many more on the way.

AMSDOS and CP/M*

CP/M* is *the* standard disc operating system for 8-bit microcomputers.

We also supply a special version of DR. LOGO* for CPC 464 users.

Our disc drive system includes a number of extensions to BASIC in the AMSDOS operating system that allow the disc to use files originally created for cassette, and vice versa.

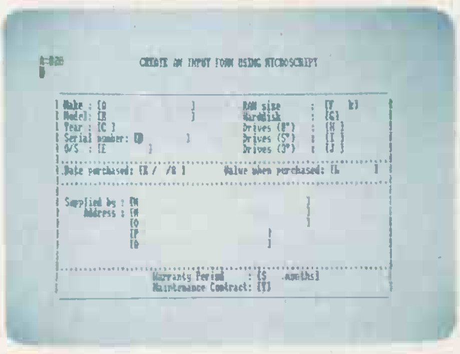
Software also takes care of the necessary file management so that CP/M* files can exist alongside these AMSDOS files.

Data files may even be shared between AMSDOS and CP/M*

Word processing, data management, accounting, ledgers – you'll find an AMSOFT program to suit whatever kind of business you want to do on your CPC 464.

There's even a range of programs that teach you professional business practice.

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



Microscript

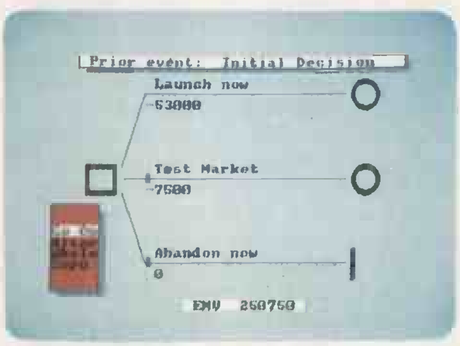
£239

complete with green screen VDU (GT64) and FREE software pack worth over £100.

£349

complete with colour monitor (CTM640) and FREE software pack worth over £100.

CPC 464 complete with monitor and datacorder



Decision Maker

CPC 464. Really gets down to business.

At the heart of it all, of course, is the incredible Amstrad CPC 464 computer.

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

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

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

The CPC 464.

It does whatever you want it to do. But that, of course, is your business.

Optional 80 column dot matrix printer DMP-1. Operates at up to 50 characters per second.

AMSTRAD

ONE GREAT IDEA AFTER ANOTHER

BOOTS COMET Currys Dixons Greens John Menzies RUMBELOWS spectrum WHSMITH WIGFALLS AND OTHER COMPUTER STORES

*CP/M and DR. LOGO are Trade Marks of Digital Research

I'd like to know more about the businesslike CPC 464 complete computer system. Please send me literature right away.

NAME

ADDRESS

POSTCODE

To: Amstrad Consumer Electronics PLC, Brentwood House, 169 King's Road, Brentwood, Essex CM14 4EF.

PRICES CORRECT AT TIME OF GOING TO PRESS. NOT ALL STORES STOCK ALL PRODUCTS.

SCREENTEST

Microscript

Will Microscript fill the gap for Amstrad users who are eager for a WordStar-style word processor? Stephen Applebaum takes a look.

WordStar has been the market leader in word processors for several years now, with many users swearing by it (and a good few swearing at it as well). Microscript, one of the latest business packages for the Amstrad, should go some way to pleasing both types of user — it echos many of WordStar's facilities, and is much easier to use.

Like WordStar, Microscript's major drawback is that it is a disk-based package, making it rather slow compared to word processors stored in ROM (especially when handling large documents). But if time is not of the essence, you should find that Microscript covers virtually all your word processing needs.

Before sitting down in front of an Amstrad, thinking that you can just happily tap out a letter, you should make sure you have a good supply of disks and a working copy of the Microscript source disk. This second point is important because, as I discovered, the system won't function if you try to write to a disk other than that containing the OS on a one-drive system.

When Microscript is loaded and a selection to open a new document is made, instead of doing what you intended it to do, the system returns the report: Bdos Err on A:R/O — you have tried to write to a read-only disk.

The first screen is the main menu. There are eight options from which to choose, the first one being C/ Create a new document, the function that results in an error prior to making a working disk using FILECOPY *.*.

On a single-drive system, a document's name has two parts: one to indicate the filename and a second to remind the user of the type of file. A twin-drive system has a third parameter which tells the OS to access the disk in drive B (B:filename.extension).

After receiving the name of a file, Microscript whirs its disk a few times and asks you to 'Please wait'. It's amazing just how much waiting you have to do while Microscript shuffles data on its disk, scrolls to the end of a document, or whatever. A seemingly innocuous statement like 'Please wait' can soon grate. Eventually you can get down to the nitty-gritty of actually writing something. Compared to other word processors, Microscript's display in edit mode is quite stolid. Pressing ESC+R followed by a number between one and nine remedies that, however, placing a ruler along the top of the screen. This is a line of dots along which can be placed special characters to control tab settings, margin widths, heading positions, and so on.

There are nine rulers, each of which can be called, changed and stored by the user. A tenth ruler, 0, is always the current one: that is, when a ruler is selected from one of the nine locations it is moved to memory 0. All nine rulers can be used simultaneously, making page layout quick and simple.

Editing

Microscript's editing facilities are as comprehensive as those of, say, View or Wordwise and include the same kind of cursor movements. Two of the four arrow keys to the right of the Amstrad's main keyboard move the cursor one character to the left or right, while the other two move it up or down a line. Two other commands, ESC+T and ESC+B, move the cursor to the top or bottom of the document respectively. When either of these two commands are used, Microscript searches its disk for the end of the document. If the document is long, it is often quicker to scroll to the bottom of the document using the cursor keys.

Further quick cursor movements are available for editing by combining one of the arrow keys with the control (CTRL) function. For example, (CTRL) —> moves the cursor to the far right of the line, while (CTRL) <— moves it to the far left. Smaller movements of one word are possible using (CTRL)T and (CTRL)R, which move the cursor one word to the right and one word to the left respectively.

Microscript's use of escape/control codes is similar to that of WordStar and extends throughout all the word processor's functions. If the Amstrad had been designed with function keys, there would have been no need for control codes.

When you are satisfied with a document, Microscript allows it to be saved using ESC+E. Another command, ESC+Q, also exits a document back to the main menu, except this time nothing is saved.

On saving an edited document, the previous version is retained but its extension is changed to .BAK, indicating that it's a back-up. Each time the file is further edited, the back-up is overwritten as the modified text is saved back to disk. Microscript's ability to automatically back-up a file is a positive advantage over WordStar, which does not support the facility.

Option S of the main menu allows the user to search for a specific string within a named file and replace it with a new one. When a string has been searched for and a replacement entered, Microscript displays the lines where the search string occurs and asks whether or not the user wants to change them. Two other functions count the number of occurrences of the search string within the text, or simply delete it throughout the whole file.

Further changes can be made to a document using Microscript's comprehensive cutting and pasting facilities.

'Cutting' refers to a section of text marked out onscreen and a copy of the block moved to the cut-and-paste memory. Three options are available at the cutting stage: one which purely deletes the block from the screen, filling the area with blanks ready to receive new text; the other two leave the original block untouched and delete it, moving the following text up the screen to fill the space. Sections of text cut from a file can be pasted back or deleted completely.

Modes

As well as the options offered in the main menu, Microscript can function in seven different modes. Each mode is selected with the command ESC+M followed by a number between zero and seven. They are as follows:

0 Vertical text — in this mode, the cursor automatically moves down one line after each character is entered. Mode 0 is especially useful for entering data into tables.

1 Auto tab — pressing ENTER in this mode returns the cursor to the left-hand margin on the next line, rather than the left-hand edge of the screen.

2 Hold line format during merge — when text is merged from a saved document, it automatically formats with the margin settings in force at the point of the merge in the current document.

3 Defeat all visible equivalents — in this mode, the visible equivalents of control characters are prevented from being interpreted on the screen. Visible equivalents can be stored in abbreviation memories and inserted into a document without the functions they represent being made apparent at that stage.

4 Invisible type — this mode is designed as an aid for the system designer. All write-to-screen operations are disabled, allowing the operator to program the system to handle functions such as line deletions and screen clearing in the background, making them invisible to the user.

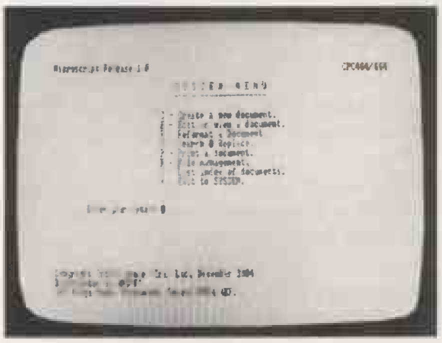
5 Insert mode — when Microscript is loaded, characters entered at the cursor in edit mode will overwrite any characters on the screen at that position. Insert mode is an alternative method which, instead of overwriting characters, automatically forces existing text to the right.

6 Hold space format during merge — mode 6 overrides mode 2.

7 Program learn — mode 7, like mode 4, is intended as an aid to the system designer. In this mode, the system automatically converts function sequences entered through the keyboard into their symbolic equivalents. For instance, pressing ENTER would return '!' rather than performing a carriage return.

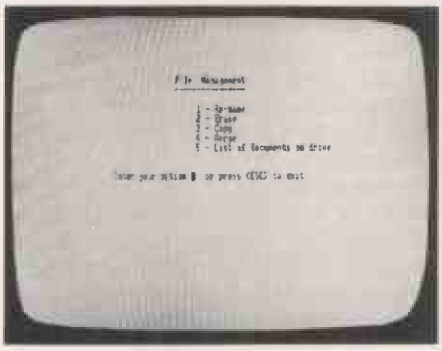
As briefly mentioned earlier, documents on disk can be merged with those in memory. To make sure that a merged file retains its original format when merged, embedded commands can be placed within the text to instruct Microscript's merge interpreter to perform a predefined operation.

An embedded command consists of a marker character, in this case a tilde, '~', followed by a control code. The command to tell the interpreter to perform a carriage return, for example, would be '~!'.

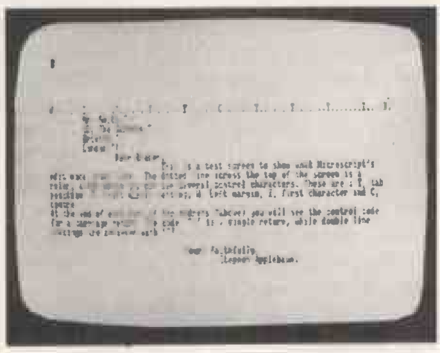


Microscript's system menu

The printing characteristics



File management options



Edit mode test screen

When you have edited and formated a document to your liking, you can make a hard copy. As well as using a print program accessed from the main menu, several printing functions and special effects can be performed through embedded commands placed at the far left of a line of text. There are seven print control characters which can be placed in a document, each of which consists of a single letter placed within a bracket. Most of these are used to format text when printing, performing functions such as forcing a new page, indicating a header, and marking the start and end of text printed in wide print mode. These last two functions apply to an option allowing up to 255 characters to be printed per line, for a maximum of 100 lines.

The embedded print function characters are used in addition to a printer-driver program. This program has 18 parameters defining line length, the number of copies to make, line spacing, and so on. Each is set up with a default value on boot-up, but can be changed to suit the user's requirements.

Included within Microscript is a program to turn it into a calculator. The calculator only works in the reformat option, selected from the main menu, and involves defining arithmetic fields represented by collections of #s placed along a ruler. Tabbing to the first field produces a series of zeros. These can be changed to any number on which can be performed one of five basic arithmetic functions: *,/,+,– and %. Up to ten arithmetic memories, corresponding to a ruler, can be used at a time, making the calculator versatile yet tedious to set up.

The documentation supplied with Microscript is very comprehensive but tends to be rather confusing in places. However, most people will find that they can use Microscript competently after just a couple of hours.

Conclusion

Microscript costs £49 and is one of the best word processors on a home micro — most will find it an excellent substitute for WordStar. Some useful features, such as a help menu, onscreen page breaks and a word count have been left out, but their omission makes very little difference to the overall package.

Probably the greatest drawback for the single-drive user is the limited disk space available on a working copy. Only 26k is available for text but can be extended to 31k by deleting several of the lesser used files. Those fortunate enough to have a twin-drive system and can use the full capacity of a disk, will find that Microscript turns their Amstrad into a powerful and 'serious' micro.

For further details on Microscript contact: Amstrad Consumer Electronics, Brentwood House, 169 Kings Rd, Brentwood, Essex. END

On the air

The idea of mobile phones communicating through cellular radio raises tantalising possibilities, but what effect will it have on data transmission? Adrian Morant examines the problems and capabilities.

So far, radio telephones have been an expensive gimmick, but cellular radio promises to change them into real business tools with a seemingly obvious potential for data transmission. But although cellular radio hit a burst of publicity earlier this year, it was never made clear what this latest example of digital technology meant for data transmission. An understanding of the technology involved helps explain this reticence.

The two cellular networks, Cellnet and Vodafone, have been set up respectively by a partnership of British Telecom and Securicor on the one hand, and Racal on the other, to provide national radiotelephone services based on cellular principles. The terms of the licences demand that they should commence operations by the end of March, 1985 (they were both, in fact, running before the middle of January) and must have expanded to cover 90 per cent of the population by 1990.

It is obviously an expensive business because, even before the first subscribers can start using the system, and thus start generating revenue, an adequate amount of the network infrastructure must be in place. Some idea of the costs involved can be obtained from the fact that Racal is foreseeing investing £200 million in the Vodafone infrastructure and has gone on record as not expecting to show any profit from it until 1987. However, when they each commenced service, they both encompassed the area within the M25 motorway ring around London, and their service areas are now rapidly rolling out not only to provide a wider service area for existing subscribers, but to provide a sales advantage in their battle with their competitor.

Cellnet and Vodafone, as network providers, are required to keep at arm's length from the provision of the service and equipment. Consequently, behind the two networks have grown up arrays of service providers. These include companies such as Air Call, Securicor and Pye Telecom which have been in mobile communications for many years. In addition, there are new names such as Granada and Dixons, as well as many smaller organisations which will be involved as retailers very much in the way that there are local shops providing in-car entertainment.

What is it?

Cellular radio is so called because the service area is divided up into a series of small cells, each of which is served by its own base station. Each one has a relatively low power transmitter, compared with the high power transmitter that is needed for each of the comparatively small number of base stations used in conventional radiotelephone systems. The size of these cells ranges from about 4km in cities to 30km in the country. The size of cell will be dictated by the anticipated number of users and the necessity of providing overall good propagation characteristics.

The advantage of this system is that the radio channels used in one cell can be re-used, with appropriate precautions such as not using them in adjoining cells, time and time again across the country without interference. Thus, the limited number of radio channels available can be put to better use than is done in existing systems; the outcome being that the cellular networks will be able to support upwards of a quarter-million subscribers compared with the 10,000 subscribers on existing systems. Consequently, it has been possible to set prices in anticipation of the large number of subscribers that will be forthcoming and which will enable economies of scale to be achieved.

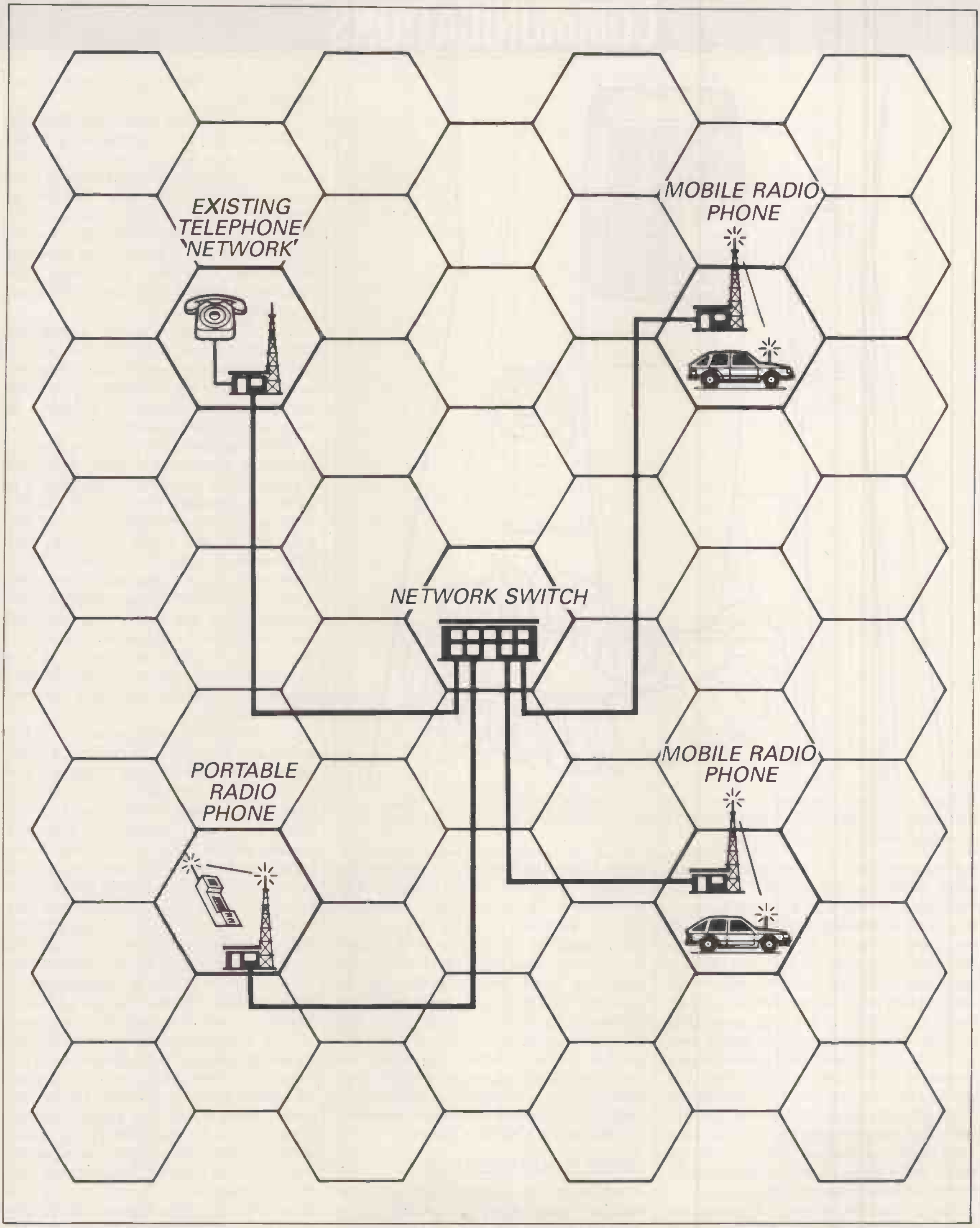
Adopted system

The system adopted is known as TACS (total access communications system) and is based on AMPS (advanced mobile phone service) which is already in operation in some parts of the US. When the TACS system was developed, it was recognised that there would be certain major differences from AMPS. It would be required to operate with 25KHz channel spacing, rather than the 30KHz used in the US; the UK service will be required to reach at least 90 per cent of the population, and the two operators must work in competition and to common standards and, in due course, to interwork. Also, the British Telecom fixed network is moving, albeit not as rapidly as many would like, towards an all-digital configuration.

A total of 30MHz in the 900MHz band has been allocated to the two cellular systems. At the lower end are the block of 600 mobile transmission channels, and at the high end are the associated land station transmission channels. In each block, Racal, designated System A, has the lower 300 channels while Cellnet (System B) has the upper 300 channels. Within its 300 channels, each system has a contiguous group of 21 control channels which are not used for speech.

The boundaries of a cell are not lines that can be readily drawn on a map: they just indicate the area over which reception from one base station is better than from the next. Consequently, while a set is switched on it monitors and compares signals from the surrounding base stations so that, when it is required for a phone call, it knows which is the appropriate one to use; this is not necessarily the nearest one, as it is rare for the radio waves to travel directly by line-of-sight between the base station and the mobile, and *vice versa*. In general, there are multiple reflections off buildings and other vehicles so that the propagation predictions are not always borne out in practice. In fact, as cellular operates at 900MHz (30cm wavelength), it is possible that conditions could vary with a physical movement of just a few centimetres. In addition to the mobile's antenna, on a hand-held portable or mounted on a moving vehicle in the case of a car set, the changing position of other vehicles could produce a noticeable effect.

When a mobile is switched on it scans all 21 control channel frequencies associated with its system. It will, however, find only two or three of them and lock onto the strongest one. Then, when it detects an 'idle' condition which says that the appropriate reverse direction control channel is free, it will transmit its full registration particulars. These include its mobile identification number (MIN), its serial number, class (that is, whether it's a hand-portable and what its power output is), and its



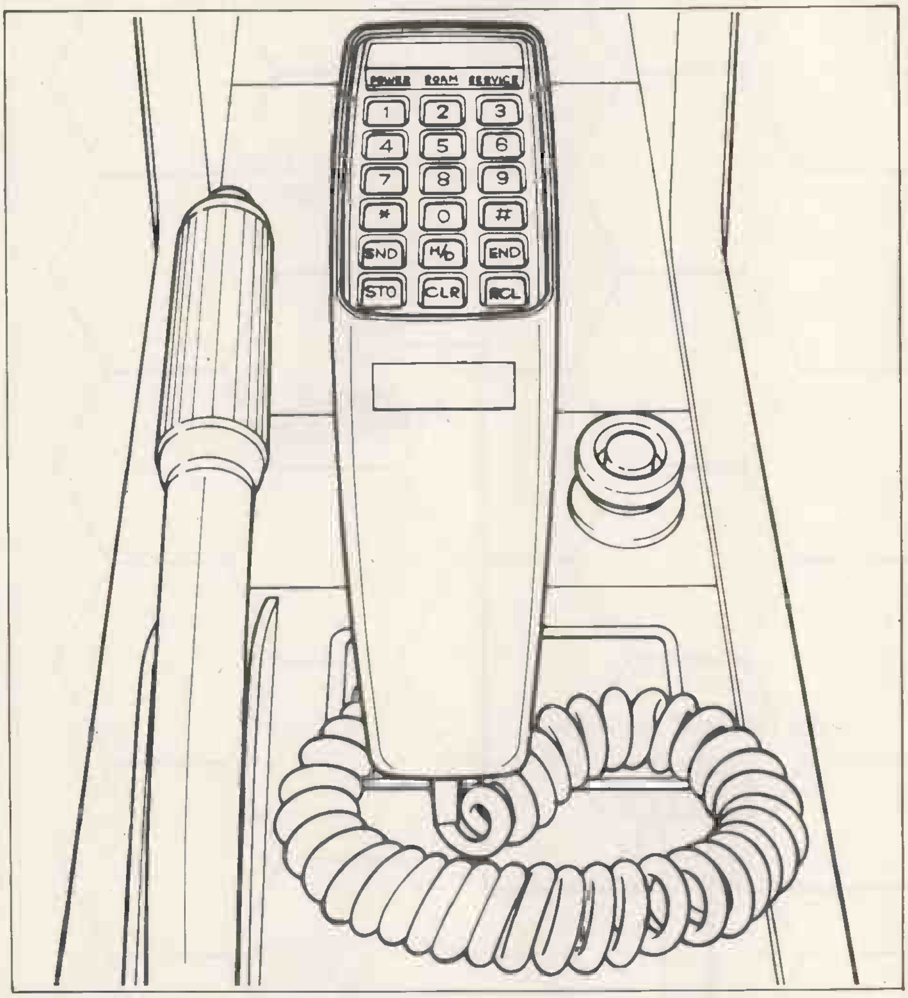
home identification (the number of the control centre where it is registered and where its billing details are held). This enables the system to keep a record of the mobile's current location — information that will be needed when it is necessary to direct a call to that mobile.

Initiating calls

Prior to initiating a call from a mobile, the number is keyed in. Then, when the SEND button is pressed in order to initiate a call from a mobile, the mobile selects the base station with the best signal from those that are in the vicinity. Having done so, it sends, on a control channel, the telephone number that was previously keyed in, together with its own identity. (Here, it should be noted that the full number, complete with its area code, must be used.)

The base station then designates the channel to be used for the subsequent conversation, sets its status to busy, and forwards the telephone number to the control centre (variously called 'mobile switching centre' or 'electronic mobile digital exchange') which, in turn, sends it to the PSTN (public switched telephone network) so that the call can be connected.

Similarly, when calling a mobile from a fixed telephone, the subscriber dials



Behind the two networks have grown up arrays of service providers, including companies such as Air Call, Securicor and Pye Telecom, to produce and market the in-car equipment.

the access code for the required network (0860 or 0836 for Cellnet or Vodafone respectively), followed by the required mobile identity number. At the control centre, a look-up table is referred to in order to find the nearest base station to that mobile; the control centre then requests two or three base stations in that vicinity to page that mobile. The mobile replies to the one with the best signal, and a handshake between the base station and the control centre designates the channel that will subsequently be used for the call. The alert/ringing tone is applied over the voice channel, and speech can commence as soon as the called party in the mobile takes the call.

As a mobile moves it must be 'handed-off' from cell to cell. This means that as the radio signal strength falls, the control centre will switch that conversation over to a free channel on an adjoining base station. As previously stated, the control channels are monitored to see which is the best base station for the mobile to communicate with. Consequently, when it is detected that it would be best to change base station, and thus channel, the control centre makes the necessary preparations. Once this is done, it uses the voice channel to send a retune command to the mobile. The mobile acknowledges this by sending a signalling tone; it switches off its transmitter, and retunes to the new channel before switching back on again to allow the call to resume. This hand-off takes about 300 milliseconds and can occur up to five times per minute, so even though the quality of the speech obtained via cellular radio is appreciably better than that normally received via the existing radiotelephones, there are problems in respect of data transmission.

Data transmission

It can be seen that data transmission via cellular radio cannot be better than a dialled-up call via the PSTN. This is because the PSTN forms part of the connection used for cellular radio so that, no matter how good the radio path is, the telephone portion is still in circuit.

As the data will have to be sent via a combined PSTN and radio path, it is necessary to cater for the vagaries of both media. While the performance of the former is well known, the words of Richard Jarvis, technical director of Racal Vodata Ltd, at a recent conference on Cellular Radio provide a good summary:

'A good way of understanding the characteristics of a cellular radio channel from a non-voice viewpoint is that it is either very good or very bad with little inbetween. Outside the period of Rayleigh fading and when there are no hand-offs or "blank and burst" signalling, the channel is better than a typical telephone channel. Otherwise the channel is so bad that no transmission is possible at all.'

The 'blank and burst' signalling referred to here is similar in effect to hand-off. It can occur at any time during a call when, for example, the base station wishes to instruct a mobile to reduce its power output.

While specialised, and expensive, modems have been used for data transmission via radio in the past, it is logical to consider the use of the CCITT V series modems because part of the path is via the PSTN. To date, V21 (300bits/sec) and V23 (1200/75) have been most commonly used. However, V22 and V22bis (1200 and 2400bits/sec respectively) are becoming popular because of their full-duplex capability; the latter, in particular, as it is the proposed standard for the UK Teletex service and should therefore become more common.

In view of the variable quality of the path, it is necessary to carry out more advanced forms of error detection and correction procedures than parity checking. In data transmission where there is a high probability that line quality will be good, it is normal to use block mode protocols such as Bisync (binary synchronous) and SDLC (synchronous data link control) which use some form (such as block check character or cyclic redundancy check) for checking the integrity of a block. The result of an error being detected is that an automatic repeat request (ARQ) is generated and returned to the sender.

This is probably going to be inadequate for cellular radio because, as the block error rate increased, the number of repeat requests would rapidly rise and, before long, the system would crash. It can be avoided by the expedient of still using the same V series modems but using forward error correction protocols. These involve the provision of redundancy within the transmitted data so that, on receipt, it is possible to detect and correct at the receiving end an appreciable number of errors in transmission.

This would reduce repeat requests to an acceptable level. In addition, if transmission is carried out at 1200bits/sec or above, the effective data throughout should not be less than 300bits/sec and thus provide an effective means of data communication via cellular radio. END

The new Data General/One. The only industry-standard PC you can use on a camel.

The new Data General/One portable computer is really going places.

Quite apart from being powered by mains electricity, it will run for up to 8 hours using rechargeable batteries.

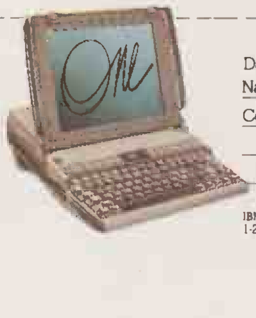
Suddenly, all those hours spent on trains and being driven between meetings become valuable working time.

All the more valuable because at around 10lb. the Data General/One is the only portable of its kind that gives industry-standard performance. That means it's completely compatible with a wide range of IBM® PC software: including Wordstar,® Lotus 1-2-3™ and dBase II®

And like desk-top computers (but unlike most other portables) it has a full-size 25-line high definition screen.

The Data General/One also has a 512KB memory, almost 1.5MB of integral disk storage and the ability to communicate with mainframes (either directly or from remote locations over telephone lines).

If you're investing in a portable computer, it's worth buying the one that supports you all the way.



For full details and the name of your nearest Dealer post this coupon to: Dealer Operations, Data General Limited, 7 Kenrick Place, London W1H 3FF. Or telephone Pat Cunningham on 01-935 9461.

Name

Company & Address

Phone

PCW 5 • 85

Data General
a Generation ahead.

BENCHTEST

ProLite vs Commuter

The Texas Instruments ProLite and the Visual Commuter are aimed at that part of the market which lacks true IBM PC compatibility in a portable system. Colin Barker puts these two lapheld through their paces to see if they can fill the gap.

There has always been money to be made by filling a hole in IBM's product line. Compaq proved that by its success with an IBM PC-compatible portable that continues to sell very well even after the arrival of the 'real thing'. Now some respected names are trying to cash in on the absence of a PC work-alike lapheld system from IBM.

First on the scene was Data General (see Benchtest, December 1984) and now Texas Instruments (TI) has joined the fray with the ProLite. TI is cautious about claiming complete PC compatibility although the name suggests a lightweight version of TI's own Professional Computer which is not completely IBM-compatible. Also, the ProLite uses the Sony 3½in disk drives — a standard not yet supported by IBM.

The Commuter, on the other hand, claims to be 100 per cent IBM compatible. Built by terminal manufacturer Visual in the US and exclusively distributed by Micro Age in the UK, the Commuter has 5¼in drives and will run most IBM PC software. However, it will not run off batteries and is too large to fit on a lap. In fact, you would have to find a new word to describe it since, thanks to the LCD screen, it is also a lot smaller and more convenient to carry than the Compaq and other 'luggables'.

Although not strictly in the same category, it is nonetheless worth comparing these two systems as they offer an interesting choice: forsake IBM PC compatibility and go for a convenient, battery-powered lapheld, or give up the idea of battery power and have 100 per cent compatibility in a system which is a lot easier to carry around than a portable. It seems that we cannot have both — yet.

The Texas Instruments ProLite incorporates some imaginative ideas

ProLite

Hardware

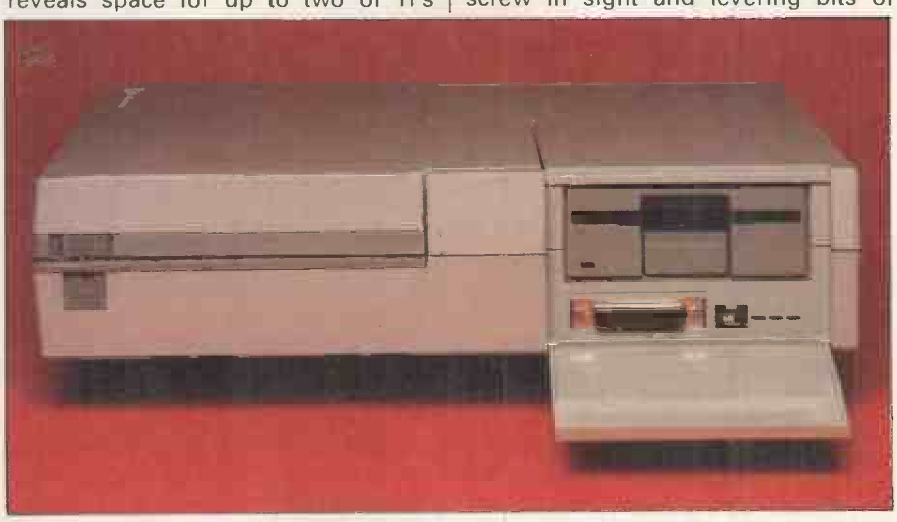
If you prefer the sleek, slimline type of executive briefcase, you have no chance of fitting this system into it. Although its dimensions, 13.1ins × 11.5ins × 3ins, are slightly smaller than the Data General One, they do not include batteries or the optional second disk drive. These are options, not available with the test model, that fit along the back of the system adding about 3ins (for just the battery) and 4ins (for combined battery and second disk drive) to the length of the system. The basic system weighs in at a fairly hefty 10.5lbs excluding the separate power supply and cord.

All the system's working parts are well protected — the disk drives, screen, keyboard and plugs are closed to the outside world. Unfortunately no carrying handle is supplied so you will still need a case to carry it around.

To get into the system you first release two catches at each side of the front of the system; this reveals the tilt-up screen and keyboard. Cleverly, TI has incorporated a powerful spring under the keyboard which pushes it up to a good typing angle as the screen is raised. The single hinge on the screen is firm enough to hold it in any position, which is important as it is an LCD screen that requires a lot of light. It needs some adjustment to get it into the ideal position.

On the right-hand side of the system a fold-down cover reveals the disk drive, a parallel printer port, and a power line for the optional TI Portable Printer. A similar door on the left-hand side reveals space for up to two of TI's forthcoming range of option modules. A flip-up cover at the back hides the bus connector for the battery or battery/disk packs. Next to that is the mains power socket.

First impressions of the machine are good. Despite the plastic case, it has a substantial feel to it. The keyboard, although cramped, is well organised and the same goes for the positioning of the slots, disk drives and other bits and bobs. It proved impossible to get into the system, despite undoing every screw in sight and levering bits of



The ProLite's disk drive, parallel printer port and optional printer power line

Two of TI's forthcoming range of option modules can be placed in these spaces

plastic with a screwdriver. Repeated cries of 'Open Sesame' resulted in groans from the system but no opening. However, there was evidence that all the important parts are fixed to a substantial metal chassis inside, so if the system slips from your lap it should (stress *should*) only result in dents to the plastic casing.

The system is powered by the Intel 80C88 processor (the low-power CMOS version of the 8088) and comes with a standard 16k of ROM and 256k RAM in 256k bit chips. There is space for internal upgrades which must be fitted by TI or a dealer, and these include the 8087 maths co-processor, graphics board and RAM expansion to a maximum 768k.

The internal disk drive is the neat Sony 3½in with a formatted capacity of 720k; this can happily run off batteries but not for too long. According to TI, the battery pack is good for two to six hours depending on disk access. There is a low-power light just below the screen which gives warning that it is time to start closing down the system when the batteries are low.

There is no shortage of options advertised for the system by TI, none of which were available with the test model. These consist of two types — options that plug in the side or the back. The two slots at the side are for TI branded, plug-in modules — they will not take standard IBM PC-type plug-in boards. The most interesting options are for communications, and these will have to be available when the system hits the market if the ProLite is to fulfil the plans of TI.

Busy executives who already have a TI Professional or, more likely, an IBM PC, and who want a system they can carry around with them that uses the same software as the desk-top machine, and can transfer information to and from that machine as well as communicate through a modem to the outside world, form the market for this system, according to TI. To comply, TI is providing three types of communications.

The simplest is the drive access link. This involves a plug-in module for the ProLite with a serial connection that plugs into the back of the desk-top PC. This disables the ProLite's keyboard, and the desk-top can then read the ProLite's disk and pick up information.

For the direct connect link an asynchronous/synchronous communications module is needed together with a linking cable, communications software for the ProLite and compatible software for the desk-top. This allows both computers to communicate with each other, and could be especially useful for transferring applications from the 5¼in disk format of the desk-top to the TI's 3½in disks. It would get around some of the limitations of the ProLite's non-standard disks but it will be impossible to use copy protected software, such as Lotus 1-2-3, Symphony or Framework, that requires a program disk to be inserted when starting the application.

Finally there is a modem link. A plug-in modem will fit into one of the expansion modules and offer communications via a telephone jack. This is waiting for approval from British Telecom.

Only the base system was available from TI so I could not test any of these communications links.

After spending some hours on this system, I have mixed feelings about the screen. It is a 10in screen (9.2ins × 4.4ins) which gives a full 80 characters by 25 lines, so it is compatible with standard PC displays. But most computer screens have a 3:2 width/height ratio: this is more like 2:1. The result is that although the ProLite gives you a full-width character set, there is no space between the lines and no descenders on the letters in the standard display format. Add to this the poor luminence that is always a feature of LCD displays of this type and you have a screen that is not just poor to read — use it for any length of time and you find it is diabolical.

To minimise eye strain, it is vital to have good lighting conditions with this system. It is quite easy to read in normal/good office light, but remember that this system is designed to be used outside the office.

Impressive graphics can be created with the bit-mapped 640 x 200 display. The demo that came with the system showed this off well and the graphics produced were clear and fast.

The keyboard is one of the system's good features. Despite cramming 79 keys into a 10ins x 4ins area, TI has produced a keyboard which should suit the two-fingered or touch typist. The springs underneath push it up to a good angle, and are firm enough to make it impossible to push down when pressing the keys. The keys click to give an audible response — they also clacked a bit on the pre-production model.

The keys are well laid out with easy-to-locate double-sized SHIFT keys and an L-shaped RETURN. The standard typewriter layout is supplemented with 12 function keys along the top, plus ESCAPE, LINE FEED, INSERT, DELETE, BRK/PAUSE and PRINT. NUMBER LOCK is on the same key as CAPS LOCK with a small light. Press this key and the light shines red showing CAPS LOCK mode. Hold down SHIFT and press the key, and a green light shows that you have activated the numeric keypad which is incorporated in the right-hand side of the alpha layout. This is a neat and functional use of the limited space.

The cursor keys run in a line to the right of the good-sized space bar, and CTRL, ALT and HOME complete the layout. The only IBM PC function not represented on the key tops is SCROLL LOCK.

At the top of the keyboard is a removable plastic panel, under which a legend can be fitted to accompany applications software that use the function keys for specific jobs. The only minus point for the keyboard is the height from the desk, 1.75ins, which could cause problems for touch typists.

System software

On starting up the system by means of the on/off switch at the front, the ProLite quickly reveals a complete absence of any of the interesting ROM software that you often get with portable systems. No, it says, none of that funny business here, let's have a system disk.

After the system disk is inserted, it is just like any other MS-DOS or CP/M-86 computer (the two operating systems available for the system) with one exception. TI has come up with Natural Link, which is another 'user-friendly' shell for the 'difficult to learn' MS-DOS operating system. On the face of it, this type of thing is a good idea. However, the opening menu is crammed with information which makes it fairly difficult to follow what to do. This was not helped by the fact that the shell and TI's implementation of MS-DOS was undocumented on the test model.

To check for any hardware problems a diagnostic disk is provided. This takes the user through a menu system and it is possible to test each individual component (screen, keyboard, graphics ROM, RAM, and so on) separately or the whole lot can be done in one go. This takes about 30 minutes, and all the actions and operations are prompted and documented onscreen.

TI plans to make CP/M-86 and the UCSD-p operating systems available for the ProLite, too.

Applications software

There will be no bundled software with the ProLite but users will, according to TI, be able to choose from the wide range of applications available for the TI Professional. The two systems are compatible, the company says, so software can be easily ported.

The test system was supplied with Multiplan, Easywriter II and Basic. Multiplan and Easywriter appear to work exactly as they do on a standard MS-DOS system with a standard screen. It takes a while to get used to the 'flattened' appearance of the information on the screen, due to the screen's rectangular shape, but it was possible to read all the information. Reverse video, as used, say, for highlighting Multiplan prompts, causes the screen no problems although highlighted words are not easy to see.

TI plans to make much of the software available in cartridge form. What these applications will be and how much they will cost has not yet been revealed.

Documentation

The only manual available for the evaluation system was a short and simple set-up guide in the standard A5 binder. Easy to read and follow, it sets out all the details of plugging in the right bits, adjusting the screen, and so on. An operating system guide will be available with the systems delivered to customers.

Prices

The base system with monochrome graphics, single disk drive, 256k RAM and MS-DOS will cost £2995. The top system with two drives and 512k RAM costs £4250. The 45cps thermal printer which can run off the ProLite's batteries will cost £450, and the battery pack itself will cost around £100. The large fake leather carrying case costs an extortionate £85 — I'd forget it and use a large briefcase.

Benchmarks: ProLite

BM1	1.3
BM2	4.4
BM3	9.4
BM4	9.7
BM5	10.6
BM6	18.6
BM7	29.3
BM8	31.5
Ave	14.35

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

Commuter

Hardware

The Commuter is not a lapheld, but it is a lot smaller than your average IBM PC-compatible portable system thanks to its half-height floppy disk drives and an LCD screen. It measures 15.5ins × 18ins × 3.4ins and it's the system's lack of depth that makes it far less bulky than the Compaq and similar systems.

With the LCD screen and two disk drives (the minimum configuration sold in the UK) it weighs in at 21lbs, which is about seven pounds lighter than the Compaq. (In press and sales material Visual gives the weight as 16lbs, but this is for a system without a screen and with only one disk drive.)

As delivered, the system looks like a light grey briefcase with a stout, rubber carrying handle. Put it on a desk with the handle towards you and, by releasing two catches, the screen can be lifted up, revealing the keyboard. At the back, the whole of the rear panel can be removed to expose an impressive array of connections.

It is tricky to get into the system, but it can be done by removing two screws at the front and another five that run along the top of the backplate. In order to fit a lot of equipment into a small space, the Visual engineers have minimised cabling: one motherboard runs the width of the system and ¾ of the length. On this board is the Intel 8088 (well, the NEC version), 256k of RAM in 256k bit chips, sockets for another 256k of RAM and the 8087 maths co-processor, plus the controller for twin floppy disks, the chips for handling the LCD screen and those necessary to give it complete compatibility with an IBM PC equipped with the colour/graphics adaptor, ROMs carrying comprehensive diagnostics, and a ROM carrying ANSII standard terminal emulation firmware. This is a lot of equipment to fit on one board, but it's not all. Connected to the back of the board are I/O ports for a standard IBM monochrome monitor, a high-resolution monochrome or colour graphics monitor, a parallel printer, and a bus connector for an expansion box which will take standard IBM PC add-on boards. There are also two RS232 ports for asynchronous and synchronous communications.

It is obvious that to compensate for the lack of space for expansion boards, Visual has tried to pack as many features into the basic system as possible and to good effect.

The power supply is cooled with a small fan. This means extra weight, but weight has been traded against space — the Commuter is so packed with components that convection cooling is clearly not possible. The fan and power supply are secured to the casing with a stout metal plate, and the only other heavy components are the disk drives and the keyboard. Four screws secure the keyboard to the motherboard and a raised, heavy-duty plastic stand holds the disk drives in place. The inside of the system gives the impression of solidity and intelligent use of space as, although there is a lot packed inside the box, you get the impression that it will stand a fair amount of rough treatment as it is carted around.

The disk drives are half-height 5¼in drives with 360k capacity. In operation they are quite reliable and are much quieter than the standard IBM PC drives. However, to load, the disks have to be pushed right in, and then a switch

Benchmarks: Commuter

BM1	1.4
BM2	4.8
BM3	10.4
BM4	10.6
BM5	11.5
BM6	20.4
BM7	31.7
BM8	32.4
Ave	15.4

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

has to be pushed in too. It is quite easy to forget to push the switch and you then find a disk error message.

The keyboard is the same as on the IBM PC apart from these differences: SCROLL LOCK and CAPS LOCK have red indicator lights; there is little feedback on the keys—they do not have the 'give' of the IBM keyboard and there is no click sound; and the keyboard is not recessed properly so that function key overlays, as supplied with applications packages such as Lotus 1-2-3 and Open Access, do not fit properly. But overall the keyboard is good and ensures complete compatibility with the IBM PC.

The screen is suspended above the system on two arms. It can be removed by unclipping the arms and disconnecting the screen's lead, and with that out of the way, a monitor can be placed on the system box. The 10.5ins screen measures 9.9ins × 3.2ins, which makes it longer and flatter than the ProLite screen. It gives the full 80- × 25-character display, but the standard screen images of packages like Lotus 1-2-3 are distorted by the odd shape.

Although it is quite possible to read the screen, it is not easy for two reasons. Firstly, the screen has poor luminence so the ambient lighting has to be bright. Secondly, it is impossible to adjust the position of the screen — it rests in one position and that is it. Although the screen has a contrast control to its right, this does not make up for having to use it in one position. The whole computer has to be positioned very carefully, with no light directly reflecting onto the screen if it is to be read at all.

Any reservations I had about LCD screens after using the ProLite were increased after using this system. LCD screens are really not adequate for normal computer usage for any length of time. The poor luminence means that the eyes have to strain to read them, and they are easily affected by movements in ambient light, such as someone walking behind you while you are using the system. This means the eyes constantly have to refocus. Also, the strange shape of the screen means the images are distorted. In this respect at least, the screen on the Data General One is much better than either of the ones reviewed here.

The vast array of ports at the back of the system more than make up for the lack of space inside in which to fit standard IBM boards. The Commuter can take any kind of screen that will fit an IBM PC, it can be directly connected to a modem and emulate standard mainframe terminals, it can be attached to most kinds of printer, and, if that is not enough, an expansion box can be fitted to the bus connector. This should only be needed if you want more than 512k RAM, which is likely if you want to run Symphony, Framework or the other big integrated software packages, or if you have a need for some kind of specialist board. However, the expansion box is the same size as the Commuter and considerably lessens its portability.

System software

There is a minimal ROM on the system that goes through a simple self-test and then prompts the user to start by

Technical specifications: ProLite

Processor:	Intel 80C88
ROM:	16k
RAM:	256k expandable to 512k
Mass storage:	One or two 720k micro floppy disks
Keyboard:	79 keys
Size:	13ins × 11.5ins × 3ins
Weight:	10.5lbs
I/O:	Parallel printer port, two TI proprietary expansion ports, bus connector for battery pack and/or second disk drive
DOS:	MS-DOS version 2.0
Battery:	3lb optional battery pack gives two to six hours power

Technical specifications: Commuter

Processor:	Intel 8088
ROM:	16k
RAM:	256k expandable to 512k
Mass storage:	Two × 360k floppy disk drives
Keyboard:	83 keys in standard IBM PC layout
Size:	15.5ins × 18ins × 3.4ins
Weight:	21lbs
I/O:	Composite video, RGB monochrome, parallel printer asynch/synchronous, asynchronous, and expansion bus ports
DOS:	MS-DOS version 2.1
Bundled software:	Microsoft GW-Basic

In perspective

These two differing products are staggered across a market that at present exists more in the minds of the computer industry marketing men than in any real sense. Potentially, there are many businessmen and women who already use a desk-top machine and want some kind of portable system to carry around between office, home and remote working site. This market has been proven, they say, in the past success of the Osborne and the current success of the Compaq. However, there is another argument that says the success of the Osborne and Compaq was based more on the availability of a cheap system running industry-standard software (first CP/M and now PC-DOS).

But the computer industry is sticking to its guns and there is a host of portable systems available and about to be launched, from the notebook computers like the Tandy 100 to the semi-portable IBM PC compatibles. The ProLite and the Commuter are trying to occupy two distinct slots between these extremes.

The ProLite is a fully portable system competing with the HP110 and the Data General One. It is a creditable attempt to compete except that it does not have the excellent engineering and ease of use of the 110, has an inferior screen to the Data General One and is also more expensive than the latter. Like all lapheld portables it's a compromise, and an uneasy one at that, between convenience and usability.

The Commuter, on the other hand, makes fewer allowances for convenience. It is a semi-portable requiring a mains supply. It is too large and heavy to fit on anyone's lap, but it is a lot less bulky than the likes of the Compaq. It is probably the only system on the market which is practical to carry for more than 100 yards and yet offers 100 per cent IBM PC compatibility.

All the battery-powered models have to use the small 3½in disks. Until IBM offers a standard in that format, there is little chance of a genuine IBM PC-compatible lapheld system emerging.

For APRICOT and F1.

VIZAWRITE PC WORD PROCESSING

VIZAWRITE is probably the easiest business program that you will ever use!!

Right from the start, just type onto the screen and your words are instantly laid out on the page.

Just like a professional typist, VIZAWRITE knows when to end each line so that pages are produced with neat margins, inset paragraphs and perfectly lined up tabulations.

Now you can concentrate on what you're typing, not how to type. Documents take on a new look of professionalism. Produce memos, lists, letters and complete reports with incomparable speed and ease.

VIZAWRITE can also proof-read your work, excellent at picking out those 'juggled' words that get typed when the phone rings.

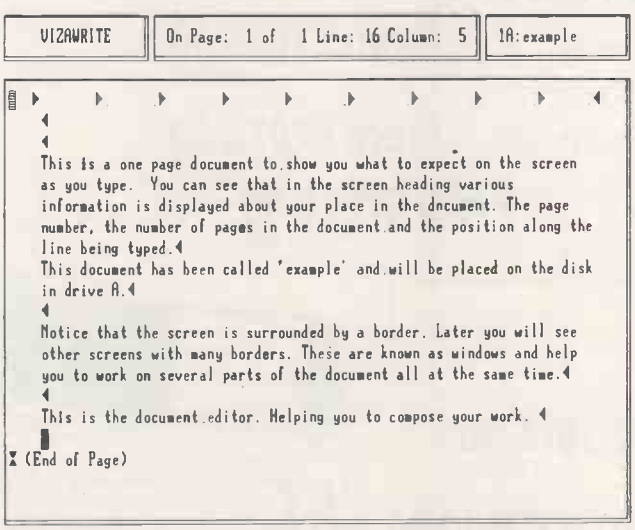
Document statistics, how many words you've typed, VIZAWRITE shows you — instantly.

VIZAWRITE is so easy to use, THE TIMES featured it again and again in no less than three separate articles on word processing for newcomers.

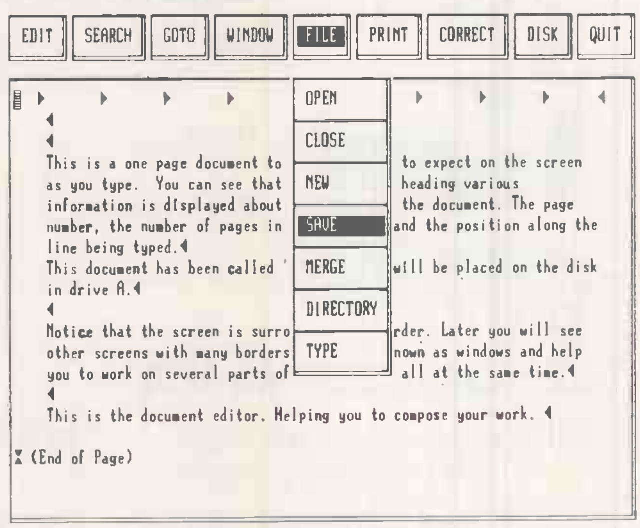
We've even included some of the latest software 'fashions', such as WINDOWS to view several documents at once, such as PULL DOWN MENUS that assist command selection, such as on-screen HELP if you can't find the manual!!... and much more.

Over the page we have listed each and practically all of VIZAWRITE's powerful layout and filing commands.

Remember that VIZAWRITE has achieved an ease of use that you won't find in any specification. It's intuitive, simple and fast.



The Document Editor Screen



The Command Menu

VIZA SOFTWARE

Call us now, or fill in the coupon for more details.

VIZA SOFTWARE LTD.
Chatham House,
14 New Road,
Chatham,
Kent ME4 4QR.
Tel: (0634) 45002

Please send me further details of the VIZAWRITE PC and the name of my nearest dealer.

Name

Company

Address

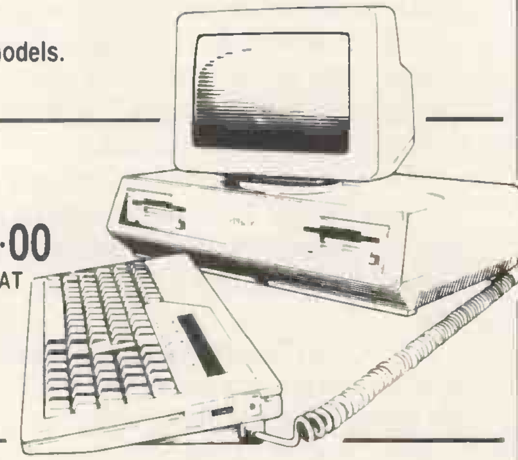
PCW

KGB
THE PRICEBREAKERS!

IBM AT, XT AND PC

IBM AT Enhanced 512K RAM, 20MB Winchester. Screen. Keyboard. 1·2MB Floppy. **From £4514·40** ex VAT

Contact the KGB for details of other models.

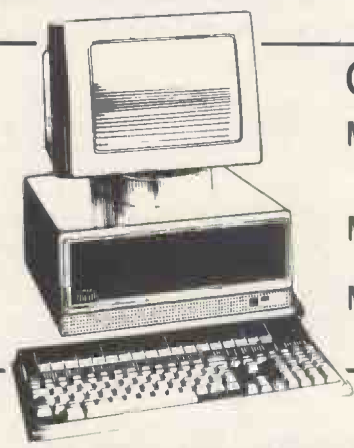


APRICOT PC, Xi, PORTABLE AND POINT 7

PC 256K RAM, 2 x 315 Floppies, 9 inch Screen. Keyboard, Supercalc. Superwriter. Superplanner. DOS. **From £1470·00** ex VAT

Xi As PC but with 10MB Winchester. **From £2470·00** ex VAT

Contact the KGB for details of other models.

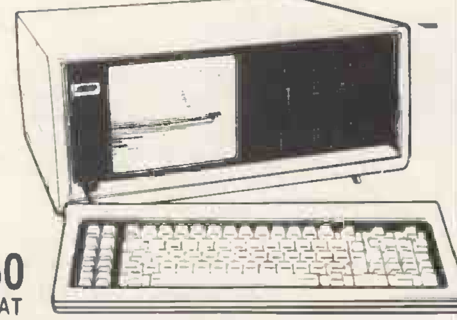


OLIVETTI M24 AND M21

M24 128K RAM. 2 x 360K Floppies, Screen. Keyboard. DOS. **From £1615·50** ex VAT

M24 As above but with 10MB Winchester **From £2875·50** ex VAT

M21 Transportable. As M24 **From £1615·50** ex VAT



COMPAQ AND COMPAQ PLUS

COMPAQ Transportable. 2 x 360K Floppies, 256K RAM. Keyboard. Integral Screen. DOS **From £1975·50** ex VAT

COMPAQ PLUS As COMPAQ but with 10MB Winchester **From £3550·50** ex VAT

PLUS A GREAT RANGE OF SOFTWARE FOR A WIDE VARIETY OF APPLICATIONS!

FREE CAD SEMINARS — RING WINDSOR 50111 FOR DETAILS

KGB MICROS LIMITED
106 St Leonards Road, Windsor,
Berkshire, SL4 3DD
Tel: Windsor (07535) 50111 Telex: 848521

Authorised dealer for
olivetti

IBM Personal Computer

Specialists in Computer Aided Design

To KGB Micros Ltd., 106 St Leonards Road, Windsor, Berkshire SL4 3DD
Please Send Free Literature Pack.

Name ____________________
Position ____________________
Address ____________________
____
____________________ Tel: ____________________

loading a system disk or setting up the system as a terminal. There is a routine in the ROM that allows the system to become a dumb terminal connected to a mainframe by a modem; this could be extremely useful when using the Commuter on site to load data into a mainframe back at the office. It is compatible with any standard ANSII terminal, according to Micro Age. There is also an extended diagnostics routine in the ROM that can be used to test the screen, memory, disk drives, and so on.

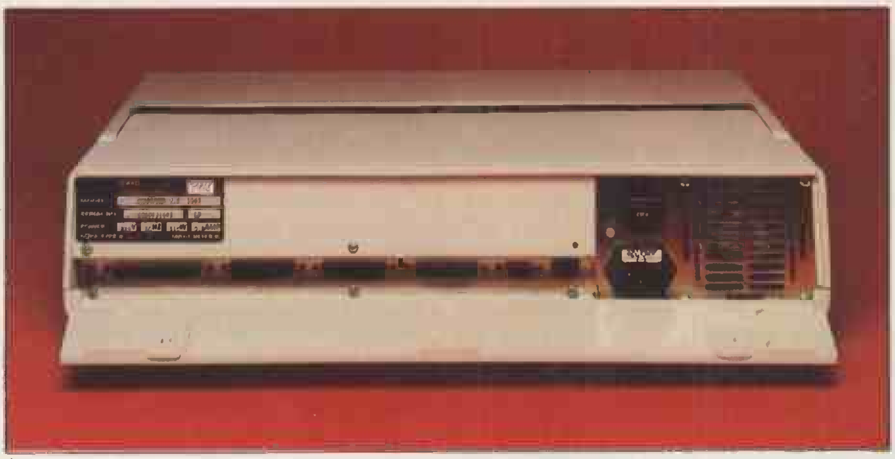
The Commuter's version of MS-DOS, supplied with the system, is functionally compatible with PC-DOS versions 2.1 and higher. This, along with the BIOS, allows the system to run IBM PC software.

Applications software

Microsoft GW-Basic is supplied as standard with the system, but there is no other applications software. The Commuter is aimed at people who already use an IBM PC with plenty of applications, and who want a system which can be easily transported to home or remote sites away from the office while using exactly the same software.

The Commuter runs most IBM PC software you care to try — it ran *all* the ones I tried. Two difficult PC packages for compatibles to run are Lotus 1-2-3 and the Microsoft Flight Simulator. It ran both to interesting effect — flying on an LCD screen is like flying at dusk with no instrument panel lights!

In fact, the LCD screen does not enhance any of the packages I tried, and for any serious, lengthy work you will have to carry a monitor with the system. On the LCD, graphics are distorted and 'busy' screens are difficult to follow. However, with a monochrome or colour monitor, either of which can be plugged in the back, it gives the same standard of display as the IBM PC. It can also be used with a TV.



The Commuter's vast array of ports compensates for the internal lack of space

The Commuter's keyboard ensures complete compatibility with the IBM PC

Documentation

The system comes with two thick manuals for GW-Basic and DOS, and both are rehashed versions of the standard Microsoft manuals. There was no *Guide to Operations* with our system. Micro Age assumes that the user knows how to use a PC, but this does not raise any serious problems: if you can use an IBM PC, you can use the Commuter.

Prices

The basic system with the LCD screen and twin disk drives costs approximately £2300. This is a little vague as, for the time being, Micro Age only intends to sell the system in volume to corporate clients. There are plans to sell through dealers eventually, but at present it is not available for customers who just want a single system. The one-off price will be fixed when it becomes available through dealers.

Conclusion

There is a lot of sense in Micro Age only making the Commuter available to corporate clients to begin with as that should be the system's largest market. Auditors, salesmen, marketing people and others who have an IMB PC in the office and want something compatible with the desk-top PC that is not as arm-stretching as the IBM or Compaq portables, should look at this system.

It offers good value for money as it has a lot of the 'extras' for the IBM PC already crammed into a small box. It is a sturdy, well-designed system, with the bonus of convenience.

On the other hand, at over £3000 for a battery-powered, single-disk system, TI is not exactly giving its ProLite away. Price aside, the TI system is good for those who want a genuinely portable computer with more power than the Epson and NEC 'notebook' computers. For those who already own a TI Professional Computer this could be a wise purchase, but for IBM PC users I cannot vouch for the stated ability to upload information from the ProLite. I can't vouch for the battery pack either, and with a TI-declared performance of only two to six hours, depending on disk usage, that does not look like the last word in battery technology.

On the plus side, it is a neat, compact system with some imaginative ideas (the module slots and ability to transfer information to and from PCs or through a modem) thrown in. It's a mixed verdict on this system. It's good in parts but there are better battery-powered portables around.

My main reservation with both micros, as with all systems of this type, is the screen. END

Discovery 1

Stephen Applebaum looks at the Discovery 1, a powerful and versatile disk system for the Spectrum.

Owners of the BBC, Amstrad and even the humble Atmos have had the luxury of disk storage for some time. Sadly though, Spectrum owners have had little to cheer about with few systems being produced that are good enough to replace a cassette recorder. The Microdrive was a good try on Sinclair's part, but it never really paid off because of the lack of available software and unreliable tapes. But never fear: Opus, a London-based supplier of peripherals, might have come up with the answer in the form of the Discovery 1.

Rowland Hoar, an Opus director, calls Discovery 1 the 'complete peripheral centre', which could explain why it's such a monster compared with other Spectrum disk systems. Within a comparatively large, heavy metal box resides a 3½in half-height drive, power supply, and a chip-encrusted PCB containing the circuitry for five interfaces.

Hardware

Working around the outside of Discovery 1 reveals a nice collection of interfaces and ports, subtly peeping through the case. On the right-hand side are two edge connecters: one is a 56-way type, similar to that on the rear of the Spectrum; the second, smaller one is a 26-way bi-directional parallel printer port. The latter will work with any Centronics printer, but as yet there is no software available to allow the special Sinclair graphics characters to be printed; instead, '?' appears on paper. However, Romantic Robot, one of the software houses converting programs to run on the Discovery 1, is working on a package to make this possible.

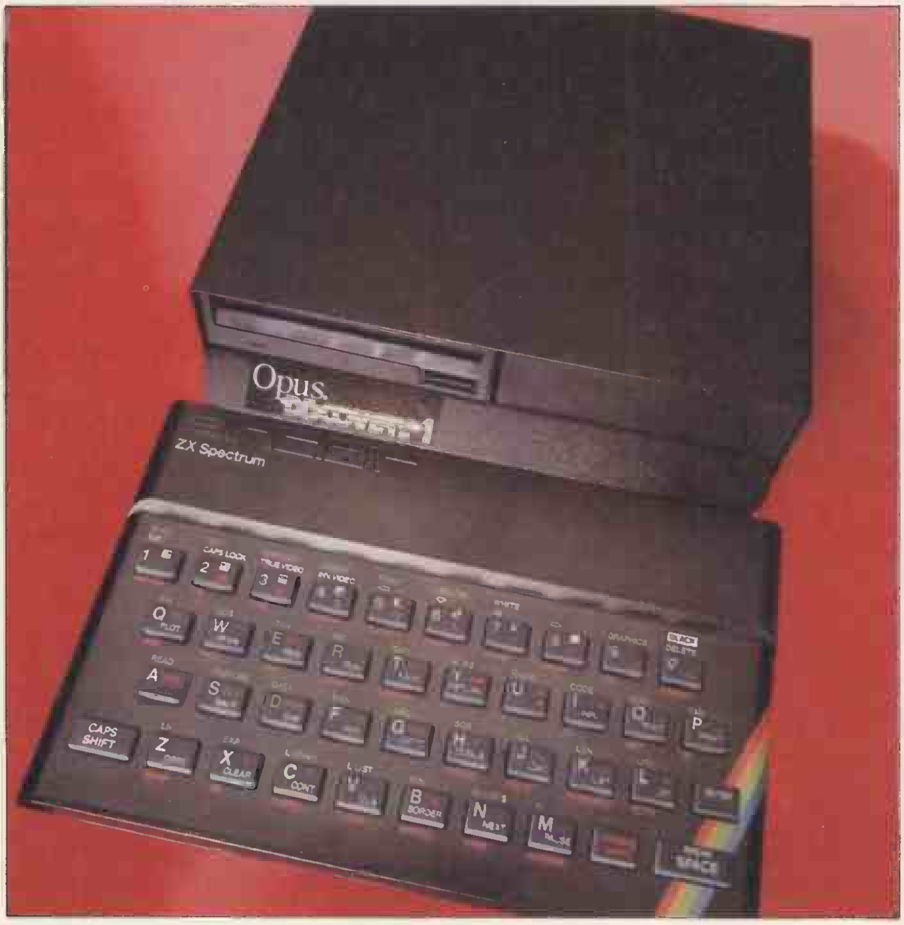
On the same side as the two edge connecters, there is a nine-pin D socket for a joystick. Any joystick based on the so-called Atari standard can be plugged into the socket, and as Kempston's protocol has been adopted, the joystick will be compatible with a wide range of software (when it is available).

Moving to the rear of the box, there's a video port for linking the system to a television or green-screen monitor, and an on/off switch. Discovery 1 avoids using the Spectrum's external power supply by having its own built in. This powers both the disk drive and Spectrum, as well as any peripheral plugged onto the through connecter.

Removing several screws from the base of Discovery 1's case and sliding off the top reveals the system's guts in all their glory. On the left-hand side of the unit sits the disk drive, while a space next to it is reserved for a second one. Discovery 1 can be upgraded to a twin-drive Discovery 2 or, alternatively, bought with the higher specification. If you want to take the upgrade path, it is recommended that an official Opus dealer fits the second drive for you.

Below the disk drive is an expansive heat sink and below that, the PCB. The most obvious chips on the board are a large disk controller and an 8k ROM, in which is contained all the firmware to allow the system to accept Microdrive commands. A vacant socket allows an extra 2k CMOS static RAM to be added to the Discovery 2 upgrade.

Discovery 1 attaches to the Spectrum via the computer's edge connecter. Spectrum and Spectrum+ keyboards fit onto the system without any bother, but owners who have fitted, say, the Dk'Tronics or Fuller keyboard will have problems because of the height restriction imposed by Discovery 1's front design. However, by using a ribbon cable the two can be made to communi-



cate at the expense of the unit's compactness.

In use

Getting started with Discovery 1 involves formatting one of the two blank diskettes bundled with the package. Microdrive owners will find the procedure familiar as the Discovery 1 uses almost the same syntax: that is, both use extended mode commands (the red ones below the keys on the Spectrum keyboard). The command to format a disk is FORMAT "m";1;"<disk name>", where 'm' informs the computer that it is a disk (Microdrive) command, and 1 specifies the drive used. Cataloguing the formatted disk gives its name and capacity.

An unformatted disk has a capacity of 250k, but 70k is lost in formatting along with another 1k for the catalogue, leaving the user with 179k free space. Unless you are thinking of setting up a large database, 179k will be enough for most purposes and corresponds to about 60 sides of A4 paper.

Basic programs can be loaded and saved with LOAD* "m"; 1;" <filename>" and SAVE* "m"; 1; "<filename>" respectively. Programs written in machine code, however, rely on the user specifying how long the program is and what location it is to be stored at: SAVE* "m"; 1; "<filename>" CODE 32500,67 where 67 is the length of the program in bytes and 32500 is the memory location it is to be stored at. These are rather long-winded, so Opus has added a short form where 'm' is omitted.

Thanks to random access filing, the speed at which a program can be accessed on a disk is far greater than cassette and, to a lesser extent, the Microdrive.

As stated earlier, almost all the commands used with Discovery 1 are the same as those for the Microdrive, although there are a few exceptions. When a file is saved with the same name as an existing one, the old file will be overwritten. Tape devices, because they have no way of knowing where a file is located, are not able to overwrite files of the same name.

Auto-run files can be saved using the command LINE, but unlike the Microdrive they can be merged with another program in memory.

As well as saving Basic and machine code programs, Discovery 1 can store data such as lists of numbers, names, and so on. The commands are very different to the usual SAVE and LOAD, with 'streams' and 'channels' having to be specified by the programmer.

The procedure for storing and retrieving data is as follows: a file is opened with the command OPEN#; this creates a buffer of around 300 bytes (600 bytes in the Microdrive). Data can be sent to the file (or buffer) with the PRINT# command. When a buffer is full, or the user has no more data to enter, the buffer can be cleared with CLOSE# and the data written to disk. Until CLOSE# is used, all the data in the file is stored in RAM and can be altered without affecting the disk.

Retrieving the data from the disk is done in almost the same way, except that the file is specified as an IN (input) file rather than an OUT (output) file.

Streams and channels are just cryptic names for information moving around the system (in a 'data stream') and the input/output device (channel) it is 'linked' to.

The Spectrum has 16 streams labelled 0 to 15. Streams 0, 1 and 2 are already assigned and therefore best left alone by the user. For your reference, streams 0 and 1 are used for input from the keyboard and for output to the lower half of the screen. Commands such as INKEY$ and INPUT make use of streams 0 and 1. Stream 2 is used for output to the upper part of the screen. Commands PRINT and LIST make use of stream 2.

Although I have only mentioned streams 0, 1 and 2 being assigned to specific channels, stream 3 is also automatically linked to an output device, in this case to the printer. This can be changed if necessary.

Channels are either input or output devices and there are several predefined ones available on the Discovery system —

Channel K: input from the keyboard and output to the lower part of the screen.
Channel S: output to the upper part of the screen.
Channel P: output to the ZX printer.
Channel m: input or output to a disk file.
Channel b: input or output to the parallel port. This channel sends and receives characters without making any changes and is used as a binary channel.
Channel t: input or output to the parallel port. Unlike channel b, the t channel expands Basic tokens and prints graphics characters as ?. Channel t is therefore used as a text channel.

Here's an example of how a stream can be linked to a channel:
OPEN#4;"t" links stream 4 with the parallel port.

Another interesting feature of the Discovery 1's design is the inclusion of a command for setting aside 32k of the Spectrum's memory as a RAM disk. CLEAR 32767 frees the memory, while FORMAT 5;"<filename>" recognises and formats it as another disk. File processing speeds can be greatly increased, giving the programmer the chance to make quick changes to data before transferring the file to disk.

In addition, 2k of RAM is added in the Discovery 2 upgrade. The RAM gives the Discovery system more flexibility, as all the system's look-up tables and machine code entry points can be stored and changed.

The documentation provided with Discovery 1 comes in a 34-page operating manual. On the whole it is well written, although much of the information tends to be so condensed that several important points have been glossed over. Its outstanding feature is a section describing the theory behind streams and channels; this is something that many bewildered Microdrive owners would be glad to read.

Conclusion

However good a Spectrum disk system is, and there is no doubt that the Discovery 1 is very good, it will be made or broken by the quality of useful software available for it. Unfortunately Boots, the exclusive supplier of the Discovery 1, has gone the way of Rotronics, producer of the Wafadrive, and commissioned games as the bulk of its software.

Games such as Mugsy, Codename Mat and Jasper might have been successful on tape, but it's unlikely that they are a big enough carrot to tempt Spectrum owners into forking out £199.95 for a Discovery 1.

Mini-Office is the only business program so far available, and that is limited in the extreme. It seems that Boots has felt misguidedly obliged to pamper to Spectrum owners who use their machine for fun rather than 'serious' business applications. Could it be that only Watford Electronics, which bundles Tasword 2, OmniCalc and Masterfile with its disk interface, knows where the market for disks is? It certainly seems that way. END

Technical specifications

Disk size:	3½ins
No of tracks:	40
No of sides:	One
Capacity (unformatted):	250k
Capacity (formatted):	179k
Track-to-track access time:	3msecs
Power supply:	240v 50Hz input
	Price
Discovery 1	£199.95
Discovery 2	£329.95
Discovery+ (second drive)	£139.95
Centronics cable	£9.95

All prices inclusive of VAT.

Further details from: Opus Supplies, 158 Camberwell Rd, London SE5 0EE. Tel: (01) 701 8668

Adventures in text compression

RAM limit is constantly a restriction on applications that store substantial text in memory — but there are solutions. Here, Peter Finch explores the attractions of text compression.

Why does the world use eight bits to store each character? History, in particular IBM's choice of an 8-bit byte more than 20 years ago, has led to an industry standard. (Some mainframe and mini manufacturers, for example Control Data and DEC, still use 6-bit characters, but these only provide 64 possibilities and thus exclude lowercase letters.) In the micro world the ASCII (American Standard Code for Information Interchange) character set with its 95 printed characters is the standard, but eight bits provides 256 potential variants, 161 of which ASCII does not use.

Hence the attraction of text compression. The trouble with most methods, though, is that they are usually sophisticated algorithms requiring, for instance, large memories, disk-based dictionaries, or considerable processing power. For adventure games, or applications that store substantial text in memory (for example, word processors), users of home micros such as the BBC need something simpler. Firstly, they need more text for their RAM, so providing good compression with a small overhead for the storage of the program and any associated workspace and data. And secondly, they need fast unpacking of the compressed text. Fast packing is also advantageous, but text tends to be looked at more often than it is updated. This is certainly true for adventures.

Program objectives

After some thought and experimentation with character-counting programs, I came up with the following requirements for the text compressing programs in this article.

1 Full ASCII 95-character set.

2 Newline, ASCII code 13. (Some machines use a code for carriage return followed by a newline code; not the Beeb, which just uses the one code to show the start of a new line.) Without newline, the text would have to have an implicit line length and short lines would have to be extended on the right up to this length, thus wasting those bytes we are trying to save. ASCII characters and newlines (and no others) are given by SPOOLed or BUILDed text. (The BEEB O.S.*SPOOL command creates an ASCII file from an internal one. The *BUILD command is used to make an ASCII file direct from the keyboard.)

3 End-of-text (EOT) marker. Although not essential, such a marker is extremely useful in any text manipulation. It is much easier to have a pointer to text to be printed rather than having both pointer and length.

4 Permit some redundant codes so that readers can add their own codes: for example, maths characters or colour control characters.

5 Programs should be written in Basic, which is compact and allows readers to modify the program to their own needs and writing styles.

6 Minimum code and table overheads, especially for the unpacking program.

7 A goal for text compression of ⅔: that is, for 20k RAM, you can store 30k characters of text.

I excluded dictionary-based systems because of their need for lots of memory either in RAM or on disks. Next I investigated Huffman codes (see the article 'An Introduction to Data Compression' by Harold Corbin, *Byte*, April 1981), a compression technique using a variable number of bits per character. But the programming overhead is significant since you have to program with bitstreams, which means that the decoding program has to examine the input file bit by bit to decide whether or not it has looked at enough to decode a character.

Then an article by J Pike (*Journal of the BCS*, vol 24 p324) prompted me to look at 4:8-bit representation of characters. The 4:8 approach allows you to program using ½bytes, which is easy

4 bit code	Immediate character	ASCII char in range
0	Blank	
1	a	
2	e	
3	i	
4	o	
5	r	
6	s	
7	t	
8	l	
9	n	
10		32- 47
11		48- 63
12		64- 79
13		80- 95
14		96-111
15		112-127

Fig 1 Interpreting a 4:8-bit compressed code stream

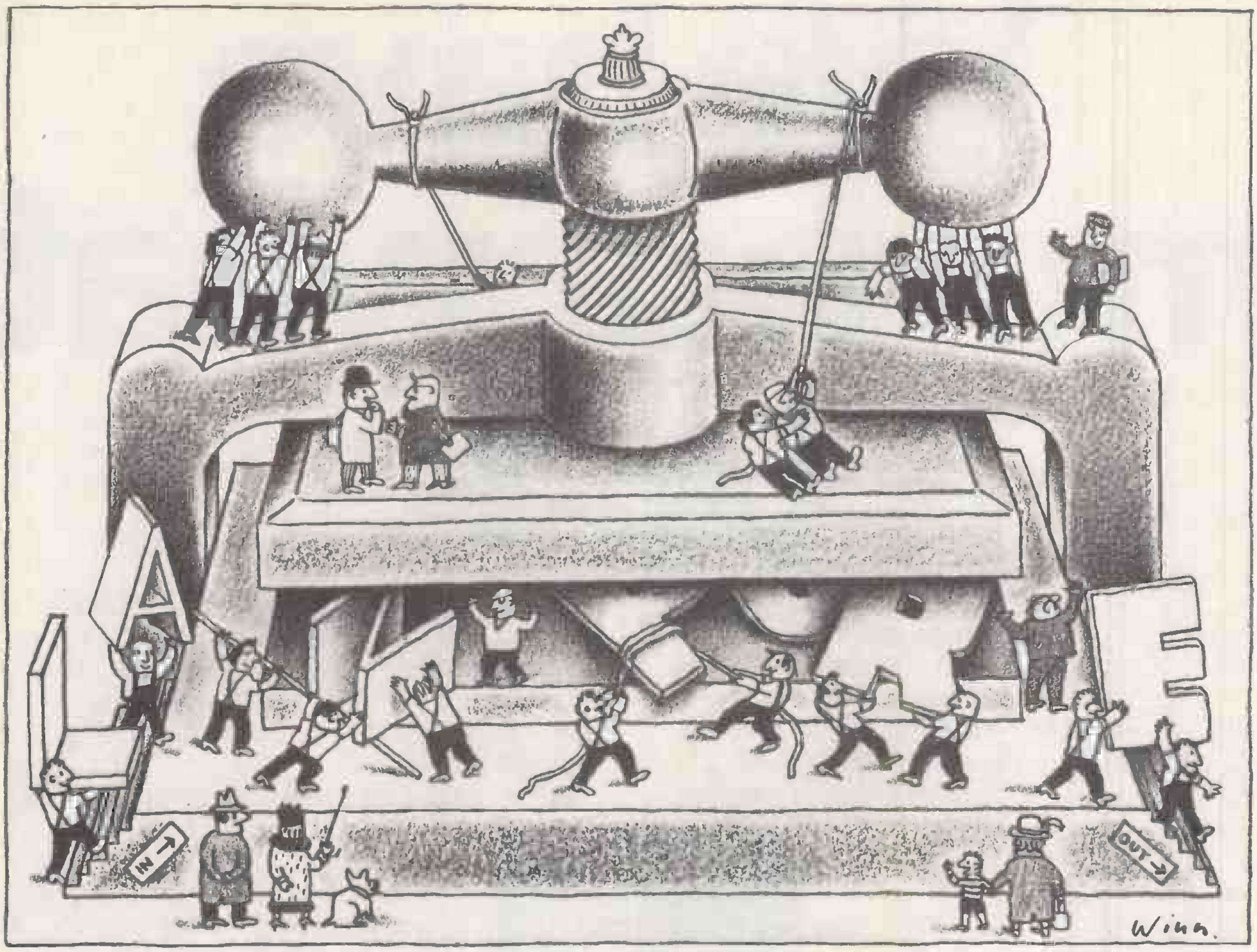


Illustration by Chris Winn

and quick on the Beeb. A statistical analysis of other articles showed that the goal of ⅔ compression was obtainable.

The approach

My basic approach was to use four bits to represent blank (or space) and the nine most frequently-used characters (in my case, 'aeiorstln', which, with blank, make up 70 per cent of my text). All the other characters, plus newline and EOT, stay at eight bits.

Fig 1 shows how to interpret a 4:8-bit compressed code stream. For codes 0 to 9, the character is as given. Codes 10 to 15 give one of six subtables, each giving a range of 16 ASCII characters. The following four bits state which value in the subtable to use, and newline and EOT are mapped onto codes 32 and 127.

I came up with two programs, Pack and Unpack, in two different versions to match different applications. The file-oriented versions, printed here, are suitable for large amounts of text. The other versions, intended for text in RAM such as in most adventure games, are simpler — just remove the references to the files.

Typically, for the Pack program, input will still be from a file but the compressed text will be stored in RAM. For the Unpack program, input will come from an array in memory and will be extracted using the byte indirection operator '?' (the BEEB PEEK). Output will be to the screen with a PRINT.

The Pack program, shown in Fig 2, takes a standard text file from disk in ASCII format and compresses it to another disk file.

It uses the following variables: AV%(126-97), a vector containing an integer value for ASCII characters from 97-126. This allows a rapid check of these characters (mainly the lower-case letters) to see which have a four-bit code. A non-zero value gives this code; C%, the byte from the input file; A%, the code from AV% if the character C% is in the range 97-126; IC% and OC%, counters of input and output bytes; OB%, a byte-sized buffer to prepare a byte for output; OBE, a Boolean flag, true if output byte buffer OB% is empty; T$, name of file; CR%, contains the subtable index; and CL%, contains the subtable number.

Looking at Fig 2 in more detail, lines 260-290 initialise the scalar variables, 310-380 set the values in vector AV%, and 390-450 open the input and output files after requesting their names.

The two procedures PROCOUT4 and PROCOUT8 output a 4-bit character or 8-bit character respectively. The first will only write a byte to the output file if the output byte buffer is already half-full. PROCOUT8 always outputs a byte, but if the buffer was half-full on entry, it will be on exit.

Each time around the main loop (lines 480-590), the program reads in a byte and checks to see if it is one of the nine letters or a blank that can be compressed to four bits. If so, PROCOUT4 is called. Otherwise, if the character is legal (a newline ASCII 13 or in range 32-126), PROCOUT8 is called. This loop terminates when the end-of-text in the input file is reached, when the special end-of-text code of 127 is written to the output file.

The Unpack program is shown in Fig 3. Since it is intended to be short, it is written in a compact style with short names and only REMs at the start of the listing, so that these can easily be deleted. Without the REMs, it uses about 270 bytes.

The variables are as follows: A%, Boolean flag saying whether four bits are available for decoding, or if another byte must be read in; E%, Boolean flag — true if at end of input text; I%, integer holding the current four bits being decoded; C%, integer holding the byte just read in; and R%, integer holding the right-hand four bits of C%.

Lines 100 to 130 initialise Boolean variables, and open the input and output files.

The function FNB returns the next four bits to be decoded. Each second time that it is called it reads in a character, under the control of the variable A% which is flip-flopping between true and false (line 250).

Each time around, the main loop (140-210) makes a call to FNB (line 159)

We have more of what it takes.

That's right. Not only have Tandy got more, you get more from Tandy. Great computers at prices you'll agree with.

This is where the Tandy 1000 steps on to the stage to take a bow. It really is a PC-compatible business computer with a difference–the difference is it will cost you less for a whole lot more.

Have you noticed how some computers need a catalogue of add on extras even before you can plug them in–extras you feel ought to be part of the deal? Well Tandy feel the same way.

Half an answer to your business needs is no answer at all.

With the Tandy 1000 you get a really useful business software program we've called DeskMate. This puts your Tandy 1000 to work from day one, with word-processing, spread-sheet analysis, electronic filing, tele-communications and electronic mail. And we give you those so-called "extras," like adaptors to use a monitor, printer, joy stick and light pen, plus a disk operating system and BASIC. And our colour graphics adaptors are built-in as standard.

If your tireless Tandy 1000 is helping you at home, we've got some tantalising programs for home learning and fun available too.

So now you know–we've got more of what it takes. Have you?

TANDY®

COMPUTERS

The range that's clearly superior

Tandy Corporation (Branch UK), Bridge Street, Walsall, West Midlands WS1 1LA. Telephone: 0922 648181.

Fig 2 The Pack program

```
 10 REM Program          PACK
 20 REM Author           P.M.Finch
 30 REM Version 1.5      July 1984
 40 REM Program subject to Copyright
 50 REM
 60 REM Object of Program:  TEXT COMPRESSION
 70 REM
 80 REM  CODING RULES
 90 REM 1ST 4 BITS:
100 REM 0..9: SPACE AND 9 COMMON CHARS (aeiorstln)
110 REM 2ND 4 BITS:
120 REM 10..15: 6 SUB TABLES (6*16=96 CHAR CODES)
130 REM
140 REM ORDER  0  1  2  3  4  5
150 REM CODE  10 11 12 13 14 15
160 REM HEX    A  B  C  D  E  F
170 REM FROM  32 48 64 80 96 112
180 REM ..     .  .  .  .  .  .
190 REM TO    47 63 79 95 111 127
200 REM
210 REM SUBTABLE IS GIVEN BY (CHAR -32) DIV 16
220 REM CODE IS THIS + 10
230 REM N.B. 32 IS USED FOR NEWLINE AND 127 FOR END OF TEXT
240 :
250 REM    INITIALISATION
260 IC%=0: REM INPUT COUNTER
270 OC%=0: REM OUTPUT COUNTER
280 OB%=0: REM OUTPUT BYTE BUFFER
290 OBE=TRUE: REM TRUE IF OUTPUT BYTE BUFFER IS EMPTY
300 DIM AV%(126-97)
310 FOR I%= 97 TO 122
320   READ C$
330   IF C$<>"" THEN AV%(I%-97)=VAL C$
340   NEXT
350 REM THIS DATA STATEMENT PERMITS FLEXIBLE REDEFINITION
360 REM OF THE SET OF 4 BIT CHARACTERS
370 REM a bcde fghi jkl mn o pqr s t uvwxyz
380 DATA1,,,,2,,,,3,,,8,,9,4,,,5,6,7,,,,,,,0
390 REM OPEN FILES
400 INPUT"NAME OF INPUT TEXT  (DEFAULT IS A.TEXT)",T$
410 IF T$=""THEN T$="A.TEXT"
420 F1=OPENIN(T$)
430 INPUT"NAME OF OUTPUT TEXT (DEFAULT IS P.TEXT)",T$
440 IF T$=""THEN T$="P.TEXT"
450 F2=OPENOUT(T$)
460 :
470 REM  MAIN LOOP
480 REPEAT
490   C%=BGET#F1
500   IF EOF#F1 THEN 590
510   IC%=IC%+1
520   IF C%<33 THEN 570
530   IF C%<97 THEN PROCOUT8:GOTO590
540   A%=AV%(C%-97)
550   IF A%=0 THEN PROCOUT8 ELSE PROCOUT4
560   GOTO590
570   IF C%=32 THEN A%=0:PROCOUT4:GOTO590
580   IF C%=13 THEN C%=32:PROCOUT8 ELSE PRINT"IGNORE INPUT CHAR ",C%
590   UNTIL EOF#F1
600 REM END OF TEXT - FINISH OFF
610 C%=127
620 PROCOUT8
630 CLOSE#0
640 PRINT"INPUT AND OUTPUT COUNTERS"'IC%,OC%
650 PRINT"COMPRESSION IS ";OC%*1000 DIV IC%/10;"%"
660 END
670 :
680 REM  THIS PROCEDURE IS CALLED TO OUTPUT A 4 BIT CHARACTER
690 DEF PROCOUT4
700 IF OBE THEN OB%=A%*16:OBE=FALSE:ENDPROC
710 REM FULL BYTE READY TO BE OUTPUT
720 OB% = OB% + A%
```

```
730 BPUT#F2,OB%
740 OBE=TRUE
750 OC%=OC%+1
760 ENDPROC
770 :
780 REM  THIS PROCEDURE IS CALLED TO OUTPUT A 8 BIT CHARACTER
790 DEF PROCOUT8
800 OC%=OC%+1
810 REM SET C% LEFT AND C% RIGHT
820 CL%= C% DIV 16 + 8
830 CR%= C% AND 15
840 IF OBE THEN BPUT#F2,CL%*16+CR%:ENDPROC
850 REM OUTPUT BUFFER IS HALF FULL
860 OB%=OB% + CL%
870 BPUT#F2,OB%
880 OB%= CR%*16
890 REM FLUSH BUFFER IF EOT
900 IF C%=127 THEN BPUT#F2,OB%
910 ENDPROC
```

Fig 3 The Unpack program

```
 10 REM Program          UNPACK
 20 REM Author           P.M.Finch
 30 REM Version 1.5      July 1984
 40 REM Program Subject to Copyright
 50 REM
 60 REM Object of Program: Expansion of compressed text
 70 REM
100 A%=TRUE
110 I=OPENIN("P.TEXT")
120 O=OPENOUT("E.TEXT")
130 T%=FALSE
140 REPEAT
150   I%=FNB
160   IF I%<=9 THEN BPUT#O,ASC MID$(" aeiorstln",I%+1,1):GOTO210
170   O%=(I%-8)*16+FNB
180   IF O%>126 E%=TRUE:GOTO210
190   IFO%=32 O%=13
200   BPUT#O,O%
210   UNTIL E%
220 CLOSE#O
230 END
240 DEF FNB
250 A%=NOT A%
260 IF A% THEN =R% ELSE C%=BGET#I:R%=C% AND 15:=C% DIV 16
```

and if this value is less than or equal to nine, it directly outputs the relevant character. Otherwise it calls FNB again to get the value in the subtable and calculates the ASCII value to be output (line 170). Line 180 checks for the end-of-text code and line 190 for the end-of-line. Line 200 outputs the ASCII character, and the loop continues until the end of the text is found.

Repeated characters

The algorithm in Fig 1 reduces all these blanks to four bits, except those on the end of a line which are truncated. Further compression can be achieved by introducing a special code to represent multiple consecutive blanks. Some spare codes exist. Those 8-bit codes corresponding to the 4-bit letters are not used: for example, the letter 'a' has the 4-bit representation 1, hence its ASCII value 97, in the subtable with the range of values 96 to 111, is spare. This could be used to represent a 'repeated blank' code, and the following four bits would be a count of how many blanks had been compressed; thus 12 bits (four for subtable + four for position in subtable + four for blank count) could replace 16 blanks, or even more depending on the compression rule used. The Pack program would now have to count the blanks and if there were more than three, then this repeated blank character would be used. Similarly, any repeated character can be copied but an extra byte would be needed to state which character was being repeated, so the effective gain is lower.

The disadvantage of this sophistication is that the Pack and Unpack programs become longer, which may cancel out the benefit of having better text compression.

Simplified alphabets

One way to get an improvement in text compression without complicated coding is to cut down the character set used. For a particular application, for example an adventure game, it may be sufficient to use a 76-character set, made up of 26 upper- and 26 lower-case letters, 10 digits, blank, EOT, and 12 special characters. Then only four subtables, giving $4 \times 16 = 64$ characters are needed, with blank and 11 characters being shortened to four bits. The gain here is fairly small. With my texts, I would expect my compression to improve from 66 per cent to 63.5 per cent.

The Sphinx adventure from Acornsoft begins with the following text:

'You are on the top of a mountain. In the distance a small building can be seen. All around you is dense forest. A road leads north. There are exits to the north, south, east and west.'

The Pack program reduces this text from 183 to 117 bytes. Admittedly this is a simple text without many special characters or capital letters, but it is typical adventure game text and does give a compression of better than 64 per cent. The RAM version of the Unpack program expands and prints this to the screen in 1.6 seconds. END


QUALITY NEVER LOOKED SO GOOD–
Now everyone with a BBC or IBM PC will want to get their paws on CUB's sleek new D series plastic cabinet – a triumph of ergonomics and up to the minute design. Within it is the CUB 653 MEDIUM RESOLUTION colour monitor – the perfect mate for computer users who wish to combine the advantages of brilliant, low cost colour graphics with 80 column processing software.
CUB 653's remarkable depth of colour is enhanced by minimal screen glare, thanks to a super high contrast CRT. Even in well lit environments the 653 (H) × 585 (V) resolution and 0.43mm dot pitch produces 80 column text which is pin-sharp and easy to read. Owners of SHARP, RML 480Z, APPLE Series, WANG and other leading computers needn't feel left out, because CUB 653's compatibility extends to these models and many more.
PICK ONE UP FOR JUST £299 inc. VAT
NEW LOW PRICE, NEW PLASTIC CABINET – THERE'S NEVER BEEN A BETTER TIME TO BUY.
Standard Resolution version also available in new cabinet. Both Standard and Medium resolution models produced in metal cabinets if required.
MICROVITEC 653
CUB
COLOUR DISPLAYS
Microvitec PLC, Futures Way, Bolling Road, Bradford, BD4 7TU, West Yorkshire
Tel: (0274) 390011 Telex: 517717
Available from High Street Computer Retailers and selected branches of W. H. Smith, Harrods, John Lewis Partnership, John Menzies with selected models available from larger branches of Boots.
1984

Micro surgery

When your business micro stops working, do some simple checks before you call the maintenance engineer — it may save you time and money. Jim McCartney shows you how.

To err is human, they say, but to foul things up completely, you need a computer. This is true inasmuch as it is practically always a waste of time to check the computer's arithmetic, but if you do have a breakdown, the system can lose or scramble a large amount of data in a very short time. This is why you should take copies every day, without fail, and keep backup copies of everything. If you don't, it proves that you are so new to the game that you haven't been clobbered yet.

Faults and remedies

Micros are complicated machines and break down in complicated ways. It is not, therefore, possible to give a comprehensive list of faults and remedies, but here is a list of common faults and some remedies which may help you to get out of trouble on your own without waiting for the engineer, or to avoid calling out the engineer on a wild goose chase.

Tests on disk systems also produce a useful printout for the engineer to look at, as faults have a nasty habit of vanishing when the engineer comes. The printouts will show that something really is wrong, and give him an idea of what it is.

Total hardware failure: this is most common in the early weeks, and is not unusual when the machine is just out of the packing case. New users are often convinced they are doing something wrong. If the system won't do anything in the book, call the engineer. This is why you should always insist on an engineer delivering the system, setting it up, and testing it thoroughly before departure.

Static faults: not very common, but if you find that when you walk across the office and touch a radiator, you get a mild shock, then static could cause problems on micros. Symptoms: sudden jump in display, system crash or possibly auto-reboot, and always when someone is close to the machine and touches it. If crashed, re-boot — there is rarely any permanent damage.

Cure: antistatic mats around and on the desk. If it continues to give trouble, operators should avoid wearing clothes made from synthetic fabrics.

Power supply glytch: the sensitivity to this fault varies greatly between machines, but the majority will tolerate anything up to a positive supply interruption. Symptoms: as for static, but in the middle of normal operations. Often associated with a quick flicker in fluorescent lights. If someone is working a thermostatted electric heater on the same socket, try at least plugging the thing in somewhere else. If you suspect this fault, ask your dealer about other users' experience on your type of machine. If you are having awful bother with a new installation on an industrial site, try getting a good stabiliser on sale or return from your dealer for a week: it will help to establish if this problem really does exist.

The unconnected printer fault: I have frequently been called to inspect 'faulty' machines only to find that the printer has not been turned on, or (more probably) is not online when the machine reaches a printout. This usually results in a hang-up until someone twigs. Good software will warn you to turn on the printer. For your own applications, the following program procedure is useful:

Print message: "TURN THE PRINTER ON, STUPID!"
Line feed to printer (LPRINT)
Clear message
Start printout . . .

If the printer is already on, the message will be an unreadable flash and no action is needed.

A similar hang-up may occur if the interface or cable is damaged. The fault is then identified by everything else being OK for printing.

If you have several micros, some of which run on serial printers and some on parallel printers, you can also cause this hang-up by using the wrong boot program.

VDU failure: VDUs rarely fail electronically without acting up a good deal beforehand. If your display suddenly blanks out, or fails to come up, the most likely problem is a bad connection. A faulty or disconnected VDU will allow the program to proceed normally, so if the machine boots satisfactorily otherwise and can give a printout, suspect the VDU.

Example: under MS-DOS or PC-DOS, boot a DOS disk, then type ALT-P or CTRL-P to direct output to the

Illustration by Roy Ingram

printer, and type DIR <return>. A printout of the directory suggests that the rest of the system is OK.

If your VDU is independent from the machine, try another bit of coaxial cable if you have one. If you have another machine, swop VDUs.

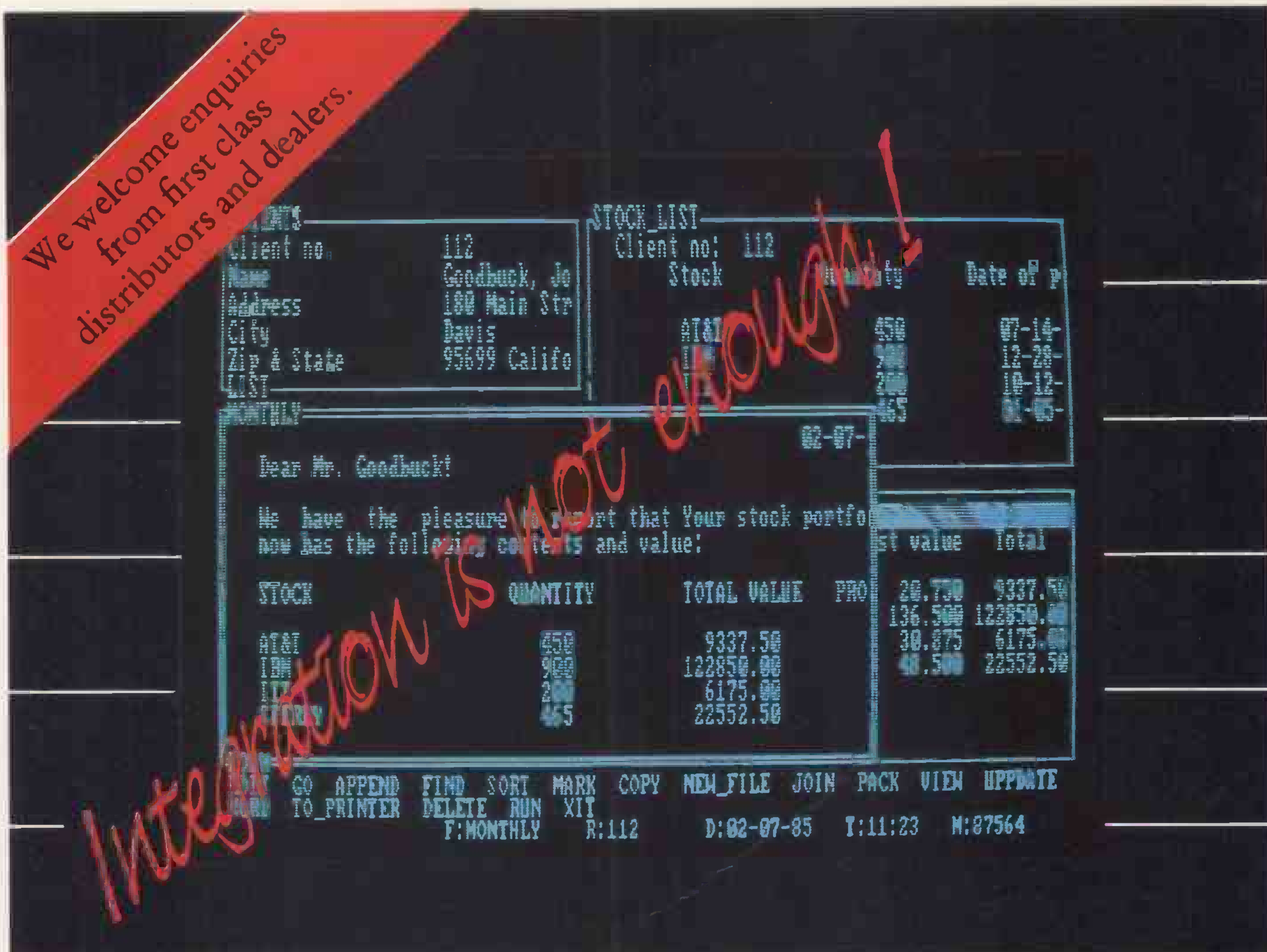
RAM failure: most common in early weeks, also frequently occurs after plugging in additional memory. Symptoms: some programs will run, some won't, or will crash in the middle. If you are working with spreadsheet-type applications, a RAM failure has a nasty way of corrupting your data while continuing, apparently, to function normally.

If the RAM fault is in the program/OS area, the chances are that you won't notice it on many programs; it depends what part of the program or DOS is being used. If the application does encounter this type of fault, it will almost certainly cause a complete crash or hang-up. Your display may or may not change, but the machine will not answer to the keyboard.

If the RAM fault is in the data area, it can be hard to pinpoint because it will give rise to inexplicable errors. If you have two machines of the same type, and your software runs on one but not the other, or only occasionally, then there is probably a fault of this type present. Typical symptoms other than a crash are wild and erratic error messages on an application which has hitherto behaved impeccably, but this can also be caused by a corrupted file on a floppy disk. To distinguish between the two, scan or dump the files in use when the fault occurs.

A typical RAM fault in a spreadsheet will cause a hang-up when the cursor, the printout or the recalculate attempts to traverse a faulty cell, but it may simply miscalculate it and proceed onwards. You can use a spreadsheet program to check out the large areas of RAM which a spreadsheet can occupy. A simple method is to set the cells so that each adds 1 to the previous cell until available memory is filled, then recalculate the model as many times as the keyboard buffer will allow.

Example: on VisiCalc, set A1 = 1+A1, A2=1+A1, and replicate A2 down to A254, relative. Then B1 = 1+A254, B2=1+B1, and replicate to B254. Then replicate B1 to B254 from C1, D1, and so on, until memory is full. Adjust the last column to leave a minimum working space. Set up a window so that the start



Too many integrated software packages force you to trade power for integration. Especially in their data base environment. The Digilog C5 reflects our idea that powerful collecting, manipulating and maintaining of data is a very essential part of any integrated software package.

Digilog C5 is a window based integrated software environment that easily exchanges data between its parts without sacrificing the power and flexibility you get from the best separate programs on the market.

Unlike some of our well-known competitors you do not have to buy a separate data base if you need to handle more than a small amount of information.

- A relational database with dynamic, unlimited length records. Unlimited number of records, key fields, search and sort conditions and relations.
- A structured programming language to build your own automatic applications like general ledger, accounts, etc.
- A 3 dimensional "stacked" spreadsheet environment. Unlimited number of rows and columns. Empty positions do not occupy memory space. Easy access to all database information.
- A word processing and report writing environment with full access to all spreadsheet and database information.
- A graphics function that puts your spreadsheet and database information into easy to understand pictures.

Extensive use of "prompting" and context sensitive help screens.

Digilog C5 is very sensibly priced below £400.00 retail excl. VAT and runs on IBM PC, XT and compatibles with minimum 256K and 1 disk drive.

Distributors and OEM's: Please contact Mr Lennart Ahden at tel. +46 (8) 34 34 49 or telex 21869 for information on our distributor and OEM terms.

Dealers: Please contact Mr Poul Heye at tel. +46 (8) 34 34 49 about our dealer introductory offer.

Digilog C5

DIGILOG

Box 5110, 402 23 GOTHENBURGH, Sweden
Tel. 08-34 34 49, 031-20 29 00.
Telex. 21869 AHDEN S.

and end are both in view, and then press the recalculate key (!) and REPEAT until the machine beeps. On Apple VisiCalc this will recalculate 32 times without stopping.

Any RAM faults in the data area will cause aberrations in the finally calculated sum. A single recalculation will not always show up an intermittent fault.

A RAM fault is often no more than a single bit on a chip which is 0 when it should be 1, or *vice versa*. It most often occurs during the first 20 hours of use of new RAM; old machines rarely develop RAM faults if they are in a reasonably clean condition. RAM or other chip faults can occur because of overheating — many business micros now have a fan to keep the insides cool. RAM faults in the early stages can be transient and are notoriously liable to disappear when the engineer comes. You may find heat-sensitive faults which only show after a system has been running for 15 minutes or longer.

Basic afficionados can test RAM by writing a short program to POKE &HFF into all locations from LOMEM to HIMEM (leaving just enough space for the program and variables), and then reading them back to make sure they are still the same. Repeat using &HO, and repeat the lot half-a-dozen times. However, unless you have this type of thing worked out beforehand, the engineer will be with you by the time it's running correctly. This system is useful for home users.

Floppy drive failure: it can be very tricky to distinguish between disk failures and drive failures, so I'll deal with the two together. Firstly, on a busy system, you should clean the heads once a week without fail. Secondly, use a good-quality floppy disk. Thirdly, if the disk system appears to fail in any way, clean the heads and try again.

A physical disk failure (media failure) is usually sudden and permanent, and often occurs when end-of-day copies are being run, with a failure to copy. DOS error messages vary so greatly in style and quality, and depending whether they are encountered in a program or out of it, that it isn't possible to offer any comprehensive guide. One thing which they have in common is incomprehensibility to the average non-technical computer operator; another common feature is a generality so broad as to be almost meaningless.

MS-DOS and its relatives, working from DOS rather than through a language will, however, give you drive, track, sector and error data, which are extremely valuable.

If you get a disk copy failure, try the following procedures — in order of increasing desperation! — to recover the data and diagnose the fault.

Before you start, set the system to print out the DOS operations on listing paper — then you and the engineer will know what happened.

```
100 'FILE INSPECTION UTILITY "DATADUMP"
110 ON ERROR GOTO 370
120 PRINT CHR$(27)"E": L=0: BL$="          "       'ESC code clear screen
130 PRINT "FILE CONTENTS PRINTING UTILITY 'DATADUMP'": PRINT
140 FILES: PRINT
150 INPUT "FILE NAME (ALT-C to terminate):  ",FI$
160 INPUT"Line length : ",LIN%
170 INPUT"Start at line : ",START%
180 INPUT"Finish at line: ",FIN%
190 INPUT"Do you want text, hex, or both? (t/h/b):",Q$:
       IF Q$<>"t" AND Q$<>"h" AND Q$<>"b" THEN 190
200 PRINT:PRINT"PRESS ANY KEY TO STOP...."
210 OPEN "R",£1,FI$,LIN%: FIELD £1, LIN% AS B$
220 LPRINT CHR$(15)      'condensed print for EPSON
230 LPRINT "DATADUMP.BAS utility on file:     "FI$
240 LPRINT "Line (record) length = ";LIN%;"  Starting byte = ";
    (START%-1)*LIN%+1
250 LPRINT
260 FOR J% = START% TO FIN%:
       A$=INKEY$:
       IF A$<>"" THEN 350
270    GET£1,J%:
    IF Q$="t" THEN 300
280    LPRINT LEFT$(STR$(J%)+BL$,7);:
       FOR K%=1 TO LIN%:
       B%=ASC(MID$(B$,K%)):
       HX$=RIGHT$(("0"+HEX$(B%)),2)+" ":
       LPRINT HX$;:
       NEXT: LPRINT
290 IF Q$="h" THEN 320
300    LPRINT LEFT$(STR$(J%)+BL$,7);:
       FOR K%=1 TO LIN%:
       B%=ASC(MID$(B$,K%)):
       IF B%<33 OR B%>126 THEN B%=46
310    LPRINT CHR$(B%)"  ";:
       NEXT: LPRINT
320 IF (J%-START%+1) MOD 24 = 0 AND Q$="b" THEN LPRINT CHR$(12): GOTO 340
330 IF (J%-START%+1) MOD 48 = 0  THEN LPRINT CHR$(12)
340 NEXT J%
350 LPRINT: LPRINT
360 RUN
370 IF ERR=62 THEN B$=CHR$(255): RESUME NEXT
380 PRINT"ERROR: ";ERR;" LINE: ";ERL
390 END
```

Fig 1 File inspection utility

1 Retry the copy.
2 Clean the heads and try again.
3 Try a new or re-formatted copy disk—the error messages will indicate if the copy rather than the original is at fault.
4 Copy in opposite direction, for example from B: to A: instead of A: to B:. If this works, you may have a faulty drive.
5 Try copying on another machine if you have one.
6 If you haven't had a good copy so far, the original disk may be bad.

Prepare a new copy disk, and copy individual files from the suspect disk using, for example, COPY *.* B: under MS-DOS. The odds are that most of the files will copy but one or more will fail. If you get a couple of failures, copy any files further down the directory one at a time and isolate the failures. There's a fair chance that the bad files were not in use since the last copy you made; if so, you can get them from there. During this procedure, a failure to format or initialise the new copy disk, or a failure to copy any files at all, suggests a drive failure.

7 If current data files won't copy, but there is no evidence of a drive failure, you have lost the work since the last copy. Produce a new set of master disks from the last copies and start again.

Floppy drive failure should be suspected on new systems or on systems which have been in use for some time, especially those which consistently access the data disks. This simply causes wear and tear on the mechanical systems, and sooner or later they start to behave oddly, usually on an intermittent basis. Look out for the following symptoms during daily running on well-established software:

1 Error messages related to DOS.
2 Error messages indicating that a wrong data type has been read from a file.
3 Garbage in the files — sometimes identifiable in printouts or displays as parts of other files; also numbers in scientific notation with huge indices, for example 7.73845584621E-34 (assuming that you don't normally deal with such numbers).
4 Error messages indicating that a record or file cannot be found or does not exist, or that the record number is invalid. This is usually a result of reading false links or pointers.

The cause of these faults may be the disk drive reading from a wrong track, or from a file which has had a wrong sector overwritten on it. If you suspect this, print out a dump of any of the files which might be affected; a length of file which is totally foreign proves the presence of a drive fault, and you need test no further. The printout will also serve to convince the engineer that you really do have a problem.

The program in Fig 1 will read files and print the contents in hex, ASCII characters, or both. It was written in MS-Basic on a Sirius with an Epson printer, but should work with very minor modifications on any hardware using any recent version of Microsoft Basic, on any MS-DOS, PC-DOS or CP/M type of file. It works by pretending that the file, regardless of contents, is a random access file with a record length equal to line length. It will read past the end of sequential and text files, in which the end is otherwise indicated by hex 1A. If it reads a BSAVEd file, for example from an array, the first few bytes may be non-data.

A disk containing corrupt data in this way is to be distinguished from a disk which is physically damaged or worn out. If the corrupt data is caused by the drive, the disk can of course be re-used and it will copy perfectly. The substantial danger is that if it's not dealt with, the corrupt data will be copied to all your current copy disks as well in the course of a few days. Anything that can go wrong sooner or later will, so it's a good idea to archive your master disks monthly in an ongoing system.

Twin floppy failure: the following procedure applies to MS-DOS, and so on; those familiar with the CP/M family can easily translate to a SUBMIT file.

To thoroughly test disks and twin floppy drives, prepare a special system disk with DCOPY on it and otherwise containing as much old data as you can collect, so as to leave it nearly full. If you don't have enough files to fill a disk, copy the same file under several different names. Leave enough space to write the file TEST.BAT under EDLIN:

```
1 DCOPY A: TO B:/E
2 DCOPY B: TO A:/E
3 TEST.BAT
4 ^Z
```

Running this batch will copy from A: to B:, back again and repeat until someone intervenes. You should keep a master copy and a spare of the disk, as a failure will probably leave you with a half-copied working disk. To use the disk, boot it in A: and direct the output to the printer, so that you have a record of what happened. The maintenance engineer will appreciate this.

To test the drives, put a good blank or spare used disk in B: and execute TEST.BAT from A:. To test a suspect disk, first copy any files you need from it, then use this in B:. Half-a-dozen good copies in each direction can be taken as evidence that there is no problem. A bad disk will give errors on one or perhaps two adjacent tracks all the time. A bad drive will generally distribute errors more or less at random over tracks and sectors, but they will be on one drive or the other and you may find them all on one side on double-sided systems.

Neither the disk nor the drive fault will necessarily occur all the time, but a disk fault is the more likely to be consistent. A drive fault may occur only once out of three or four times, or even disappear completely under test.

The erratic nature of this type of fault always makes it seem to vanish when the engineer comes — this is why you need to do several copies in each direction, and to obtain some printout as evidence.

If you get apparent evidence of a bad disk, repeat the same test with a good disk in case the drive is causing a track-related fault — this is unusual but sometimes happens.

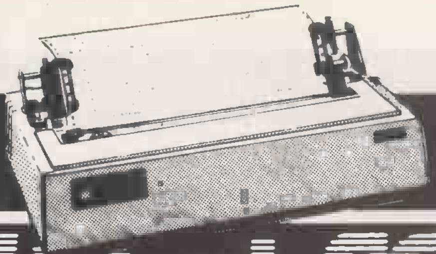
If you do find a bad disk, inspect the disk surface to see if you can spot the cause. Look out for a damaged track which could be caused by a faulty head or by trapped grit. You may see crumple marks caused by the user pushing in the disk carelessly and bending it, or other evidence of mishandling, or you may see nothing at all.

If you find evidence of a faulty drive, don't use the machine again until the engineer has attended to it.

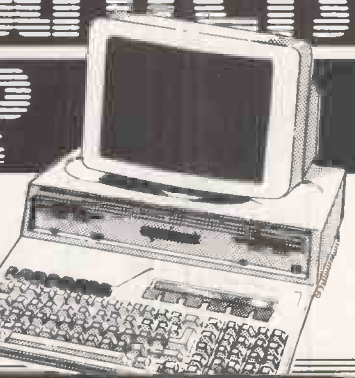
Hard disks: one of the main characteristics of hard (Winchester-type) disks is their reliability as compared with floppies. A drive which is in any way unserviceable will, in most cases, fail to come up at all. If it does come up, and you find corrupted files or lost data, make sure that the problem is not in any way caused by associated floppies (for example, copying bad files from floppies). Copy any suspect files from the hard disk to a good floppy; a copy failure caused by the hard disk will be reported by the DOS. Likewise, you can use the file dump program in Fig 1 for closer inspection. If you continue to have problems, there is unfortunately nothing you can do except call the engineer.

Restoring or erasing corrupted data: 99 times out of 100 this is a lost cause. It's easiest to go back to the last good copy and re-do the day's work when the system is fixed. To do anything about a lost block requires an intimate knowledge of the DOS and a set of very good DOS utilities, and is really only useful where you can do without the lost block, for example in text files from word processors.

If you have a random access file in which only a short length is corrupted, as revealed by DATADUMP, it is quite easy to write a short basic routine to replace the bad records with blank records, but unless you know the full details of the file structure (that is, as related to other files) this can land you in as much trouble as before. The golden rule here is, unless you know exactly what you are doing, and all its implications, and can do it faster than it would take to re-work it from existing copies, then forget it. The other golden rule is—always make copies. END



Which PRINTER FOR What COMPUTER?



Micro General the Specialists for Printer Selection

Contact us for our expert advice on all your interfacing problems

It's not just a question of plug in and let's go. There are now over 200 different connector situations. How do you know that your computer will accept the printer of your choice? We at Micro General do not sell boxes off the shelf. As computer engineers we help you to choose and install the right printer for your computer. The advice is free and it could save you some embarrassing mistakes – Buy from us for peace of mind.

APRICOT F1

a full blown business micro

For the first time business user a genuine business machine with some amazing 'high tech' features. – See the Apricot's mouse execute previously complex tasks at a single key stroke, and the new infra-red device means there's no cable connection to the keyboard, giving desk top planning a new meaning.

- 256K RAM 720 single disk.
- MS-DOS
- Rapid Display manipulation and special effects.
- Expansion and Outport facilities.
- Colour/Mono Monitor or VHF for your T.V.
- Extremely light (under 13lbs) – totally portable.
- Price includes SuperWriter, SuperCalc, & SuperPlanner software.
- Well over 1000 software packages now available.

LEASE F1
from £6 per week
CALL FOR DETAILS
DEMO NOW

Now in our 5th year of business!

IBM 34/36/38 USERS

Call for details on the DATASOUTH TX-5180
High performance equivalent to the IBM 5224

from £2695 + VAT.

SHINWA CPA80 MATRIX PRINTER

£199 + VAT

Fantastic value – look at these features

- Friction and Tractor feed as standard
- 100 cps Bi-Directional Logic Seeking
- True Descenders + Sub and Superscript
- Italic Printing/Auto Underlining
- High Res. and Block Graphics

JUKI PRINTERS/ PRINTER TYPEWRITERS

MODELS FROM £325 + VAT

- 2K BUFFER
- 20 cps max
- High reliability
- Diablo protocols

TRY BEFORE YOU BUY!

Bring your micro to us and match with our range of printers – full workshop facilities available to iron out all technical hitches! CALL US FOR PRINT SAMPLES.

TRADE or PRIVATE CUSTOMERS take advantage of our

INTERFACING CONSULTANCY

INTERFACES & CABLES AVAILABLE FOR:

VIC 20	NEW BRAIN	COMMODORE 64	OSBORNE
PET	ORIC	TANDY	SIRIUS
SPECTRUM	DRAGON	SHARP	SAGE
SINCLAIR QL and more!			

INTERNAL & STAND ALONE BUFFERS from £65 + VAT

PRINTER SWITCHES from £85 plus VAT.

MICROLINE LOW COST PRINTERS

PRICES REDUCED

In our opinion this range of printers represents the best value. From our service records we can tell that it has proved to be an extremely reliable printer. If you are looking for fast thru-put (Accounts or Data printing) check it out NOW!

- Up to 25% faster thru-put than nearest rival
- Near letter quality (92/93/84)
- Ideal printer for business systems – Statements, invoices etc.
- Multiparts – up to 6 copies.

Microline 82A	120 cps	POA
Microline 83A	120 cps	£450 + VAT
Microline 84	200 cps	£750 + VAT
Sheet feeder for M84 £299	IBM version available	
Microline 92	160 cps	£299 + VAT
Microline 93	160 cps	£550 + VAT

The ideal alternative to EPSON FX100 – Faster thru-put and near letter quality. Recommended for IBM, SIRIUS, APRICOT

EPSON MATRIX PRINTERS

EPSON RX80T	100 cps	£210 + VAT
EPSON RX80F/T	100 cps	£230 + VAT
EPSON FX80	160 cps	£340 + VAT
EPSON RX100	100 cps	£390 + VAT
EPSON FX100	160 cps	£499 + VAT
EPSON LQ1500	200 cps	£995 + VAT

PRICES REDUCED

HIGH SPEED HIGH QUALITY LOW PRICE!!

DUAL MODE

ONLY £299 + VAT

CANON PW-1080A

- 160 cps and quiet too!
- High Resolution graphics
- Down loading to user-optional characters.
- Near letter quality – italic, gothic and orator fonts optional.
- Epson code compatibility.

MICRO GENERAL

DEALER/OEM ENQUIRIES WELCOME
■ Always call for the best possible price.

Access/Visa

(PCW 5)
Unit 25, Horseshoe Park, Pangbourne, Reading, RG8 7JW Tel: 07357 4466

Acorn Music 500

The Acorn Music 500 synthesiser comes with its own language and stunning sound facilities. But at the relatively low price of £200, is it all it could be? Noel Williams takes a look

For several years now the worlds of music and micros have been growing closer together. Since the first mainframes there have been dedicated musicians churning out weird and wonderful computer compositions, but it's only recently that electronic barrel organs have turned into toys that anyone with a small overdraft can afford. You could now own a recording studio equivalent to that used on the first Beatles records for about £1000, and digital technology has brought the price of keyboard synthesisers down to less than £400.

But Acorn has gone one stage further and put synthesiser and mini-studio into one box, added a new language called Ample, and set you on the road to stardom for less than £200.

Hardware

The Music 500 looks like a disk drive whose slot the manufacturers carelessly forgot to include. This is not surprising as the housing for the synthesiser is a standard Acorn half-height cream disk drive box with the addition of a mains cable, ribbon cable for the 1MHz port on your BBC, and a five-pin DIN socket for a lead to your hi-fi. No lead is supplied for this socket. An on/off switch completes the setup, but there is no LED to tell you that the thing is both switched on and working. This is more of an oversight than it might appear as your music can fail to reach the hi-fi for any one of a number of software reasons, so it would be comforting to know that at least the hardware was functioning properly.

The ribbon cable is barely two feet long, so if your stereo does not sit next to your Beeb you will begin your musical career with a bout of cursing as you manufacture a hi-fi cable of extraordinary length — it's about time Acorn considered the ergonomics of all its wonderful attachments. If you have a second processor, disk drive, monitor, joysticks, printer, Beeb *and* a synthesiser and stereo system to cater for, your living room soon begins to resemble the lair of a hi-tech junkie.

But the outside of the box is not meant to impress; it's the inside which will have everyone using their Casios as bookends. Put simply, the sound facilities of the 500 are stunning. The sound quality approaches that of the £1000 keyboard synthesisers. It has a range of at least five octaves, more for certain types of sound, and offers a degree of control better than that available on hardware three times the price. What it does not have is a real-time musical interface (piano keyboard, that is) or any facility for linking with other musical instruments. You can't drive the sound of the 500 from other studio equipment, nor can you play it as a real-time instrument unless you write a program to use the Beeb's qwerty keyboard as a real-time instrument. It also seems likely that the analog port can be read by programs written in Ample, so solder freaks should be able to build their own keyboards. There are rumours of a keyboard to come in a few months, and Hybrid Technology, the company which developed the 500, reputedly has a device of its own for synchronising the 500 to external sources, but at the time of writing there is no sign of it coming onto the market.

> *'Put simply, the sound facilities of the 500 are stunning. The sound quality approaches that of the £1000 keyboard synthesisers. It has a range of at least five octaves . . .'*

Ample

The Music 500 is basically a single instrument which can only be controlled by programs written in the music control language, Ample. For dedicated musicians who have little interest in programming or technology, this is undoubtedly bad news. No worthwhile sounds can come out of the system without a program; the songwriter must therefore learn a new idiom.

Programmers will find the system much more rewarding because Ample is quite a sophisticated language. It is based on Forth and so has all the unfriendliness of that language together with the extremely powerful virtures of compilation rather than interpretation, plus the Forth concept of the 'word'.

For those unfamiliar with Forth, an Ample program consists of a series of words. Words can be defined as combinations of other words, which include standard control structures such as IF/ELSE, FOR, and REPEAT/UNTIL, as well as provision for reading from and writing to memory addresses. The definition can be carried out in immediate mode, in which case the word is added at once to the dictionary of available words, or it can be defined in a listing (which looks like a standard Basic listing except for full stops after the line numbers), in which case it is only added to the dictionary when that program is run. Words can be edited at any time, they can be used in immediate mode simply by typing the word and, most importantly, one user-defined word can include in its definition other such words.

For example, the word 'concerto' could be defined as [piano righthand 800 TEMPO]. Here, 'piano' is a user-defined word describing an instrument, 'righthand' is a user-defined word describing a tune, and TEMPO is a predefined Ample word describing the speed at which the tune is to be played. 'Righthand' may itself use other user-defined words as part of its definition, such as [up1 down1 down1 up1]. 'Up1' and 'down1' will be musical phrases which are used in the whole passage. 'Up1 might be [0:CDEFGABC], which is

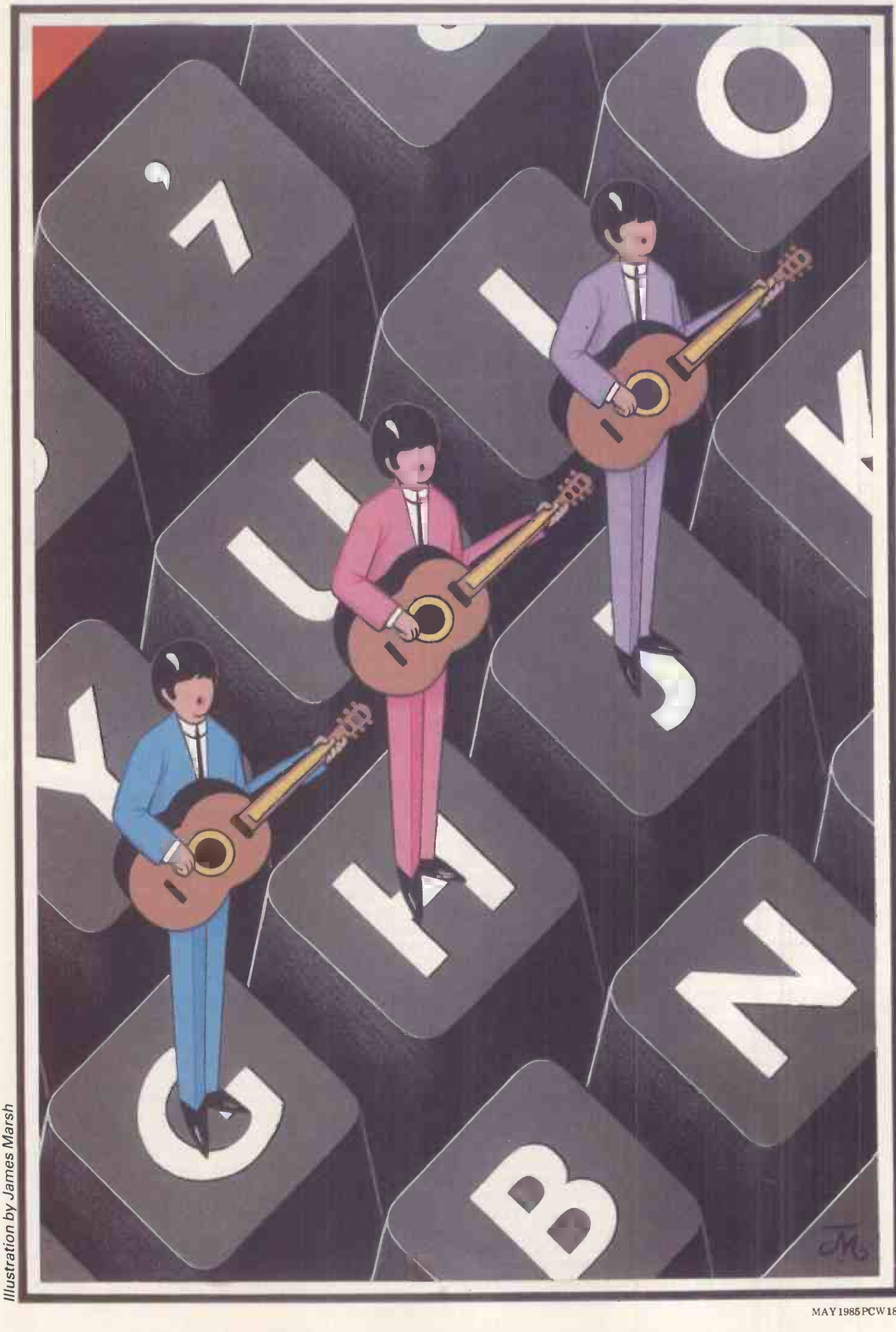


Illustration by James Marsh

Ample notation for a scale of a rising octave from middle C.

Three aspects of sound are controllable using Ample; the easiest to understand is the writing of tunes. A tune is a series of notes and rests, usually held as a single word. Notes are represented by their conventional alphabetic name (A to G) with – indicating flat and + indicating sharp. An upper-case letter means 'play the note above the previous note', while lower-case indicates 'play the note below the previous note.' Rests are indicated by ^. The octave of a given note can be set by the ':' word, so '–2:' is 'two octaves below middle C'.

Duration of notes and rests can be set by the ',' word, so '48,' is a crochet in the default system. The actual length of a crochet changes with the tempo of the piece though its relative length remains the same.

All this is quite unremarkable, apart from the ability to create one- and two-third hemi-demi-semiquavers and Ample's unique use of upper and lower case. It becomes exciting when you realise that no less than eight tunes can be played at the same time: in the simplest setup, if no tune uses complex instruments or plays chords, this means you have an eight-piece band at your fingertips. Chords reduce the number of melodic lines.

Imagine a situation where eight players each have one instrument, each instrument can only be played in one way (that is, with one 'voice'), and each voice has two contributing sounds. Each of those sounds will be on its own channel, giving a total of 16 channels. This is the situation with the Music 500. The maximum number of players is eight, the maximum number of voices is eight, and the maximum number of channels is 16. If one player wants a chord of two notes then this is appropriating an extra voice, which means the maximum number of players is now only seven. A three-note chord removes another voice and player, and so on. It is, however, possible to assign channels to voices, voices to instruments, and instruments to players dynamically during a piece if no more than eight voices are called at any given moment, so you can give the impression of a symphony orchestra playing eight instruments at a time.

Synthesising

The second major facility the Music 500 offers is the means of synthesising the sounds the tunes will use: that is, creating the instruments themselves. As with chords, complex instruments require several voices of several channels, so limiting the number of players possible. A sound consists of a waveform (which controls the basic sound the oscillator produces) overlaid with envelopes for pitch and/or amplitude

~CHECKOUT~

(volume) which control how the stable waveform alters with time. No sounds are built into the system so all instruments must be synthesised. However, a set of 13 waveforms and 13 envelopes are provided on cassette (together with a tape-to-disk transfer program). These can be put together to create new sounds, or you can create your own using Ample. Waves can be created harmonically or geometrically. Envelopes can be created by using the familiar Attack/Decay/Sustain/Release model or by defining your own equivalent as a pattern of 16 segments. For example, this would allow Attack/ Decay / Attack / Sustain / Decay / Attack/ Sustain patterns, or indeed any envelope shape you care to imagine.

> *'Acorn could have made the synthesiser package much more friendly than it is. The manual contains errors and is little help to those with scant knowledge of programming, music or sound synthesis.'*

Waveform synthesis is a complex business, especially if you want to reproduce the sound of a real instrument. Experimentation produces interesting results, but these are seldom exactly what you require. This is one area in which the comprehensive manual falls down: it provides almost no guidance on how to obtain particular types of sound, and what it does provide is scattered throughout the book. There must be very few people who are competent enough at programming to be able to handle the language and knowledgeable enough about sound synthesis to be able to create the sounds they want with the guidance given here.

However, quite passable results can be achieved using just the preset waveforms and envelopes. For example, a passable electronic organ can be defined as waveform 10 with amplitude envelope 13 and pitch envelope 6, thus:
"organ" [10 WAVE 13 AENV 6 PENV]

This organ only uses one channel. More elaborate instruments require several channels, each with different sounds. The second channel in any pair can be used to modulate the first channel in several ways. Modulation is an effect whereby the waveform of one sound is combined with the waveform of a second sound to produce more complex results. 'Fat' sounds result from detuning: that is, using two sounds which are identical except that the pitch of one is slightly lower than that of the other. Ring modulation can be used to produce harsh noise, metallic sounds or pure harmonic sounds such as those found in woodwind instruments. Frequency modulation produces very rich sounds, such as strings and gongs. Synchronisation enhances harmonics, and the CYCLE command can be used to create vibrato and tremolo effects. All these possibilities are available on the 500.

This moves us into the final area of sound control, that of effects. As control is not limited to preset musical sounds or to the conventions of musical notation and timing, the programmer/ composer can treat the 500 as an eight-channel digital recorder onto which almost any sounds and effects can be programmed. These can range from tonal 'treatment' of music, such as stereo panning (there are seven programmable stereo positions available), delay, echo and fades, to music which is entirely constructed out of sound descriptions without any musical notation at all, such as ambient music resulting from very slow modification of repeated waveforms.

Conclusion

Acorn could have made the synthesiser package much more friendly than it is. The manual contains errors and is little help to those with scant knowledge of programming, music or sound synthesis. The company has produced a box which has facilities bordering on the professional, but has presented them in a way that professionals will find hard to accept (no keyboard, no interfacing) and for which amateurs will need extreme dedication to penetrate. Almost certainly it will not sell as well as it deserves to until a friendlier interface is available, or at least a book which explains some of the principles of programming with sound and Ample.

Having said that, it's a marvellous system and rewards perseverance. If you're a musician without a Beeb the expense of computer, monitor, synthesiser and disk drive (an almost compulsory option) probably means that a conventional synthesiser plus sequencer is a better bargain. If you need a micro then the Yamaha CX5 music computer comes with a keyboard and preset voices. But if you have a Beeb or you want flexibility, excellent sounds and a new challenge, you could not spend a better £200. END

GET THEM TOGETHER

TOTAL INTEGRATION

Would you like to have your financial forecasts and your word processing produced by one simple and easy to learn computer package?
Word Result and Calc Result can get them together for you.

WORD RESULT does everything you would expect of a word processor – such as letters, memos, updates, mail merge (i.e. combining your mailing list with standard letters) – PLUS it supports eight European languages with built in hyphenation (great for international businessmen, language schools, etc.). Word Result will automatically save information whenever you stop typing – to guard against unexpected power cuts etc.

CALC RESULT is a financial spread sheet which comprises 32 full pages with 64 columns by 254 lines which can be consolidated with ease. Pie and bar charts are displayed on screen and can then be saved and printed. All formulas are locked automatically. Financial forecasts have never been simpler!

TOTAL INTEGRATION Word Result and Calc Result have been created for the IBM and compatibles with true integration – giving you the freedom to use each program either separately or together.

TOGETHER Word Result and Calc Result can help your busy office take the strain.

Why not send the coupon in TODAY and find out what else these programs have to offer?

Why not send this coupon in TODAY and find out what else these programs have to offer?

Please rush me details of
WORD RESULT / CALC RESULT

NAME ______________________

COMPANY ______________________

POSITION ______________________

ADDRESS ______________________

____

____

Send to: **HANDIC SOFTWARE LIMITED**
5, Albert Road, Crowthorne, Berkshire RG11 7LT.
Tel: (0344) 778800

handic
software ltd.

CHECKOUT

Votan VPC 2000

Jerry Sanders looks at the Votan VPC 2000, a voice-recognition processor board for the IBM PC and compatibles that acts as a sophisticated telephone answering machine.

The Votan VPC 2000 turns a common-or-garden microphone into an input device superior to either keyboard or mouse. It's a case of look — no hands as you issue commands to the operating system, to an application, or call up blocks of text into a word processor document.

The Votan VPC 2000 card consists of a main voice processor board with a smaller telephone interface card piggy-backed onto it, and occupies a single full-size slot in an IBM PC or plug-compatible micro.

The cards contain encoding and decoding firmware and about 23k of RAM for holding vocabulary templates — the equivalent of some 75 seconds of speech. Also onboard is a microphone input, the speaker output, and telephone I/O circuitry and ports. A good-quality microphone and a small speaker are included in the price.

The Voice Key software provided on disk includes VKSETUP, which enables the user to define keystroke-equivalent responses to voice commands, input the commands themselves and record voice responses. The main program, VKRUN, is invoked once at the beginning of a session to install the Voice Key programs in about 20k of RAM, and set the interrupt links between the board and the micro — its the same principle as installing a mouse before running, say, MicroSoft Word. Supplementary programs may then be called to load in sets of voice templates, cause the microphone to be polled or temporarily disable polling. An on-off switch on the microphone has the same effect.

The price of Votan includes a Voice Application Development Language (VADL), and Voice Operating Software (VOS) consisting of a compiler, a vocabulary builder and a run-time interpreter for VADL programs. These would be used by applications developers wishing to add Voice Key functions to their own applications and write application-specific training sessions for end-users. I understand that Votan now also comes with Speak-Easy, a first-encounter training session on disk, but it was not supplied for this review.

I'll concentrate here on using VKSETUP for training Votan to drive an off-the-shelf application since it demonstrates the system's main features.

Setting up

The Votan 2000 is available for the IBM PC and compatibles as well as a limited range of other machines (at a higher price); the compatible used in this review was a Compaq Deskpro 4 with a 10Mbyte Winchester disk, courtesy of Compaq (UK). The Votan card went from its box straight into the Deskpro's slot four without modification.

With the Votan card in place you plug in the microphone and the speaker provided with the system, and boot up. The review disk provided contained an autoexec batch file which executed VKRUN, the main recognition program, and loaded a set of templates while the screen obliged by displaying a trace of what was going on.

Training

Votan works as a command interpreter or dictation taker after being trained to 'recognise' the voice of the user. VKSETUP is menu-driven and contains help screens to supplement the Votan manual. All new applications are daunting to the first-time user and Votan was no exception, but eventually the manual responded encouragingly to my gradual familiarity with its contents.

Here are some useful definitions.

A *template* is a bit-image (digital recording) of a voice command held in memory or saved onto disk. A *label* is the command word or phrase associated with a template, and a label may have one or more templates attached to it. The more templates that are attached, the more likely the card is to correctly identify the command phrase.

A *set* consists of up to 64 labels and their templates, identified by a filename. Up to 10 sets can be used at once giving a total of 640 voice-activated PF keys, each consisting of up to 30 keystrokes.

Messages, as opposed to templates, are recordings of your voice associated with particular labels, which play back through the speaker when that command word is issued. Messages don't need to be recognised, and so don't have templates attached to them.

With VKSETUP you can choose to define labels for as many sets as you want, and record single or multiple templates for those labels. VKSETUP also allows you to record messages for some or all labels and, most important, input the keystrokes to be executed when you issue a voice command.

Any key, including the SHIFT, CTL and ALT keys can be programmed, so the package should be able to cope with any off-the-shelf package. I tailored it to WordStar.

Having decided on your labels, the first stage is to type them into the key definition screen. Once your words are in place, the screen becomes a prompt sheet as you speak each word into the microphone. Pressing PF1 causes the speaker to beep, after which you say your word and press PF1 again to train the next word. Pressing SHIFT/PF1 at the beginning of a training session causes the trainer to automatically advance to the next label after each template has been made.

Votan also allows you to train words for continuous recognition; this facility gives the VPC 2000 its ability to recognise command strings made up of groups of labels, or continuous speech. If you plan to issue a command such as 'Change directory to voice and run VKSETUP' it's a good idea to train 'voice' as an embedded word using PF5. In this mode, a number of templates are taken at once and can be assigned to the appropriate label so that Voice Key has a variety of samples to match to.

The total amount of memory for each set is limited to around 23k, which means that multiple templates can't be extracted for every one of 64 words. I found that choosing polysyllables for labels usually made multiple templates unnecessary, but multiple extraction is necessary where labels are monosyllables, such as the numerals.

It's words like AND and TO that make the difference between computer talk and human talk. These and other non-command words can be trained as nulls: that is, they are noted but not acted on. The reason for doing this is that, with a large vocabulary, it's possible that an untrained word could be misinterpreted for one that *is* in the vocabulary and a command could ensue. But if the word is trained as a null, it won't cause any codes to be sent to the CPU.

Votan can use up to 10 different sets, which are held in RAM to be swiftly switched in and out of the card as required and are never overwritten, but to take advantage of the potential 640 command words or phrases your PC will need about 225k of RAM for the templates alone.

The current set is always stored on the card. Up to nine other sets can be assigned to machine RAM by adding parameters to the command used to run Voice Key. These are loaded into RAM, together with their labels and messages if any, when Voice Key is run. A typical autoexec batch file might look something like this:

```
VKRUN/T4/S5
VKLOAD WDSTAR/S0
VKLOAD TEXTBLOX/S1
```

where 64k of RAM is assigned to key definitions and templates (T4), and 96k to messages (S5). The template and key definition (and message if any) files for WordStar commands are then loaded from disk into RAM and onto the VPC 2000 as set 0, while a second group of files containing chunks of text for 'instant dictation', such as a letterhead or standard sentences, is loaded into RAM as set 1.

Switching sets onto the card is achieved by defining a label such as SET1CHANGE as a command in set 0; when the command is issued, set 0 is switched out of the card and set 1 switched in. At this point, if you're not careful, you'll realise you didn't include a command in set 1 to switch set 0 back into the card. The manual, it should be said, warns you of this pitfall, but the warning only works if you happen to have read the manual!

Answering back

The Votan board uses disk space in the way a tape recorder uses magnetic tape to record a human voice. As well as listening to what you say and matching it with a stored template, it can speak back to you in your own voice to request confirmation of an erase command, for example.

It takes a minimum of about 4k to record a second of speech, and the same principle applies here as with magnetic tape recording of sounds. With a tape recorder, the faster the tape travels, the more tape is used for each word, and the accuracy of recording and reproduction is enhanced. VPC 2000 can be set to record at up to 16k per second.

To test the memory I recorded the same 70-word passage (a paragraph from the *Compaq Guide to Operations*) twice, once at 4kbits per second (very low grade) and once at 16. The memory used for the text was 13k and 38k respectively, although at 4kbits per second I sounded like Donald Duck imprisoned in a diving bell surrounded by a shoal of electric eels.

A rate of around 9kbits per second gave acceptable results, and I was told later that the card is in fact optimised at around that speed. But even at that rate, if your friends are given to gossiping on the telephone, you'll need to make full use of the Deskpro's hard disk for storing their calls.

Telephony functions are provided on the board, but at the time of writing they are still awaiting the BT green sticker. When approved for telephone use in the UK, the Votan will enable any PC to which it is fitted to answer the phone, record a message on disk, and/or playback a pre-recorded message down the line. But note that Votan itself does not incorporate a modem on its already well-stacked board: it just gives you a hole to plug one into.

Any telephone answering machine can do that, and without a modem, you say. True. But no answering machine could obey an instruction from a call box to start up a comms package and tramsmit a file to you down the telephone, or receive one, both of which the Votan board can, in theory, do without twitching a chip.

Conclusion

£2500 is a lot to pay for the privilege of swearing at WordStar and having it respond by issuing a smart succession of control Ys. An example application for which it is proving cost-effective is taking phone calls for inventory, checking a database of stock and responding with a yes or no, while at the same time debiting the stock record by the appropriate number of items in the database and issuing a despatch order to another part of the system.

The price of the board also reflects its novelty. Votan is only buying small quantities of components at the moment and doesn't hold vast stocks; the price should come down significantly over the next 12 months. END

Summary

Product:	Votan VPC 2000 board and Voice Key software
Manufacturer:	Votan Inc, Freemont, California
UK supplier:	Voice Input Ltd, 15 St Margaret's Road, Girton, Cambridge CB3 0LT. Tel: (0223) 276097
UK price:	£2500 (IBM PC and plug compatibles); enquire for others

SCREENTEST

Microsoft Basic 2·0

Microsoft leads the race to produce languages for the Macintosh, but following the disappointing Basic 1.0, true Macintosh compatibility was still required. Does Basic 2.0 make the grade? Peter Jackson takes a look.

When the Macintosh was launched in January last year, it had no programming languages. No Basic in ROM, no Pascal on disk, no C on a Winchester — nothing at all for the programmer to get hold of once the novelty of mousing around with MacPaint and MacWrite had palled.

The pundits were astonished. What did Apple think it was doing, cutting off prospective software developers from the machine? Ah, said Apple, all the developers have to do is buy a Lisa with a hard disk drive to hold the Pascal compilers and libraries, and nothing could be simpler. We will even sell you a set of appallingly obscure technical manuals for $100, Apple enthusiastically continued, so you can figure out how the Mac does what it does.

The pundits had to be led away to dark rooms with wet towels on their foreheads. And Microsoft launched MBasic for the Mac in something of a rush.

The trouble was that the rush was apparent in Microsoft Basic Interpreter Version 1.000 for the Macintosh (Basic 1.0) and it was hailed with less than complete enthusiasm. It was impossible to produce a Basic application that *looked* like a Macintosh application, for instance, since the interpreter had no commands to create pull-down menus or set up multiple output windows. The Mac's four-voice sound chip was ignored, and only a Spectrum-like beep could be used. And 'radical ease of use' was not there even for the Basic programmer. Entering a line of code in Basic 1.0 involved typing it in the Command window and then transferring it to the List window by hitting RETURN. Editing a line involved reversing the process, moving the line from the List window to the Command window and changing it there. There was certainly no full-screen editor.

In fact, if it wasn't for the screen windows — up to three list windows to show different parts of a program, and one output window to add to the small Command window — this was just any other Basic. Any programmer familiar with Microsoft Basic could write working Mac programs with Basic 1.0, but it was a frustrating experience.

Microsoft badly explained the famous Quickdraw routines in the Macintosh ROM and how they could be used with a Basic Call statement, which did nothing to give programmers a push in the direction of experiment.

However, getting a product on the market fast was important, and gave Microsoft the chance to drop heavy hints about Microsoft Basic Interpreter Version 2.000 for the Mac (Basic 2.0). Now Basic 2.0 is out and the effect is shattering.

Until MacBasic and MacPascal arrive from Apple — and it's taken well over a year for them to get to 'real soon now' status — the new MBasic must be the most painless way to write Mac applications with anything like the subtlety of Write and Paint.

The difference starts at boot-up. Like most other Mac applications from the US, Basic 2.0 comes with a US version of the operating system. With the Mac the keyboard codes, date and time formats, and currency symbols are set in software, and the most obvious symptom of a US operating system on a UK keyboard is that the bottom line of keys doesn't work properly.

Localizer

Unlike other software suppliers, Microsoft gets round this by including a utility called Localizer on the program disk. Localizer installs the appropriate routines in the operating system files, and this only has to be done once for the program disk and any backup copies to boot with the right codes in place. Localizer can be used on any package, and can be moved to a utilities disk for future use. A nice extra.

There are two Basic interpreters on the disk: one with a $ symbol, named Basic (d); and one with a π, called Basic (b). The only difference between them is the floating point number format — the $ version uses binary-coded decimal format and double-precision to eliminate the rounding errors that can cause trouble in financial packages, while the π uses the IEEE floating point format and defaults to single-precision. The d and b stand for decimal and binary.

In practice the $ version is slower but more accurate, particularly with transcendental functions. For ordinary program jobs the π version is the one to use, since rounding errors only matter in finance where the pennies count.

Double-clicking on the π icon — or selecting and opening it from the File menu — starts up the interpreter.

The first screen shows the three main windows, with the Untitled output window taking most of the screen, the Command window for immediate mode commands, and the List window. The List window is the active one at the start, indicated by its title bars and the visible scrolling arrows.

This is the first change from MBasic 1.0. The program is typed straight into the List window and can be edited there with the same full-screen editing commands as MacWrite. Program text can be selected by dragging the cursor over it, cutting and pasting from place to place in the program, and changing it at any time just by placing the cursor at the appropriate point and inserting or deleting text. Even MacWrite features like double-clicking to select a word for

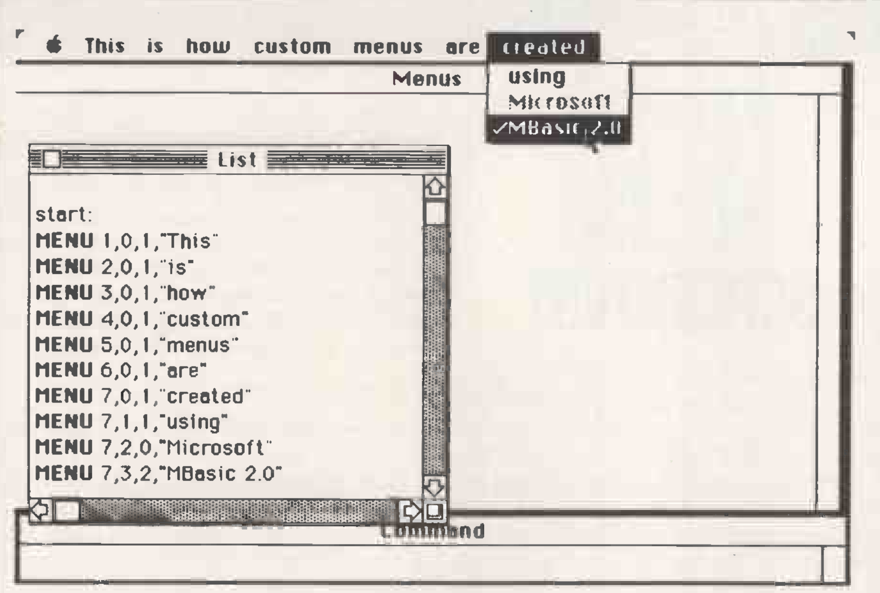


Fig 1 The Menu command provides custom menu bars and simple parameters

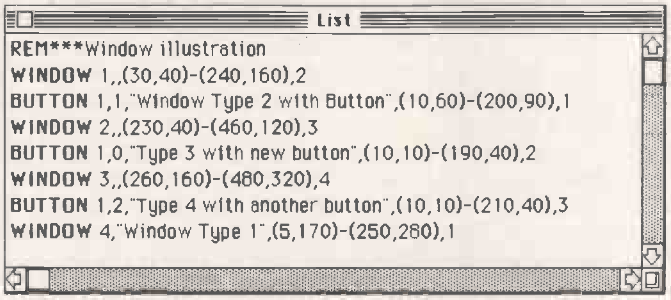


Fig 2 A few lines of Basic will put a window onscreen

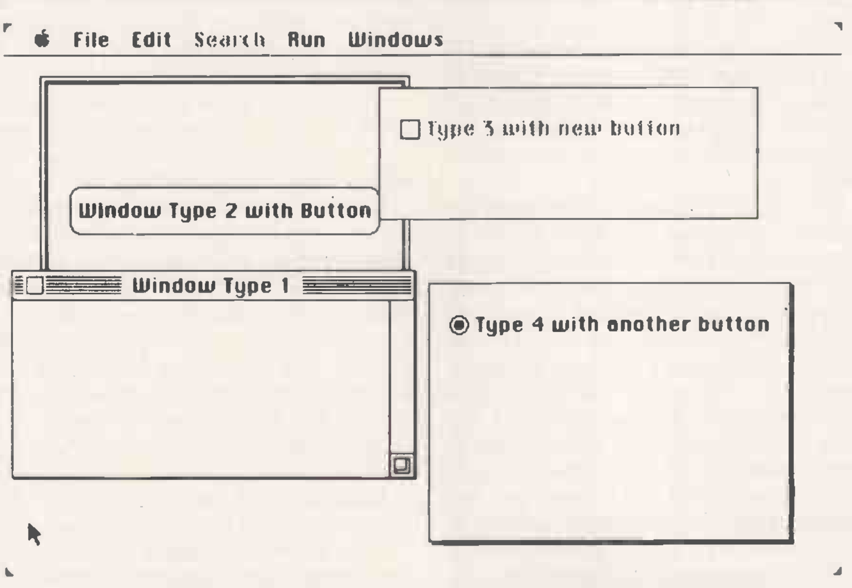


Fig 3 A window complete with title: buttons and a mouse will change its size

cutting are supported. As in Basic 1.0, multiple list windows can be opened to compare different parts of a program and cut and paste from one section to another.

The next change from the old Basic is that no line numbers are necessary, and if numbers are used they work as labels and not as organising elements. The program lines stay in memory exactly in the order they were typed, and changing line numbers does not change that order.

To replace the line numbers, Basic 2.0 has introduced name labels to mark out program blocks such as subroutines. This means that subroutines can be given meaningful names without using REM statements, and there is no problem about the GOSUB jumping to the wrong place if the line numbers change — a familiar problem in other Basics. The GOSUB just goes for the label, wherever the program block might have been moved to.

Other changes to the presentation of the language rather than its operation become obvious as soon as any simple program is typed in, or one of the seven sample programs on the disk is loaded in using Open from the File menu. When RETURN is hit at the end of each program line, all the reserved words in the line are 'bolded' on the screen. The bolding goes off a program line if a change is made to that line, and comes back on when the mouse is clicked somewhere else or the RETURN key is pressed.

Mac features

I won't review every feature of the interpreter, as it is mainly another late-version Microsoft Basic with all that implies. But the specific Mac features are well worth a closer look.

The most obvious additions to the command list are the Window, Button, Edit Field and Menu statements.

The Window statement has a few parameters that specify where it is to go on the screen, what it is to be called and look like. Up to four output windows can be opened at once, each looking like one of the four standard Mac windows. The first is a document window with a title bar at the top and a size box so that the user can alter the size of the window once it is on the screen. The second is what Mac users know as a 'dialog box' with a two-line border, normally used for warnings. The third is a window with a single-line border, and the fourth is a plain window with a shadow to give a 3D effect.

Windows, particularly dialog boxes, are not much use without buttons for the user to 'press' with the mouse or boxes for typed input, and the Button and Edit Field commands allow the programmer to place as many buttons as required (in the three standard Mac button styles) inside any window, as well as include text input boxes that automatically respond to standard Mac editing commands.

The Menu command provides custom menu bars at the top of the Mac screen, with simple parameters governing where on the bar the menu is to go, what its pull-down contents will be, and whether those items are active, inactive (dimmed on the screen) or checked with a tick (Fig 1).

Until programmers have played with Window, Button and Menu, it is difficult to convince them how useful these commands are. For example, a few lines of Basic (Fig 2) will put a window on the screen complete with a title (Fig 3), put buttons inside it and immediately — thanks to the interpreter's internal interface with the Mac's ROM — let you click the mouse on a button and watch it flash or change the size of the window in normal Mac fashion.

The Dialog function

But all this would be cosmetic without the Dialog function which, with the

Menu, Mouse, Timer, and Break functions, is the heart of a Basic Mac-style application.

Although Microsoft include these functions in the manual's Advanced Topics chapter, they form the event-trapping repertoire that is crucial to using Basic 2.0 to the full.

When a program is running, the interpreter looks for a Dialog On, Menu On, Timer On, Break On, or Mouse On statement and, after finding one, checks after each statement to see if a specified event has happened. These events can be a dialog event — clicking a button on the screen or typing in an edit field, for example the passage of time measured with the real-time clock in the Mac — a Break command (COMMAND-FULLSTOP), a selection from one of the custom menus at the top of the screen, or mouse movement or clicking.

Then a set of similar statements, On Dialog and so on, can redirect the program to particular subroutines.

The easiest way to see how it works is to examine the Dialog function which is the most complicated. After this, the rest are easy.

Dialog is always followed by a number in brackets, as in Dialog (n), and the value of n determines what the function does. Dialog (0) can have any value from 0 to 7, and its value tells the program which dialog event has happened, from clicking a button in the window to hitting RETURN in an edit field. Dialog (1) returns the number identifying the button which has been clicked, Dialog (2) returns the number of the selected edit field, Dialog (3) returns the number of the selected output window, Dialog (4) returns the number of an output window whose close box has been clicked, and Dialog (5) returns the number of the output window that needs to be refreshed — that is, rebuilt after being overlapped by another window.

Basically, this is how it works. Nothing happens as long as Dialog (0) is 0. Then if a button has been clicked, the program finds out which by reading Dialog (1). Then a standard On Dialog (1) GOSUB transfers control to the appropriate part of the program.

Similarly, edit field input can be taken in by a subroutine that is called when Dialog (0) is 6.

This might sound complex, but it is really very simple when you consider what the function is doing. With just a few lines of code, a program can create a window with buttons and space for text entry, detect any activity in that window, and do the appropriate thing. It's amazing when you see it working.

The other event-trapping functions work similarly. Menu (0), for example, returns a number telling the program which menu item on the menu bar was selected, and then resets to 0 after execution to allow polling of the menu bar. Menu (1) returns a number corresponding to the last menu item selected.

With long variable names to label the subroutines, and separation of subroutines from the main program so that execution can never fall through to the subroutines — aren't labels so much better than line numbers? — a real Mac application can be written surprisingly easily.

Overlapping

There are problems though. When an output window overlaps another, the interpreter does not save the contents of the obscured window, so that if the lower window is activated again its contents need to be refreshed and directly restored by the program. Microsoft warns that simultaneously checking for various events can cause trouble if the events pass control to the same event-handling subroutines, or if those subroutines use the same variables.

Some careful planning is required to make the bits of the user interface fit together and work properly, but it really is worth it. Like so much else about the Mac, seeing it in action is the only way of believing.

The same applies to the graphics routines in Basic 2.0, which mainly involve calls to the Quickdraw routines built into the Mac's ROM and used conspicuously in MacPaint. These are fast and effective, and the Call function in Basic 2.0 gives the programmer access to cursor handling, various typesizes and fonts, and graphics functions like rectangle and arc drawing as well as pen control. The names of these routines as used with Call are the standard Mac or Lisa Pascal names, so readers of Basic 2.0 programs should not be surprised to see lines like CallPaintOval or Call InitCursor, or even CallEraseRoundRect, appearing in the listings.

Other graphics routines are all Microsoft's own work. Get takes a 'snapshot' of a selected part of the screen, and stores it in an array; Put puts it back on the screen wherever the user wants. One obvious use of the pair is animation, where the location of successive Puts, using subtly altered arrays, is changed slightly; the action is very fast indeed. The final major graphics function is Picture, which draws a picture at a specified location using lower-level Quickdraw graphics commands from an array.

Basic 2.0 also gives full command over the Mac's sound synthesiser chip, with the Sound command specifying frequency, duration and volume of a voice, and the Wave command laying out the shape of the sound waveform and controlling multi-voice sounds.

Conclusion

This might all seem like an unconditional paean of praise for Microsoft's implementation of Basic 2.0, and indeed that's not far from the truth. But the things the interpreter lets the programmer do have penalties associated with them.

When the interpreter is loaded, the RAM space available for programs — in a 128k Mac — is around 20k less than that of a Commodore 64. Microsoft's manual includes a section on memory management, which states bluntly that 'you may be disappointed by the memory limitations imposed by the hardware'. A Clear statement is provided to alleviate this problem by taking memory bytes from the stack, or from the heap — where transient sections of the interpreter from disk are stored — for the data segment where the program, its buffers, and its data goes. Alternatively, Basic 2.0 makes it easy to do overlays where sections of a program are called in from disk and temporarily written over other parts already in RAM.

At boot-up time and before using Clear there are 21,000 bytes in the data segment, 13,702 bytes in the heap, and 6574 unused bytes on the stack.

Swapping bytes around between these areas can give more space in the data segment for programs and data, but as Microsoft says, taking space from the heap obviously slows down execution since less of the interpreter can then be resident in RAM, and disk accesses increase. 'The trade-off decision is one that should be made on a program-by-program basis,' as the manual puts it.

Naturally, a 512k Mac would make these problems things of the past.

The other drawback is that the interpreter has to do a lot of work while a program is executing, and as it is not all in RAM at once (that would take the user RAM down to below zero) a lot of disk accessing goes on. Execution speed is not spectacular thanks to that, but is still adequate. Here, adequate means faster than BasicA on the IBM PC.

Basic 2.0 is what Basic 1.0 would have been if Microsoft hadn't been in such a hurry to get a product out of the door, but at least Microsoft got a Basic out onto the pundits' Macs. Apple's semi-compiled MacBasic should definitely be a runner 'real soon now'. END

Tecmar Graphics Master™ for high-resolution colour and monochrome graphics, with complimentary PC Paintbrush™ programme.

TECMAR MAKES YOUR PC EVEN BETTER.

Tecmar is the leading manufacturer of add-on peripheral equipment for the IBM® PC and Apple Macintosh.™

In fact, Tecmar offers more than 150 products in all, covering an enormous variety of applications. These extend through graphics and communication products, specialized interfaces, memory and multifunction cards, to over 30 hard-disk configurations.

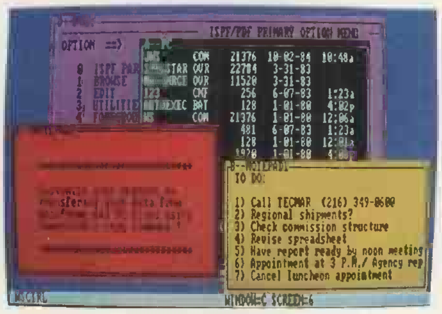
And Tecmar backs up its products with the best support services available.

So, when you're ready to bring out the best in your PC, ask for our catalogue.

Contact your local Tecmar dealer or one of the Tecmar distributors listed here.

Tecmar International Inc.,
Chaussée de la Hulpe 181,
1170 Brussels, Belgium
Tel. (02) 672.23.98 Telex 20256
Authorized distributors:
- First Software Ltd., Basingstoke, England. Tel. (0256) 463.344
- Electroplan Ltd, Royston, England. Tel. (0763) 411.71

Tecmar
MAKES THE BEST PC'S EVEN BETTER



Tecmar Powerlink™ links your PC to mainframes, with windowing and easy-to-use file transfer software.

Tecmar Maestro™ multifunction board to enhance your IBM PC AT, with 24 complimentary business productivity programmes.

Tecmar flicker-free high-resolution Colour Monitor, with 16 true colours and PC Paintbrush.

Tecmar MacDrive™ fixed or removable hard-disk drives for your Apple Macintosh, with print spooler, hard-disk partitioning and back-up software.

IBM is a registered trademark of International Business Machines. Macintosh is a trademark licensed to Apple Computer, Inc.
PC Paintbrush is a registered trademark of the ZSoft Corp.

HCM INTERNATIONAL DIV.

The C library

In the last of the series, Les Hampson examines library functions and gives solutions to the more common mistakes that newcomers will make.

The C programs you write will combine your own functions with those in the library supplied with the compiler. Some of the standard functions are so widely used that they tend to be thought of as part of the language, but not even the most frequently-used functions are built in. What is actually provided and how it works depends on the originator. Most versions have functions similar to those provided under the Unix operating system, but there are inevitably some compromises which have to be made to match the operation of CP/M, MS-DOS, and so on. This article considers the essentials of a typical library, and concludes the series by looking at some common errors and sources of information.

The library functions for a particular version of C will be described in the manual. Apart from information on what a function does, this describes the arguments expected, the value returned, data types, and how errors and exceptions are handled. You will probably have functions for console and file input and output, string manipulation, memory management and maths.

Input and output

Access to the display, keyboard and disk files is by means of function calls. These operations are hardware-dependent and require a low-level link to the operating system. Any library should have suitable functions as they are required by everyone and few users will want to write their own. All input and output in C is a 'file' operation with access to devices treated as a special case. This means that you are provided with a file for the display so characters written to it appear on the screen, and another for the keyboard which can be read.

A disk file is simply treated as a sequence of characters. This can be read or written sequentially with a position marker moving along at each access, or the user can set the position giving random access to the information. Two modes of file access using separate sets of functions are provided under Unix, and for most other systems the libraries duly emulate these. The 'low-level' functions provide direct access to the operating system for reading or writing a number of bytes, but give few other services. In many programs you want to read or write only a few characters, often just one, at a time, but this cannot be efficiently done with this approach. So 'high-level' or 'stream-style' functions provide file access, using a buffer in memory which is automatically replenished or written to disk as required. These also provide comprehensive services, including formatted output and input.

For most purposes you can keep to the high-level functions, which are meant to meet the needs of the user rather than the operating system, but generally it's not a good idea to mix the two methods in a program. The usual stream functions are:

fopen:	open existing file or create new file
fputc:	write a character
fgetc:	read a character
fseek:	change position in a file
fread:	read a number of bytes
fwrite:	write bytes
fclose:	close file
fprintf:	formatted output
fscanf:	formatted input
fputs:	string output
fgets:	string input

Before you can use a disk file it has to be opened using the fopen function. You can specify that read, write or append operations are going to be used. After negotiation with the operating system this returns an identifier for use in subsequent operations. By convention, this is a pointer to a block of data which holds essential information, including the present position and the buffer address. The various input, output and seek functions can then be used, and finally the file is closed so that the buffer is written to disk and everything is tidied away.

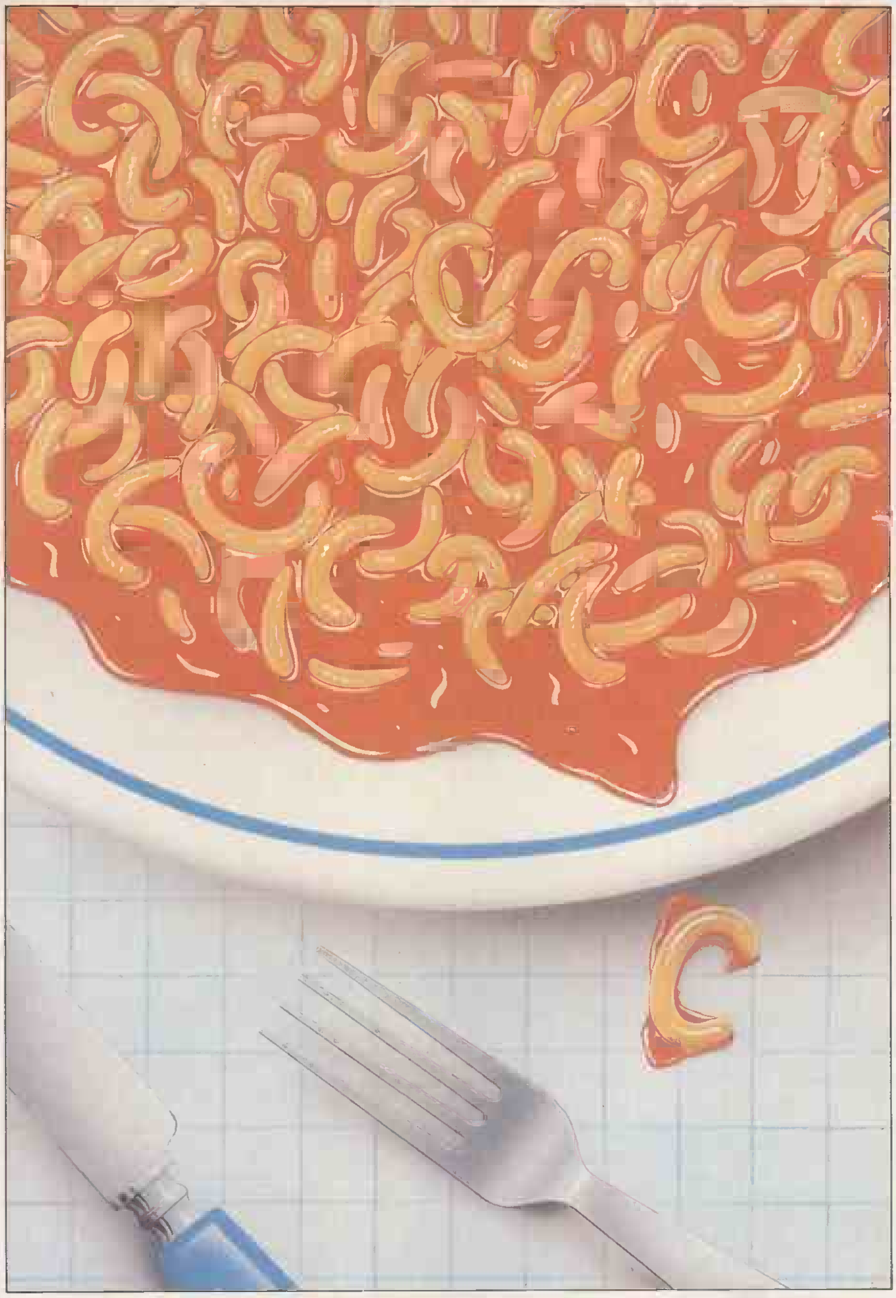
Some basic file operations are illustrated in Fig 1. Note that the function fseek, which changes the position for the next access, has a long value passed to it and returns the new position or -1L on error. All the file functions return special values if anything goes wrong and at end-of-file; these can be tested and action taken.

For access to the console, three standard file identifiers are provided — stdin, stdout, and stderr. These can be used with the file functions to read or write characters although some operations, like calling fseek, obviously have no meaning. It is usually possible to access other devices like printer and serial port in a similar way. Communication with the console is so common that a special set of functions is provided for convenience. Getchar gets a character from the keyboard and is equivalent to fgetc(stdin), whereas putchar is the same as fputc to stdout. Similarly, gets and puts will probably be provided for string operations.

Consequently, access to stdin and stdout can be redirected to disk files. For example, you might write a utility to display a file directory and, when required, send the output to disk. However, stderr cannot be redirected, and so is useful for ensuring that error messages appear on the display. Since redirection is not an intrinsic feature of many operating systems, including CP/M, it has to be provided through code in the executable files.

Input and output can be formatted in any way required by using functions which accept a string indicating how the other arguments are to be handled. Formatted output to the display uses the printf function (Fig 2). The first argument is the control string and the others are the variables to display. You can probably work out that the % symbol starts a control sequence which includes a letter indicating what type of argument to expect (c/character, s/string, d/decimal, x/hexadecimal, f/float). A width and precision can also be specified. Any other characters are printed literally, so this function can be used just to display a message.

There are two features of microcomputer operating systems which affect disk access. CP/M keeps account of its files in units of 128 bytes, and pads out the last unit with an end-of-file marker (0×1A, ASCII 26) as required. This means that the reading functions must check for the marker, and care is required in functions which change the position in the file since the end of data is not directly known. Some versions have a different mode for text (any 0×1A is taken to be the end) and binary files. Even using version 2 of MS-DOS, which provides Unix-like file access, the problem has to be faced as many programs first developed for CP/M, such as Microsoft Basic and WordStar,



```
#include "stdio.h"     /*defines type FILE and stdin etc*/
#define ERR -1

long fseek();          /*returns present position as a long*/
FILE *fp;              /*declare a file identifier*/
int i;
char c,array[100];

main()
    {
    fp=fopen("myfile","w");                     /*create myfile*/
    if(fp==0) exit();                           /*could not create*/
    for(i=0;i<500;i++)                          /*write 500 chars*/
            {
            if(fputc(i%127,fp)==ERR)
                    {
                    puts("write error");
                    exit();
                    }
            }
    if(fclose(fp)==ERR) puts("close error");
    else
        {
        fp=fopen("myfile","r");                /*open for reading*/
        if(fp==0) exit();                      /*could not open*/
        if(fseek(fp,200L,0)==200L)             /*position 200 chars from sta
                fread(array,1,100,fp);         /*put 100 x 1 byte in array*/
        fclose(fp);
        }
}
```

Fig 1 File access

pad out the files they write.

The second problem is that both CP/M and MS-DOS use a linefeed/return pair to initiate a new line, whereas Unix uses only a linefeed (this is the newline character '/n'). Different implementations try to achieve compatibility in different ways but there is not much consistency. In some versions special access modes are used to control the expansion, although an argument can be made for leaving it all to a simple filter routine. The library manual will explain how these problems are tackled.

String manipulation

Although C treats strings simply as arrays of characters, library functions are available to deal with them as units. These will add one string to the end of another, copy and compare strings, check for the occurrence of a character, determine the length, and convert strings to numbers. All the string routines are simple and any variations required can be written, given some basic knowledge of pointers.

The flexibility of C and the library functions allow you to use any type of input: for example, a Basic-like routine to display a prompt and input a string could be written. A common need is to enter a number at the keyboard but there is no standard function to do this. One approach is to combine various library functions to do the job: for example, gets to read in a string and then an atoi (ASCII to integer) or asscanf (formatted input from a string) function to do the conversion. Alternatively, a simple function could be written (Fig 3); you could develop this to allow a leading sign, error checking, and so on.

The getchar function is not suitable for many uses because it echoes the character to the screen, pressing <control> C can abort the program, and it often uses a buffer which only makes the characters available after the RETURN key has been pressed. Most libraries have an alternative function which simply returns the value of a keyed character.

Memory management

When a program is loaded into memory, some is used for the code, some for permanent data, and some is reserved for the stack which grows and shrinks for function calls and local data. There may well be some extra accessible memory which can be used if suitable management functions are provided. This is likely to involve a function, malloc, to allocate memory and another, free, to release it. These can be used to provide a variable amount of space for an array (Fig 4).

The library functions are by nature general, and some, printf for example, involve calling in a lot of code. If this matters, write your own function to give just the properties you need. If all you want to do is display strings and integers, it is not difficult to avoid using printf. There is nothing to stop you writing all the functions you need and not use any from the supplied library. The other things that affect the size of your programs are the overhead (how big is a 'do nothing' program) and the 'granularity' of the library. Some versions link your program to only the functions you call, others call in 'modules' containing groups of functions, and some even add the whole standard library. There is a wide difference between implementations, and a basic program might vary from 2-20k for these reasons.

```
char cdog[]="sailor";
int var=128;
float num=123.6789;
main()
    {
    printf("abcdefgh\n");
    printf("Hello %s\n",cdog);
    printf("%d %x\n",var,var);
    printf("The number=%7.2f",num);
    }

/*
OUTPUT is

abcdefgh
Hello sailor
128 80
The number=123.68
*/
```

Fig 2 Formatted display output

```
int getnum()
    {
    int num=0;
    int c;

    while((c=getchar())!='\n')   /*get input until RETURN pressed*/
        {
        if(c>='0' && c<='9') num=num*10 + (c-'0');
        else break;              /*stop if non-digit*/
        }
    return num;
    }
```

Fig 3 Function for number entry

```
char *ptr;
char *malloc();          /*returns pointer to char*/

ptr=malloc(1024);        /*try and allocate 1024 bytes*/
if(ptr==0) puts("memory not available");
else
    {
    ptr[215]=128;        /*can now use as array*/
    free(ptr);           /*release memory when finished*/
    }
```

Fig 4 Dynamically-sized array

```
#define MAXCOLS 80
#define TRUE 1
#define BEGIN {        /*for Pascal and typing enthusiasts*/
#define END }
#define beep() putchar(7)
#define max(x,y) (x>y? x:y)
```

Fig 5 Substitution directives

The preprocessor

The C preprocessor is the first stage of converting a written program into machine instructions. It reacts to simple directions in the source file which indicate that substitutions should be made, additional files read in, or part of the source code ignored. This is all done before any compilation and makes programs easier to read and to change, and more flexible. The basic use is substitution, which is requested by directives as shown in Fig 5.

It is much better to use symbols like MAXCOLS instead of numerical constants because they are clearer in the middle of a large program and simplify changes. You can also substitute for C keywords, functions calls, or use arguments in the form of 'macro' definitions. The preprocessor will correctly expand a statement like y=max(z,8), but as it knows nothing whatever about C and just blindly substitutes one thing for another, such macros should be simple. You can see that they can save a function call, but perhaps with some increase in program size.

The preprocessor can be directed to read in another file before compilation, perhaps because the same information is needed in each module of a program. One use is for global data declarations, for example:

#include "global.dat"

Most implementations of C require a file called 'studio.h' to be included in every program as it contains essential information, for example the definition of the type FILE, stdin, stdout and stderr. The actual contents vary from version to version to bring their approaches in line with expected behaviour.

Directives are very useful for selecting parts of the code for particular purposes. This is invaluable if you are writing a program for a number of machines and need different sections of code to account for all their quirks. Rather than have several source files which all have to be kept up-to-date, you can just have one with sections. For example:

```
#ifdef IBMPC
/*machine-specific code, data, definitions, and so on, go here*/
#endif
```

and select the ones you want with a single #define directive at the top of the file. A similar use is to remove or add sections of code during development and debugging.

Common mistakes

No-one should expect to learn C without making a lot of mistakes. Syntax errors, like omitting a bracket, will produce an error message from the compiler. If you see a huge list of messages don't panic — a mistake has confused the compiler so that it doesn't know good code from bad. Just correct the first few problems and try again. When they are sorted out there may still be other errors which mean the program won't do what was intended. Some of the most common are:

Misplaced—
  for(i=0;i<10;i++); <— error
  arr[i]=i;.

Confusing = with ==
  if(x=45) probably isn't what is meant. If you find this confusing use '#define EQ ==' in every file and then write if(x EQ 45).

Missing type of returned value for function.
  Unless a function returns an int, the type should be declared before it is used as well as in the function definition.

Providing arguments of the wrong type —
  int x=5
  y=sqrt(x); sqrt needs a double argument

Providing the wrong number of arguments —
  printf("%d %d",23); the second number displayed will be whatever happens to be at the expected place in

memory.

Confused operator precedence — while(c=fgetc(fp)!=EOF) should be while ((C=fgetc(fp))!=EOF)

Confusing a character constant and a string — 'A' is not the same as "A"

Wrong array bounds — int array[7]; array[7]=45; array[6] is the last element

Not providing space in a character string for the NULL at the end.

Omitting the break statement in switch cases so control unintentionally falls through to the next case.

Declaring a pointer but not making it point at anything before use. Pointer errors can cause mysteriously varying results, depending on whether memory in use is overwritten or not.

When you get rid of all such errors, the program will not do what you want if the logic is wrong. This is the time to use printf statements to display the values in variables at critical points, or to use a debugging aid.

Some newcomers to C complain that they have written a program which is no faster than the same thing in interpreted Basic (this could be doing something like displaying the square root of numbers from 1 to 1000). The complaint is based on a misconception of what is going on. The time taken will be dominated by calculating the root and displaying the number, and even in Basic these will use an efficient machine code routine. The slow, interpreted portion controlling the loop will have an insignificant effect on the total time — using a compiled language like C can only speed up your contribution to the program. Conversely, do not worry that a function call has to be made in C for even simple operations like comparing strings — the same process is used in Basic if you say 'if a$=b$', but this is hidden from the user and will be less efficient. Writers of C compilers make sure that calling a function and returning is very fast.

Conclusion

The standard reference book on C is *The C Programming Language* by Kernighan and Ritchie (Prentice Hall 1978): this is essential for any serious C user. A useful additional reference text which is less terse is *Programming in C* by SG Kochan (Hayden 1984). Introductory texts include *The C Primer* by Hancock and Krieger (McGraw Hill 1982), and the *C Programming Guide* by Jack Purdum (Que Corp 1983).

The C Puzzle Book by Alan Feuer (Prentice Hall) will appeal to some people because it presents fragments of code and asks what they will do. Many important concepts are covered and you have the chance to figure out and test your answer.

Looking at other peoples' source code can be a useful way of learning how to best use (and not to use) the language. Something of a cult has built up around using C on micros and provides a useful supply of programs to study. You can get a lot of public domain (free) software in source form from the US. It includes the code for editors, games and all kinds of utilities. The best starting point is the C Users' Group (PO Box 97, 415 Euclid, McPherson, Kansas 67460) which lists what's available in periodic bulletins.

Some companies sell libraries of specialised functions for things like statistics, communications, display windows, graphics and database manipulation which you can use in your programs.

Some C implementations provide the source code for the library and even for the compiler itself. If you really want to see how C makes everything happen then these will be of interest. The best-known compiler in source form is Small C, which gives a useful subset of the language for Z80, 8080 and 8086 processors. END

To help you get the best from the Teach Yourself C series, *PCW* has arranged special discounts on several C packages. Identify your machine or operating system from the list below and send the offer tab on the corner of this page with your order to the appropriate address. Enclose a cheque for the full amount, and make sure you state clearly which package you require. This list is not comprehensive. Other suppliers such as Conguin Software and Grey Matter are worth contacting for their prices. Conquin is at 14 Goodwood Close, Morden, Surrey and Grey Matter at 4 Prigg Meadow, Ashburton, Devon.

Company/Address	Machine/Operating System	Package	Price (includes VAT and UK p&p)
Hisoft 180 High Street North Dunstable, Beds	Spectrum	Hisoft C	£22.50 (normal price £25)
System Science 6-7 West Smithfield London EC1	CP/M-80	Software Toolworks C80, Mathpak and *C Programming Language* by Kernighan and Ritchie	£90 (normal price £119.15)
	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)
MLH Technology 14 Burgamot Lane Comberbach, Cheshire	CP/M-86, versions 1 and 2 of MS-DOS and PC-DOS	DeSmet C without debugger	£142 (normal price £170.78)
		DeSmet C with debugger	£199.50 (normal price £234.03)
	CP/M-80 version 2.2 and upwards, AppleIIE with CP/M card	BDS C	£136.25 (normal price £159.27)
	PC-DOS	'Introducing C' Tutor	£142
MMG Consultants 19 St Andrews Road Great Malvern, Worcs	CP/M	Small C-80	£75 (normal price £110.98)

C DISCOUNT VOUCHER

SCREENTEST

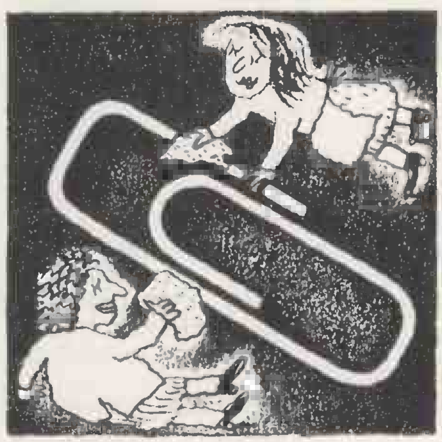
Perfect II

The UK versions of the Perfect Software packages Perfect Filer, Perfect Writer and Perfect Calc have finally arrived. Kathy Lang looks at the rewritten programs and considers their merits as a data management system.

Many readers will be familiar with the Perfect range of filing system, word processor and spreadsheet which was supplied, often 'free', on a range of 8-bit computers (see *PCW*, March 1985, 'Perfect power'). Perfect II is a new range of completely rewritten programs, available at the moment only for the IBM PC, but with an Apricot version promised soon. Perfect II is imported and distributed by Thorn EMI, whose software arm has spent six months translating the packages into a more appropriate form for the British market — with support for the pound sign, recognition of the usual British day/month/year date format, and a number of other modifications including an overhaul of the manuals.

Maximum file size	OSL (1 disk)
Max record size (ch)	1 screen
Max no fields	128
Max field size	80/400
Max digits	14
Max prime key length	NA
Special disk format?	N
File size fixed?	N
Link to ASCII files?	YF
Data types	N,C,D, L,T, and so on
Fixed rec structure?	Y
Fixed record length stored	Y
Amend rec structure?	CO
Link data files?	N
No data files open	NA
No sort fields	9
No keys	NA
Max key length (chars,fields)	NA
Subsidiary indexes kept up-to-date?	NA
Data validation	Adeq
Screen formatting	P
Unique keys	NA
Report formatting	D,C
Store calculated data	No%
Totals & statistics	No%
Store selecn criteria	P
Combining criteria	A,O%
>1 criterion /field?	Y
Wild code selection?	SW
Browsing methods	AF
Interaction methods	M/C
Reference Manual+	****
Tutorial Guide+	****
Reference Card+	N
Online Help+	****
Hot-line?	P

Fig 1 Features and constraints



Perfect II consists of three separate packages: a data management system, Perfect Filer; a word processor, Perfect Writer; and a spreadsheet, Perfect Calc. Each package may be directly invoked from DOS or from the main Perfect II menu, whence you return each time you exit one of the individual modules. The three packages have the same basic approach: you can operate each through the pull-down menus or via command sequences once you are familiar with the way the packages work. Perfect Writer and Perfect Calc also permit the use of a mouse, and provide the ability to view two documents or spreadsheets through windows. The three packages are sold separately at £149.95 each.

In practice you would be unlikely to buy Perfect Filer on its own, because as far as I can discover there is no means to construct reports for printing from Perfect Filer without the aid of a word processor or editor. (You can echo the contents of the screen exactly on the printer, but this provides printing of individual records only.) While the initial price looks extremely attractive, the need to have at least an editor as well must be taken into account. Nevertheless, the requirements of most users do cover more than just one of the trio (spreadsheet, word processor, filer), and in any case the spreadsheet and word processor can be fully used without the need for any link to another program. The modest price of the three Perfect II modules and their ease of use should mean that the suite will provide some formidable competition in the 'simple and cheap' part of the market.

Constraints

A single Perfect Filer field is limited to the length of a screen line — 79 characters. Unlike most others, Perfect Filer allows you to construct multiple fields which can be considered as though they were single items. Although you are nominally limited to a field length of 79, in practice this limit is effectively 395. In addition to the usual field types of numeric and character, you can also define what Perfect Filer calls Group fields. Obvious examples include Name (which includes title, first name and surname) and Address, as well as less obvious instances such as Date (where the day, month and year are identifiable as separate parts), Time (consisting of hours and minutes), National Insurance number and logical (Yes/No). This feature could be extremely valuable in many applications since the group variable may be referred to either as a whole or by its constituent parts, thus saving a lot of time in selecting and reporting upon records which include such variables. You can even create you own group variables, provided they conform to one of the templates provided by the basic group variables.

Other limits are typical of packages of this type — a record must be capable of display on a single screen (including any text needed to identify field values), files may not span more than one disk, and you can't link fields in separate files. Records are stored in a fixed format with fixed-length fields so that the maximum amount of space which might be necessary is used, whatever the actual length of the information.

The most notable constraint is the absence of any calculation features within Perfect Filer itself. You can't even

'In practice you would be unlikely to buy Perfect Filer on its own, because as far as I can discover there is no means to construct reports for printing . . . without the aid of a word processor or editor.'

total the columns of figures in a report. The only way to calculate with Perfect Filer variables is to transfer records to the spreadsheet, carry out calculations there and, if necessary, transfer the results of these calculations back to Perfect Filer.

File creation and indexing

The first step in creating a Perfect Filer file is to type on the screen a representation of how the records should be displayed, using captions and messages as you wish, and entering underscores where the variables are to appear. This paint-a-screen approach is made easy by Perfect Filer's combination of menus and help information.

The next stage, however, while still easy, is more tedious. You are asked to identify each field in turn by name, even if the names are identical with the captions you've already typed in — there is no way to request that a name and the field caption should be the same. Perfect Filer does not use indexes in the conventional sense, but when editing a file there is a special function for recalling a record by specifying the value of its first field.

Once a record format has been set up and information entered into the file, you can still change the format but only by copying the data.

Data input and updating

Records can be added to Perfect Filer files simply by typing them in on the form designed at file creation, and amending the records with full cursor movement before saving. You can echo the previous record if a lot of replication is involved; you can also enter the current date and time into record fields.

Existing records can be recalled for retrieval in two ways. You can enter a value for the first field in the record, and the first record which meets this value will be displayed. Partial searches are permitted, so that entering the characters 'Smith' at the start of a surname field will retrieve records for Smith, Smithson, Smithers, and so on, as well as SMITH, since Perfect Filer ignores case when matching. The alternative method is to specify a set of selection criteria which will then be used to test each record for retrieval. The tests allowed are exactly the same as when extracting records for reports, and like them may be stored permanently or entered and executed in the same operation without saving the test rules. Once a selection has been activated by either method, it remains in force until countermanded so you can use either method to browse through the file at will, displaying one record at a time on the screen.

BM1	Time to add 1 new record	2secs
BM2	Time to select record by primary key	2-32secs
BM3	Time to select record by secondary key	NA
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	3secs/2secs
BM5	Time to access record using wild code	2secs/inst
BM6	Time to index 1000 records on three-character field	NA
BM7	Time to sort 1000 records on five-character field	1min 40secs
BM8	Time to calculate on one field per record and store result in record	NP
BM9	Time to total 3 fields over 1000 records	NP
BM10	Time to add 1 new field to each of 1000 records	13mins 30secs

Time to import a file of 1000 records: NA

Notes: NT=Not tested NP=Not possible within Perfect Filer += including scrolling
Where two times are given, first is access to first record, second is access to each subsequent record

Fig 2 Benchmarks recorded on IBM PC/XT

Perfect Filer does not provide any facilities for making multiple changes to records in one automatic operation. This kind of batch updating could be achieved using Perfect Calc, but my later comments about calculations equally apply to this method of updating.

Screen display

Each Perfect Filer file is associated with a single-screen format which is set up when the file is created. In addition, reports formatted by Perfect Filer can be displayed on the screen, before or instead of printing them.

Printed reports

Perfect Filer has a powerful set of facilities for formatting reports, including commands for setting page numbers and controlling page breaks, headers and footers, centring, and positioning by specifying column numbers. Record variables may be embedded anywhere in the report format, so it is also possible to produce personalised letters and labels using this approach. Groups of records may be selected for reporting.

Perfect Writer is one of the most powerful packages on the market for handling running text, and comes with an array of features of considerable benefit to the writer of long documents.'

Records may be sorted before the report is created, using up to nine sort fields. There are some neat facilities for controlling printing when the values of sort fields change, but no provision for totalling or subtotalling numeric fields (unless you use the Perfect Calc transfer route).

The other major gap in the reporting facilities is that, while Perfect Filer has many formatting facilities, it does not include an editor with which to create the template for the report. To do this, you must have a separate editing program to store the template information containing both data specifications and formatting details.

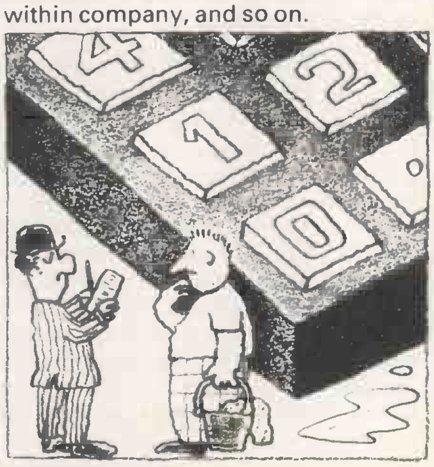
If you have also bought Perfect Writer you can construct the template with it, and if you wish also embed Perfect Writer formatting commands which provide you with extra formatting commands, such as the ability to change margins and to use standard text formats. If you take this approach, then to produce the report you must go through three stages: first, the report is set up using Perfect Writer, then processed by Perfect Filer and the result stored in a file, and finally, the report is printed by Perfect Writer.

Selection and sorting

Selecting groups of records for editing, display or printing can be achieved by setting up appropriate selection criteria. These may be temporarily set up and immediately executed, or they can be stored in a named file and then executed. Selections may be of two kinds. You can select using matching, which involves specifying one or more character sequences which a field should match. For example, if you wished to extract the records of all the residents of Essex and Cornwall, you would enter each county name in turn onto the record template (which is just a blank record form, using the same layout as that used for data entry). Where the string entered is shorter than the field length, partial matching is used so that Smith matches Smithson and Smithers as well. Once again, Perfect Filer ignores differences in case.

The alternative method of matching is called comparison matching, which involves specifying that a field should equal, be less than or greater than a stated value. Again, you can have several comparison tests on a single field, for example to allow selection of particular quarters in a series of years. You have no choice as to how criteria are combined: for a record to be selected, all comparison criteria must be passed (except, of course, where they are mutually exclusive) but only one matching criterion need be satisfied.

The only way in which you can see Perfect Filer records in a different order, other than entry order, is in a report (which may be a set of labels or of personalised letters). Then you may sort the data on up to nine fields — name within department within region within company, and so on.



Calculation

Perfect Filer provides no facilities for calculation. The only way to handle totalling, batch updating or any numerical manipulation of Perfect Filer variables is to transfer them to Perfect Calc, carry out the required calculations, and transfer the results back to Perfect Filer if necessary. This approach could, for example, be used to accumulate totals for a Perfect Filer report. However, because each Perfect Calc spreadsheet is limited to a maximum of 255 rows and 52 columns, the largest set of records you could handle in this way would be 255 records of 52 fields each. By clever manipulation of several spreadsheets you could accumulate totals over larger sets of records or fields, but this would be difficult for a novice to accomplish, and tedious for the experienced user.

Tailoring

In common with most other packages costing under £200, Perfect Filer permits only one file to be processed at a time, nor are there any facilities for tailoring the package to the needs of particular users.

Security & housekeeping

You can copy records between Perfect Filer files within the package, but to copy or delete complete files you need to use the appropriate DOS commands. No security system of passwords or the like is provided.

Links with outside

Within the Perfect II suite, you can transfer information between Perfect Filer and Perfect Calc by setting up a transfer map to determine which fields in your records match cells in the spreadsheet. This is accomplished by entering cell names into a screen display showing the record layout as it usually appears when entering information. You then specify the name of the spreadsheet to link to — this will be created if it does not already exist. The transfer format is saved to allow subsequent re-use with the same files.

Perfect Filer records are held in ASCII format in plain text files so that they can be typed under DOS, and read and written by other packages and programs. The data file always has an extension of .RF, while screen formatting and group field information is held in separate files. The format of a data file is not, however, completely straightforward: the first part consists of information about the numbers of records in the file, the number and length of fields, and so on, followed by the records. Each record is preceded by a digit which indicates whether the record is current, or whether the record space may be re-used because the record has been deleted.

Setting up a file in Perfect Filer format involves a little detective work which could easily be avoided if the format were shown in the manual. When writing information from Perfect Filer files for use elsewhere, you can use the report facilities to construct the format you need since reports may be written to a text file rather than printed.

User image

I found Perfect Filer extremely easy to use: although I read the manual, I rarely

Package	Cost (£)	Summary
DMS+	195	Stripped-down version of Delta from same supplier — one file open at a time, no tailoring. Good letter-writer. Usable manuals, but no road map of menus. Separate set-up and execute (for example, in selection) tedious. Good value for money at this price.
Friday!	195	Simple, cheap, good-value package for single-file, fixed-format records. Drawbacks are clumsy approach in letter-writer and designing screen formats. Excellent tutorial manual and menu charts, reference manual is good, used from screen to manual.
Pearl	195	Economical storage of varying length records, multiple indexes allowed and kept up-to-date, paint-a-screen formatting for screens and reports (though no letter-writer). Entry screens can write to several files at once. Good manuals. Excellent value.
Perfect Filer II	149.95	An easy-to-use package for handling text information such as names and addresses, with good report and label formatting. Lack of calculations, and need to have editor or WP to construct formats, are serious drawbacks. WP & spreadsheet in same family.

Fig 3 Comparison of similar data management packages

needed to use it while at the keyboard. Individual functions are obtained either through pull-down menus, or directly through commands which are avoided once you know your way around. You can also continue to use the menu option approach but delay the appearance of the menu for some seconds (under your control), so that the menus appear only where you are unsure of the keys to press. It would still have made the package easier to use at the beginning had there been some kind of 'road map' — as always, it is easy to see what the package can do, but less easy to be sure what it can't do, and to see where each function is situated on the menu tree. A menu map is provided for Perfect Writer, but not for Perfect Filer. Other aspects are reasonably well catered for too, including setting up record display formats, though personally I don't like having to give column coordinates when I need precise control over the layout of a report.

Documentation

Each Perfect II module has its own manual with an introductory section aimed at getting novices off the ground, followed by a reference document which is very readable and easy to understand. It's all a bit hearty for my tastes but then I used the original US documentation; the manuals have been rewritten for the British market, so they may be less of a culture shock. Plentiful use is made of diagrams though not of actual screen pictures, so you don't get any impression of the way the pull-down menus work in conjunction with your displayed records. In addition, each package comes with a template for the function keys on the IBM PC which are used to initiate the most commonly-used features. The cursor pad is also sensibly used.

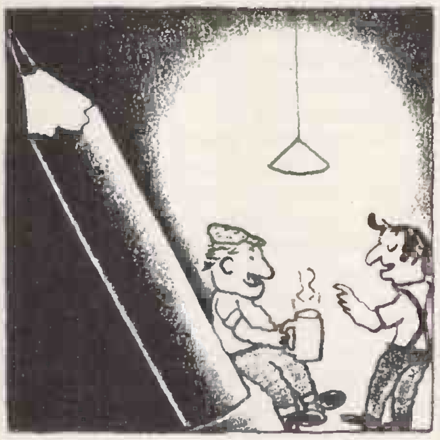
For Perfect Filer, this approach is fine (although I would still like a road map). For Perfect Calc and Perfect Writer, however, I very much missed the Reference Summary which was provided with the mark one versions of the Perfect suite.

Perfect Writer

Perfect Writer is one of the most powerful packages on the market for handling running text, and comes with an array of features of considerable benefit to the writer of long documents. It has two main modes of operation. The default mode is Verbatim, which is 'What you see is what you get' (WYSIWYG) but provides only very basic formatting facilities. Changes of margins are allowed but are not stored permanently; only one set of tabs stops is permitted per document and these must be at regular intervals (for example, every five characters). The only form of emphasis is underlining (though this does display correctly on the screen).

The authors of Perfect Writer clearly expect that you will prefer to work in the mode in which formatting is controlled by environments, which permit you to specify indented sections of text, two-column text such as you find in glossaries, and a variety of other formats. Their operation is controlled by specifying the start and end of the text to be formatted, and including the name of the environment. The actual layout is constructed when the document is printed, so this mode is definitely not WYSIWYG. (The two modes of operation can be intermixed, since Verbatim is actually an environment too.) A similar approach of bracketting text is used to provide a wider range of emphasis, and there are other goodies such as indexing.

Another unusual feature is cross-referencing, which allows you to place a



marker in a point in the text which is to be referred to elsewhere. Perfect Writer will automatically insert the correct page number when the document is printed. There is also a thesaurus, allowing you to request alternatives to the word you have typed, and a spelling checker. The speller is fine, except that it only allows you to use one dictionary at a time. Both speller and thesaurus are included in the Perfect Writer price.

Perfect Writer is thus an extremely powerful document processor, but is almost useless for typing tables. For that, you would do better to use Perfect Writer in conjunction with Perfect Filer or Perfect Calc, since in either package you can construct a table which can be printed to a text file and read within Perfect Writer.

Perfect Calc

Perfect Calc is probably the most powerful of the three packages relative to its competitors. Its major drawback, the limitation to 255 rows by 52 columns, should be more than compensated for by the ability to reference cells in one spreadsheet from within another, to have up to 15 spreadsheets in memory at once, and to display two spreadsheets at once using the windowing features.

The calculation capabilities provide a wide range of functions, including standard deviations and net present value which are not universally available. Movement around the spreadsheet is quick and easy; recalculation is not only under either manual or automatic control, it can also be confined to specified regions to avoid unnecessary computation.

Conclusion

Perfect II provides three packages which can be used independently or together for the basic functions required by most micro users: data management, word processing, and spreadsheet. The data management system, Perfect Filer, is quite adequate for applications involving straightforward text such as mailing lists, but lacks any internal calculation facilities. To produce reports, you need an editor or word processor, so it would normally be used together with Perfect Writer. This provides a bevy of document processing features, including very powerful editing and layout facilities, but is less than helpful when it comes to producing tables.

Perfect Calc is a powerful and versatile spreadsheet which can be used in conjunction with the other two packages by passing files across.

All three packages are easy to use, and the common user image makes it much easier to learn all three than to learn three separate packages. If this tempts you, have a good look at the features of the modules which interest you most, and make sure they will be adequate for your needs. END

Summary

Supplier	Thorn Emi
Tel	(0252) 543333
Cost (£)	149.95
Systems	PC
Version reviewed	2.0 (UK)
Type	N,F
Features	Simple, inexpensive file management system allowing access to one file at a time, fixed-length, fixed-format records. Group variables speed up typing. Powerful report formatting, selection and sorting.
Drawbacks	No calculations: transfer to spreadsheet for these. Report construction needs editor or WP.
Ease of use	Very good, but would be even better with a road map.

Class networks

As computer studies become an integral part of the school curriculum, the hardware needed to cope with many levels of user capability must also expand. Teachers Fintan Culwin and John Martins describe one school's RML network.

When your school micro collection expands from three to over 30 in just three years, networking becomes a necessity rather than a luxury. The basis of a network is independent computers (stations) which are able to communicate with a master station or server, and via the server access peripherals such as disk drives or printers. Communication times down a network can never be as fast as communication times to a directly accessed peripheral. However, with the costs pooled, the stations can have access to a much larger backing store or a higher quality printer than if each had its own provision. Most of the uses for computers in schools do not depend on fast peripheral access, and budgets are to say the least tight.

'The students . . . have developed the game of Beat the Guard. The aim is to change the notice board message without stealing a manager's password — two students caused versions II and III to be hastily improved.'

Consequently, networking is an attractive proposition. By providing a large networked backing store, a vast amount of software can be made accessible to all the stations simultaneously without the need for an enormous quantity of disks. Installation of software is only the initial task: regular maintenance is needed to keep any system operating. Where the machines have their individual disk collections, this becomes a time-consuming and onerous chore. With a network, a range of new tasks becomes necessary but the majority of the basic tasks can now be performed on one centralised disk storage area.

For an isolated micro it is possible, but not recommended, to skimp on disk maintenance tasks. If a disk becomes full, outdated or damaged, it is possible to survive by switching disks between machines. On a network this is less possible, as such negligence will affect all stations and back-up facilities are not as readily available.

The networks that the school uses and manages are based on RML (Research Machines Limited) 480Z micros. These are connected by coaxial cable to a purpose-designed Z80-based server. The server is supported by backing store and spools output from the stations to a printer. The school manages four networks, with backing store ranging from 320k of single-density 5in drives to 18Mbytes comprising a 16 Mbyte Winchester and 8in disk.

For a network with a limited and specialised use, for example one entirely located within the maths department, the storage capacity of the latest model of 5in drives (1.2Mbytes) is more than adequate. For a general-purpose network based on 8in drives with a capacity of 2Mbytes, this storage is not adequate. A compromise has to be made by having one disk permanently in place holding a selection of the most commonly used software, and exchanging the second disk as the needs of the users change. On a Winchester-based system it is possible to hold the system and applications software on the Winchester, using the floppies only for students' work files.

Maintenance

Management tasks can be divided into various categories; the simplest perhaps being the booting of the network and the physical maintenance of the hardware. Routine tasks concern the monitoring of faults, both hardware and software, and deciding on appropriate action. A utility is available which dynamically monitors all networks traffic, identifying the amount of signals being generated by each station and the server, and allowing faulty stations or cables to be detected. Software problems are more problematic to identify and cure. The monitoring, renaming, erasing and moving of files can be performed while the network is up, using the familiar range of CP/M commands (DIR, STAT, TYPE, REN, PIP, and so on). In network mode these commands work at network speeds, in this case irritatingly slowly. A faster method of performing these actions is obtained by using a station as a terminal to the server, giving the terminal exclusive access to the server and its resources. For efficient operation it is necessary to take down the network and perform these tasks on a regular basis.

Some tasks can only be undertaken when the network is in maintenance mode; the most important being the regular backing up of the Winchester onto floppy disks. This is occasionally done by image copying the Winchester, and more routinely by copying files that have not been marked as having been previously backed up. Code compression routines have been incorporated into the 'flop' and 'flip' software to save time and floppy disk space.

'. . . the advantage of the RML system is clear — running standard commercial packages means that support, training and applications are immediately available. The only problem is resolving administrative demands.'

The operating systems used on the networks are based on CP/M. The servers use MP/M, allowing them to attend to their own needs and the network's concurrently. The stations run under CP/NET, which is functionally very similar to CP/M 2.2 with additional network-specific enhancements.

One of the biggest problems with the network concerns the manner in which CP/M systems organise disk directories. The directory for each surface can be partitioned into 16 different allocations. These are referred to as user areas, numbered from 0 to 15. Movement from one user area to another is by using the system command USER.

With one exception, stations can only access files from the user area in which they are resident. User area 0 has a special status, as files within this area can be designated to be available to any other user area. This is done by setting the SYS attribute of the file's directory entry. The only other attribute supported is read/only (R/O) with a default of read/write (R/W). There is provision within the MP/M system for further attributes to be set (passwords, time stamps, and so on) but they are not used by the network.

This organisation is adequate for small micros performing a limited number of tasks for a small number of users. On general networks, however, this does not give sufficient flexibility to the network manager to assign different areas to different groups and different levels of user. When a station logs on to the network, CP/M prompt (A>) is displayed. This indicates that the station has been placed in user area 0 on drive A, which is the most populated and sensitive place on the whole network.

On a Winchester-based system this is usually the Winchester drive itself, where all the systems software has to be located. On a floppy network it is the surface of the server disk, where a selection of the most widely used software is based. Letting students loose here can cause an immense amount of problems. The least of these is having to pick out and remove small Basic or text files from among the plethora of system files; the worst is having the students copy you with the erasing procedures.

A more disturbing problem concerns the amount of pre-knowledge and training that is required to supervise an operating system when it's loading and running an applications program. With a stand-alone machine or a dedicated network, it is possible to prepare turnkeyed disks which take care of this. On a general-purpose network this option is not available. This can be valuable experience for a computer studies student, but can prevent other students and non-specialised teachers from getting to grips with the system.

Security

A minor problem concerns the ease with which users can migrate from area to area. On a trivial level this will allow students into the games area when you aren't watching. More importantly, it prevents you from preparing next term's exam on the network as you can guarantee that it will be common knowledge before you can spool it out.

These points were appreciated early in the networks development. RML was aware of the problems, but admitted it was not planning to produce a front end to solve them. We considered these factors so disturbing, that we have produced a suitable front end ourselves. The system we have been developing over the past two terms is called GUARD, designed to meet the problems outlined above.

On booting onto the network, an amended command processor takes control away from the network user and transfers it to the GUARD.COM utility. GUARD announces itself with a notice board on which the network manager can write a message to be broadcast to all users. Beneath this a password is demanded; if a valid password is not produced within three attempts, the station locks up and has to be rebooted. There are three types of password. One category sets user area and drive, leaving the station at system level (but the USER command is removed). A less privileged password can be defined which turnkeys a specific application, usually a menu, which allows the user to progress into his chosen program. Exiting from the application causes GUARD to be recalled, preventing autobooted users from ever meeting the operating system.

Network managers have a password allowing them to control GUARD. Passwords can be defined, deleted or listed; autoboot commands can be added and the notice board can be changed. The USER command itself is retained, allowing the manager to wander around the system.

GUARD has been heavily tested by students and teachers using our network, and also by other network managers. Network managers no longer have to be in constant attendance to the system: teachers find they are able to use the network with their classes without the operating system getting in the way of their application. The students, in addition to having easier access to the system, have developed the game of Beat the Guard. The aim is to change the notice board message without stealing a manager's password — two students caused versions II and III to be hastily improved. The main aim of GUARD was to ease the manager's task; as a protection system it can be beaten relatively easily still, but it is sufficiently troublesome to deter all but the most persevering.

Schools
RML Basic versions 5&6 (Microsoft)
SBAS (SPA structured Basic)
TCL Pascal
Edinburgh Logo
ZASM Z80 macro assembler
Touch 'N' Go typing tutor
Txed
WordStar
Word
Quest
Sir
Viewdata (CET local viewdata and communications package)
Multiplan

Colleges
CIS Cobol (with forms and animator)
Fortran

Available from RML at extra cost
Prospero Pascal
Algol
dBasell
Sage Accounts

Fig 1 RML bundled educational software

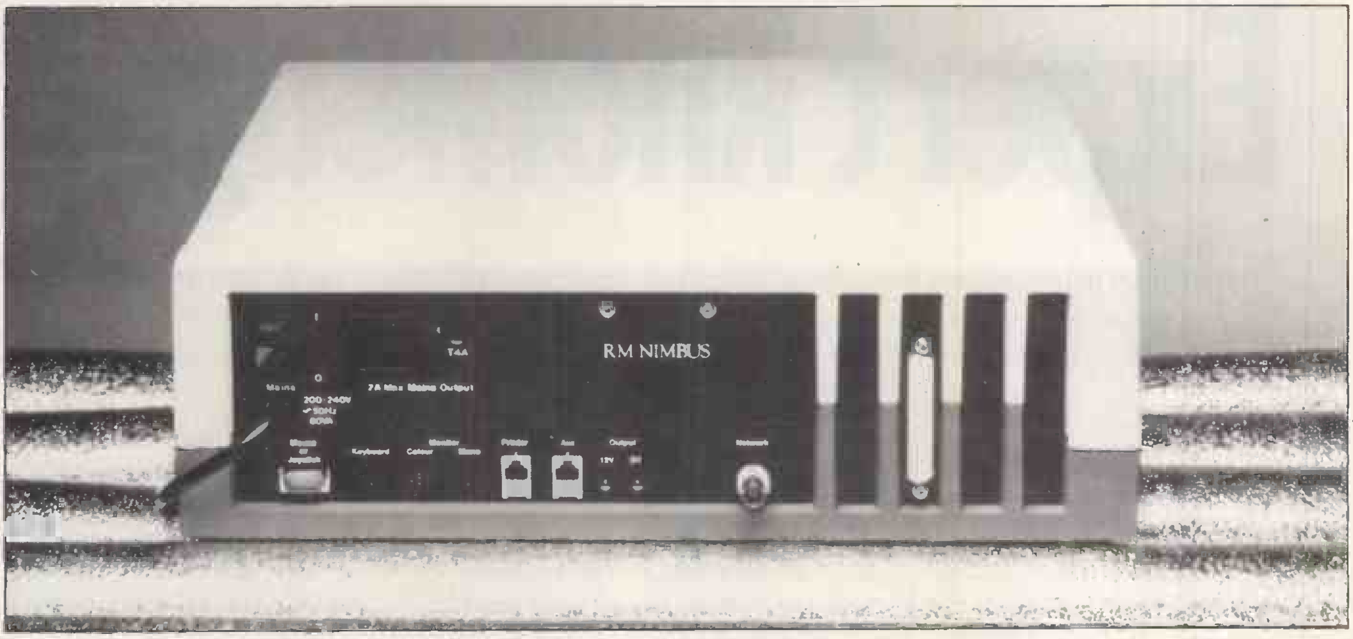
Bundled software

Educational purchasers of networks receive a bundle of software as outlined in Fig 1. From an educational point of view two major factors are worth considering. The inclusion of industry standard packages such as WordStar, Multiplan and Cis-Cobol, and the availability of dBaseII make RML an obvious choice for training. Curriculum innovations such as CPVE (Certificate of Prevocational Education) and TVEI (Technical and Vocational Educational Initiative) encourage the integration of vocational and educational development; both of these also stress the relevance of information technology. The ability of a network to offer students contact with systems which are in common commercial use enhances the value and validity of the exercises.

The second educational consideration concerns the choice of an introductory programming language. A full implementation of Logo is provided and is used in the lower school introductory courses. It would be adequate for all programming needs up to O level, but market pressure from our students (and our conservatism) insists on Basic. SBAS is a structured Basic with facilities including sensible variable names, simple indexed loop structure, repeat until, while wend, procedures and functions with parameters passed by reference and by value, case of structure, and global and local variables. Perhaps the most useful facility is hidden libraries. These are libraries of SBAS procedures and functions which SBAS will load when started. The procedures are hidden from the user and are effectively language additions. An example of use could be to implement turtle graphics within Basic to ease the transition from Logo to Basic.

The commercial packages (WordStar, dBase, Multiplan) have been adapted for use on the network, usually from previous 380Z versions, but problems sometimes remain. WordStar is becoming notorious for crashing networks by leaving printer files open. More significantly, dBaseII will only allow one user to open a data file at one time. The rationale for this is to allow for write access; one user could be attempting to read a record at the same time another user was attempting to write to it. The network supports record locking, allowing two or more users write access to the same file by 'locking' a record while it is being written to. dBaseII and other single-user packages are not capable of taking advantage of this facility, although some progress is being made.

The networks spend most of their time running educational packages for



RM's Nimbus comes with network hardware built in. The network can support up to 64 workstations on a maximum of 1200 metres of coaxial cable. The system works at 0.8 megabits per second which should suffice for educational use

other subjects. Although the quantity of packages available for the 480Z is less than that for other educationally favoured machines, the average quality is much higher. In particular, as a DOI (Department of Industry)-supported machine, programs produced by the MEP (Microcomputers in Education Programme) are generally made available for all supported machines. As the educational software market matures, software publishers are rapidly appreciating the number of 480Zs used in schools and producing program versions for all DOI-supported machines. We have rarely failed to obtain an educational program due to its unavailability for the 480Z.

The last task that may be allocated to a school-based network is school administration. Here the advantage of the RML system is clear — running standard commercial packages means that support, training and applications are immediately available. The only problem is resolving the educational and administrative demands made on the system.

Conclusion

The Advisory Unit for Computer-based Education (ADCUBE) publishes a guide for schools and colleges intending to upgrade to a network. No currently available network fulfils the specification fully. One particular omission from the chain network is the ability of a controlling station to slave a remote station, allowing the manager to view a student's screen, display the manager's screen or take over the station. However, in all other categories the chain network meets the specification.

When deciding on a network, price cannot be overlooked. The RML package is not the cheapest when considered in terms of purchase price. When the value of the bundled software is taken into account against the cost of providing this on a station-by-station basis for its nearest rival, the chain network must be the cheapest path. Add to this the physical quality of a 480Z compared to machines primarily designed for home use, the advantages of introducing students to CP/M and the memory available for hi-res graphics applications, and the decision leans towards RML.

Future developments for the network will probably be based on the 16-bit RML Nimbus. As a network server, the more powerful processor and greater amount of memory available will further reduce the network response times. The Nimbus operates under MS-DOS which is good news; the bad news is that it will pretend to have a CP/M directory organisation when acting as a network server. The hardware aspect of the chain network is of a very high standard, and the software, reliability and operation are equally high. We do, however, have reservations concerning the ability of RML to develop and deliver suitable user-friendly front ends and utilities for the system. In education, the attitude 'you can have it in any colour you want as long as it is CP/M' will not make it easy to take the network to uncommitted teachers.

The DOI took a bold step four years ago in supporting every secondary school's acquisition of a stand-alone micro; it extended that to cover primary schools. That programme is now complete. With the educational needs that can only be supported by networking and the Government's stated support for information technology, support for the acquisition of network capacity is the only logical next step.

Fintan Culwin and John Martins are full-time computer studies teachers at Crofton Secondary School (ILEA) and part-time lecturers at South East London Technical College (ILEA). All views expressed are based on personal experience and opinion, and not on ILEA policy.

Enquiries concerning GUARD should be directed to: Inner London Educational Computing Centre, Bethwin Road, Camberwell, London SE5.

The network acquisition guide is available from ADCUBE c/o Hatfield Polytechnic, or local MEP information centres. END

Technical specifications

64k Z80 server running MP/M 2.2 with serial printer interface, and .8Mbit per second network interface capable of supporting one printer and 16 stations.
Maximum network length: 1200m.
Maximum backing store: four × 16Mbyte Winchester drives plus 2Mbyte 8in floppy.
480Z station comprises a 64k Z80 micro running CP/NET with 52k available for user. 32k separate HRG memory, modulated, composite and TTL video output. Two serial ports and a user port. Capable of supporting 1.2Mbytes of local storage, 192k silicon disk and printer.

Expert knowledge

Artificial intelligence programs need not present a daunting programming challenge — you can use simple algorithms to operate on knowledge representations. Graham Storrs explains intelligent knowledge-based systems in the light of their central role in AI.

The Japanese Fifth Generation computer project and our very own Alvey project, aimed at stimulating the development of the next generation of intelligent and powerful computer systems, have laid great emphasis on the importance of Intelligent Knowledge-based Systems (IKBS). To many, the term simply means 'expert systems', but the use of knowledge in all kinds of intelligent programs has been a central theme in artificial intelligence (AI) for almost two decades.

Historical domain

Early in the history of AI, researchers attempted to build programs which could reason in general ways about problems. They produced 'problem solvers' and 'theorem provers' which worked on arbitrary problems to find solutions; this work led to little real success but it did reveal an important principle. This was that, to reason intelligently about some aspect of the real world (a 'domain' in the jargon), a computer program needed to have access to a great deal of knowledge about the world it was working in. Abstract theorem provers were fine for abstract domains (such as logic and mathematics) where the fundamental laws of the system (its axioms) can be stated. But in the world of people, objects and events where we don't know the axioms, the only way to encode the expected behaviour of the system is in large collections of facts, and of relationships between facts which the program can then examine and use.

The pattern for most modern AI programs was set by Terry Winograd at the beginning of the 1970s. He wrote a program that simulated a robot (called SHRDLU) which inhabited a world of simple blocks, boxes and pyramids. SHRDLU could be given commands in English to move the blocks about and could be asked to describe the current arrangement of the blocks, its own goals, and its reasons for having done something. Its performance was very impressive and had been achieved by separating SHRDLU's knowledge about the 'blocks world' from its reasoning processes. With this arrangement, SHRDLU appeared extremely clever even though its reasoning ability was rather limited. Almost all its apparent intelligence was coded in its knowledge of its domain; ask it about any other subject and it would fail dismally.

Having realised that domain knowledge is necessary for high performance, the emphasis in AI shifted away from creating general intelligence to finding ways of putting knowledge into programs. Ways of representing the ideas and relationships we use to describe the real world were looked for so that they could be given to computers to reason out. There was also a need for programming languages with enough expressive power to tackle this formidable job. Lisp was one of the first languages to be adopted for this task, with Pop2 appearing about the same time (currently having a revival in the guise of Poplog) and Prolog following a few years later.

Knowledge and networks

The most popular of all knowledge representations has been the 'semantic net'. The basic idea is simple. Concepts (which roughly correspond to nouns in everyday use) are the 'nodes' in the network, and the links between nodes represent relationships between concepts (we can think of these as verbs). One of the most important types of link is called the IS-A link and is used to categorise concepts thus:

```
          IS-A
parrot ------------> bird
          IS-A
trout  ------------> fish
```

We can add other IS-A links to create a hierarchy, like this:

```
            animal
             ↗ ↖
     IS-A   /   \  IS-A
           /     \
        bird     fish
         ↗         ↖
  IS-A  /           \  IS-A
       /             \
   parrot           trout
```

and we can add other kinds of links to give properties to our concepts, as in Fig 1.

Fig 1

```
                          animal ----> eats
                           ↗ ↖
                  IS-A    /   \  IS-A
                         /     \
  has wings <---bird            fish ----> can swim
                 ↗                ↖
          IS-A  /                  \  IS-A
               /                    \
can talk <--- parrot               trout ----> is edible
```

Such a network would translate into some kind of data structure in a programming language. The exact structure is not important — it could be Lisp lists or Prolog clauses; in Basic it might be arrays of strings or records in a file. For the network to have any meaningful interpretation (semantics) we must have a way of interpreting the different types of link in terms of operations in the programming language. To see how this works, think of what it means for a trout to be a fish. We would expect, for example, that trout would have any properties that fish (as a group) have. That is, trout should *inherit* the properties of fish. Yet just saying a trout IS-A fish does not accomplish this. We need a piece of code which takes the properties of fish and attaches them to trout. More generally, the routine should attach to any particular concept all the properties of all the concepts above it. Trout should get the 'can swim' property from fish and the 'eats' property from animal (but nothing from bird or parrot).

```
10 REM ** some data for a semantic net in BASIC **
20 NUMOBJS=5:REM        the number of objects known about
30 REM  first the object names ...
40 OBJ$(1)="animal"
50 OBJ$(2)="bird"
60 OBJ$(3)="fish"
70 OBJ$(4)="parrot"
80 OBJ$(5)="trout"
90 REM  next the properties ...
100 PROP$(1)="eats"
110 PROP$(2)="has wings"
120 PROP$(3)="can swim"
130 PROP$(4)="can talk"
140 PROP$(5)="is edible"
150 REM finally, the IS-A tree ...
160 ISA$(1)="topnode":REM       the "root" of the tree
170 ISA$(2)="animal"
180 ISA$(3)="animal"
190 ISA$(4)="bird"
200 ISA$(5)="fish"
```

Fig 2 A representation in Basic of a semantic net

Basic intelligence

In Fig 2, I have represented this network as a set of arrays in Basic. There is an array (OBJECT$(i)) to hold the names of our concepts, and two other arrays (PROPERTIES$(i) and ISA$(i)) to hold a property name for each object and to point to the name of the type of object that it is. (Note that 'animal' IS-A 'topnode'; this is for the benefit of programs using the network as we will see.)

In Fig 3 there are some simple routines, written in BBC Basic, to operate on the network. The function FNOBJNUM(O$) returns the array index of the object called O$; the procedure PROCPRINTPROPS(O) prints the property associated with the object indexed by O and then works its way up the IS-A hierarchy, recursively, printing the properties of all the objects it finds.

The thing to note about these procedures is that they do very simple things —they find an index or search a tree. It is from such simple routines for graph searching and list processing that AI programs are built. No-one would suggest that a tree searching routine is 'intelligent'. Rather, it's what such routines can do when they operate on a suitable knowledge representation that makes us think they are clever in some way.

This is not the most efficient implementation of a semantic network: it was mainly designed to be easy to understand. It is also rather limited in that each object can only have one property, inheritance can only be from a single parent node, and so on, yet it is a surprisingly powerful representation. You might like to consider ways of extending it, enabling it to 'learn' new concepts, say, or of using it in teaching programs or diagnostic systems.

Semantic nets first appeared in language understanding programs in the late Sixties. Since then their widespread use has led to increasing sophistication and considerable effort to tie down their formal properties. In particular, ideas such as strictly limiting the *types* of links and nodes allowed and of partitioning off sections of a net to represent notions such as context or scope, have been incorporated in the past 10 years.

'SHRDLU appeared extremely clever even though its reasoning ability was rather limited. . . ask it about any other subject and it would fail dismally.'

Expectations

The demands of writing programs to understand natural language have been a constant spur to the development of knowledge representations. In the 1970s, Marvin Minsky suggested a scheme based on 'frames'. A frame is meant to model the idea that when we think of a concept, we expect that certain other pieces of knowlege will be available. If we were about to walk into a room and someone told us it was a bedroom, we would expect to find a bed, walls, a window, wardrobe, and so on, inside. That is, we have a frame for a bedroom which has a number of 'slots' in it, each slot being for a particular piece of information we are expecting. When we open the door and see the room, these slots are filled by the particular bed, window, and so on, that we see.

Frames have the useful property of allowing defaults. If some of our information is missing (for example, we did not notice what kind of wardrobe was in the room), the appropriate slot can be temporarily filled by a default value. Modern frame-based systems also allow procedures to be attached to slots so that different kinds of information will be expected according to what the procedure does.

In other attempts to bring expectations into the representation, ideas such as 'scripts' and 'plans' were introduced. These are meant to describe situations, such as dining in a restaurant, where the participants and the events are so stereotyped that they can be expected to appear every time these situations are encountered. Thus, in a restaurant, you would expect diners, waiters, tables, chairs and menus. The waiter would serve the diners, the diners would have conversations across the tables, eat food, drink wine, and so on. What is more, the events in a script will unfold in a well-defined sequence.

Scripts have been represented as a

```
1000 REM ** a routine to print the properties   **
1010 REM ** of an object                         **
1020 PRINT
1030 PRINT"Enter the name of an object for which"
1040 PRINT"you would like to see the properties ";
1050 INPUT ONAME$
1060 OBJID=FNOBJNUM(ONAME$):REM find array index of
                               named object
1070 PRINT
1080 IF OBJID=0
       THEN PRINT"That object is not known":
          GOTO 1110
1090 PRINT"The properties of ";ONAME$;" are "
1100 PROCPRINTPROPS(OBJID):REM  print the properties of
                               the indexed object and
                               its ancestors
1110 END
2000 REM ** to find the array index of an object **
2010 DEF FNOBJID(OB$)
2020 FOUND=0
2030 FOR INDEX=1 TO NUMOBJS
2040    IF OB$=OBJ$(INDEX)
             THEN FOUND=INDEX:INDEX=N
2050 NEXT INDEX
2060 =FOUND:REM          the function returns its result
                         in the variable FOUND
3000 REM ** to print the properties of an object **
3010 DEF PROCPRINTPROPS(OB)
3020 PRINT TAB(15) PROP$(OB)
3030 IF ISA$(OB)<>"topnode"
       THEN OB=FNOBJNUM(ISA$(OB)):
          PROCPRINTPROPS(OB)
3040 ENDPROC
```

Fig 3 Some routines in BBC Basic to operate on the network in Fig 1 special kind of semantic net called 'conceptual dependency' nets. The important thing about these is that they are based on the idea that there are only a very few 'primitives' in the language of knowledge with which all knowledge can be described. The primitive INGEST, for example, is the basis of all processes where something passes from outside to inside of something else (like eating, or putting a tape in a cassette player). In many ways this is similar to the idea of case structures where verbs have a number of *cases*

'Once it is known that AI programs use simple searching algorithms to operate on knowledge representations, the mystique disappears and people tend to see artificial intelligence as something of a con.'

(rather like slots in frames) which must be filled with the appropriate nouns. A verb like 'hit' might have cases for an actor (the thing that does the hitting), an object (the thing that gets hit) and an instrument (which is used for the hitting). If the actor, object and instrument cases for hit are filled with 'man', 'nail' and 'hammer' respectively, we get an idea like 'the man hit the nail with a hammer'.

Logic and expert systems

Recently there have been several attempts to show that the various representation techniques are formally correct and complete. It is important to show this because we need to be able to trust the inferences that programs make from such structures as semantic nets. Unfortunately, this is proving very difficult and some researchers argue that, to be safe, we should stick to systems which we know are formally sound, such as predicate logic. This comes at a time when logic programming (using a language based on predicate logic, such as Prolog) is becoming very popular.

In logic programming, it is simple to encode knowledge as either simple facts as in

happy(John)

or

loves(Mary,John)

which we can take to mean 'John is happy' and 'Mary loves John', or as 'if—then' rules which relate facts together, such as

happy(John):- loves(Mary,John)

where ':-' can be read as 'if', giving us 'John is happy if Mary loves John'.

Facts and rules in this form have a natural appeal, and form the basis of another knowledge representation technique called a 'production system'. A production is a rule which says that if a certain condition is true, then perform a particular action (which might be to make some consequence true). Expert systems such as Mycin and Prospector use this type of representation and it has proved to be a very powerful one in that it can capture the knowledge of a human expert (in a small domain) very concisely, and in a way that allows rapid computation of inferences. The rules naturally form tree structures (since they each call upon rules lower down for justification of their condition part) and simple tree searching routines can then follow the paths of inferences through the rules. These routines are often referred to as the system's 'inference engine' for this reason.

Languages

These days, the AI programmer has a number of languages at his disposal specially designed for representing knowledge. Some of the more popular are KRL, KL-ONE (pronounced 'clone'), KIPS and SRL. Each is based on a particular representation technique (semantic nets or frames) and allows the programmer to set up a knowledge base more easily then a more general-purpose language would.

The various expert system 'shells' (expert systems with no rules in them, just the inference engine and a rule editor) such as EMYCIN and OPS-5 must also be considered as knowledge representation languages. Shells like these are now available for the larger micros in the form of APES (a Prolog-based expert system shell from Logic Based Systems Ltd) and a Mycin-like shell called MicroExpert (which has been available for the Apple and other micros for some years now). Expert-Ease (a package from the ill-fated Export Systems International) is also in some ways like an expert system shell and runs on the IBM PC and lookalikes.

Conclusion

Once it is known that AI programs use simple searching algorithms to operate on knowledge representations, the mystique disappears and people tend to see artificial intelligence as some-

'No-one would suggest that a tree searching routine is 'intelligent'. It's what such routines can do when they operate on a suitable knowledge representation that makes us think they are . . .'

thing of a con. A recent attack on expert systems likened them to a man in a room taking in symbols he did not understand, manipulating them according to rules he had been told by others, and passing out answers which made no sense to him. The criticism is fair but it misses the point that, whether the man (or the computer) understands what he is doing or not, the *system as a whole* is behaving intelligently.

What is more, the separation of knowledge representation and inference mechanism is thought, by psychologists, to be part of the basic organisation of the human mind. END

Datagramming

Geoff Wood demonstrates how to enhance VisiCalc by datagramming, or print-to-file programming, which increases its power and speed.

Few users of spreadsheets are aware of a simple technique that enhances the power of VisiCalc and some (but not all) other spreadsheets.

The technique is known as datagramming, or print-to-file programming. It is not mentioned in the VisiCalc manual but is a very powerful and useful aid. In effect, it is a way of automatically typing labels and values into a worksheet to obtain results that would take much longer by hand.

This article is written in the context of VisiCalc or FlashCalc on Apple micros, but it can be readily converted for use with other micros such as the IBM PC, and other spreadsheets.

In order to understand datagramming, you should know how VisiCalc saves and loads worksheets. A worksheet file on a disk is simply a special type of text file similar in structure to the text files used by many word processing programs such as Apple Writer. When you instruct VisiCalc to load a file, the program reads the test file and carries out the programmed instructions.

A simple example is shown in Figs 1 and 2.

The formula in D3 is +B3+C3, replicated into D4 on a relative basis. The formula in B6 is +B3+B4, replicated across on a relative basis. Fig 2 shows this worksheet printed out with the /SS,S1 command.

There is one line for each cell (except the blank cells) starting with the lowest right cell and working to the left and upwards. (The reason for starting with the lowest right cell rather than the top left is to speed up the loading. If VisiCalc started by loading in the top left cell, it would have to re-establish the overall size of the worksheet for each new column or row.)

The first entry reads >D6:+D3+D4. This is exactly what you would type on the keyboard to enter the formula +D3+D4 in cell D6. The > sign means 'Go to' and the D6 after the > sign gives the coordinates of the cell to go to. The colon has the same effect as pressing the RETURN key. The formula +D3+D4 is then typed into the cell as a value. Similar formulae are entered in C6 and B6.

```
>D6:+D3+D4
>C6:+C3+C4
>B6:+B3+B4
>A6:"Totals
>D4:+B4-C4
>C4:1600
>B4:2000
>A4:"1984
>D3:+B3-C3
>C3:800
>B3:1000
>A3:"1983
>D1:/FR"Profit
>C1:/FR"Costs
>B1:/FR"Sales
>A1:"Summary
/W1
/GOC
/GRA
/GC9
/X!/X>A1:>A1:
```

Fig 2 VisiCalc worksheet as a text file

The next entry reads >A6:"Totals. This means 'Go to cell A6 and enter the label "Totals.' The inverted commas before the word Totals mean that VisiCalc treats the entry as a label rather than a formula. (Note that the year entries in cells A3 and A4 are labels, not values.)

The next few entries are self-explanatory until you arrive at >D1:/FR"Profit. The /FR means 'Format the entry on the right.' Four of the last five rows are simple: they mean 'Set the Window Command at 1' Set the Global Order of Recalculation to Columns (rather than Rows) 'Set the Gobal Recalculation to Automatic (rather than Manual)', and 'Set the Column Width to nine characters'.

The last entry is not so clear. It uses the /X command which is not mentioned in the VisiCalc manual. /X! means 'Change the direction indicator to vertical'. /X>A1 means 'Move the worksheet so that cell A1 is in the top left-hand corner', and >A1 means 'Move the cursor to cell A1'.

Column>	A	B	C	D
Row 1	Summary	Sales	Costs	Profit
2				
3	1983	1000	800	200
4	1984	2000	1600	400
5				
6	Totals	3000	2400	600

Fig 1 Summary sheet

(If you have not used the command /X before, try typing it at the keyboard followed by any valid cell coordinates, then press the RETURN key: it moves that cell to the top left-hand corner of the screen. If the command is issued while the cursor is in the second window, it moves that cell to the top left-hand corner of the window.)

The file shown in Fig 2 can be created and saved with Apple Writer (or other word processing programs) or with VisiCalc itself. With Apple Writer, each entry must be on a separate line. With VisiCalc, you must type each entry on a separate row, preferably using only one cell per entry. The easiest way is to use column A and, if necessary, widen the column. (You can use two or more columns if you wish because the entries are saved with the /PF command.) Each entry must be typed as a label and the file must be saved as a Print File. (It is a good idea to also save the file with the /SS command so that you can recall and edit it. Print Files cannot be recalled into VisiCalc.)

If you prefer, you can type your entries in a logical order from the top left cell to the bottom right. VisiCalc will still load such a file but it may take longer than if you start with the bottom right cell. However, if having loaded the worksheet you then save it with the normal VisiCalc /SS command, it will re-load at normal speed.

Once you grasp the idea that VisiCalc commands can be issued in the form of lines of instructions, you can create files to carry out a wide range of tasks. For example, Fig 3 shows a file to insert another row into Fig 1 and to amend the formulae for the totals.

```
>A3:/IR"1982
>B3:500
>C3:400
>D3:+B3-C3
>B7:@SUM(B3...B5)
>C7:@SUM(C3...C5)
>D7:@SUM(D3...D5)
```

Fig 3 File for changing the summary worksheet

The first line moves the cursor to A3 and inserts a row; it then enters 1982 as a label. The next two lines insert values in columns B and C and the following line inserts a formula in column D. The last three lines amend the formulae on row 7 to add all three rows of figures together.

The effect of loading this file in on top of the summary worksheet is shown in Fig 4. Of course, this is a very simple example designed to illustrate the principles of datagramming. You could achieve the same effect faster by loading in Fig 1, then typing the commands shown in Fig 3 one at a time.

Where datagramming comes into its own is for repetitive work which would otherwise involve typing in many commands. It saves time and reduces the chances of error. Once a datagram is correctly set up, it will automatically carry out the commands that would normally be typed in one at a time.

Updating budgets

A more sophisticated example of datagramming is shown in Figs 5 to 8. This involves updating monthly budget figures in such a way as to automatically enter the cumulative figures.

A simple budget statement with three columns for the current month and three columns for the cumulative data is shown in Fig 5. (In practice, the budget statement could have many more rows and columns.) The figures in columns D and G are calculated with simple formulae to show the difference between the budget figures and the actual figures. (Note that where actual sales are lower than budget the difference is shown with a minus sign, but where costs are lower than budget the difference is shown as positive.) The profit figures are calculated with formulae to show the difference between sales and total costs.

This worksheet could be saved and re-loaded next month for updating. But when you enter next month's figures, the cumulative totals will not be automatically updated. The only way to do this manually would be to set the global

```
>D3:/B        >E7:#+B7
>B5:0         >E8:#+B8
>B7:0         >E9:#+B9
>B8:0         >F5:#+C5
>B9:0         >F7:#+C7
>C5:0         >F8:#+C8
>C7:0         >F9:#+C9
>C8:0         /X>A1:
>C9:0         >D3
>E5:#+B5
```

Fig 6 Datagram to update budget statement

recalculation order to manual (/GRM), amend the data in columns B and C, set the cursor in each of the cells in columns E and F (except row 11) and use the /# command to hold the numbers, then type in a + sign and the coordinates of the corresponding cell in column B or C.

The datagram shown in Fig 6 will automatically delete the current month's sales and costs (both budget and actual), and insert formulae in columns E and F to automatically update the cumulative figures when next month's figures are entered.

The first line of the datagram puts the cursor in cell D3 and deletes the date entered there. The next eight lines take the cursor down columns B and C and replace this month's entries with a zero. The next eight lines take the cursor down columns E and F and 'fix' the numbers therein (using the # command) but also enter a formula to add the next month's figures from columns B and C. Fig 7 shows the result of loading this datagram into Fig 5.

The final stage is to enter the label November in cell D3, then enter the budget and actual figures in columns B and C. As you do so, assuming the global recalculation order is not set to manual, the figures in columns D to G and row 11 will be automatically updated. The effect is shown in Fig 8. END

Column >	A	B	C	D
Row 1	Summary	Sales	Costs	Profit
2				
3	1982	500	400	100
4	1983	1000	800	200
5	1984	2000	1600	400
6				
		3500	2800	700
7	Totals			

Fig 4 Summary worksheet after loading the change file

Column>	A	B	C	D	E	E	G
Row 1	Budget Statement						
2							
3		This month:—		October		Cumulative	
4		Budget	Actual	Variance	Budget	Actual	Variance
5	Sales	1000	1100	100	10000	9800	−200
6							
7	Material	500	550	−50	5000	4900	100
8	Wages	200	225	−25	2000	1900	100
9	Overhead	250	250	0	2500	2600	−100
10							
11	Profit	50	75	25	500	400	−100

Fig 5 Budget statement

Column>	A	B	C	D	E	E	G
Row 1	Budget Statement						
2							
3			This month:—			Cumulative	
4		Budget	Actual	Variance	Budget	Actual	Variance
5	Sales	0	0	0	10000	9800	−200
6							
7	Material	0	0	0	5000	4900	100
8	Wages	0	0	0	2000	1900	100
9	Overhead	0	0	0	2500	2600	−100
10							
11	Profit	0	0	0	500	400	−100

The formula in E5 is 10000+B5
The formula in E7 is 5000+B7
The formula in E8 is 2000+B8
The formula in E9 is 2500+B9

The formula in F5 is 9800+C5
The formula in F7 is 4900+C7
The formula in F8 is 1900+C8
The formula in F9 is 2600+C9

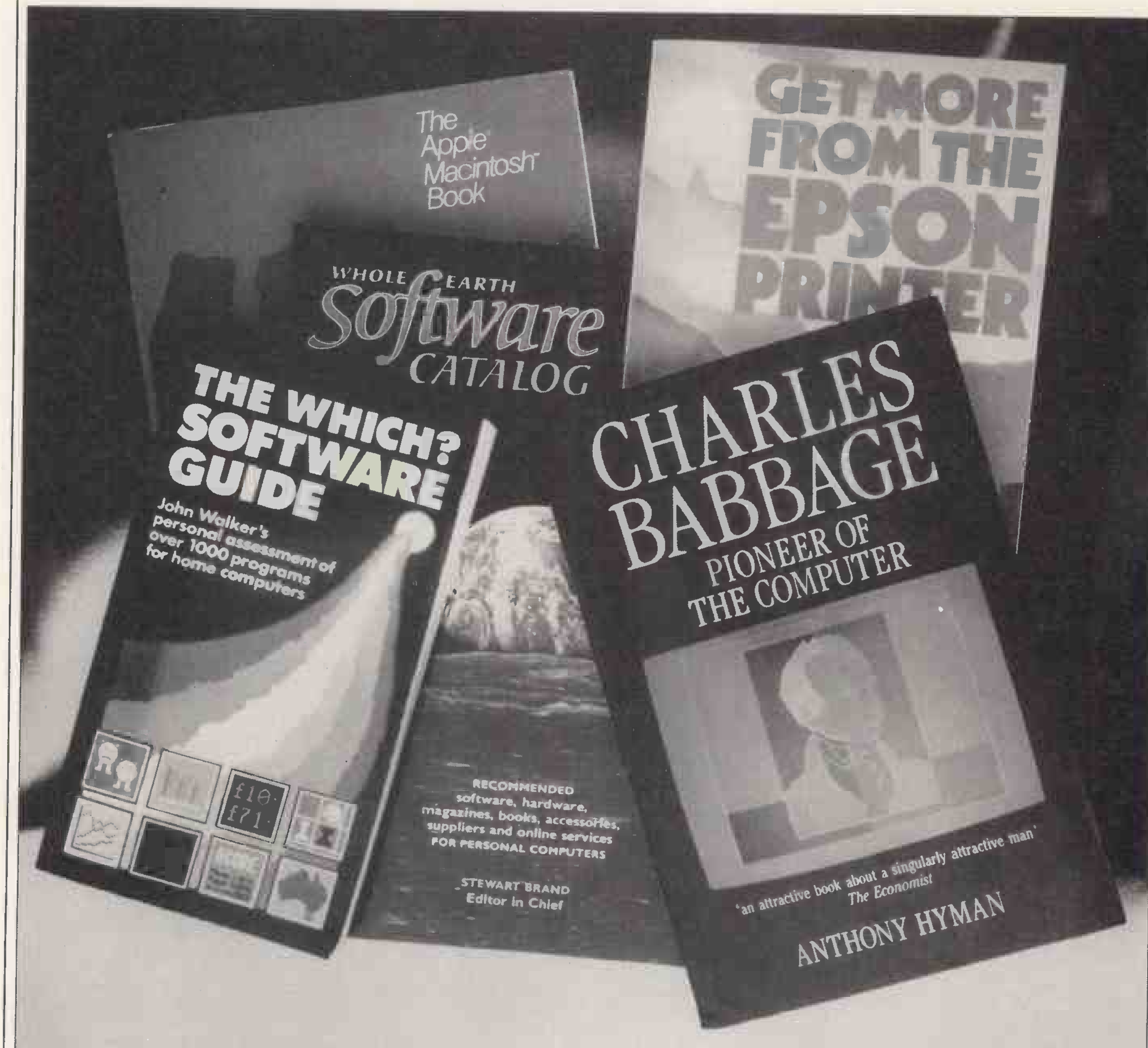
Fig 7 Budget statement after loading datagram

Column>	A	B	C	D	E	E	G
Row 1	Budget Statement						
2							
3		This month:—		November		Cumulative	
4		Budget	Actual	Variance	Budget	Actual	Variance
5	Sales	1100	1200	100	11100	11000	−100
6							
7	Material	550	600	−50	5550	5500	50
8	Wages	220	225	−5	2220	2125	95
9	Overhead	275	260	15	2775	2860	−85
10							
11	Profit	55	115	60	555	515	−40

Fig 8 Budget statement after updating

BIBLIOFILE

A book to read with your wholefood muesli, a Macintosh primer, and a look back to the Victorian era are among this month's book selection. David Taylor tucks into the Mac and samples the rest.



Mac with relish

Title: Mac — The Apple Macintosh Book
Author: Cary Lu
Publisher: Microsoft Press/Penguin
Price: £15.95

Cary Lu, who used to make films for *Sesame Street*, is now micro editor for America's *High Technology* magazine, and has been hired by Microsoft's new publishing outfit to write the definitive Macintosh primer. He's done a good job.

Apple's extraordinary Mac is, without question, a revolutionary machine: tough competition indeed for the previously all-conquering IBM PC (and clones) in the desk-top market.

Ironically, it's so simple to get the hang of a Mac that you scarcely need much in the way of written instructions.

One of the Mac's greatest strengths is, after all, inspired use of icons — pictures and symbols at which you point via a mouse to get action, thus by-passing keyboard input and the jargon-littered, tortured syntax that often goes with it.

Personally I find the Mac's tick-tock keyboard touch its single most irritating failing, yet I'm bound to add that so much else about Mac's idiosyncratic interface with users is so breathtakingly good that you can soon learn to live with it. Mac is quick, neat, powerful and almost comically user-friendly. Now that the really smart software is coming through thick and fast it gets harder and harder to tear yourself away.

Unluckily for Lu you might think Mac's own documentation is, moreover, a model of its kind. Nevertheless, there's a fascination in comparing notes as you work through this book, hands on, and there's plenty of high-level and technical information besides basic instruction. There are thought-provoking asides on Mac versus IBM PC for example, using a Mac in a car (cellular telephones are here) or more long-term stargazing toward intelligent systems.

The whole is commendably thorough, seldom patronising, nicely presented and entertainingly readable. A good book for a terrific computer

Games blow-out

Title: The Which? Software Guide
Author: John Walker
Publisher: Consumer's Association with Hodder & Stoughton
Price: £7.95

This is a fat compilation of mostly fun-and-games packages for (chiefly) the BBC micro, Commodore 64 and Sinclair Spectrum.

In the light of several recent analyses which suggest that home-computing tastes are shifting away from zap-kapow larks towards more serious-minded, semi-professional applications, there's a certain gloom sets in as you flounder in among sober-sided assessments of Cuthbert Goes Walkabout, Splat!, Revenge of the Mutant Camels and Jet Set Willy (both identified as five-star best buys) or Metagalactic Llamas Battle at the Edge of Time.

The author kicks off on a moody note, quoting a disillusioned definition of a home computer as 'a wonderful solution looking for a problem'. The implication he intends, of course, is that this book is packed with 1001 irresistible reasons for rushing out to the shops right now.

Who could resist the blandishments of Alien Dropout, 'featuring killer moths', or Noc-a-Bloc, in which 'the snobees have transmogrified into spods'? Which conscientious teachers could deny their flock the learning experience of Amazing Ollie ('four maze games to help with counting featuring an animated octopus called Ollie')? What better for a rainy day than Shirley Conran's Magic Garden, except that 'as with all limited databases, it can take five or six minutes to load before it can be used, in which time the information could have been discovered from a book'? Um.

This book tries hard, mustering small-fry business, graphics-for-the-sake-of-it and computing-as-a-hobby software alongside the arcade flim-flam and numberless adventures. Until quite recently, it would have seemed spot-on for the legions of free-spending happy hackers, but lately the wind blows chillier. Watch and see what *kind* of software now gets the big business for machines like the QL.

Killer moths and transmogrified spods may soon, I suspect, be in overdue retreat.

Holy Smoke

Title: The Whole Earth Software Catalog
Editor-in-Chief: Stewart Brand
Publisher: Corgi
Price: £8.95

A telling comparison this: a self-conscious summary of all-American trends in software purchase and a curious mixture of useful, well-researched analysis and gee-whiz, soft-in-the-head philosophising.

Editor-in-chief Brand sets the tone with tablets of stone like: 'Software is a new enough kind of thing in the world that humans are still figuring out how to deal with it. Though it can be bought and sold, you can't see, hear, touch, taste, smell, eat or burn it . . . Personal computers have an inherent outlaw element. This makes them enjoyable and creative and morally interesting. More on that in a moment.'

At which point I made an excuse and left this section headlined Shopping, rushing on to explore the summaries and *précis* reviews, sectioned off into Analyzing, Organizing, Managing, Writing, Telecommunicating and so on, with Playing much more of an afterthought.

The nutshelled recommendations of the *Whole Earth* team are for handy quick reference rather than really useful analysis. Many are irritatingly hip. Framework is 'fast 'n' easy'. Symphony is introduced with: 'In all of baseball history, only Johnny Vander Meer threw two no-hitters in a row'. XYWrite II 'babies you about as much as Perry White babies Clark Kent' and is given 'some sort of a bottom-line endorsement.'

If you can take this style of writing, *Whole Earth* can provide a whole bunch of facts as well as opinions, but bear in mind that quite a bit applies only to the US market.

Pretty pictures

Title: Get More From The Epson Printer
Author: Susan Curran
Publisher: Collins
Price: £7.95

This delightfully daft book presupposes that you're never likely to be satisfied doing anything so mundane as just printing out humdrum letters and numbers with your Epson. You're going to want to have hours of fun making it do special characters, print sideways, handle subtly-shaded screen dumps, fiddle about with typefaces. Of course you are.

It's jolly difficult to do, as Susan Curran is the first to acknowledge, but provided you can program and have an Epson then days can pass happily by as this book teaches you to stitch together Basic routines that will result in, say, a little picture of a man on a motorbike, or an obviously amateurish yet nevertheless home-made letterhead, perhaps featuring either long and thin letters or short and fat ones.

An alternative, of course, is to buy software that looks after your printer for you. Susan Curran, once an insurance underwriter by the way, presumably wouldn't call that much fun.

Computing's age of steam

Title: Charles Babbage — Pioneer of the Computer
Author: Anthony Hyman
Publisher: Oxford University Press
Price: £4.95

This is a riveting book: the extraordinary story of a Victorian mathematician and polymath, inventor of what Anthony Hyman rightly describes as 'one of the great intellectual achievements in the history of mankind' — Babbage's Analytical Engines: the mechanical precursors of today's computer science.

It was in the early 1830s while Babbage (together with his great friend and fellow brainbox, the astronomer John Herschel) worked on computations for the Astronomical Society that he was struck by the number of errors in the mathematical tables in universal use for logarithms, trigonometric or other mathematical functions. 'Finding many discordancies, I expressed to my friend the wish that we could calculate by steam, to which he assented as to a thing within the bounds of possibility.'

Babbage spent most of the rest of his life struggling, single-handed, to realise his dream. He produced designs far in advance of the capacity of contemporary technology and, as a result, never entirely succeeded. Nevertheless his most sophisticated (uncompleted) engine, conceived of a central processing unit which would take data from a store and operate upon it from a program recorded on punched cards.

Anthony Hyman's sympathetic biography fleshes out much else in Babbage's busy life, his reputation as a philosopher and reformer, and the social whirl of his salon where his circle included Wellington, Darwin, and Faraday. Although some of Babbage's pioneering machinery remains on show in the Science Museum, the fame he undoubtedly deserves has until quite recently been elusive. This estimable book should do much to put that right. 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.

SPEEDING UP THE SPECTRUM

The following routines will save processing time on either Spectrum: machine code routines to change the value of PROG in order to speed up GOTO and hence GO SUB, FOR NEXT loops, and so on; and as an example of this, and also of using string arrays instead of string variables, a routine for INPUTing data. It is rather lengthy but more user-friendly than any I have met in a professional Basic program or even most machine code programs.

1) GOTO lines late in a Spectrum Basic program are slow, and make some FOR NEXT and other loops a lengthy process. If you temporarily change the system variable PROG to point to the middle of your program, you can hide the first part of the program and dramatically speed up some jumps.

I use two machine code routines, 'prognext' and 'progback' (Fig 1). Prognext sets PROG to the address in NXTLIN, which is the address of the next program line. Progback resets PROG to its normal value, which it calculates from STREAMS and CHANS. If you have set up a channel of your own, you will get a STATEMENT LOST error report unless you have opened a stream to point to it. Both routines return zero and are relocatable anywhere above RAMTOP. They are normally used in pairs, and there must be no references to earlier lines while PROG is changed.

Fig 2 shows a typical use, setting up data for a new run. At the end of a very long program, the time for a similar loop was cut from 288 frames to 55.

Fig 3 shows a use in which there is more likely to be an error while PROG is changed, and here a safety device is included in case anyone tries to RUN with PROG pointing to line 2015.

2) When a string variable is assigned a new value, it is always moved to the end of the variable list which is why string manipulation can be slow.

It is often worth avoiding the use of a string variable either with, for example, LET k=CODE INKEY $, or by using a string array. Fig 3 inputs a string of up to 30 characters (with CAPS LOCK set) using the main screen. It uses LAST K (23560) to take advantage of the auto repeat, and is much faster than simpler input routines that use string variables.

Mrs Rosemary Oakeshott

```
3000 LET prognext = USR "a"
3010 LET progback = prognext + 10
3030 RESTORE 3050
3040 FOR i = prognext TO prognext + 44: READ a: POKE i,a: NEXT i
3050 DATA 42,85,92,34,83,92,1,0,0,201,33,16,92,175,6,19,190,48,1,
          126,35,35
3060 DATA 16,248,198,4,79,42,79,92,9,126,254,128,32,6,35,126,254,
          40,56,217,195,236,27
```

Fig 1 Prognext and progback

```
9900 REM set up array from data in line 9040 onwards
9920 RESTORE USR prognext: REM computer now thinks prog starts at 9925
9925 DIM a(100)
9930 FOR i = 1 TO 100: READ a(i): NEXT i
9940 DATA
```

Fig 2

Fig 3

```
10 REM Declare variables to get them high on list
20 DIM a$(31): LET key = 0: LET len = 0: LET curs = 0
30 REM
```

```
1000 REM
2000 REM input i$ with up to 30 chars
2002 REM enter at 2010 to edit i$
2005 LET i$ = ""
2010 RANDOMISE USR prognext: GO TO 2020: REM prog points to line 2015
2015 RAMDOMISE USR (USR "a"+10): RANDOMISE USR 7148: REM it is an error
     if you get here. Reset PROG & report STATEMENT LOST
2020 LET a$ = i$: LET len = LEN i$: LET curs = len: PRINT£0;: REM
     PRINT£0 clears bit 5 of flags
2025 REM
2030 PRINT AT 0,0; ">";a$(TO curs);"*";a$(curs+1 TO len+1)
2040 IF PEEK 23611,<224 THEN GOTO 2040
2050 POKE 23611,PEEK 23611-32: LET key = PEEK 23560: BEEP .004,40
2055 REM
2060 IF key >= 32 AND key <= 90 THEN IF len < 30 THEN LET a$(curs+1 TO)
     = CHR$ key + a$(curs+1 TO): LET curs = curs+1: LET len = len+1:
     GOTO 2030
2070 IF key = 12 THEN IF curs THEN LET a$(curs TO) = a$(curs+1 TO):
     LET curs = curs-1: LET |len = len-1: GOTO 2030
2080 LET curs=curs-(key=8 AND curs)+(key=9 AND curs<len)
2090 IF key<>13 THEN GOTO 2030
2095 REM
2100 PRINT AT 0,1; a$(TO len+1)
2110 LET i$=a$(TO len)
```

ALPHABETICAL SORT

This routine sorts a list by initials (but can be expanded with a subroutine or multi-dimensioned arrays). The sort is arranged 510-530 and the printed sort at 550-590. This listing is from a Sharp but needs little change for any Basic.

Sort time for 400 entries is 24 seconds; on the Sanyo MBC550 it is around five seconds. The sort program takes 345 bytes plus 26 for the array, and requires four bytes per entry (this can be three if the string$ does not have a space before the number). Resort varies little. If it was frequent, lines 515 and 520 could be moved to 435, thereby creating sort on entry with no noticeable delay and instant print from 550.

The technique is of interest rather than the program, as it can be used to good effect in many areas. Data can be merged from several sources and sorted on entry.

H W Parker

```
10 REM ALHABETICAL SORT ROUTINE - H.W.PARKER KNIGHTON  POWYS
100 DIM S$(200):S1=1
110 DIM S2$(25)
200 REM CLS:PRINT ".     MENU":PRINT "      -------"
210 PRINT "1.  ADD TO LIST":PRINT:PRINT"2.  LIST AS ENTERED"
220 PRINT:PRINT "3.  LIST SORTED"
230 PRINT:INPUT X:ON X GOTO 300,400,500,200
300 REM CLS:PRINT"."
310 PRINT "ENTER  .  TO END":PRINT
320 FOR S1=S1 TO 200:PRINT S1+1;" ";:INPUT ":";S$(S1)
330 IF S$(S1)="." THEN 200
340 NEXT S1
400 REM CLS ?"."
410 A=1
420 FOR S=1 TO S1:PRINT S$(S); A=A+1
430 IF A=20 THEN A=1:INPUT "C = CONTINUE : E = END:";A$:IF A$="E" THEN 450
440 NEXT S
450 INPUT "E = END : R = REPEAT ";A$:IF A$="R" THEN 400
460 GOTO 200
500 REM CLS:PRINT".":FOR I=0 TO 25:S2$(I) ="": NEXT I
510 FOR S = 1 TO S1-1
515 Z = ASC(S$(S))-65
520 Y=LEN(STR$(S)):S2$(Z)=S2$(Z)+SPC(4-Y)+STR$(S)
530 NEXT S
540 INPUT "SORTED L = LIST :";L$
550 A=1:B=0
560 FOR S= 1 TO LEN(S2$(B))+4 STEP 4:W=VAL(MID$(S2$(B),S,4)):IF W=0 THEN 600
570 PRINT S$(W):A=A+1
580 IF A=24 THEN INPUT "C = CONT:";A$ :A=1
590 NEXT S
600 B=B+1:IF B<26 THEN 560
610 INPUT "END OF LIST ";A$:GOTO 200
```

COMMODORE 64 JOYSTICK READER

This routine is a joystick reader. There are many methods of reading the joystick from Basic, but they all involve slow bit manipulation and a whole series of commands to return a simple value. This program is entirely in machine code, so it operates almost instant-

aneously and returns a three-character string. The string is put into any specified variable; it always contains three characters, and represents the condition of either one of the joysticks. The command takes the form:
10 SYS 49152,1,A$

In this case, the variable A$ would be left containing a string, representing the condition of joystick number one (on port one). It is possible to use any name for the string variable, and either one or two for the port number. The data returned is always one of the following:

—:	No direction
U–:	Up only
D–:	Down only
L–:	Left only
R–:	Right only
UL:	Up & left
UR:	Up & right
DL:	Down & left
DR:	Down & right

'F' indicates that the fire button is being pressed. The string 'ULF' would mean that the joystick was being pushed up and to the left, with the fire button being pressed.

The demonstration program shows it in use. If you miss out one of the commas or don't use the exact syntax required, the program will halt with a syntax error.

Steve Mehen

```
10 REM ******************************
20 REM *                            *
30 REM *  STEVE'S JOYSTICK READER   *
40 REM *  ----------------------    *
50 REM *    COPYRIGHT JAN., '85     *
60 REM *    -----------------       *
70 REM ******************************
80 :
85 AD=49152:CS=0
90 FOR L=0 TO 21:FOR E=1 TO 7
100 READ DA:CS=CS+DA:POKE AD,DA
105 LS=LS+DA:AD=AD+1:NEXT
110 READ C:CS=CS+C:IF LS<>C THEN 200
120 LS=0:NEXT:IF CS<>30362 THEN 300
130 PRINT:PRINT"ALL DATA COMPLETE."
140 END
150 :
200 PRINT:PRINT"DATA ERROR IN LINE";
210 PRINT 500+L*5:STOP
220 :
300 PRINT:PRINT"THERE ARE AT LEAST TWO"
310 PRINT"ERRORS IN THE DATA, POSSIBLY"
320 PRINT"INCLUDING THE LINE CHECKSUM."
330 STOP
499 :
500 DATA 32,253,174,201,49,240,9,958
505 DATA 201,50,240,5,162,11,108,777
510 DATA 0,3,233,49,73,1,133,492
515 DATA 10,32,72,192,32,82,192,612
520 DATA 32,115,0,32,253,174,32,638
525 DATA 139,176,133,73,132,74,165,892
530 DATA 122,72,165,123,72,169,67,790
535 DATA 133,122,169,192,133,123,32,904
540 DATA 158,173,104,133,123,104,133,928
545 DATA 122,76,44,170,34,46,46,538
550 DATA 46,34,166,10,189,0,220,665
555 DATA 41,31,133,10,96,165,10,486
560 DATA 72,41,15,133,10,169,15,455
565 DATA 229,10,10,170,189,122,192,922
570 DATA 141,68,192,189,123,192,141,1046
575 DATA 69,192,104,41,16,208,6,636
580 DATA 169,70,141,70,192,96,169,907
585 DATA 45,208,248,45,45,85,45,721
590 DATA 68,45,45,45,76,45,85,409
595 DATA 76,68,76,45,45,82,45,437
600 DATA 85,82,68,82,40,67,41,465
605 DATA 83,46,77,69,72,69,87,503

READY.
```

```
10 REM JOYSTICK READER DEMONSTRATION
20 REM READER (C) STEVE MEHEW, 1985
30 :
40 POKE 53281,0:POKE 53280,0:PRINTCHR$(147)
50 PRINT:PRINT"PLUG JOYSTICK INTO PORT 2"
55 PRINT:PRINT
60 SYS 49152,2,A$
70 PRINTSPC(4);A$
80 PRINTCHR$(145);:GOTO 60

READY.
```

AMSTRAD TEXT PROCESSOR

The Amstrad CPC464 has a powerful resident program editor. Here is a short program which uses its facilities to provide a simple text processor.

Each line of input text must be preceded by an apostrophe, and the last line of text must be finished by pressing the ENTER key. This line must not be subsequently edited.

Hugh Pitcher

```
10 INPUT"Enter c/d/e/p/s to create, display, edit, print or save the text: ",a$
15 IF a$="c" THEN GOSUB 45 :AUTO 100
20 IF a$="d" THEN stream=0 :GOSUB 50 :GOTO 55
25 IF a$="e" THEN GOSUB 45 :LIST 100-
30 IF a$="p" THEN stream=8 :GOTO 55
35 IF a$="s" THEN INPUT"Enter filename: ",f$ :SAVE f$ :GOTO 80
40 GOTO 10
45 KEY 139,CHR$(206)+CHR$(13)
50 MODE 2 :INK 0,25 :INK 1,0 :RETURN
55 i=900
60 WHILE PEEK(i)<>192 :i=i+1 :WEND
65 i=i+1 :n=PEEK(i)
70 WHILE 31<n AND n<164 :PRINT#stream,CHR$(n); :i=i+1 :n=PEEK(i) :WEND
75 PRINT#stream :IF n<>206 THEN 60 ELSE END
80 KEY 139,CHR$(13) :MODE 1 :INK 0,1 :INK 1,24 :END
```

BBC OS CALLS

These hints and tips have many uses, both from Basic and machine code, and can also be used as a method of program protection.

OSBYTE calls on the BBC:
*FX 200,x where x is
0-normal break & escape
1-escape disenabled
2-break clears memory
3-esc disenabled & break clears memory
*FX 201,1 disenables keyboard.
*FX 201,0 re-enables keyboard.
*FX 138,0,x inserts ASCII value x into character buffer. x=128 gives function key 0 so that:

10 *KEY 0 *."MCHAIN"
20 *FX 138,0,128
30 END

will catalogue the disk and type chain ready for another program.
*FX 211,channel number — this redefines the channel number for the BELL character (& COPY KEY) :default=3.
*FX 212,amplitude or env. number
— for env:- (ENV-1)*8 AND 255
— for sound:- (VOL-1)*8 AND 255
For example, *FX 212,216 gives softer bell (VOL=−4) :default=144
*FX 213,freq. Bell frequency: default=101.
*FX 214,duration. Bell duration: default=7.
*FX 219,ASCII Define TAB key: default=9.
*FX 220,ASCII Define ESC key: default=32.
*FX 247,76
*FX 248,lo
*FX 249,hi

These redefine the BREAK key's vector, and can be used to jump to the user's own routine in the computer.
*FX 255,8-15 mode number+8 on break.

Memory locations:
?&355 current mode number.
?& 350,?&351 — start of screen memory as seen by 6845 chip. These vary as the screen is scrolled.
¯!&3C2 gives the execution address of a tape program.
¯!&3BE gives the load address of a tape program.

Finally, $&3B2 gives the last used file name, again only on tape.

M F Warriner

ATARI ASSEMBLER

The Atari assembler-editor lacks an important feature — the ability to direct output to the printer. This feature would be very useful if, for example, you wanted to use the built-in disassembler to disassemble a large block of memory. It would be nice if you could dump the whole disassembly listing to your printer, to be perused at your leisure. Or if you were debugging your program using the TRACE command, to have a printed copy of the trace listing.

Fortunately there is a way of tricking the system to divert the output meant for the screen to your printer instead. While in debug mode type:
C346<A6,EE

This substitutes the address of the putbyte subroutine of the printer handler for the putbyte subroutine of the display handler. Whenever the assembler-editor tries to print a character on the screen, it will appear on the printer instead.

To redivert output to the screen, type in the following in debug mode:
C346<A3,F6

This puts the address of the putbyte subroutine of the display handler back into its proper place.

Hans Hsu

END

Alternative systems

CBBSs explained and new UK bulletin boards introduced, courtesy of Peter Tootill

CBBS systems have the problem that there is a certain amount of variation between systems, albeit not as much as with TBBS — the main CBBS function menu (Fig 1) is more or less standard. What does vary is that not all systems implement every possible feature. For example, the B command on the standard CBBS menu alters baud rate, and many systems don't have this facility. Fig 2 lists the commands in full. Only one of these commands leads to a sub-menu, and that is M for 'modem' (the file transfer section). You will also find a sub-menu in the message entry mode, after you have entered the message (Fig 3).

Some CBBS systems are introducing menus in a similar way to TBBS and Forum-80. These menus are usually parts of the main function menu (Fig 1) broken into groups: for example, 'utilities' could include the C, D, N, P, V, and X functions (see Fig 2 for more details). The message entry and modem sub-menus are much the same as standard CBBS systems, but with the commands in full instead of just initial letters. When you become accustomed to the system, you can choose the expert mode (key 'X') and just the function summaries, as in a standard CBBS system, will be provided. You can escape the sub-menus by hitting CARRIAGE RETURN.

Function: /, A, B, C, D, E, F, G, H, K, M, N, O, P, Q, R, S, T, U, V, W, X, #
Please select option:
(or ? if not known) ???

Fig 1 The main CBBS function menu

(/) Quick logoff
(A)lter baud rate
(B)ulletins
(C)ase change
(D)uplex, echo on/off
(E)nter a message
(F)irst-time user information
(G)oodbye. Leave system
(H)elp
(K)ill/erase messages
(M)odem section
(N)ull selection
(O)ne-line summary of messages
(P)rompt bell on/off
(Q)uick summary of messages
(R)ead messages
(S)ummarise messages
(T)ime and date
(U)sers' flags
(V)ideo backspace
(W)elcome
(X)pert user mode
(#) Show caller number

Fig 2 Full list of CBBS commands

A = Access to another software area
D = Display files available
M = Messages for this section
R = Receive File from you * Xmodem protocol
S = Send file to you * Xmodem protocol
T = Type a file (use if you don't have Xmodem)

Fig 3 Available modem functions

Entering messages manually while online is a similar process to other BBSs. There is normally no provision for private messages (electronic mail). Messages prepared offline can only be uploaded to CBBS systems one line at a time: they don't have the block entry mode that TBBS and Forum-80 provide, which can be a problem if your software doesn't allow you to send prepared messages in this way. You can usually get around it by putting half-a-dozen or so spaces at the start of each line, which gives the BBS time to process each line while the spaces are being sent, and you shouldn't lose any message content.

The message editor on CBBS is very flexible. It gives you the option of retyping the line (as TBBS) or replacing a portion of it. If finger trouble or line noise meant that 'Frod' appeared in your message when it should have been 'Fred', then R/Frod/Fred/ should do the trick.

CBBS has powerful keyword searching facilities which enable searches through messages for particular items of interest. As an example, '35,BBS and software' would start at message number 35 and search for messages containing the words 'BBS' and 'software'. Unlike TBBS, CBBS allows you to search the whole message and not just the subject, to and from fields, although you can narrow the search. (For more details, type 'help' and 'messages' next time you call a CBBS.)

CBBS also have a number of built-in commands such as NEWS, CHAT, MINE, and HELP. The first is obvious, the second pages the sysop to chat to you via the keyboard, and the third checks for messages to you. The help system is easy to use — you just type 'help' followed by the function you need help on: for example, typing 'help messages' will give you information on entering messages.

There are other keywords, but there is some variation here between CBBS systems.

CBBS supports file transfer using Xmodem protocols. The commands are in the modem sub-menu, and are 'S' for send a file to you, and 'R' for receive a file from you. Text files can be downloaded in standard ASCII mode (but without buffer control codes). Upload is only possible by using Xmodem protocols.

Online drinks

The Americans have a new line in 'intelligent' vending machines, which apparently phone the depot when they are getting low and request more stocks. Two of these clever machines in

Omaha caused a bit of a stir by repeatedly dialling the depot on a Sunday — alert telephone operators thought that it was burglars. Obviously there are intelligent vending machines and not-so-intelligent vending machines.

New bulletin boards

A few new BBSs have started up recently.

Liverpool Fido on (051) 260 5607 runs from 10pm to 8am daily, but on Bell 103/212a tones only; however, you can use CCITT V.22 as this is compatible with Bell 212a.

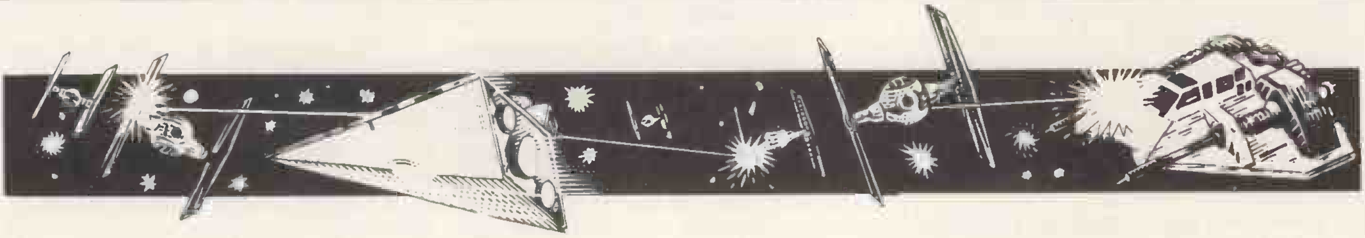
Fido is interesting: it was developed in the US with the object of enabling messages to be shuffled around between Fido systems. You can leave a message for someone on one Fido system and it will automatically be sent to the system he normally uses. This obviously incurs costs for the system operator and you have to pay to use these facilities.

There are a couple of BBSs in Scotland now, both Atari based, one in Livingstone on (0506) 38526 called LSBBS, and one in Glasgow called SABBS on (0698) 884 804. Both are 24-hour systems.

Marctel is a BBC-based BBS that uses homebrew software. It is operational for limited hours at present, but plans to be available 24 hours in due course. It runs Monday-Friday from 8pm to 9pm, Saturday from noon to 4pm, and Sunday from 1pm to 5pm. 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, ring-back 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
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 + 1200/75
CBBS SW	(0392) 53116	300/300 baud rate; 24 hours daily
CBBS Surrey (Woking)	(04862) 25174	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 conjuction 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 weekdays; 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 weekdays; 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 W Midlands Stourport	(0384) 635336	300/300 baud rate; 6pm-8am daily
Manchester Open Bulletin Board	(061) 7368449	300/300 baud rate; 24 hours daily + 1200/75
MBBS-Mitcham	(01) 640 2617	300/300 baud rate; 10am-10pm 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. Bell 103 midnight-8am 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) 341 7840	300/300 and 1200/75 baud rate (including Prestel compatibility); 24 hours daily; temporary number for the TBBS Nottingham system
WABBS-Worthing	(0903) 42013	300/300 baud rate; 24 hours daily; ring-back system (dial the number, let phone ring once, and then ring back); Atari-based



Aspiring small businessmen and icon lovers start here! Tony Hetherington looks at two adventures without text which are just part of this month's selection of top games for the Commodore 64, Macintosh and Spectrum.

Enigma adventure

Title: Shadowfire
Computer: ZX Spectrum/Commodore 64
Supplier: Beyond
Format: Cassette
Price: £9.95

Shadowfire is an adventure game without text. Beyond's latest release uses Mac-style icons which replace the usual confusing text input phrases. For example, instead of typing USE THE . . ., you simply select the icon which shows a finger pressing a button.

This technique speeds up the process of data input which is vital — in Shadowfire you have six characters to control in a real-time adventure. These characters are a curious collection of thieves, murderers and other assorted criminals who are collectively known as Enigma.

The object of the game is, with this galactic A Team, to invade the spaceship of the evil General Zoff and rescue an ambassador who has been kidnapped. Evil in this game is, of course, a relative term since your own party aren't exactly Sunday school material. Indeed, some of the characters have their own ideas and objectives so you should keep a close eye on them. Each character also has a specialist skill which you will have to use in order to complete the adventure. For example, only Manto can operate the transporter that carries others onto the ship.

Similarly, Severina the thief and accomplished murderess is skilled in unlocking locked doors, whereas Syylk the insectoid is pure strength. Your party is completed by Toric, a winged humanoid, Zark, who comes complete with a cybernetic arm, and a weapons droid called Transmaul.

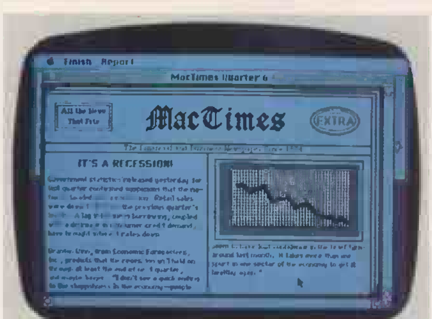
Each character possesses strength, agility and stamina which are represented by bars on that character's first screen. Also displayed are a picture of the character along with their location, and icons that lead to other screens. Selecting the green VDU icon takes you to the movement screen which displays arrows pointing in eight directions; any solid arrows indicate the directions in which the character can move.

The red VDU icon leads to the combat screen where you decide the tactics employed by a character when he meets one of Zoff's many droids. Such tactics include all-out attack, holding your position, or running away.

The final VDU icon accesses the object screen, which displays objects found in the rooms as well as those carried by the character.

This screen also includes icons to pick up and drop objects as well as the finger pressing the button that was mentioned earlier.

This game is easier to play with a lightpen, which is probably why one is included as a game-playing option; the others are the keyboard, and both analogue and digital joysticks.



Shady dealings

Title: MacManager
Computer: Apple Macintosh
Supplier: Pete and Pam
Format: Disk
Price: £46 + VAT

The Mac *is* a games machine. Despite its lack of colour, it does have high-resolution graphics and a growing library of excellent games; MacManager is a welcome addition to this range.

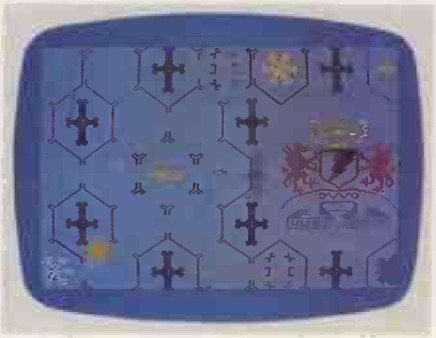
Between two and nine players compete as company managers in the booming business of making widgets. Each manager can be controlled by a human or the computer, and are named after Snow White and the eight dwarves (the eighth dwarf *á la* Mac is Nerdy).

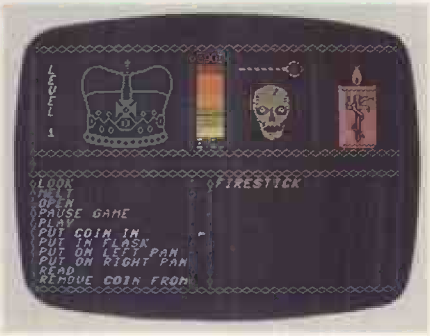
The game is played in a series of turns or quarters, in which the players make their decisions for the next quarter. But before the decision-making process begins, the players, like all business executives, read *The Times*; in this case it's *The Mac Times*, which reports on events that may or may not affect the widget industry. These events range from a transport strike to a report of a pie-eating competition sponsored by, for example, Sneezy.

You must then decide your policy for the coming quarter by determining the price you will charge for your widgets, and the level of production. You may also decide to invest in your factory to increase production capacity, or plough your resources into hyping your widgets. Then it's time to sit back and wait for the quarter's results to come through. With a little luck your company will be successful, and grow from the shed with a bike outside that you start with to a massive complex complete with a helicopter.

However, just being successful isn't enough, since the object of the game is to make the most profit within the game that can last for between eight and 32 quarters. This will require some strategy, which will probably lie somewhere between the mass production/low price technique and the low production/high price policy (which is naturally backed up by a lot of hype).

MacManager contains one serious bug. It is intended for a so-called business machine and therefore will be played by people who should be working. At first sight a game involving balance sheets and operating costs would seem an ideal cover, but this is blown by a rather loud and irritating tune played at the end of each turn!





All the sevens . . .

Title: Ice Palace
Computer: Commodore 64
Supplier: Creative Sparks
Format: Cassette
Price: £9.95

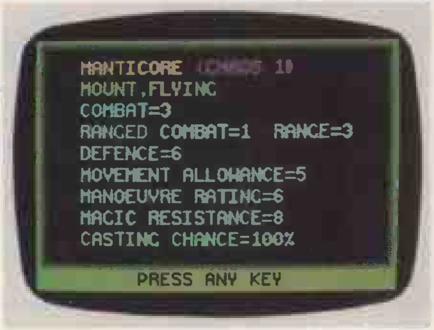
The second entry in this month's adventures without text category is Ice Palace from Creative Sparks. The object of the adventure is to collect the seven segments of the Ice Crown that are spread throughout the seven levels of the palace.

Naturally the present owner of the crown isn't going to let you get away with it, and sends her winged minions to corrupt you. The attack continues until you are either totally evil and give up your quest, or you succeed.

The game is played on two screens: the first is a plan of the level you are currently on; the second is the adventure screen. The palace consists of a series of hexagonal rooms, some containing symbols. A room containing a black cross is impassable, whereas an ice room depicted by a snowflake is merely difficult to cross. A sword indicates that there's an object in the room, and pressing the space bar takes you to the adventure screen where the object can be examined; the object's description appears in one of the screen's windows. The other areas display the time left in the adventure by a burning candle, a colour scale showing your corruption from good to evil, a skull whose eyes flash when you're under attack on the action screen, and an action selection area.

The action selection screen is used to select adventure-style actions such as sharpening a knife. These actions are presented as scrolling text that can be selected with a joystick.

Initially I thought that having available every necessary command and object would make the game easy to solve, but this wasn't the case. I suspect that objects such as tuning fork C are included as red herrings to confuse people who are cheating. It's also unlikely that you'll be able to spare the time to view the list of commands, as you'll soon be under attack.



I'll put a spell on you

Title: Chaos
Computer: ZX Spectrum
Supplier: Games Workshop
Format: Cassette
Price: £9.95

Chaos is a game for up to eight players, each controlling a wizard in a spell-casting duel to the death. The combatants can be controlled either by the computer or human players, but in a game involving more than one human player the others should agree not to look at the screen during each player's turn.

A player can select one of his spells for casting from his initial selection of 12 spells. Since this selection is randomly made from a choice of over 50, it's almost guaranteed that each game will be different.

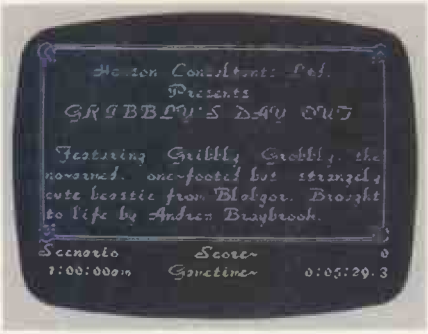
When each wizard has selected his spell, the game progresses to the movement and combat screen. Here, the results of the spells are determined along with the wizards' movement and creations around the arena. When all the wizards have moved and any enemies have been fought, they select their spells for the next turn. The game continues in this manner until only one wizard remains alive.

Most of the spells summon up creatures such as lions, crocodiles, giants, dragons and bears, but some can summon the undead forces of zombies, spectres, vampires and ghosts which are particularly powerful since they can only be slain by other undead creatures.

Obviously, with all these dangers around, wizards will want to protect themselves by employing spells such as magic swords, shields, armour and wings to improve themselves, and castles, citadels and woods they can hide in. But not even these defences will protect them from powerful spells such as justice and degree, which can destroy a wizard in a single blow.

Each spell has a unique strength of character which is determined by a set of values that can be examined by the players before casting. These values indicate the movement, range and combat strength of the spell, and also provide ranged combat for those who can fight from a distance: for example, an elf can fire his bow.

There is also the spell's casting chance, which indicates a spell's potential success. A spell illusion will always succeed, and will appear in the arena as if it is real until another wizard disbelieves it. Consequently, wizards can use illusions to confuse and mislead the other players.



Forever blowing bubbles

Title: Gribbly's Day Out
Computer: Commodore 64
Supplier: Hewson Consultants
Format: Cassette
Price: £7.95

Gribbly Grobbly is a fully grown Blabgorian, and as such has a large head, a single foot and can fly by pure thought. He can also store mental energy in his psi bank for later use, which is particularly useful as prolonged concentration gives him a headache.

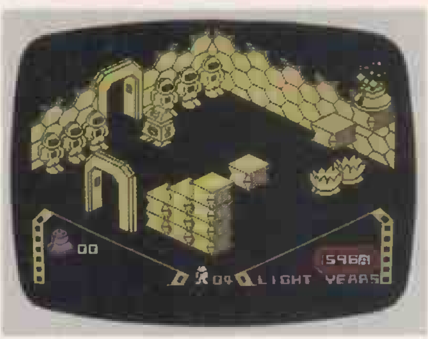
Flying requires a lot of psi energy so Gribbly usually bounces along the ground, taking care not to hit any of the rocks or trees. If he does, he must immediately return to the psi bank to replenish his energy.

The young Blabgorians are known as gribblets, and have two legs and a hard shell to protect their heads from the harsh sunlight. They are also in danger from attack by worm-like creatures which will use the gribblets to transform themselves into flying creatures.

It is Gribbly's job to find the gribblets and carry them back to safe caves, using his bubble-blowing skills to warn off any approaching creatures.

The ability to blow bubbles is the only form of defence used by Gribbly, as he lives in a non-aggressive society. Indeed, instead of killing the totally evil Seon (a Blabgorian who was mutated by a psi bank accident) they exiled him to the sky and built an energy web to imprison him there. Gribbly can pass through this web by deactivating strands of it, but he must be careful not to let Seon out.

The landscape is reminiscent of the one in Quicksilva's Bugaboo, but Gribbly's Day Out is more a game of controlled flying rather than frantic hopping.



Survival of the strongest

Title: Alien 8
Computer: ZX Spectrum
Supplier: Ultimate
Format: Cassette
Price: £9.95

The ship's journey is almost over. It started long, long ago on a dying planet where the last of the guardians were cryogenically preserved and stored onboard. Now they are reaching their destination and the ship is on its final approach.

As it slows down from hyperwarp speeds it is open to attack from alien creatures, but the ship is protected by indestructible robodroids which will destroy anything, including Alien 8 cybots. You are an Alien 8 cybot.

All this interferes with your main objective, which is to repair the cryogenic chambers by locating the thermolec valves and replacing them in the correct sockets. However, finding them is only part of the problem: you have to pick them up and take them to the correct chamber. Actually getting to them is the problem as they are protected not only by the robodroids, but also by spikes, which are slippery and disappearing blocks that populated Alien 8's forerunner, Knight Lore. Just getting from one doorway to another is enough to thwart most cybots, and it will take several attempts before a serious assault on the game can be made.

The graphics are of the same high quality that were first used in Knight Lore, but with the addition of a reprogramming sequence. Reprogramming is the sad fate of all cybots that fail in their mission, and means being hit several times with a boxing glove, a walking stick and a hammer.

Alien 8 is an easier game to play than Knight Lore, largely due to the fact that your character doesn't continually turn into a werewolf. But it's a harder game to solve since you have more to do: as well as finding objects, you also have to place them in the right locations while avoiding the robodroids and a steady alien invasion. Definitely not for the faint-hearted.

Seek and destroy

Title: Moonraker
Computer: Commodore 64
Supplier: Statesoft
Format: Cassette
Price: £8.95

Your mission, now that you've decided to accept it, is to protect the planet Geevor's mineral wealth by seeking out and destroying any scavengers.

The surface of Geevor is pitted with craters and ravines that are represented on the screen in two displays: the first is an accurate map (unfortunately a rare occurrence in games); the second is a 3D view of the area that you are currently flying through.

Between the two displays is an altimeter which displays your height above the planet's ground level, as well as the relative level of the terrain you are currently over. Under these displays are your score, fuel level and time remaining for the mission.

A particularly nice feature is that you can buy extra fuel with your points score, which is necessary as hyperspacing uses a lot of fuel but it's the only way of avoiding the scavengers' fireball protector.

The instructions suggest clever manoeuvres involving diving into deep ravines to hit the protector, but this is just as hazardous as ramming it.

Moonraker was written by a mathematician and it shows — the graphics are mathematically modelled line drawings which effectively illustrate your suicidal attempts to charge through the ravines.

Should you manage to get a scavenger in your sights, your joystick-controlled lasers will destroy it. END

THE ONLY S100 WORTH REMEMBERING.

HTE

Our range includes 6 different memory cards.

HIGH TECHNOLOGY ELECTRONICS LTD., 303/305 PORTSWOOD ROAD, SOUTHAMPTON, SO2 1LD. TEL: (0703) 581555 TELEX: 477465 HTEL G.

OWL

COMPUTER TRAINING & CONSULTANCY

QL TRAINING

- INTRODUCTORY & INTERMEDIATE COURSES
- COVERING ALL THE STANDARD PACKAGES – QUILL, ABACUS, ARCHIVE, EASEL
- REGULAR HOTEL COURSES
- IN-COMPANY COURSES AT YOUR CONVENIENCE ■ MSC GRANTS AVAILABLE

Contact OWL on (044 282) 7302 or write to OWL, Dept OA1, Freepost, Tring, Herts, HP23 4BR

PICK UP THE PHONE FOR THE BEST PORTABLE PACKAGE.
(0280) 816087

F

FRASER
Associates Limited

FREE SOFTWARE & TRAINING WITH EVERY SYSTEM.

Phone (0280) 816087 for more information.

- Impartial advice from trained consultants.
- On site training.
- On site servicing & fully equipped workshops.
- Complete After Sales telephone support.

Bristle Hill, Buckingham MK18 1EZ Telephone (0280) 816087

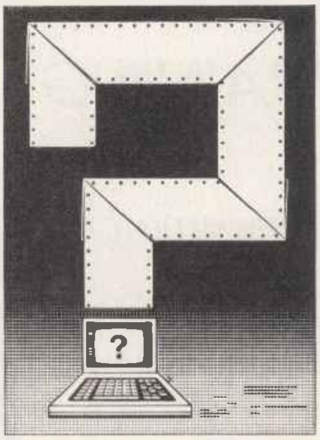
SANYO

ACT

EPSON

Authorised Service Centre.

Simon Goodwin takes his toolkit to your problems. The address to write to is Computer Answers, PCW, 62 Oxford Street, London W1.



In search of QL Pascal

Further to the review 'Mind your language' in *PCW*, February, could you please advise me when and where the full ISO Pascal compiler for the QL will be available.
D Rayner, N Humberside

Sinclair has commissioned an implementation of ISO (International Standards Organisation) Pascal, but it hadn't announced any delivery date or price at the time of writing.

The program is apparently being written by Metacomco (26 Portland Square, Bristol); the company's other compilers were reviewed in the article you mention. You may get advance notice about the Pascal compiler by directly contacting Metacomco.

The full ISO specification is somewhat daunting, even for a QL, so it may be a while before the program passes all the tests, but Metacomco hopes to have something to show by the beginning of May.

Channel crossing

On retirement I wanted to learn to program with a view to using a home computer for data processing. I purchased a Dragon 32 and, after experience of programming helped by various books, I purchased a disk drive and found it most useful. However, for data processing the manual was less than helpful. I can see no way to convert cassette programs for use with the disk. All books deal only with cassettes and state: 'With the disk drive there will be another channel number.' I have tried up to 30 and get only an error reply.

How can I find the channel number, and are there any books or articles which deal with the Dragon disk and data processing?
Dr R Berry, Coventry

Dragon Basic is designed to be 'device independent'; this means that you only need one set of commands to send data to any device — the display, cassette, printer, disk drive, and so on. This scheme originally appeared in DEC Basic Plus for minicomputers, and cropped up later in Microsoft Basic which is the version of the languge used — with minor variations — by IBM, Apple, Commodore, Tandy and Dragon, among others.

In Basic the PRINT statement is generally used to transmit information, and the INPUT statement to receive it. You tell the computer which device to use with a 'channel number'. On the Dragon you use channel number −2 to send data to the printer:
PRINT #−2, "DATA"
and channel number −1 to send data to the cassette recorder:
PRINT #−1, "DATA"

You could, in principle, divert a printout to cassette by just changing the channel number. This is easily done, especially if you use a variable in place of the value '−1' or '−2'.

Channel 0 corresponds to the screeen. This is a special case which spoils the rule in the interest of convenience as you don't have to specify a channel number to use the screen; the computer assumes you want channel 0 if you don't tell it otherwise:
PRINT "DATA"

There is an important difference between the cassette and the other devices, which is obliquely explained on page 130 of the Dragon manual. You have to use an extra command — an OPEN — before you can write data to the cassette, and a CLOSE when you've finished. You can write data to the printer or the screen, however, without any preamble.

With a disk drive you are able to use another 15 channels — numbers 1 to 15. As with the cassette, you have to use an OPEN command to tell the sytem the name of your file, and to reserve memory for the buffer. Disk drives are able to wind back and forth quickly, so you can have more than one file open at once — hence the 15 possible channel numbers.

Each open channel uses up memory; if space is very tight you might get an 'Out of Memory' error when a file is opened, in which case you will have to make room by simplifying the program, reserving less string space (with CLEAR), or dimensioning smaller arrays. Make sure you CLOSE files as soon as you've finished with them, or you could needlessly tie up memory.

To convert a cassette program to use the disk drive, you only need to change the channel numbers used in OPEN, PRINT, INPUT and CLOSE statements; typically, you might change all the '−1' values into '1's. If you forget to change any statements, the computer will give an error message when it tries to access the file. If the PRINT or INPUT seems correct, check that you haven't overlooked an OPEN or CLOSE.

A number of books on Dragon disk usage are available from Tandy shops — the Tandy Colour Computer is very similar in operation to the Dragon. Books about disk programming in Microsoft Basic should also be helpful.

Data efficiency

I am writing a program for the unexpanded Vic-20, some of which is in Basic and some in machine code, but I'm having trouble using the data in the arrays (dimensioned in Basic) in the machine code part of the program.

Could you enlighten me on the easiest or most efficient way to read data from arrays when in machine code.
ERD Mitchelmore, Dartmouth

The key to this problem lies in the data you are processing, but unfortunately you don't say much about that. There are routines within the ROM which locate array values, but they're complicated and not really designed for the purpose you have in mind.

If you're using floating point numbers (decimals) then you're probably best advised to write your entire program in Basic and forget about the code: machine code to manipulate decimals tends to be verbose and slow, so there's little to be gained by using it.

If you're working with whole numbers only, the obvious solution is to make things easy for the code. Rather than use Basic arrays, you should store the data in memory along with your machine code, using PEEK and POKE to read and write values from Basic, and LDA and STA from machine code.

It is quite easy to simulate an array with PEEK and POKE. If you're using an array of dimensions (5,6), the Basic command A(J,K) = A(L,M) would become POKE BASE + J * 6 + K, PEEK (BASE + L * 6 + M). We've assumed that stored values fall within the range 0 to 255, and BASE contains the address of an area of 42 otherwise unused bytes. Notice that, since array subscripts in Vic-20 Basic start at zero, we've had to multiply by six, rather than five, when working out the address of the data.

If you need to store positive and negative values, you can add 128 to each number before you POKE it, giving an effective range of −128 to 127. The limit of 256 possible values need not hinder you either — if you use two bytes for each value there's room for numbers between 0 and 65535.

As an example, the following line will PRINT the value stored at position J in a table of 100 values. We've assumed that values of J start at 0 for the first entry in the table, and BASE contains the address of an area of 200 otherwise unused bytes:

```
PRINT PEEK
  (BASE+J*2)+256*PEEK
  (BASE+J*2+1)
```

In this case the data is stored in pairs of bytes, like addresses in machine code: the second byte contains the number of multiples of 256, and the first contains the remainder. To store the value of K at J, use:

```
POKE BASE+J*2+1,INT(K/
  256):
```

```
POKE (BASE+J*2),K-
  256*PEEK(BASE+J*2+1)
```

If you need to manipulate strings from machine code, the same approach can be used. POKE characters and string lengths into memory so that they can be read by machine code.

The aim of the process is to keep things simple. It's quick and easy to write Basic, and harder to write machine code, so it's a good idea to adapt the Basic to cope with the idiosyncracies of machine code. Another advantage of using PEEK and POKE is that the Basic commands mimic the machine code LDA and STA.

Once you've broken the data shown into bytes or values between 0 and 255, you can use any organisation you like for the stored data.

Dual-purpose peripheral

I have an Oric Atmos 48k and have just bought the Oric modem which plugs into the expansion port at the back. I have also ordered the Oric micro disk drive which also fits into the expansion port.

Is there an adaptor available that enables both items to be plugged in and used at the same time?
P Sargent, Blackburn

Oric has anticipated your problem. The lead from the computer to the microdisk (supplied with the drive) contains a socket which duplicates all the signals available at the back of the computer. If you plug the disk into the computer, and then connect the modem to the new socket, both peripherals should be ready to go.

Computers in architecture

I am a second-year Architecture student and am considering buying a computer as an aid to my course and my future job as an architect. The problem is, which computer? Ideally it should have good graphics facilities for future computer-aided design (CAD) applications.
V Thomas, London N10

When choosing between computers, personal criteria generally outweigh the technical ones. There isn't much real difference between popular computers, other than price and (sometimes) availability. It's usually best to buy a cheap one and explore the possibilities at first hand. Speaking as an ex-CAD programmer, I'd advise you to put your future needs on one side unless you're planning to write your own architectural software in the next few months.

Computer-aided design systems are only slowly making their way from minicomputers to micros, but by the time you graduate there should be lots to choose from, on new hardware like Atari's Amiga. CAD is one of the few areas in which increased computer power is really needed.

Today's fledgling systems run on machines like the Apple (Robocom), BBC Micro (various draughting packages) and the IBM PC (shaky versions of minicomputer software). A few companies are working on packages for the Sinclair QL which has lots of memory and a minicomputer-like processor, but I haven't seen anything wonderful yet.

For the time being I suggest you aim for a computer on which you can word process your coursework reports. Consider any machine with at least 32k of memory and a display 60 or more columns wide. Second-hand computers are often a good buy for serious applications — you'll need a printer too.

Leave the choice of a full-scale CAD system until it's tax-deductable, and remember that there's no point buying hardware unless you can get the right software to go with it.

Over the counter

I am considering becoming a home computer dealer (mail order at first). Could you tell me if there are any laws and regulations to be followed, and also give me details of any wholesale distributors.
J Oldham, Ruislip

Don't do it! Or at least, don't do it without a great deal of thought. It seems as though dealers go bust almost every day, often for no fault of their own. To enter the market now you'll need substantial capital or a very good nose for a niche in the market — business is no longer booming in the way it was four or five years ago. At the very least you should set up a limited company, so that you're not personally liable for the debts of your business.

It initially seems a great idea to become a computer dealer. All you need to do, apparently, is contact a manufacturer and thus get in touch with a distributor. Then you place a couple of adverts, and wait for the cheques to come rolling in.

In practice, you'll find that you must keep substantial stocks so that you don't keep customers waiting as supplies to you fluctuate. Magazines might even check this. It represents a lot of money tied up in products that could become obsolete overnight, or be slashed in value at the whim of some American marketing mandarin.

Five years ago the micro market was growing at a great rate. It could do that without much strain, since it was quite tiny. A handful of magazines preached to isolated punters. There were few outlets for advertisements and products.

Nowadays most business is done through retail stores, which draw on the capital and management skills of large organisations. Distributors were hurt when the first wave of keen but incompetent dealers went to the wall: they'll want guarantees before they'll give you credit. Profit margins are small, as hundreds of firms fight over each market sector.

When you've got the goods — and the orders — you must cope with business rates, VAT returns (if you turn over more than a few thousand pounds a quarter), faulty products, bouncing cheques and disappearing despatches. You have to keep good accounts, for your own security as well as for the scrutiny of tax officials.

Unless you've got what the Americans call a 'unique selling proposition' — a captive market or a captive product — you're probably on your way to bankruptcy or liquidation. But if you're still determined to give it a whirl, research your proposed market by scanning advertisements and talking to existing dealers, then take advice from a bank manager.

Age of Aquarius?

Are there any books available on the Aquarius computer system, as books and software for this machine seem to be as common as ZX-81's with colour.

Is it possible to use the games paddles in your own programs, or are they only for use in cartridge games?
S Forster, Derby

The only book about the Aquarius that I can trace is *The Aquarius and how to get the most from it* by the ubiquitous Ian Sinclair. It's published by Granada Publishing ((01) 493 7070) and costs about £6.

If you're still stuck after reading the book, try printing the value read with the IN function, using parameters between 0 and 255. Look for a parameter value that gives a changing result as the paddles are manipulated. The paddles are almost certainly port-mapped, which means that they will be connected in such a way as to alter the value at a given port as they are adjusted.

Financial routines

In the December 1984 issue of *PCW* there was a financial program by J McCartney, which is the kind of program I have been searching for. Unfortunately I am only conversant with Sinclair Basic, and hard as I try I cannot translate the program.

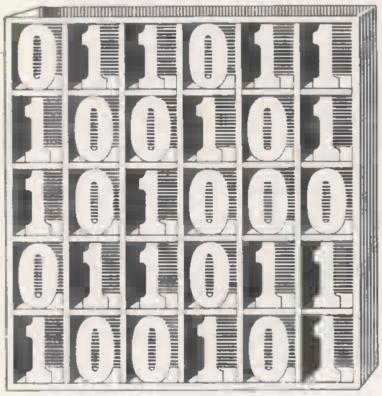
Could you supply the formulae that have been used in all 12 calculations?
W Wallis, Taylor Hill, Huddersfield

The key routines are between lines 30,000 and 41,000 — you'll obviously need to alter the line numbers to fit.

The routines should work in Sinclair Basic if a few small changes are made. Many of the variable names are followed by £ signs. These tell the Sirius to use double-precision arithmetic and should be omitted on a Sinclair computer, which always uses a level of precision mid-way between that of single- and double-precision on the Sirius. The circumflex signs in line 30,040 and elsewhere should be typed as upward arrows on the Spectrum: press SYMBOL SHIFT and H. Type 100 in place of C%.

The rest of the program is rather verbose, and is mainly concerned with keyboard and display handling. In essence, the only subroutines you need are those at line 1000 (to read input values into the array IN$), line 600 (to print the value of the answer, A) and line 800 (to process inflating withdrawals). You'll also need to set up FN I which is defined in line 20050; again, type 100 in place of C%.

Once you've got these routines working, you should add your own 'bells and whistles' to make the program user-friendly. END



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.

6502 PARALLEL PROCESSING

PARALL from Martin Ford of Redruth, Cornwall, is a complete suite to set up and run a parallel processing system on a normal 6502 machine. The only requirements are a 6522 VIA and a large memory.

A true parallel processing system would use a whole bank of processors simultaneously acting on common or connected data. One example of this concept is the method used to analyse visual data in some machine intelligence experiments.

An array of simple processors work simultaneously on one pattern. Each processor decodes only one aspect of the pattern, but the entire analysis is completed in the time it would take a single sophisticated sequential processor to recognise a straight line.

Common usage of the term, however, refers to 'time-slicing' the execution of several user programs on one sequential processor — a process also known as 'time-sharing'. Originally this was done to maximise the actual processing time of fast, expensive mainframes at the back end of a multi-user system. The slower peripherals (and even slower users) at the front end, being mainly concerned with I/O, never noticed that a few dozen other users also thought they had sole access to the computer.

Cheap personal micros have tended to reverse the pattern, and multi-user systems often have several relatively cheap computers sharing one expensive printer or one disk drive. Nevertheless, there are still occasions when it would be desirable to run two or three programs 'simultaneously'.

With PARALL in control you can document your next Subset contribution while testing the next-but-one. At the same time your computer could be deciding whether or not to take your bishop, preparing your tax returns, and printing out the results of its three-day investigation into the latest Numbers Count challenge.

But there is a small price to pay for all this sophistication. The time taken to exchange the machine state, stack and data of one program for that of the next does reduce throughout. Martin estimates that, with interrupt intervals at 0.01 seconds, overall efficiency will approximate 90 per cent of single program use.

The queue

Queues have a first-in, first-out structure and need at least two adjustable pointers — one to the end of the queue (as storage pointer) and the other to the front (as retrieval pointer). Each pointer is wrapped back to the first allocated byte of queue space whenever it goes past queue space.

The amount of queue space in PARALL is allocated dynamically and grows downwards in memory from QFL,H. The physical end of the queue space, where the data of new programs can be stored, is indexed by QBL,H. Within the cycle of the existing queue. QNL,H acts as end pointer for the storage of data from an interrupted program. This storage address is saved in the interrupted program QSQ location to be used as the front pointer for retrieval after one complete cycle of the queue. QWL,H acts as working pointer for both storage and retrieval.

Documentation rules OK?

The documentation of PARALL does rather bend the Subset rule of one datasheet to one routine. Because of PARALL's length, its 17 routines have to be compressed into a single datasheet with each receiving only minimal individual documentation.

DATASHEET 1

```
:=================================================================
:= PARALL    Parallel processing by time slicing (suite name).
:> START     Start parallel processing with one program.
:> SGNON     Sign-on another program in sequence.
:> SGNOFF    Take current program out of sequence.
:> FORCE     Force change to next program in sequence.
:=================================================================
:JOB         To simulate parallel running of multiple programs by
:            running each in sequence for a timed interval, with
:            queued storage of program stack and workspace.
:ACTION      Time-slice operation ON interrupt:
:            [ Save machine state, stack and workspace blocks
:              used by current program to next free queue space.
:              Index next program and queue space in sequence.
:              Load machine state, stack and workspace blocks
:              from indexed queue space.
:              Return-from-interrupt to new program. ]
:-----------------------------------------------------------------
:CPU         6502
:HARDWARE    6522 Versatile Interface Adapter (VIA).
:            RAM for queue storage and program parameter blocks.
:              Queue storage is dynamically allocated, working
:              down from high memory.
:SOFTWARE    Internal subroutines and interrupt routines:
:            STPUSH, ADDPRG, INTRPT, NEXTPR, SVSTK, SVBLK, LDSTK,
:            LDBLK, SET, QSTOWS, STKLEN, BLKINF, QWNEW & PLREGS.
:            External routines possibly required:
:            HANDLE - To handle non-PARALL interrupts.
:            COLD   - System cold-start on PARALL termination.
:-----------------------------------------------------------------
:INPUT       The starting program must pass the address of the
:            highest byte of Queue memory to START in ME,F, and
:            the address of its parameter-block in M8,9.
:            Each subsequent program must pass the address of its
:            parameter-block to SGNON in M8,9.
:            Parameter-block format (maximum 255 bytes):
:              Bytes      0,1:  Execution address.
:              Byte         2:  Maximum 6502 stack use.
:              Byte    N*3+0:  Length of workspace block N.
:              Bytes N*3+1,2:  Address of workspace block N.
:            (See individual routines.)
:OUTPUT      (See individual routines.)
:ERRORS      Stack use in excess of 245 bytes by any client
:            program will cause stacking error. Queue storage
:            could overwrite programs or parameter-blocks.
:REG USE     (See individual routines.)
:STACK USE   Stack prior to START is lost.
:            Maximum stack available to any client program is
:            241 bytes. The remaining 15 bytes are required by
:            PARALL for: RTI/RTS address              - 2 bytes,
:                        registers P, A, X, Y, PIF - 5 bytes,
:                        internal subroutine calls - 4 bytes,
:                        PARALL self interrupting  - 4 bytes.
:            Stack use of individual routines may not be
:            meaningful in the context of Queue-saved stack.
:RAM USE     M0 to MF
:            "QSQ": 256-byte (maximum) block sequentially storing
:            two 2-byte pointers of each client program (N):
:              Byte N*4+0,1: Queue storage pointer.
:              Byte N*4+2,3: Parameter-block pointer.
:LENGTH      536
:CYCLES      Not given.
:-----------------------------------------------------------------
:CLASS 2      -discreet       *interruptable      *promable
:-**---       -reentrant      -relocatable        -robust
:=================================================================
:
QBL    =    M0         :Physical Back of Queue address, lo-byte.
QBH    =    M1         :Physical Back of Queue address, hi-byte.
QNL    =    M2         :Next on Queue address, lo-byte.
QNH    =    M3         :Next on Queue address, hi-byte.
PSQI   =    M4         :Program Queue Sequence Index.
PSQM   =    M5         :Maximum Program Queue Sequence value.
QWL    =    M6         :Queue Working pointer, lo-byte.
QWH    =    M7         :Queue Working pointer, hi-byte.
PBPL   =    M8         :Parameter-Block Pointer, lo-byte.
PBPH   =    M9         :Parameter-Block Pointer, hi-byte.
WSPL   =    MA         :Work-Space Pointer, lo-byte.
WSPH   =    MB         :Work-Space Pointer, hi-byte.
TEMP   =    MC         :Temporary storage.
PIF    =    MD         :Program Interrupt-disable Flag.
QFL    =    ME         :Physical Front of Queue address, lo-byte.
QFH    =    MF         :Physical Front of Queue address, hi-byte.
QSQ    =    $hilo      :Start address of Queue Sequence block.
```

```
:= START      User program entry point to start parallel
:             processing with first program.
:HARDWARE     6522 VIA.
:SOFTWARE     STPUSH, LDSTK/LDBLK, PLREGS.
:INPUT        Registers contain initial program values.
:             PBPL,H addresses new program Parameter-Block.
:             QFL,H addresses highest Queue location.
:OUTPUT       First program sequence parameters set up.
:             Exit made via PLREGS to first program.
:             Stack above call/jump to START is lost.
:
START  JSR    STPUSH        :Ensure ADDPRG returns to START.  20 lo hi
       LDA    #$80          :(Return here from ADDPRG.) Make  A9 80
       STA    PIF           :sure all interrupts ignored      85 MD
       SEI                  :until first program starts.      78
       LDA    #$40          :Initialise VIA to interrupt      A9 40
       STA    VIA+11        :on Timer 1 time-out.             8D lo hi
       LDA    #$C0          :Enable VIA to interrupt, (but    A9 C0
       STA    VIA+14        :6502 still ignores them).        8D lo hi
       LDY    #0            :Set sequence index to            A0 00
       STY    PSQI          :first program, then go restore   84 M4
       JSR    LDSTK         :saved stack & workspace, exit    20 lo hi
       JMP    PLREGS        :to start parallel processing.    4C lo hi
:----------------------------------------------------------------------
:= STPUSH     Internal subroutine to save registers and initialise
:             pointers during PARALL initialisation.
:SOFTWARE     ADDPRG.
:INPUT        Registers contain initial program values.
:             PBPL,H addresses new program Parameter-Block.
:OUTPUT       Registers pushed on stack.
:             Back of Queue and Next in Queue pointers set up.
:             Program sequence set up.
:             First program state saved on Queue.
:
STPUSH PHP                  :Save register values on stack,   08
       PHA                  :these will be saved in the       48
       TXA                  :first program's Queue stack      8A
       PHA                  :storage space as initial         48
       TYA                  :input values.                    98
       PHA                  :Save $00 on stack also as the    48
       LDA    #0            :initial PIF value, ensuring      A9 00
       PHA                  :program can be time-sliced.      48
       LDA    QFL           :Initialise pointers - next       A5 ME
       STA    QBL           :available Queue space in         85 M0
       STA    QNL           :Next in Queue pointer and        85 M2
       LDA    QFH           :back of Queue address in Back    A5 MF
       STA    QBH           :of Queue pointer start at        85 M1
       STA    QNH           :First in Queue address.          85 M3
       CLD                  :Ensure binary arithmetic.        D8
       CLC                  :Ensure no carry in when          18
       LDA    #$FC          :addition sets index to first     A9 FC
       JMP    ADDPRG        :sequential program in ADDPRG.    4C lo hi
:----------------------------------------------------------------------
:= SGNON      User program entry to add a new program to sequence.
:SOFTWARE     ADDPRG, FORCE.
:INPUT        Registers contain initial program values.
:             PBPL,H addresses new program Parameter-Block.
:OUTPUT       New program sequence parameters set up.
:             New program state saved on Queue.
:             Exit made to parent program.
:             Input register values lost to parent program.
:
SGNON  PHP                  :Save input P and A as initial    08
       PHA                  :state of new program.            48
       LDA    #$80          :Ensure time-out interrupts       A9 80
       STA    PIF           :will be ignored.                 85 MD
       TXA                  :X and Y also will be saved in    8A
       PHA                  :new program's Queue stack        48
       TYA                  :space, all input values are      98
       PHA                  :lost to parent program.          48
       LDA    #0            :Ensure saved PIF value will      A9 00
       PHA                  :let program to be time-sliced.   48
       CLD                  :Ensure binary arithmetic.        D8
:
FREELP LDA    PSQM          :If room then skip out to add     A5 M5
       CMP    #$FC          :new program to end of sequence.  C9 FC
       BCC    ADDPRG        :Else force change-over to next   90 05
       JSR    FORCE         :program in sequence and repeat   20 lo hi
       BCS    FREELP        :until a SGNOFF occurs.           B0 F5
:----------------------------------------------------------------------
:= ADDPRG     Internal subroutine to add new program to sequence.
:SOFTWARE     STKLEN, QWNEW, SVBLK.
:INPUT        A = current maximum program index. C = 0.
:OUTPUT       New program sequence parameters set up.
:             New program state saved on Queue.
:             Exit made to parent program or START.
:
ADDPRG ADC    #4            :Allow for new program in         69 04
       TAY                  :maximum index value, getting     A8
       STA    PSQM          :it in Y to index new sequence    85 M5
       LDA    QBL           :values. Store Back of Queue      A5 M0
       STA    QSQ,Y         :address as program's initial     99 lo hi
       STA    QWL           :Queue storage address, with      85 M6
       LDA    QBH           :same address going into the      A5 M1
       STA    QSQ+1,Y       :working pointer for initial      99 lo hi
       STA    QWH           :stack & workspace save.          85 M7
       LDA    PBPL          :Copy Parameter-Block             A5 M8
       STA    QSQ+2,Y       :address to program sequence      99 lo hi
       LDA    PBPH          :parameters from input value      A5 M9
       STA    QSQ+3,Y       :in Parameter-Block Pointer.      99 lo hi
       JSR    STKLEN        :Get maximum stack size and       20 lo hi
       JSR    QWNEW         :adjust working pointer for it.   20 lo hi
       LDA    #$F8          :Set program's minimum stack      A9 F8
       STA    (QWL),Y       :pointer at highest Queue byte.   91 M6
       LDX    #5            :Index for 5 stack bytes.         A2 05
:
QSTATE DEY                  :Loop - pulling input register    88
       PLA                  :values from 6502 stack and       68
       STA    (QWL),Y       :storing them in reverse order    91 M6
       DEX                  :at the top of the program's      CA
       BNE    QSTATE        :Queue stack storage space.       D0 F9
:
       DEY                  :Index next Queue byte and copy   88
       LDA    (PBPL,X)      :lo-byte of program's execute     A1 M8
       STA    (QWL),Y       :address from Parameter-Block to  91 M6
       DEY                  :saved stack. Index next byte.    88
       STY    TEMP          :Save Queue index and index       84 MC
```

```
       LDY    #1            :hi-byte of execute address,      A0 01
       LDA    (PBPL),Y      :getting it in A.                 B1 M8
       LDY    TEMP          :Re-index Queue stack space and   A4 MC
       STA    (QWL),Y       :save execute address hi-byte.    91 M6
       JSR    SVBLK         :Now save workspace on Queue.     20 lo hi
       LDA    QWL           :Altered working pointer now      A5 M6
       STA    QBL           :addresses back of Queue, so      85 M0
       LDA    QWH           :update Back of Queue pointer     A5 M7
       STA    QBH           :from working pointer.            85 M1
       LDA    #0            :Enable normal PARALL operations  A9 00
       STA    PIF           :to continue on interrupts.       85 MD
       RTS                  :Return to parent program.        60
:----------------------------------------------------------------------
:= FORCE      User program entry point and internal subroutine to
:             force program changeover before time-out.
:SOFTWARE     NEXTPR.
:INPUT        None.
:OUTPUT       PIF set. Current program state saved on Queue.
:             Next program state brought down and entered.
:
FORCE  PHP                  :Save P, as interrupt would have  08
       SEC                  :done, then set flag to ensure    38
       ROR    PIF           :RTS exit next time around.       66 MD
       JMP    NEXTPR        :Go to program change-over.       4C lo hi
:----------------------------------------------------------------------
:= SGNOFF     User program entry point for self termination.
:SOFTWARE     LDSTK/LDBLK, PLREGS, COLD.
:INPUT        None.
:OUTPUT       Current program removed from sequence.
:             If no programs left then exit made to COLD,
:             Else next program state brought down and entered.
:
SGNOFF LDA    #$80          :Stop possible interrupt causing  A9 80
       STA    PIF           :PARALL to change programs.       85 MD
       CLD                  :Ensure binary arithmetic.        D8
       LDX    PSQI          :X = current program index.       A6 M4
:
QSQDWN CPX    PSQM          :Loop - shifting all or any       E4 M5
       BCS    LSTOFF        :program sequence parameters,     B0 09
       LDA    QSQ+4,X       :above the removed program,       BD lo hi
       STA    QSQ,X         :down by four bytes bringing      9D lo hi
       INX                  :next program in sequence into    E8
       BCC    QSQDWN        :current index position.          90 F3
:
LSTOFF LDA    PSQM          :If sequence now empty, exit      A5 M5
       BEQ    TOCOLD        :PARALL to system cold-start.     F0 24
       SBC    #4            :Else reset maximum index to one  E9 04
       STA    PSQM          :less program. Unchanged index,   85 M5
       LDY    PSQI          :in Y, now indexes next program.  A4 M4
       CMP    PSQI          :Test if index now beyond end of  C5 M4
       BCS    DONEXT        :sequence, continuing if not.     B0 14
       LDY    #0            :Else index 1st in sequence, in   A0 00
       STY    PSQI          :Y and index variable.            84 M4
       LDA    QNL           :Next in Queue pointer now        A5 M2
       STA    QBL           :addresses Back of Queue, so      85 M0
       LDA    QNH           :update Back of Queue pointer     A5 M3
       STA    QBH           :from Next in Queue pointer.      85 M1
       LDA    QFL           :Reset Next in Queue pointer      A5 ME
       STA    QNL           :to address first program's       85 M2
       LDA    QFH           :saved stack and workspace from   A5 MF
       STA    QNH           :Front of Queue pointer.          85 M3
:
DONEXT JSR    LDSTK         :Get program's stack & workspace  20 lo hi
       JMP    PLREGS        :then exit to program.            4C lo hi
:
TOCOLD JMP    COLD          :Exit PARALL to system.           4C lo hi
:----------------------------------------------------------------------
:= INTRPT     Internal interrupt routine to test interrupt type
:             and jump to appropriate action.
:HARDWARE     6522 VIA.
:SOFTWARE     NEXTPR, HANDLE.
:INPUT        PIF = $00 (accept) or $80 (ignore interrupt).
:OUTPUT       Appropriate action initiated.
:             Interrupt timer reset if interrupt ignored.
:
INTRPT PHA                  :Save A (P saved on interrupt).   48
       LDA    VIA+13        :Test if interrupt occurred       AD lo hi
       AND    #$C0          :because of VIA Timer 1 = 0,      29 C0
       CMP    #$C0          :skipping out if not to routine   C9 C0
       BNE    INTHAN        :dealing with other interrupts.   D0 10
       STA    VIA+13        :Clear interrupt flags and test   8D lo hi
       BIT    PIF           :if program has disabled PARALL,  24 MD
       BMI    INTIGN        :ignore interrupt if so.          30 04
       PLA                  :Okay to change programs, so      68
       JMP    NEXTPR        :restore A and go to changeover.  4C lo hi
:
INTIGN PLA                  :Restore A, set timer to give     68
       JSR    SET           :program another time slice and   20 lo hi
       RTI                  :return to current program.       40
:
INTHAN PLA                  :Restore A and jump to external   68
       JMP    HANDLE        :routine for alien interrupts.    4C lo hi
:----------------------------------------------------------------------
:= NEXTPR     Internal subroutine and interrupt routine to perform
:             changeover between time-sliced programs.
:SOFTWARE     SVSTK/SVBLK, LDSTK/LDBLK, PLREGS.
:INPUT        QNL,H addresses next available Queue storage.
:OUTPUT       Interrupted program state saved on Queue.
:             Next sequential program state restored from Queue.
:             Exit to next program, pointers adjusted.
:
NEXTPR PHA                  :Save current machine state       48
       TXA                  :(registers) - P has already      8A
       PHA                  :been pushed by interrupt         48
       TYA                  :or FORCE entry.                  98
       PHA                  :                                 48
       LDA    PIF           :Also save current program's      A5 MD
       PHA                  :Interrupt-disable flag.          48
       CLD                  :Ensure binary arithmetic.        D8
       LDY    PSQI          :Y = current program index.       A4 M4
       LDA    QNL           :Move address of next available   A5 M2
       STA    QSQ,Y         :Queue storage to program         99 lo hi
       LDA    QNH           :sequence parameters in QSQ,      A5 M3
       STA    QSQ+1,Y       :then go save program's stack     99 lo hi
       JSR    SVSTK         :and workspace on Queue.          20 lo hi
       LDA    PSQI          :Test if current program is       A5 M4
```

```
        CMP  PSQM        :last in sequence,              C5 M5
        BCC  LDNXTP      :continue with next if not.     90 12
;
        LDA  QWL         :Else working pointer now       A5 M6
        STA  QBL         :addresses Back of Queue, so    85 M0
        LDA  QWH         :move this address to Back of   A5 M7
        STA  QBH         :Queue pointer.                 85 M1
        LDA  QFL         :Reset working pointer to       A5 ME
        STA  QWL         :Front of Queue from Front of   85 M6
        LDA  QFH         :Queue pointer. Next program    A5 MF
        STA  QWH         :will be first in sequence, so  85 M7
        LDA  #-5         :ensure program index is reset. A9 FB
;
LDNXTP  ADC  #4          :Index next program in          69 04
        TAY              :sequence, putting index in Y   A8
        STY  PSQI        :and in index variable.         84 M4
        LDA  QWL         :Working pointer now addresses  A5 M6
        STA  QNL         :what will be next available    85 M2
        LDA  QWH         :Queue storage after load, so   A5 M7
        STA  QNH         :move it to Next in Queue.      85 M3
        JSR  LDSTK       :Get program's stack & workspace 20 lo hi
        JMP  PLREGS      :then exit to program.          4C lo hi
;----------------------------------------------------------------
:= SVSTK     Internal subroutine to move all program stack from
:            6502 stack to Queue storage.
:SOFTWARE    QSTOWS, STKLEN, QWNEW. Falls into SVBLK.
:INPUT       Y holds current program index.
:OUTPUT      Stack copied to Queue store. Stack unchanged.
;
SVSTK   JSR  QSTOWS      :Get queue-sequence pointers.   20 lo hi
        JSR  STKLEN      :Get max stack in X & Y, set    20 lo hi
        JSR  QWNEW       :queue pointer down X bytes.    20 lo hi
        TSX              :Get current 6502 stack pointer BA
        INX              :adjust it above return address E8
        INX              :from SVSTK/SVBLK.              E8
        TXA              :Save it, via A, to highest byte 8A
        STA  (QWL),Y     :of queue stack storage space.  91 M6
        DEY              :Index next highest byte.       88
;
SSTKLP  INX              :Loop, copying stacked values   E8
        BEQ  SVBLK       :(until end of 6502 stack)      F0 08
        LDA  $100,X      :from 6502 stack to queue stack BD 00 01
        STA  (QWL),Y     :storage in reverse order.      91 M6
        DEY              :Index next queue byte, repeat  88
        BNE  SSTKLP      :else fall through to SVBLK.    D0 F5
;----------------------------------------------------------------
:= SVBLK     Internal subroutine to move all workspace blocks
:            blocks from program workspace area to Queue storage.
:SOFTWARE    BLKINF, QWNEW. Fallen into from SVSTK.
:INPUT       QWL,H addresses top of program workspace on Queue.
:OUTPUT      Workspace saved on Queue.
:            QWL,H adjusted past program workspace on Queue.
;
SVBLK   LDY  #3          :Set index to 1st workspace     A0 03
        STY  TEMP        :size byte in parameter-block.  84 MC
;
SBLKS   JSR  BLKINF      :Loop - get next block size in X 20 lo hi
        BEQ  SBLKND      :(exit if size = 0 = block end) F0 0F
        JSR  QWNEW       :else set pointer down X bytes. 20 lo hi
        LDY  #0          :Index block from 1st byte.     A0 00
;
SBLKLP  LDA  (WSPL),Y    :Loop - transferring workspace  B1 MA
        INY              :bytes to queue workspace store C8
        STA  (QWL),Y     :(queue pointer is 1 byte lower 91 M6
        DEX              :than queue block). Repeat      CA
        BNE  SBLKLP      :for block of X bytes.          D0 F8
        BEQ  SBLKS       :Then test for another block.   F0 EC
;
SBLKND  RTS              :Exit on zero block terminator. 60
;----------------------------------------------------------------
:= LDSTK     Internal subroutine to move all program stack from
:            Queue storage to 6502 stack.
:SOFTWARE    QSTOWS, STKLEN, QWNEW. Falls into LDBLK.
:INPUT       Y holds current program index.
:OUTPUT      Stack loaded to top of 6502 stack. S adjusted.
;
LDSTK   JSR  QSTOWS      :Get queue-sequence pointers.   20 lo hi
        JSR  STKLEN      :Get max stack in X & Y, set    20 lo hi
        JSR  QWNEW       :queue pointer down X bytes.    20 lo hi
        LDA  (QWL),Y     :Get saved 6502 stack pointer   B1 M6
        TAX              :from highest queue stack space AA
        PLA              :to X. Pull return address from 68
        STA  TEMP        :LDSTK/LDBLK, saving it         85 MC
        PLA              :temporarily in TEMP and A.     68
        TXS              :Set stack pointer for program  9A
        PHA              :and push return address        48
        LDA  TEMP        :to top of repositioned stack   A5 MC
        PHA              :ready for RTS.                 48
        DEY              :Index next highest byte.       88
;
LSTKLP  INX              :Loop, copying stacked values   E8
        BEQ  LDBLK       :(until end of 6502 stack)      F0 08
        LDA  (QWL),Y     :from queue stack storage to    B1 M6
        STA  $100,X      :6502 stack in reverse order.   9D 00 01
        DEY              :Index next queue byte, repeat  88
        BNE  LSTKLP      :else fall through to LDBLK.    D0 F5
;----------------------------------------------------------------
:= LDBLK     Internal "fall into" routine to move all workspace
:            blocks from Queue storage to program workspace area.
:SOFTWARE    BLKINF, QWNEW. Fallen into from LDSTK.
:INPUT       QWL,H addresses top of program workspace on Queue.
:OUTPUT      Workspace loaded to correct addresses.
:            QWL,H adjusted past program workspace on Queue.
;
LDBLK   LDY  #3          :Set index to 1st workspace     A0 03
        STY  TEMP        :size byte in parameter-block.  84 MC
;
LBLKS   JSR  BLKINF      :Loop - get next block size in X 20 lo hi
        BEQ  LBLKND      :(exit if size = 0 = block end) F0 0F
        JSR  QWNEW       :else set pointer down X bytes. 20 lo hi
        TXA              :Index block from last byte,    8A
        TAY              :using size in X as index in Y. A8
;
LBLKLP  LDA  (QWL),Y     :Loop - transferring queue bytes B1 M6
        DEY              :to program workspace at WSP    88
        STA  (WSPL),Y    :(queue pointer is 1 byte lower 91 MA
        DEX              :than queue block). Repeat      CA
        BNE  LBLKLP      :for block of X bytes.          D0 F8
        BEQ  LBLKS       :Then test for another block.   F0 EC
;
LBLKND  RTS              :Exit on zero block terminator. 60
;----------------------------------------------------------------
:= SET       Internal subroutine to set interrupt time interval.
:HARDWARE    6522 VIA.
:INPUT       VIA must be initialised.
:OUTPUT      Interrupt flags cleared and countdown started.
;
SET     PHP              :Save registers used in SET.    08
        PHA              :                               48
        LDA  #$0E        :Put lo-byte of interval count  A9 0E
        STA  VIA+4       :in lo-byte of VIA Timer 1.     8D lo hi
        LDA  #$27        :Likewise, write hi-byte and    A9 27
        STA  VIA+5       :initiate count.                8D lo hi
        LDA  #$C0        :Clear VIA interrupt flag       A9 C0
        STA  VIA+13      :by write to interrupt reg.     8D lo hi
        PLA              :Restore registers.             68
        PLP              :                               28
        RTS              :Exit, countdown in progress.   60
;----------------------------------------------------------------
:= QSTOWS    Internal subroutine to transfer program parameters
:            from Queue sequence to page zero pointers.
:INPUT       Y indexes current sequence parameters.
:OUTPUT      QWL,H & PBPL,H contain correct program parameters.
;
QSTOWS  LDX  #0          :Index QWL, QWH, PBPL & PBPH.   A2 00
QSTWLP  LDA  QS0,Y       :Loop transferring queue store  B9 lo hi
        STA  QWL,X       :address and parameter-block    95 M6
        INY              :address from queue-sequence to C8
        INX              :page zero pointers QW & PBP.   E8
        CPX  #4          :                               E0 04
        BNE  QSTWLP      :                               D0 F5
        RTS              :                               60
;----------------------------------------------------------------
:= STKLEN    Internal subroutine: get program maximum stack use.
:INPUT       PBPL,H addresses program Parameter-Block.
:OUTPUT      A & X & Y = maximum stack + 8 for machine state.
;
STKLEN  LDY  #2          :Index parameter block and get  A0 02
        LDA  (PBPL),Y    :maximum stack size in A.       B1 M8
        CLC              :Add 8, no carry in, to allow   18
        ADC  #8          :for regs, stack pointer and    69 08
        TAX              :the start, RTI or RTS address. AA
        TAY              :Exit with full size byte in    A8
        RTS              :A, X and Y.                    60
;----------------------------------------------------------------
:= BLKINF    Internal subroutine to get size and start address of
:            one block of current program's workspace.
:INPUT       TEMP = current Parameter-Block index.
:OUTPUT      A & X = block size. Z set if A=0 (block terminator).
:            WSPL,H = start address if workspace block exists.
:            Y = TEMP = incremented Parameter-Block index.
;
BLKINF  LDY  TEMP        :Get parameter-block index and  A4 MC
        LDA  (PBPL),Y    :pick up next size byte in A,   B1 M8
        INY              :index next address byte,       C8
        TAX              :copy size byte to X and end    AA
        BEQ  BLKIND      :if 0 = block terminator.       F0 0A
;
        LDA  (PBPL),Y    :Else copy start address of     B1 M8
        STA  WSPL        :block from parameters to       85 MA
        INY              :work-space pointer, moving     C8
        LDA  (PBPL),Y    :index in Y past the address    B1 M8
        STA  WSPH        :to index size byte of          85 MB
        INY              :next work-space block.         C8
;
BLKIND  STY  TEMP        :Save index.                    84 MC
        TXA              :Size byte back to A returning  8A
        RTS              :zero information in Z.         60
;----------------------------------------------------------------
:= QWNEW     Internal subroutine to adjust working pointer.
:INPUT       X contains the adjustment size.
:OUTPUT      QWL,H lowered by X bytes. X unchanged.
;
QWNEW   SEC              :Prepare to subtract with no    38
        LDA  QWL         :borrow. Get working pointer low A5 M6
        STX  QWL         :order byte in A. Store stack or 86 M6
        SBC  QWL         :block size in page zero and    E5 M6
        STA  QWL         :subtract from lo-byte. Put     85 M6
        BCS  QWNEND      :result back. Exit if no borrow B0 02
        DEC  QWH         :else subtract 1 from high byte. C6 M7
QWNEND  RTS              :Exit, QW ready for a save/load. 60
;----------------------------------------------------------------
:= PLREGS    Internal "jump to" routine to restore and exit.
:SOFTWARE    SET
:INPUT       PIF, Y, X, A and P on stack. VIA initialised.
:OUTPUT      Timer 1 set. Registers restored.
:            RTI/RTS exit depending on state of PIF.
;
PLREGS  PLA              :Restore program interrupt flag 68
        STA  PIF         :to page zero byte.             85 MD
        PLA              :Restore Y, X and A.            68
        TAY              :                               A8
        PLA              :                               68
        TAX              :                               AA
        PLA              :                               68
        JSR  SET         :Set next interrupt interval.   20 lo hi
        BIT  PIF         :Test interrupt flag and if     24 MD
        BMI  SUBRET      :set skip to subroutine exit    30 01
        RTI              :else exit from interrupt.      40
SUBRET  PLP              :Call to SGNON or FORCE will    28
        RTS              :need this subroutine return.   60
;================================================================
```

BLOCKBUSTERS
BLOCKBUSTERS

Blockbusters is the ratings-topping, button-popping, mind-stopping quiz game of the decade, and now it's been adapted for your micro computer!

Central TV's popular programme attracts around 12 million fans, and now it's all set to become number one in the personal computer charts as well! Blockbusters is 'edutainment' of the highest level for all the family, providing a perfect introduction to the home computer.

Two players pit their wits against each other and the clock in a game which tests mental agility and general knowledge – it's exciting, educational and intense with an appeal as wide as the micro itself.

If you've got a computer in the family you've got to get Blockbusters. And if you haven't, it's worth getting one just to play Blockbusters! Now available from High Street stockists or direct from Macsen Software – just fill in the coupon below and try to contain your excitement – we'll deliver within 14 days!

This is what the experts have to say . . .
"A surprisingly addictive family game with considerable educational side-benefits" – CRASH MICRO MAGAZINE

Macsen Software, GBA Limited, 17 Nott Square, Carmarthen, Dyfed, SA3 1PQ.
Please send me a Blockbusters programme for my
BBC-B ELECTRON ☐ **SPECTRUM 48K** ☐
COMMODORE 64 ☐ (Tick appropriate box)
Price **£7.95 + 60** pence p&p.
I enclose Cheque/PO number ____________
for **£8.55** made out to Macsen Software or please debit my ACCESS/BARCLAYCARD, number ____________
Signature (Mr/Mrs/Miss) ____________
Address ____________
____
____________ Postcode ____________

THE ULTIMATE CHALLENGE!

MACSEN SOFTWARE

MACSEN SOFTWARE

CENTRAL

TRANSACTION FILE

Your chance to buy, sell or swap equipment.

● COMMODORE 4040 dual disc drive, hardly used, excellent order £280. Wordpro 3 plus word processing software + manual + ROM £120. Tel: 031-447 6027 eve.

● GRAFPAD graphics tablet for BBC £80. CGP115 four colour plotter £80. Aries 20k RAM card for BBC £50. Apple Silentype printer £80. Tel: 01-841 8857.

● APPLE IIC, monitor, stand, external disk, Appleworks and Access. All in excellent condition, some items still boxed. List £1,950 + will accept £950. Tel: (01) 930 1505 (office hours).

● ACT Sirius One 2.4Meg boxed. 50 disks DBasell, Supercalc2, Wordstar, manuals, £1,000. Tel: 01-837 8466 (London N1).

● TANDY TRS80 Model III 48k. Integral disk drives and Tandy printer Model VIII. Perfect condition and working order, both boxed with manuals, Visicalc, other programs, various books, £595. Tel: Eastbourne (0323) 33088.

● SHARP MZ80K system. Including dual disk drives, Epson MX80 F/T2 printer. Very good condition. £1,000 ono. Includes manuals, club newsletters, disk database, programmers toolbox, various Basics, business software and games. Tel: (0908) 367701.

● MICROWRITER portable word processor, 8k RAM, RS232, charger, case, manuals. Approx one year old. Cost new £450, selling for £250 ono. Tel: 0247 817930.

● VISIWORD word processor package for IBM Personal Computer or IBM PC-XT. Unwanted purchase, unopened and unused. Manual, disc etc. Best offer around £125. Tel: Cyril Toms, 01-989 1993 anytime.

● APPLE II. Parallel printer interface and coupler. Centronics, boxed, brand new, unused, £25. Sharp MZ 700, Dragon Caves cassette, £5. MZ 700 Database Filer plus Daybook VAT Accounts, £10 pair Cassette. Tel: Par 4302.

● TRS-80 Model 1. 64k, Twin disk, printer, monitor, Basic APL assembler, Forth, Pascal. Many manuals, books, discs, much software, £250. Worth it for the discs, printer, monitor alone. Tel: Bracknell 0344 426409.

● TRS-80 model IV System. Twin drives, 128k, software including CP/M+, Cobol, line printer VI (13½in professional dot matrix), Technical manual, all cables, '80 micro' magazines, £1,200 ono. Tel: 05645 78218 (24 hour).

● COMMODORE 64k. Datasette, joystick, software. Worth £325. Sell for £220, ono. 7C Lynton Road, Foleshill, Coventry, W. Midlands.

● TI99/4A, little used, Extended Basic, mini memory, assembler, editor, manual, Parsec, cassette lead, books, technical data, £150, No splitting. Tel: 0240 75899 (Chalfont St. Giles) (evenings).

● APPLE III COMPUTER, monitor and additional disk drive, software including Visicalc, Applewriter, Mail List Manager, system software with Aple II emulator, £995. Apple III disk drive, £140. Tel: (Bourne End) 25895 eves/weekends.

● COMPUTER PEN PALS CLUB!. If you would like a pen pal to swap ideas with contact: L. Thomas, 9 Crossfields, Croespenmaen, Crumlin, Gwent NP1 4DD. Send a SAE for a reply.

● APPLE II Europlus. Double disk drives, Monitor, Joystick, Manuals, Visicalc, CORD Program generator, Systematics International Accounts package, with all manuals, £1,000 ono. Tel: Simons 01-530 5902 (day). 01-550 8923 (eves).

● CROMEMCO SYSTEM THREE. With Persci 299B plus other Cromemco boards; A DM 3A isual display teminals, ideal for backup or multi-user systems. Tel: for details. (239) 213645. Mr. Z. Massey, 2a Kimbolton Road, Bedford.

● KAYPRO 2. 2×190k CPM portable computer. Complete with Perfectwriter, Profitplan, MBasic, etc. In excellent condition, £800 ono. Star 510/5 Serial printer interface, £20. t(0632) 375860.

● APPPLE EUROPLUS. 2 drives, monitor, Wordstar, Spelstar, Mailmerge, 3 Visi's, training both. Accounts Format 80, SC macro, Einstein, Merlin, Bank St, Property Management, Pascal, Ormbeta, Magicalc, Z80 CPM, 80 col, £900. Lots more, everything available separately. Tel: 01-736 7809.

● NEWBRAIN model AD. Zenith green monitor, Microline 80 printer. Would make excellent word processing system. Manuals, demo, astronomy and accounts programs. £280 ono. Lefevre 0705 863157 eve and weekends (Portsmouth).

● COLOURSOFT 80 viewdata editing teminal, 40 page memory, full editing keyboard, internal modem, 14 in colour TV, £750 ono. Tel: 01-747 0900 eve.

● APRICOT. Twin 320k disks, 256k RAM, 9 inch monitor, unwanted prize, £1,295 ono. Tel: 01-622 0801.

● APRICOT. Twin 320k disks, 256k RAM, 9 inch monitor, unwanted prize, £1,295 ono. Tel: 01-622 0801.

● HX-20 CASE, expansion unit, micro cassette books, leads, Ffogg word processing ROM, other books and software, Brother EP-44 typewriter printer, £580 or best offer. Excellent condition. Tel: 01-267 5736 eve, 01-589 1444 ext 3377 day.

● WANTED. Sharp expansion interface unit, MZ-80I/0 with cards for printer and disk drive. Would also be interested i floppy disk drive if available. Tel: 0332 880118.

● BBC model B, plus disc interface, Torch Z80 disc pack, Kaga monitor, including lots of software and accessories. For £999 only. This is no joke! Tel: Histon (022023) 4083.

● SHARP MZ-80A, 48k. Excellent condition, boxed with manuals and dust cover, £100 worth of software including Pakman, Frogger etc, £250 for quick sale. Tel: (0706) 31489.

● WANTED. Either Centronics or RS232 interface board for Newbury data (data recording instruments) 6320 printer. Tel: Bolton (0204) 56921 eve.

● PRINTER. Tandy DMP 100 50 cps. Centronics + RS232 interfaces, including dust cover and spare ribbon. All as new, £85. Also Atari word processor program C/W manuals, £30. Tel: 01-542 8628 after 6pm.

● IBM PC BITS:— Basic compiler £160, list £280. APL program £110, list £190, 8087/8088, Diagnostics £145, list £246, Basic program development system £70, list £120. Tel: John Perry on Hayling (0705) 468778.

● PAGE EUROSYSTEM SIRIUS 1 Prototype. Quick connect board complete with quick connect tool and wire, £95. Also an AP products TC40 test clip, £15. Tel: Bordon (0423) 7194.

● BBC B WITH Torch Z80. Dual 40/80 drives. RGB colour monitor. Perfect suite of software. Value, £1,700. Mint condition. Manuals etc. Exchange Apricot PC twin. Cash adjustment. Tel: (0908) 582612 eve.

● BBC B 1.2OS. Excellent condition, joysticks, user manuals, various assembler manuals, Acornsoft's Elite, Snapper, and 3 adventures, Quicksilvas Music Processor, and Drumkit, Invaders and others. £340 ono. Tel: 01-670 1828.

● BBC B. ATPL ROM board, Watford DFS, Wordwise, Exmon, Toolkit, Masterfile, Paintbox etc. Microvitec colour monitor, D/S 40-TRK disk drive, Epson MX80FT3, acoustic modem, joysticks, cassette recorder, books, magazines, £995. Tel: (0403) 731352.

● ONE COMMODORE 8032k, £390. One ITOH 1550 printer, £495. Both ex VAT. D. Raja. Tel: 01-902 5311.

● VIC 20 + 16k RAM pack, Commodore tape recorder, several games, two books. Worth over £220. Good as new, only £90 ono. Tel: 061-865 6559 for details.

● NASCOM 32k. 4MHZ. Nassys 3 + 12 in TV, Naspen, Zeap 2, debug, + games including Logichess, and lots of documents. Any reasonable offer accepted. Tel: Tyneside (091) 2634197 (after 6pm).

● TANDY MODEL III. 48k Twin disk drives, RS232 built in. Lots of disk based software, £6650 ono also Anderson Jacobson 300 baud acoustic coupler. Almost new, £150. Tel: (0584) 810015.

● TRS-80, model I, Level 2, 48k (16k+32k). Video Genie, S100 exp-int, monitor + software on cassette. All leads, ready to use, will separate. Quick sale needed, hence £80. Tel: John 01-947 8442 after 6pm.

● SHARP MZ80K. 48k. Monitor, keyboard, cassette. Excellent range of software worth £250, including Pascal, Basic, games and empty tapes. Cover, and manuals included, only £150. Also computer programming magazines. Tel: High Wycombe 28992.

● APRICOT PC. 256k, 2×720k drives, 12in monitor, internal modem card. Micromail, Superplanner, Superwriter, Supercalc. As new, 3 months old in original packaging, £1,700 ono. Tel: 01-553 4755 eve

TRANSACTION FILE ADVERTISEMENT FORM

All Transaction File ads must be submitted by readers on this form or a photocopy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £2.50. Make cheques or POs payable to *Personal Computer World*. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to help you by printing your ad very clearly. Send your completed form to: Transaction File, *PCW*, 62 Oxford Street, London W1A 2HG.

Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

WRITING FOR PCW

Your chance to contribute to the magazine.

We're offering readers a chance to get rich (well, at least richer) and to influence what's published in the magazine — by writing for it. We welcome approaches from would-be writers, including those who have never appeared in print before. It's often users with practical experience who have the most interesting things to say, so don't worry if your prose is less than perfect, we can take care of the polishing.

If you have an idea for a feature write, with a brief synopsis, outlining the proposed structure and content. If your article is already written, then send it in for consideration. Remember to put your name and address on both the covering letter and the manuscript — along with a daytime phone number if possible. Manuscripts should be typed or printed out (dot matrix output is fine), in double-line spacing with ample margins top and bottom and on each side.

Any accompanying program listings should be supplied on disk or cassette, ideally with a printout as well.

We'll try to return all submissions sent in with a suitable sae, but make sure you keep a copy of everything you submit as well.

Bear in mind that it's worth taking a look at the Back Issues advertisement to see what sort of things we have already published — after all there's no point in reinventing the wheel. And please be sure to tell us if you've contacted another magazine (perish the thought): it would be very awkward if the same article appeared elsewhere. Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work — the rate is £65 per 1000 words, and payment usually follows about four-six weeks after publication.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements, in order to avoid wasted journeys due to cancellations, printer's errors, and so on.

London	(Earls Court), Communications London Exbn. Contact: Industrial and Trade Fair Ltd, (01) 940 6065	23-25 April
London	(Wembley Conference Centre), Audio Visual Exbn 85. Contact: Mclaren Exbns, (01) 688 7788	22-25 April
London	(Wembley Conference Centre), Computer Aided Production Management Exbn. Contact: Institute of Production Engineers, (01) 579 9411	30 April-2 May
USA	(Atlanta), Comdex Spring. Contact as Comdex Winter below	6-9 May
London	(CBI HQ), Computers In Project Management Exbn. Contact: Association Of Project Managers, (0494) 8127 88	7-8 May
London	(Novotel), Apple User Show. Contact: Database Publications, (061) 456 8383	9-12 May
London	(New Hortic'l Hall), Electron + BBC Micro User Show. Contact: Database Publications, (061) 456 8383	9-12 May
London	(Barbican), Business to Business Exbn. Contact: Silver Collins & Co Ltd, (01) 729 0677	12-15 May
Birmingham	(NEC), IBM Computer User Show Conf & Exhn. Contact: Online Conferences Ltd, (01) 868 4466	14-16 May
Bristol	(Exbn Centre), Micro City. Contact: Argus Specialist Exbns Ltd, (04427) 73291	14-16 May
London	(Barbican), Business Telecom Exbn. Contact: Online Conferences Ltd, (01) 868 4466	21-23 May
London	(Bloomsbury Crest), Microfilm Exbn. Contact: Beta Exbns Ltd, (01) 405 6233	21-23 May
USA	(Anaheim), Comdex Winter (Computer Conf & Exbn). Contact: Interface Group Inc, 300 First Ave, Needham, MA 02194	21-24 May
London	(West Hotel), The 1985 International Videodisc, Optical Disc & CDROM Conf & Exbn. Contact: Meckler Communications, (01) 240 0856	29-31 May

LEISURE LINES

Brain-teasers from J J Clessa

Quickie

If you take a certain number, add it to 21 and then divide the result by 2, you get the same answer as if you multiply the original number by 7 and subtract the result from 18. What is the number?

LEISURE LINES

Prize Puzzle

The idea for this month's puzzle comes from Mr Charles Skrzynski of Hendon.

Wild geese always fly in exact triangular formation. It follows, therefore, that in any flight of geese there must be 1, 3, 6, 10, 15 birds, and so on, since these are triangular numbers.

A flock of geese flew overhead the other day heading south. There must have been well over five thousand of them. As they were passing, a number of birds broke off from the main flight and set off as a separate formation heading south-east — the majority of birds were still flying south also in exact formation.

Then a few moments later, another group left the main flight and headed south-west. This group contained the same number of birds as were heading south-east. There were now three exact formations. How many geese were there in each flight, and in total?

Answers please, on postcards only (letters will be disqualified), to *PCW* Prize Puzzle May 1985, Leisure Lines, 62 Oxford Street, London W1. Entries to arrive not later than 30 April 1985.

February Prize Puzzle

A rather easy puzzle this month with a good response of well over 200 entries, almost all giving the correct answer. The winner, chosen at random from the pile, was Mr Graham Dimond of Sheffield. Congratulations, Graham, your prize is on its way.

The answer was 625, which is the average of 289 and 961. There seems to be some controversy as to whether unity (1) is a prime number. The definition of a prime is 'an integral number which has no factors other than unity and itself'. We would be interested to learn of any published tables of primes which do not contain unity.

Prize Puzzle December 1984

A rather low response — about 60 entries — possibly because the problem was quite difficult. In fact, about 20 per cent of the entrants had the wrong answer. There were four possible solutions — each with 22 digits:

a) 2 173 913 043 478 260 869 565
b) 4 347 826 086 956 521 739 130
c) 6 521 739 130 434 782 608 695
d) 8 695 652 173 913 043 478 260

You can make other solutions with 44,66,88 digits, and so on, by repeating the above sequences of digits.

The winner chosen at random from the 47 correct entries was John Watkinson of Wisbech, Cambridgeshire. Congratulations, John.

NUMBERS COUNT

Mike Mudge delves into Euler's Totient function and presents further solutions to the Collatz problem.

Euler's Totient function

The great mathematician Leonhard Euler (1707-1789) had his dormant interest in number theory awakened by certain results of Pierre de Fermat (1601-1665). From 1747 to his death, the last thirteen years suffering total blindness, he made many valuable contributions in the field of number theory.

Theory and Definitions Euler's Totient function Ø(n), is defined to be the number of numbers not greater than n and prime to n. (That is, the number of numbers less than or equal to n and sharing no factor with n.)

n 1 2 3 4 5 6 7 8 9 10 11......50
Ø(n) 1 1 2 2 4 2 6 4 6 4 10......20

Nontotients are those positive values of n for which Ø(x)=n has no solution for example: 14,26,34,38.

Noncototients are those positive values of n for which x− (x)=n has no solution for example: 10,26,34,50.

Now we define f(n)=n−Ø(n) and observe that f(n) is less than n; thus if we iterate the function f to obtain f(f(...f(n)...)) we *must* eventually reach 1. For example: f(6)=6−2=4, f(4)=4−2=2, f(2)=2−1=1. Write s(k) to be the smallest integer which reaches 1 after k iterations.

k 2 3 4 5 6 7
s(k) 4 6 10 18 30 42
2.2 2.3 2.5 2.3.3 2.3.5 2.3.7

Question 1 Is there a pattern to the factorisation of s(k)? Is s(8)=2.3.5.7 or 2.3.3.5 or 2.3.11?

Question 2 (a) Are there infinitely many pairs of consecutive numbers n and n+1 such that Ø(n)=Ø(n+1)? For example: n=1,3,15,104.

Note that 18 solutions are known less than 10^4 and 59 less than 10^6.

(b) What about solutions of Ø(n)=Ø(n+1)=Øn+2)? (c) Consider Ø(n)=Ø(n+2)=Ø(n+4) (d) Similarly Ø(n)=Ø(n+3)=Ø(n+6) and so on.

Note that Schinzel has conjectured (1958) that Ø(n+k)=Ø(n) has an infinity of solutions for every k. However for k=3 only the solutions n=3 and n=5 are known.

Question 3 Determine the number N(y) of nontotients less than y as a function of y, extending the following table.

Y	10^3	10^4
N(y)	210	2627

Question 4 How many noncototients are there less than a given y?

Question 5 Is there a non-prime integer n, such that Ø(n) is a divisor of n-1?

Readers are invited to submit their program listings, output and hardware details together with their conclusions relating to some or all of the above questions to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffordshire, WV4 5NF. Tel 0902-892141.

A suitable prize will be awarded to the best entry received by 1 August 1985. Criteria will include accuracy, originality and efficiency, not necessarily in that order.

Please note that submissions can only be returned if a suitable stamped addressed envelope is included. Expanded reviews of previous problems together with, subject to the approval of the contributor, copies of detailed programs from the prize winning entry may also be requested.

Prize winner November

Numerous investigators discovered the six triperfect numbers mentioned; T = $2^3.3.5$ = 120, T_2 = $2^5.3.7$ = 672, T_3 = $2^9.3.11.31$ = 523776, T_4 = $2^8.5.7.19.37.73$ = 459818240, T_5 = $2^{13}.3.11.43.127$ = 1476304896 and T_6 = $2^{14}.5.7.19.31.151$ = 51001180160.

A very careful analysis by H Ibstedt of Paris in Basic on an ABC80 Metric with 32 kbyte RAM manufactured in 1979 by the Luxor company obtained these results in 3 minutes 45 seconds computing time.

However this month's prizewinner has to be Mr RF Tindall from Cambridge who has, to the best of my knowledge, pushed back the frontiers of knowledge with T_7 which is $2^{24}.3.19^2.31.113.$ 127.151.301.451.601.901.1801 the remarkable aspect of this work is that *no* computer has been used, Mr Tindall has also investigated 4,5,6 and 7-fold perfect numbers; he refers to AH Beiler, *Recreations in the theory of numbers* '. . . as having many useful tables', and I feel sure would be pleased to discuss his algorithm (of which I also have the details) with any aspiring programmers who would like their computer to deduce T_7.

Collatz problem

Recall the iterative scheme $x_{n+1} = x_n/2$ if

NUMBERS COUNT

x_n is even else it is $3x_n + 1$; x_0 arbitrary. Does the scheme always reach 1? Mr. Jacoby Thwaites from London has constructed a truly remarkable program for the BBC Micro in Basic crossed with 6502 assembler which inputs an arbitrary x_0 in hexadecimal less than or equal to about 10^{40000} and applies the above iterative scheme displaying the x_n in binary as the iteration proceeds and counting the steps for example: F(1000), the hexadecimal number represented by F repeated 1000 times undergoes 19794 increases and 15579 decreases before reaching unity. (Run time a few minutes).

This represents a totally new area of work for such a micro; I would like to congratulate Mr Jacoby on this achievement and encourage all readers interested in the approach to contact him, (01) 242 9210.

MICROCHESS

Kevin O'Connell comments on a match between International Master, Julian Hodgson and Conchess.

England now has a very strong claim to rank as the second chess nation on earth, behind only the Soviet Union. Julian Hodgson, an International Master, is ranked number 13 in England and is improving — as I write this he has just won two important tournaments, one in Holland and one in Hastings, both within the space of a fortnight. Last year, however, Julian suffered defeat at the hands of Conchess, one of the many excellent stand-alone chess machines currently available.

White: Conchess. Black: Hodgson. Alekhine's Defence.

1 e2-e4 Ng8-f6
2 e4-e5 Nf6-e4?!

(This is very uncommon, inviting White to take over a lot of space by building up a huge pawn centre.)

3 f2-f3

(3 d2-d3 is regarded as best, a normal continuation being 3 . . . Ne4-c5, 4 d3-d4 Nc5-a6, 5 f2-f4, but there is nothing wrong with the text.)

3 . . . e7-e6

(This is very risky, but very interesting. 3 . . . Ne4-c5 would be 'normal' here.)

A carefully considered move

4 Ng1-e2!?

(Conchess had a very long think before playing this move, but it is just as well that it did. After 4 f3xe4 Qd8-ha+ 5 Ke1-e2 (5 g2-g3 loses a rook after 5 . . . Qh4xe4+ and 6 . . . Qe4xh1) 5 . . . Qh4xe4+ 6 Ke2-f2 Bf8-c5+ 7 Kf2-g3 Qe4xe5+ I would really enjoy playing Black's position against a computer opponent.)

4 . . . Ne4-c5

(White was really threatening to take the knight now since the move Qd8-h4+ would simply be met by Ne2-g3 and Black would have no compensation for the piece.)

5 d2-d4 Nc5-a4

(Another highly provocative move. 5 . . . Nc5-a6 would be more normal.)

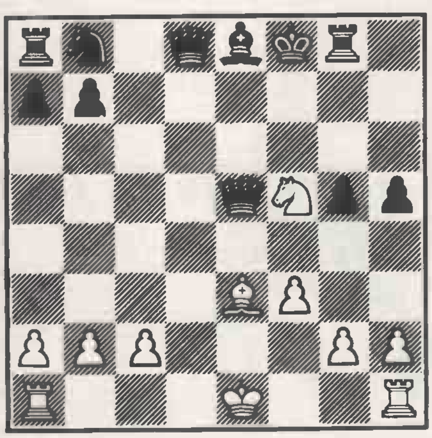
6 Ne2-g3 d7-d6
7 Bf1-b5+ Bc8-d7
8 Bb5xa4 Bd7xa4

(The computer now proceeds to outplay its strong human opponent.)

9 Nb1-c3 Ba4-c6
10 Bc1-f4 g7-g5?!

(A serious weakening of Black's position.)

11 Bf4-e5 h7-h5
12 e5xd6 c7xd6
13 Qd1-d2 Rh8-g8
14 d4-d5!



A fine, destructive move

(This is a fine move which completely wrecks Black's position. It is surprising that the program did not go pawn-grabbing with Ng3xh5.)

14 . . . e6xd5
15 Nc3xd5

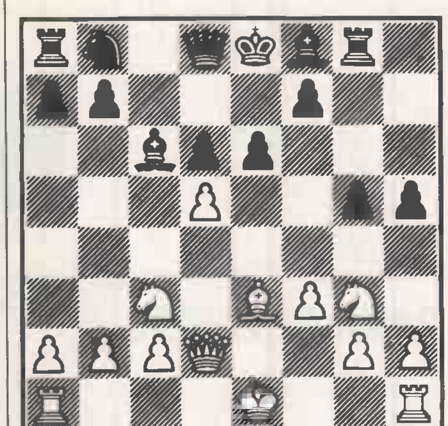
(White has a clear advantage now — all of his pieces are in play and Black's pawn structure is wretched.)

15 . . . Bf8-e7
16 Ng3-e4 f7-f5
17 Nd5xe7 Qd8xe7
18 Ne4xd6+ Ke8-f8

(Now White, two pawns up and with the better position, is clearly winning.)

19 Nd6xf5 Qe7-e5
20 Qd2-d8+ Bc6-e8

(If 20 . . . Kf8-f7 then 21 Nf5-h6+ wins easily.)



Towards a winning endgame

21 Qd8-d6+!

(It is good to exchange the queens into a winning endgame. When you are ahead, you should exchange pieces.)

21 . . . Qe5xd6
22 Nf5xd6 Nb8-c6
23 Nd6xb7 Ra8-b8
24 Nb7-c5 Rb8xb2
25 Nc5-e6+ Kf8-e7
26 Ne6xg5 Rb2xc2
27 O-O Nc6-e5
28 f3-f4 Be8-c6

(Now if 29 f4xe5, Black would turn the tables with 29 . . . Rc2xg2+ 30 Kg1-h1 Rg2xg5+ 31 Rf1-f3 Bc6xf3 mate.)

29 Rf1-f2! Rc2xf2
30 Be3xf2 Ne5-d3
31 Bf2-e3 h5-h4
32 Ra1-f1 h4-h3
33 g2xh3 Rg8-b8
34 Rf1-d1 Nd3-b2
35 Be3-c5+ Ke7-e8
36 Rd1-e1+ Ke8-d8
37 1-0 Black resigns

ACC NEWS

Have you been searching for a computer club in your area, or do you want to start a club but are unsure of what's involved? Rupert Steele has all the latest club news.

The Association of Computer Clubs (ACC) is an amateur, democratic association made up of around 150 computer clubs from all over the UK with informal links with another 300-400 groups. The ACC is run by a council composed of representatives of all the affiliated clubs (plus, in a non-voting capacity, corporate and individual members). The Council also elects the officers and committee of the ACC, who are responsible for running the association on a day to day basis.

The Association helps the clubs in six ways:

(i) By acting as a clearing house for information about clubs, maintaining a national clubs database and putting individuals in touch with their local computer clubs.

(ii) By providing two insurance schemes. One gives public liability (third party damages) insurance, including damage to rented premises (£100 excess) and member to member cover. This scheme applies free to all eligible UK ACC affiliated clubs. The other is optional, and covers equipment against accidental damage or loss including theft, while at a club meeting or in transit to or from such a meeting. It is available in 'units' of £2000 cover at £4 a year (minimum policy: 2 units). Contact me (at the address given at the end) for full written details of the insurance schemes.

(iii) Through the ClubSpot 810 database on Prestel, where computer clubs can be trained to edit their own pages on the system. This area contains a number of other features and is one of the most highly accessed information providers on Prestel. For information on how you could become a ClubSpot 810 editor, contact Andy Leeder, Church Farm, Stratton St Michael, Norwich, NR15 2QB or call/mailbox him on (0508) 30355.

(iv) By acting as the natural representative body for the computer club movement as a whole. This is a role we are anxious to expand, and a network of regional liaison officers is being set up (any volunteers?).

(v) By arranging stand space at computer fairs and exhibitions, at no or very little cost, for the use of affiliated computer clubs and user groups.

(vi) By providing help and advice in the formation of new clubs, running a register of guest speakers, and many other functions.

Write to me for an information pack and details of affiliation. The fee for local computer clubs is £7.50 a year, with higher rates for national user groups.

Club news

The Kensington and Chelsea Computer Society, KCCS new address, 12 Philbeach Gardens, London SW5 9DY, now meets on the second and fourth Wednesday of each month, at 8pm in the upstairs functions room, Hollywood Arms, Hollywood Road, off Fulham Road, London SW10. Membership of KCCS is £8 (concessions £5, family £13) and members are welcome with all levels of computer experience.

Andy Leeder has asked me to remind you about the Amateur Computer Club. They publish a newsletter called *ACCumulator* which is aimed largely at the more sophisticated hardware/systems enthusiast. Andy is membership secretary and will tell you all about it.

Several clubs this month in Scotland. David Davidson of 1 Roxburgh Place Larbert, Stirlingshire, FK5 4UE writes to tell me of the Central Scotland BBC Users Group, which was formed in late 1984 and meets monthly. Meanwhile Stewart Hutton writes to me from the heart of 'silicon glen' (83 Uist Road, Pitcoudie, Glenrothes, Fife, KY7 6RE) (0592) 744392. His club meets at the North Glenrothes Neighbourhood Centre, and is aimed to be something more than just a games playing group. His ideas include programming languages, lectures, informal workshops, competitions, hardware and software exchange, robotics and games.

Ian Watt writes to me about the Glasgow Computer Club. It meets in the Buffet Room of Pollokshaws Halls every second Monday from 7.30pm-9.30pm, with some members bringing along their own machines and equipment. The next few meetings will be on 29 April, 13 May, 27 May and 10 June. You can contact Ian on 041-638 1241 or write to him at 107 Greenwood Road, Clarkston, Glasgow, G76 7LW.

Finally from Scotland, Mrs Jill Campbell writes from 57 Hillside Road, Cardross, Dumbarton, G82 5LU. She runs Cardross Computer Club which meets once a month, with free premises and an annual subscription of £2. They run occasional simple competitions to help wean people off games and are planning to teach Basic and programming skills.

A few things from Wales this month: Roger Grenyer writes to tell me of the new Blaenau Ffestiniog Computer Club. Founded in February this year, their temporary address is care of: Cambrian Software Works, Unit 2, Maenofferen, Blaenau Ffestiniog, Gwynedd, LL41 3DL. Or call (0766) 831878. Also Welsh is 'The Bitsoc', which meets in Aberystwyth. Contact Andrew Falconer, Nevadd Cwrt Mawr, Dyfed, Ucw Aberystwyth, Aberystwyth.

Another Welsh offering is the more pronounceable Newtown and District Computer Club. Their Secretary and contact point is John Dale, 12 Popular Road, Newtown, Powys, SY16 2QJ. Among last year's activities were hands-on meetings with Texas, BBC, Dragon, Oric, Commodore 64, VIC 20 and other machines shown; demonstrations by local dealers; a car boot sale to raise funds for the club; and the Mid Wales Home Computer Exhibition.

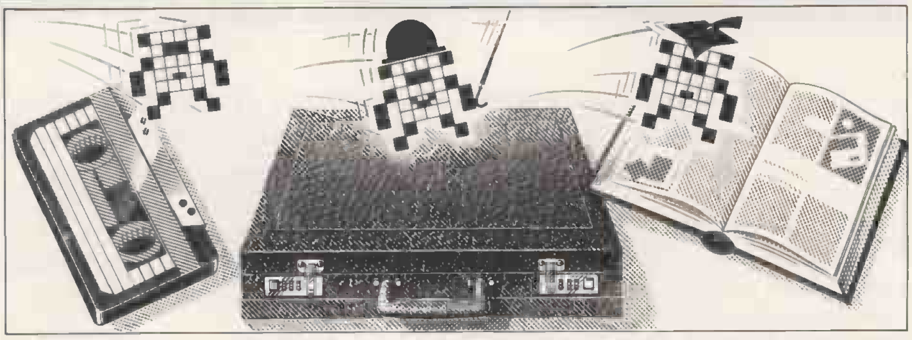
Finally, some news from Yorkshire. Keith Hook, editor of GENPAT, the Memotech Computer User Club, contacted me recently. They now have 1900 members acorss Europe and are the official National/International user club for the machine. There is a monthly newsletter of 30-40 pages, with a subscription of £16 (UK), £21 (International).

The Wakefield BBC Micro User Group meets on the first Wednesday of each month at Holmfield House, Clarence Park, Wakefield, at 7.30pm. Details of the group, which has some 70 members, are available from Wakefield BBC Micro User Group, The Secretary, 116 Pinderfields Road, Wakefield, WF1 3PL.

In Sheffield the SYPCG (South Yorkshire Personal Computer Group) meets on the second Wednesday each month for a lecture/demonstration meeting at 7.30pm in the General Lecture Theatre, St George's Building, University of Sheffield, Mappin Street. On the fourth Wednesday, they have a more social meeting, at the Clerical Technical Staffs Club, University of Sheffield, 197 Brookhill. Subscriptions are £4 (concessions £2) and I have been given three contacts: Richard Walker, 33 Conalan Avenue, Sheffield, S17 4PG; Bob Hindle, 139 Penryn Road, Sheffield, S11 8UP or tel: Sheffield 690379; Eric Cox tel: Sheffield 550368. The group is generally biased toward users actively involved in the development of hardware and software, but I am sure that beginners are welcome.

For more information about the ACC, or if you want a mention for your club here, write to me: Rupert Steele, 12 Philbeach Gardens, London, SW5 9DY or call (01) 370 0601. *Please note the change of address.* END

PROGRAM FILE



Nick Walker selects the best of readers' programs — for details on submitting your own, see the end of this section.

Two months ago I published a very popular program for the Commodore 64 that enhanced its Basic by adding extra commands to drive sprites, operating the sound channels, and providing numerous other useful commands. This month it's the turn of the 1541 Commodore disk drive to be enhanced. The Program of the Month provides a friendly menu-driven interface to this drive instead of the usual jungle of OPENs, CLOSEs and disk strings. In addition, there are extra operations not normally available from 1541 DOS; one in particular, RECOVER, is well worth typing in. It allows you to save files that have been accidentally erased, and I guarantee that if you don't type it in there will be a time in the future when you will wish you had.

Ever since I saw that hi-res screen and played with MacWrite and MacPaint, I've been a fan of the Apple Macintosh. BBC Weatherwise brings a Mac-like screen and user interface to BBC owners. Even if you're not interested in generating and printing a high-quality weather map of Great Britain, this program is well worth a look as an example of user-friendliness. Now I've seen this I'm waiting for someone to generate a desk-top manager like the Mac's — I'm sure the routines in this program would help anyone wanting to do so.

Also for BBC owners is a short program which initialises disks into a common format that can be read by both 40 and 80-track drives. If you've a 40-track drive and you want to give a program to a friend with an 80-track drive, or *vice versa*, this is the program to do it.

Apologies to Atari owners for not printing the second listing of Multi-Mode Text in the March issue. I've made up for it this month by not only publishing the second listing, but also a program which generates proper error messages instead of the usual error numbers found on Ataris.

Spectrum owners who are bored with zapping aliens may like to try Triplets, a collection of logic puzzles all with an interesting link.

On the business front there's a program that should be a boon to anyone involved in a retail business. Written in Microsoft Basic for machines of 32k or more, this program relieves some of the tedium of VAT invoicing by producing suitable quarterly reports and all the information needed to complete a VAT return.

Games
Scientific/mathematic
Business
Toolkit/utilities
Educational/Computer Aided Learning

Program of the Month
Commodore 64 Disk Utility
by Steve Mehew

I think even the most fervent Commodore fan will agree that the 1541 disk drive is awful, not only because it's very slow but also due to the convoluted commands needed to drive it. I've yet to see software that makes it operate faster, but this program certainly makes it a lot friendlier to use and also adds some extra commands.

Disk Utility for the Commodore 64 allows you to easily perform all the necessary housekeeping on your disks but without the trouble of opening, closing and playing about with disk strings that normally accompany disk work. All the disk operations are easy to use from a menu so I'll say no more about the normal ones such as DELETE, RENAME and CATALOG. However, there are a couple of extra commands.

It's possible to lock a file so that it can't be erased or saved over. This can normally only be done by altering the file entry data on the disk for which there isn't a command. This program will allow it to be done by simply entering the name of the file. It will, of course, also unlock a file.

Probably the most useful facility is the Recover option. This allows a file that has been accidentally erased or saved over to be recovered, provided that no further disk operations have occurred. There is no command for this in the normal 1541 DOS system, but this program will do it easily.

The menu option that provides a disk directory is written in machine code. This section of the program can be lifted out and used in other programs, but don't forget it is copyright material. The lines you'll need are 1890 (excluding the reference to location 2), 1900, and lines 1930 to 2250 inclusive.

```
100 rem 1541 disk utility.
110 rem (c) steve mehew, october 1984.
120 :
130 poke 2,0
140 poke53280,0:poke53281,0:printchr$(147)chr$(14)chr$(8);:poke646,5:clr
150 dimns(35):forr=1to35:readns(r):next
160 data20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,18,18,18,18,18,18,18
170 data17,17,17,17,17,17,16,16,16,16,16
180 forr=0to39:a$=a$+chr$(192):next:rn$=chr$(18):rf$=chr$(146):poke650,128:i=-1
190 forr=0to39:spo$=spo$+chr$(32):next:y=1
200 printchr$(17)rn$a$spo$a$rf$:printchr$(145)chr$(145);chr$(145);
210 t$="Steve's Amazing 1541 Disk Utility"
220 t=20-len(t$)/2:printrn$left$(spo$,t)t$:print
230 ifsrthenreturn
240 gosub 1860
250 printchr$(28)chr$(13)"   Press number of choice:":print:poke646,5
260 data"LOCK    a file.","UNLOCK  a file.","DELETE  a file.","RECOVER a file."
270 data"CATALOG a disk.","RENAME  a file.","FORMAT  a disk."
280 data"Examine disk for errors.","Read disk status.","VALIDATE a disk.","*"
290 readpo$:ifpo$="*"then320
300 i=i+1:printspc(5);:i$=str$(i):j=len(i$):ifi=10thenprintchr$(157);
310 printleft$(i$,j)"]  "po$:goto290
320 print:print:printspc(9)chr$(28)"Choice:   ";:poke198,0:poke646,5
330 ifpeek(2)<>192thengosub1890
340 getpo$:ifpo$=""thenpo=po+1:ifpo<>20then340
350 ifpo=20thenprintchr$(157);chr$(35+3*(y=1));:y=-y:po=0:goto340
360 ifpo$<"0"orpo$>"9"thenpoke53280,1:forr=0to10:next:poke53280,0:goto340
370 on(val(po$)+1)goto390,630,850,930,1220,1260,1400,1510,1760,1820
380 :
390 sr=-1:printchr$(147):gosub200
400 print:print"  Enter Fileneme to be Locked.":print:print:poke19,1:poke198,2
410 poke 631,46:poke 632,157
420 input"       NAME:   ";f$:poke19,0:print
430 iff$="."then 140
440 iflen(f$)=16then460
450 forr=len(f$)+1to16:f$=f$+chr$(160):next
460 dt=18:t$=chr$(dt):s$=chr$(1):open1,8,15:open 2,8,2,"#"
470 print#1,"u1:2,0,"+str$(dt)","+str$(asc(s$))
480 print#1,"b-p:2,0"
490 gosub600:nt$=i$:gosub600:ns$=i$
500 fori=0to7:gosub 600:ft$=i$:gosub600:gosub600
510 na$="":forsm=0to15:gosub600:na$=na$+i$:next:forsm=0to10:gosub600:next
520 ifi<>7thengosub600:gosub600
530 iff$=na$then570
540 next
550 t$=nt$:s$=ns$:if nt$<>chr$(0)then470
560 close1:close2:goto140
570 po=i*32+2:print#1,"b-p:2,"+str$(po):v=asc(ft$)or64:print#2,chr$(v);
580 print#1,"u2:2,0,"+str$(dt)","+str$(asc(s$)):print:print:printf$;" now LOCKED
."
590 close1:close2:forr=1to2000:next:goto140
600 get#2,i$:ifi$=""theni$=chr$(0)
610 return
620 :
630 sr=-1:printchr$(147):gosub200
640 print:print" Enter Fileneme to be Unlocked.":print:print:poke19,1:poke198,2
650 poke 631,46:poke 632,157
660 input"       NAME:   ";f$:poke19,0:print
670 iff$="."then 140
680 iflen(f$)=16then700
690 forr=len(f$)+1to16:f$=f$+chr$(160):next
700 dt=18:t$=chr$(dt):s$=chr$(1):open1,8,15:open 2,8,2,"#"
710 print#1,"u1:2,0,"+str$(dt)","+str$(asc(s$))
720 print#1,"b-p:2,0"
730 gosub600:nt$=i$:gosub600:ns$=i$
740 fori=0to7:gosub 600:ft$=i$:gosub600:gosub600
750 na$="":forms=0to15:gosub600:na$=na$+i$:next:forms=0to10:gosub600:next
760 ifi<>7thengosub600:gosub600
770 iff$=na$then810
780 next
790 t$=nt$:s$=ns$:if nt$<>chr$(0)then710
800 close1:close2:goto140
810 po=i*32+2:print#1,"b-p:2,"+str$(po):v=asc(ft$)and191:print#2,chr$(v);
820 print#1,"u2:2,0,"+str$(dt)","+str$(asc(s$)):print:print:printf$;" now Unlock
ed."
830 close1:close2:forr=1to1000:next:goto140
840 :
850 sr=-1:printchr$(147):gosub200
860 print:print" Enter Fileneme to be Deleted.":print:print:poke19,1:poke198,2
870 poke 631,46:poke 632,157
880 input"       NAME:   ";f$:poke19,0:print
890 iff$="."then 140
900 open1,8,15,"s0:"+f$:close1
910 printf$;" has now been deleted.":forr=1to1000:next:goto140
920 :
930 sr=-1:printchr$(147):gosub200
940 print:print"Enter Fileneme to be Recovered.":print:print:poke19,1:poke198,2
950 poke 631,46:poke 632,157
960 input"       NAME:   ";f$:poke19,0:print
970 iff$="."then 140
980 iflen(f$)=16then1000
990 forr=len(f$)+1to16:f$=f$+chr$(160):next
1000 print:print:print"Enter file type  1] SEQ":printspc(17);"2] PRG"
1010 printspc(17);"3] USR":printspc(17);"4] REL":print:poke19,1:poke 198,2
1020 poke 631,46:poke 632,157
1030 input"    Enter number:  ";yt$:poke19,0:if yt$="."thengoto140
1040 ifyt$<"0"oryt$>"4"thenpoke53280,1:poke53280,0:goto1020
1050 yt=val(yt$)+128
1060 d=0:dt=18:t$=chr$(dt):s$=chr$(1):open1,8,15:open 10,8,10,"#"
1070 print#1,"u1:10,0,"+str$(dt)","+str$(asc(s$))
1080 print#1,"b-p:10,0"
1090 gosub600:nt$=i$:gosub600:ns$=i$
1100 fori=0to7:gosub 600:ft$=i$:gosub600:gosub600
```

PROGRAM FILE

```
1110 na$="":forna=0to15:gosub600:na$=na$+i$:next:forna=0to10:gosub600:next
1120 ifi<>7thengosub600:gosub600
1130 iff$=na$then1170
1140 next
1150 t$=nt$:s$=ns$:if nt$<>chr$(0)then1070
1160 close1:close10:goto140
1170 po=i*32+2:print#1,"b-p:10,"+str$(po):v=asc(ft$)oryt:print#10,chr$(v);
1180 print#1,"u2:10,0,"+str$(dt)","+str$(asc(s$)):print:print"Now recovered "f$
1190 close1:open1,8,15:print#1,"v":close1:open1,8,15:print#1,"i"
1200 close1:close10:forr=1to1000:next:goto140
1210 :
1220 sr=-1:printchr$(147):gosub200
1230 print:sys52736:print
1240 goto1800
1250 :
1260 sr=-1:printchr$(147):gosub200
1270 print:print"Enter name of file to be renamed."
1280 poke 631,46:poke 632,157
1290 print:print:poke19,1:poke198,2:input"      NAME:    ";f$:poke19,0:print
1300 iff$="."then140
1310 iflen(f$)>16thenprint:print"This name is too long...":forr=0to4000:next:got
o1260
1320 print:print:print"Enter new name for file.":print:print:poke19,1:poke198,2
1330 poke 631,46:poke 632,157
1340 input"      NEW NAME:    ";n$:poke19,0:print
1350 ifn$-"."then140
1360 iflen(n$)>16thenprint:print"New name if too long...":forr=0to4000:next:goto
1260
1370 open1,8,15,"r0:"+n$+"="+f$:sys65511
1380 goto1770
1390 :
1400 sr=-1:printchr$(147):gosub200
1410 print:print"Enter name for disk.":print:print:poke19,1:poke198,2
1420 poke 631,46:poke 632,157
1430 input"     NAME:   ";n$:poke19,0:print:ifn$="."then140
1440 iflen(n$)>16thenprint:print"Sorry, that is too long...":forr=0to5000:next:g
oto1400
1450 print:print"   Enter disk ID.":print:poke19,1:poke198,2
1460 poke 631,46:poke 632,157
1470 input"    ID:    ";id$:print:poke19,0:ifid$="."then140
1480 iflen(id$)>2thenprint:print"Sorry, that is too long...":forr=0to4000:next:g
oto1400
1490 open1,8,15:print#1,"n0:"+n$+","+id$:sys65511:goto1770
1500 :
1510 sr=-1:printchr$(147):gosub200
1520 print:print"Do you want a fast check or a full       sector by sector check
1530 print:poke19,1:input"     [F]ull or [Q]uick  ";a$:poke19,0:print
1540 ifa$<>"f"anda$<>"q"thenpoke53280,1:poke53280,0:print:goto1530
1550 print:print:print"Check in progress.":print:print
1560 if a$="q"then1680
1570 open10,8,10,"#":open1,8,15
1580 for t=1 to 35:for s=0 to ns(t)
1590 print chr$(145)"t=";t;" s=";s;chr$(157);" ";
1600 print#1,"u1";10;0;t;s
1610 input#1,a:ifa=0then 1630
1620 input#1,b$,c$,d$:printa;",";b$;",";c$;",";d$
1630 print:next:next
1640 print:print"Press "chr$(18)" SPACE "chr$(146)" to continue...";:poke198,0
1650 geta$:ifa$=""then1650
1660 ifa$<>" " then poke53280,1:poke53280,0:goto1650
1670 goto140
1680 open10,8,10,"#":open1,8,15:fort=1to35
1690 printchr$(145)"t=";t;" s=";s;
1700 print#1,"u1";10;0;t;s
1710 input#1,a:ifa=0then 1730
1720 input#1,b$,c$,d$:printa;",";b$;",";c$;",";d$
1730 print:next
1740 goto1640
1750 :
1760 sr=-1:printchr$(147):gosub200
1770 print:print" Disk status is as follows.":print:print
1780 open1,8,15:input#1,a$,b$,c$,d$:close1
1790 printspc(4)a$","b$","c$","d$:print:print
1800 goto1640
1810 :
1820 sr=-1:printchr$(147):gosub200
1830 gosub 1860
1840 open1,8,15,"v":sys65511:print:goto1770
1850 :
1860 open1,8,15,"i0":input#1,a:ifa<>0thenclose1:printchr$(147)"DISK ERROR":stop
1870 sys65511:return
1880 :
1890 poke2,192:forr=52736to52965:reada:poker,a:cs=cs+a:next
1900 ifcs<>30910thenprint"data error.":stop
1910 return
1920 :
1930 data169,1,160,206,162,190,32
1940 data189,255,169,1,162,8,160
1950 data0,32,186,255,32,192,255
1960 data162,1,32,198,255,32,183
1970 data255,32,205,206,32,205,206
1980 data169,13,32,210,255,32,205
1990 data206,32,205,206,32,205,206
2000 data133,251,32,205,206,133,252
2010 data166,251,165,252,32,205,189
2020 data56,32,240,255,160,4,24
2030 data32,240,255,169,1,133,212
2040 data32,205,206,133,252,201,34
2050 data208,247,32,205,206,201,34
2060 data240,6,32,210,255,76,86
2070 data206,32,205,206,201,32,240
2080 data249,133,252,169,0,133,212
2090 data56,32,240,255,160,22,24
2100 data32,240,255,162,0,165,252
2110 data157,167,2,169,0,32,205
2120 data206,201,0,240,7,232,157
2130 data167,2,76,129,206,162,0
2140 data189,167,2,32,210,255,232
2150 data224,5,208,245,169,13,32
2160 data210,255,76,40,206,162,0
2170 data189,191,206,240,6,32,210
2180 data255,232,208,245,169,1,32
2190 data195,255,162,0,32,198,255
2200 data96,36,66,76,79,67,75
2210 data83,32,70,82,69,69,46
2220 data13,0,32,183,255,41,64
2230 data208,4,32,207,255,96,104
2240 data104,76,166,206,255,77,69
2250 data72,69,87,40,67,41,96

ready.
```

BBC Weatherwise

by Brian Butterworth

Weatherwise for a disk-based BBC Model B is a program for creating and printing high-quality weather maps. As such I suppose it should be called educational, but the really educational quality of this program, however, is as an example of what can be achieved on the BBC Micro.

As I stated in the introduction to this month's Programs columns, I'm a Mac fan and this program is an excellent example of the Mac's friendly user interface. Even if you've no interest in producing weather maps, it's well worth while typing in this program to see how it works.

To create the complete system you will need to type in, save and run Listing 1; this will create two more files on the disk called WEAICON and WEACHAR. Then type in and save the second program as WEATHER. After doing this, to run the program type CHAIN "WEATHER".

In use, the pointer is moved with the cursor keys. To the left are the icon weather symbols and above the map is a row of commands. To pick up a weather symbol, press RETURN over the required symbol — this symbol can then be placed anywhere on the map by positioning and again pressing RETURN. Similarly, the commands on the top of the screen can be selected by positioning the pointer and pressing RETURN, depending on the command. Further menus may appear which guide the user through options to complete his command. Like the Macintosh, the system is a lot easier to use than it is to describe. The commands available are:

a) SAVE/LOAD: to save or load the map to disk.
b) TEXT: to add text to your map.
c) QUIT.
d) ACTION: to select from CLEAR, ERASE, REDRAW, PRINT and CANCEL, and to select printer interface (serial, Centronics or user).

Any users using Basic 1 will have to modify the EQUB x and EQUW x commands to ?P%=x:P%=P%+1 and ?P%=x:P%=P%+2 respectively. Remember that EQUB and EQUW are within assembly brackets and the replacement commands are Basic.

Even if you can't muster up the effort to type in the program, a number of procedures are useful in themselves:

PROC window (x,y,a,b): creates windows similar to VDU 28,x,y,a,b.
PROC map: draws a map of the UK (very quickly).
PROC initdump: Epson screen dump, CALL DUMP% to use.
PROC initcode and PROC move: for pointer definition and sprite-like movement.

As it stands, I see no reason why the program couldn't be modified to work from cassette. If any reader manages to do this, I'd be keen to publish the lines to modify.

```
10 ******************************
20 *|                          |*
30 *|  W E A T H E R W I S E   |*
40 *|                          |*
50 ******************************
60 :
70 :
80 REM "INTRO"
90 :
100 VDU23,224,170,85,170,85,170,85,170,85
110 VDU23,225,0,60,102,102,126,102,102,0
120 VDU23,226,0,124,102,124,102,102,124,0
130 VDU23,227,0,60,102,96,96,102,60,0
140 VDU23,228,0,124,102,102,102,102,124,0
150 VDU23,229,0,126,96,124,96,96,126,0
160 VDU23,230,0,126,96,124,96,96,96,0
170 VDU23,231,0,60,102,96,110,102,60,0
180 VDU23,232,0,102,102,126,102,102,102,0
190 VDU23,233,0,126,24,24,24,24,126,0
200 VDU23,234,0,126,12,12,108,108,56,0
210 VDU23,235,0,102,102,124,102,102,102,0
220 VDU23,236,0,96,96,96,96,96,126,0
230 VDU23,237,0,102,126,126,126,102,102,0
240 VDU23,238,0,102,118,126,126,110,102,0
250 VDU23,239,0,60,102,102,102,102,60,0
260 VDU23,240,0,124,102,102,124,96,96,0
270 VDU23,241,0,60,102,102,102,106,52,0
280 VDU23,242,0,124,102,102,124,108,102,0
290 VDU23,243,0,62,96,124,62,6,124,0
300 VDU23,244,0,126,24,24,24,24,24,0
310 VDU23,245,0,102,102,102,102,102,60,0
320 VDU23,246,0,102,102,102,102,60,24,0
330 VDU23,247,0,102,102,126,126,126,102,0
340 VDU23,248,0,102,60,24,24,60,102,0
350 VDU23,249,0,102,102,60,24,24,24,0
360 VDU23,250,0,126,14,28,56,112,126,0
370 VDU23,251,0,60,102,6,28,24,24,0
380 :
390 :
400 :
410 *SAVE "WEACHAR" FFFF0C00+100
420 :
430 :
440 :
450 DATA&5000,000304043C448280807F0000000000000C020203C42010101FE00000000000
460 DATA&5020,000304043C448280807F00000103070700C020203C42010101FE0080808000
470 DATA&5040,000304043C448280807F00040C1C3C3800C020203C42010101FE00103070F0E0
480 DATA&5060,000304043C448280807F0005020F020500C020203C42010101FE000000800000
490 DATA&5080,000304043C448280807F0028107C102800C020203C42010101FE005020F82050
500 DATA&50A0,000304043C4482808079030100010306000C020203C420101C19E0080C0800000
510 DATA&50C0,00070808384984808807F0000000000000089284E112080908F2012412000000
520 DATA&50E0,00070808384984808807F0002060E1E1C000089284E112080908F2012412000000
530 DATA&5100,00070808384984808807F0014083E081400089284E112080908F2012412000000
540 DATA&5120,001248238C5010A020A010508C234812009024886214100A080A101462882490
550 DATA&5300,0103070F1F3F0707070707070707070080C0E0F0F8C0C0C0C0C0C0C0C0C0
560 DATA&5320,07070707070707070707073F1F0F070301C0C0C0C0C0C0C0C0C0F8F0E0C08000
570 DATA&5340,0000000000FFFFFFFFFF0000000000000000203038FCFEFFFEFC38302000000
580 DATA&5360,0000040C1C3F7FFF7F3F1C0C040000000000000000FFFFFFFFFF0000000000000
590 DATA&5380,10387CFE7F3F1F0F0703010000000001000000000080C0E0F1FBFFFF7F7FFFFF
600 DATA&53A0,000000000000010387CFFFFFFFFFEFEFFFF081C3E7FFEFCF8F0E0C080000000000080
610 DATA&53C0,010000000000103070F1F3F7FFE7C3810FFFF7F7FFFFFFFFF3E1C0800000000000000
620 DATA&53E0,FFFFFEFEFFFFFFCF87030100000000000800000000080C0E0F0F8FCFE7F3E1C08
630 DATA&5600,004060707870C7E7F786C4C06060303000000000000000000000000000000000000
640 DATA&5620,C0E0F0F8FCFEFFFFFFFFEFE4F0F07070300000000000000080800000000000808000
```

PROGRAM FILE

```
650 DATA&5700,006C101010101010101010106C000000000000000000000000000000000000000000
660 DATA&5720,6CFE7C383838383838387CFE6C0000000000000000000000000000000000000000
670 :
680 :
690 :
700 MODE4
710 HIMEM=&5000
720 FORR%=0TO21
730   READA%,A$
740   FORD%=0TO31
750     A%?D%=EVAL("&"+MID$(A$,1+D%*2,2))
760     NEXT
770   NEXT
780 :
790 *SAVE WEAICON 5000+800


  0REM MAIN PROGRAM
 10*TV0,1
 20MODE4
 30*FX200,1
 40*L.WEAICON
 50*L.WEACHAR
 60HIMEM=&5000
 70DIMT$(64):CT%=0
 80:
 90:
100:
110PROCscreen
120PROCinitcode
130PROCinitdump
140PROCsetpo(48,49)
150PROCmap
160ONERROR:PROCwindow(9,30,38,3):PROCmap:PROCredraw
170CLOSE#0
180REPEAT
190PROCmove
200PROCaction
210UNTIL0
220:
230:
240:
250END
260:
270:
280:
290DEFPROCdesk
300VDU23;&200A;0;0;0;0;0;
310CLS
320VDU19,7,0;0;0;
330VDU23,128,&55AA;&55AA;&55AA;&55AA;
340FORR%=0TO30
350PRINTSTRING$(40,"");
360NEXT
370VDU5
380MOVE0,31
390PRINTSTRING$(40,"")
400VDU4
410VDU19,0,7;0;0;
420ENDPROC
430:
440:
450:
460DEFPROCwindow(LX%,BY%,RX%,TY%)
470GCOL0,129
480FORR%=-4TO0STEP4
490VDU29,-R%;R%;
500VDU24,LX%*32-4;1023-(BY%+1)*32;RX%*32+32;1023-(TY%)*32+4;:CLG
510VDU28,LX%,BY%,RX%,TY%
520NEXT:CLS
530GCOL0,128
540ENDPROC
550:
560:
570:
580DEFPROCicon(N%,X%,Y%)
590LOCALO%
600N%=N%*32+&5000
610FORO%=252TO255
620VDU23,O%
630FORD%=0TO7
640VDU?N%:N%=N%+1
650NEXT
660NEXT
670VDU31,X%,Y%,252,254,8,8,10,253,255
680ENDPROC
690:
700:
710:
720DEFPROCprint(text$)
730LOCALR%
740FORR%=1TOLENtext$
750IFMID$(text$,R%,1)<"@"THENPRINTMID$(text$,R%,1);
760IFMID$(text$,R%,1)>="@"THENVDUASC(MID$(text$,R%,1))+96:PLOT0,-4,0
770NEXT
780ENDPROC
790:


800:
810:
820:
830:
840:
850DEFPROCinverse(X%,Y%,X2%,Y2%)
860VDU24,0;0;1279;1023;
870LOCALA%,B%,C%,D%
880A%=32*X%-4:C%=32*(X2%+X%)
890B%=1024-32*Y%
900D%=1024-32*(Y%+Y2%)-4
910GCOL4,3
920MOVEA%,B%:MOVEC%,B%
930PLOT85,A%,D%:PLOT85,C%,D%
940MOVEC%,B%:MOVEA%,D%
950PLOT85,C%,B%
960ENDPROC
970:
980:
990:
1000DEFPROCscreen
1010PROCdesk
1020PROCwindow(1,1,38,1)
1030VDU28,1,2,38,1
1040PROCprint("SAVE    LOAD    TEXT    ACTION    QUIT")
1050PROCsuede
1060PROCwindow(9,30,38,3)
1070ENDPROC
1080:
1090:
1100DEFPROCsuede
1110PROCwindow(1,30,7,3)
1120A$="1234567890HIJKLMNO"
1130FORR%=0TOLENA$-1
1140A%=(ASCMID$(A$,R%+1,1))-48
1150PROCicon(A%,1+3*(R%MOD2),1+3*(R%DIV2))
1160NEXT
1170ENDPROC
1180:
1190:
1200:
1210DEFPROCmap
1220S%=9:GCOL0,3
1230VDU23;&200A;0;0;0;0;0;
1240VDU19,0,7;0;0;
1250VDU19,7,0;0;0;
1260RESTORE
1270FORQ%=1TO315
1280READA$
1290IFA$="M"THENP%=4:READA$:ELSEP%=5
1300READB%:A%=VALA$+40
1310B%=B%-4
1320PLOTP%,A%*S%,B%*S%
1330NEXT
1340ENDPROC
1350:
1360:
1370:
```

```
1380DATAM,58,29,55,25,53,23,52,23,50,22,46,22,46,21
1390DATA44,21,43,17,40,15,36,11,34,10,36,9,37,11,39,9,40,9,41,12,42,12,43,13,45
,13,49,11,50,12,53,16
1400DATA55,17,57,15,57,16,61,16,61,17,65,18,65,19,69,18,73,19,77,19,79,20,81,21
,81,22
1410DATA89,25,89,26,80,26,78,27,80,27,80,30,83,30,83,32,85,35,85,40,83,43,80,43
,75,43,75,41,73,43
1420DATA75,44,76,47,72,51,68,52,74,51,72,56,73,56,71,57
1430DATA65,61,62,69,60,73,58,75,55,77,51,76,48,77,52,77,55,79,54,80,54,80,54,81
,51,80,55,82,56,83,56,84
1440DATA58,90,60,94,58,95,55,96,50,95
1450DATA46,93,48,96,47,96,48,98,52,102,52,104,52,105
1460DATA50,105,48,105,47,104,42,105,40,103,40,101,38,100
1470DATA39,97,36,96,35,95,36,92,37,90
1480DATA36,88,36,86,33,85,33,84,38,80
1490DATA36,75,37,73,36,68,38,68,38,71
1500DATA39,73,38,75,41,73,43,71,40,64
1510DATA40,65,39,63,41,61,41,63,43,61,45,61,44,64
1520DATA46,62,50,64,52,65,50,62,50,61,51,60,48,59,53,55,54,56,55,56,54,55,53,53
1530DATA53,51,54,51,53,49,54,47,54,46,52,48,53,46,52,46,51,47
1540DATA49,46,47,46,45,44,42,41,42,40,46,42,46,39,46,37,44,34,41,32,39,32,38,30
,39,30,38,29,41,27,44,29
1550DATA46,27,45,26,47,27,50,25,52,25,53,26,58,29
1560DATAM,67,17,64,17,66,16,67,16,67,17
1570DATAM,44,44,46,46,45,47,43,47,43,47,44,44
1580DATAM,41,55,43,55,44,57,44,59,42,57,41,55
1590DATAM,40,70,41,72,40,72,39,70,40,70
1600DATAM,36,90,34,91,34,93,33,95,32,93,32,94,31,93,30,93,31,91,33,89,35,89,36,
90
1610DATAM,29,96,31,97,32,98,33,98,33,100,34,101,33,101,34,103,33,103,31,102,30,
102,31,101,30,100,29,100,29,96
1620DATAM,25,86,28,95,27,95,26,94,27,92,26,92,25,86
1630DATAM,35,80,35,81,34,82,32,83,32,82,33,81,31,80,32,79,34,80,35,80
1640DATAM,31,36,34,42,33,46,33,48,34,48,33,50,32,54,34,54,36,57,37,57,37,59,36,
62,35,61,36,63
1650DATA34,66,34,67,30,67,27,66,28,63,26,69,24,66,24,68,21,67,19,66,18,64,17,63
,17,62,20,62,20,60,18,59,18,58,15,58,14,59,14,58,12,59,10,59,9,59,9,58,8,59,8,58
,9,57,9,56,7,56,7,55
1660DATA10,54,10,53,8,52,8,51,7,51,7,49,8,48,9,48,9,47,12,47,11,44,7,40,8,40,8,
39,7,38,7,37,6,36,5,37,3,36,3,35,7,35,4,33,4,31
1670DATA5,30,8,31,5,29,6,28,10,30,10,29,7,28,7,27,10,28,14,28,15,28,18,30,23,32
,23,33,27,34,30,34,31,36
1680:
1690:
1700:
1710DEFPROCinitcode
1720DIMU%1024,S%32,E%32,F%32
1730FORPASS=0TO2STEP2
1740P%=U%
1750[OPTPASS
1760LDA&71:ASLA:ASLA:CLC:ADC&71
1770STA&72:LDA#0:STA&73
1780ASL&72:ROL&73
1790ASL&72:ROL&73
1800ASL&72:ROL&73
1810LDA&72:CLC:ADC&70:STA&72
1820LDA&73:ADC#0:STA&73
1830ASL&72:ROL&73
1840ASL&72:ROL&73
1850ASL&72:ROL&73
1860LDA&73:CLC:ADC#&58
1870STA&73
1880LDA&72:CLC:ADC#320 MOD256
1890STA&74
1900LDA&73:ADC#320 DIV256
1910STA&75
1920LDY#15:.loop1
1930LDA(&72),Y:STAS%,Y
1940LDA(&74),Y:STAS%+16,Y
1950DEY:BPLloop1
1960:
1970:
1980:
1990LDY#15:.loop2
2000LDAS%,Y:ANDE%,Y:ORAF%,Y:STA(&72),Y
2010LDAS%+16,Y:ANDE%+16,Y:ORAF%+16,Y:STA(&74),Y
2020DEY:BPLloop2
2030RTS
2040:
2050.blank
2060LDY#15:.loop3
2070LDAS%,Y:STA(&72),Y
2080LDAS%+16,Y:STA(&74),Y
2090DEY:BPLloop3
2100RTS
2110]NEXT
2120OLWE%=-1:F1%=F%:E1%=E%
2130!&70=&A0A
2140ENDPROC
2150:
2160:
2170:
2180DEFPROCsetpo(M%,I%)
2190F%=F1%:E%=E1%
2200FORR%=0TO31:E%?R%=-1EOR?(R%+&5000+32*I%):F%?R%=?(R%+&5000+32*M%)
2210NEXT
2220FORR%=0TO7STEP4:Q%=!(R%+E%+8):!(R%+E%+8)=!(R%+E%+16):!(R%+E%+16)=Q%
2230Q%=!(R%+F%+8):!(R%+F%+8)=!(R%+F%+16):!(R%+F%+16)=Q%
2240NEXT
2250ENDPROC
2260:
2270:
2280:
2290DEFPROCmove
2300CALLU%
2310REPEAT
2320T%=?&70
2330Y%=?&71
2340IFINKEY(-26):T%=T%-1
2350IFINKEY(-122):T%=T%+1
2360IFINKEY(-42):Y%=Y%+1
2370IFINKEY(-58):Y%=Y%-1
2380IFINKEY(-1):TIME=0:REPEATUNTILTIME>2
2390IFT%<0:T%=0
2400IFT%>39:T%=39
2410IFY%>31:Y%=31
2420IFY%<0:Y%=0
2430IF(T%<>?&70)OR(Y%<>?&71)THENCALLblank:?&70=T%:?&71=Y%:CALLU%
2440UNTILINKEY-74
2450X%=?&70
2460Y%=?&71
2470CALLblank
2480ENDPROC
2490:
2500:
2510:
2520DEFPROCaction
2530IF(X%>=1ANDX%<=6)AND(Y%>=3ANDY%<=30)THENPROCsymbol((X%-1)DIV3+(Y%-3)DIV3*2)
:ENDPROC
2540IF(Y%<3)AND(X%>=15ANDX%<=22)THENPROCtext:ENDPROC
2550IF(Y%<3)AND(X%>=23ANDX%<=31)THENPROCactions:ENDPROC
2560IF(Y%<3)AND(X%>=1ANDX%<=7)THENPROCfilename(0)
2570IF(Y%<3)AND(X%>=8ANDX%<=14)THENPROCfilename(1)
2580IF(Y%<3)AND(X%>=32ANDX%<=38):A%=15:X%=0:CALL&FFF4:PROCwindow(1,1,38,1):PROC
print("QUIT- ARE YOU SURE (Y/N)"):REPEATA$=GET$:UNTILA$="Y"ORA$="N":PRINT:IFA$="
Y"THENVDU22,7:END
2590IF(X%>=9ANDX%<=38)AND(Y%>=3ANDY%<=30)AND(OLWE%>-1):H%=ASCMID$("1234567890HI
JKLMNO",OLWE%+1,1)-48:PROConmap(H%,X%*32+16,1023-Y%*32):PROCup("I",X%*32+16,1023
-Y%*32,STR$H%):ENDPROC
2600VDU28,1,2,38,1,30:PROCprint("SAVE     LOAD     TEXT     ACTION     QUIT")
2610ENDPROC
2620:
2630:
2640:
2650DEFPROCsymbol(A%)
2660LOCALC%,D%
2670VDU29,0;0;
2680C%=OLWE%MOD2:D%=OLWE%DIV2
2690IFOLWE%>-1:PROCinverse(2+3*C%,4+3*D%,2,2)
2700OLWE%=A%:C%=OLWE%MOD2:D%=OLWE%DIV2
2710IFOLWE%>-1:PROCinverse(2+3*C%,4+3*D%,2,2)
2720ENDPROC
2730:
2740:
2750:
2760DEFPROConmap(E%,X%,Y%)
2770VDU5
2780GCOL0,1
```

```
2790VDU29,0;0;
2800MOVEX%,Y%
2810PROCicon(E%,0,0)
2820VDU4:ENDPROC
2830:
2840:
2850:
2860DEFPROCtext
2870PROCinverse(15,1,8,1)
2880PROCsetpo(56,57)
2890REPEAT
2900PROCmove
2910UNTIL(X%>9ANDX%<39)AND(Y%>2ANDY%<30)
2920PROCwindow(1,1,38,1)
2930*FX15
2940INPUTLINE""A$
2950CLS
2960VDU26,28,1,2,38,1
2970PROCprint("SAVE     LOAD     TEXT     ACTION     QUIT")
2980VDU5:MOVEX%*32,1024-Y%*32
2990PROCsetpo(48,49)
3000GCOL0,7
3010PROCprint(A$):VDU4
3020PROCup("T",X%*32,1024-Y%*32,A$)
3030REPEATUNTILINKEY(-74)=0
3040*FX15
3050ENDPROC
3060:
3070:
3080:
3090DEFPROCactions
3100PROCsymbol(-1)
3110PROCinverse(24,1,8,1)
3120PROCwindow(1,30,7,3)
3130RESTORE3140
3140DATACLEAR.ERASE,REDRAW,PRINT,SERIAL,CENTR,USER,CANCEL
3150FORR%=1TO8
3160VDU5
3170MOVE48,960-96*R%
3180READA$
3190PROCprint(A$)
3200NEXT
3210VDU4
3220REPEAT
3230PROCmove
3240UNTIL(X%>0ANDX%<8)AND(Y%>4ANDY%<28)
3250V%=(Y%-4)DIV3:PROCinverse(1,V%*3+4,7,3)
3260IFV%=0THENCT%=0
3270IFV%=1THENCT%=CT%-1:IFCT%=-1THENCT%=0
3280IFV%=4THEN*FX5,2
3290IFV%=5THEN*FX5,1
3300IFV%=6THEN*FX5,3
3310IFV%=3THENCALLDUMP%
3320IFV%<3THENPROCwindow(9,30,38,3):PROCmap
3330IFV%=1ORV%=2:PROCredraw
3340IFV%>2:TIME=0:REPEATUNTILTIME>100
3350PROCinverse(24,1,8,1)
3360PROCsuede
3370ENDPROC
3380:
3390:
3400:
3410DEFPROCup(A$,X%,Y%,S$)
3420CT%=CT%+1:IFCT%=64THENSOUND&11,-15,150,10:ENDPROC
3430T$(CT%-1)=A$+RIGHT$("     "+STR$X%,4)+","+RIGHT$("     "+STR$Y%,4)+","+S$
3440ENDPROC
3450:
3460:
3470:
3480DEFPROCredraw
3490IFCT%=0THENENDPROC
3500LOCALR%
3510FORR%=0TOCT%-1
3520PROCrelax(T$(R%))
3530NEXT
3540ENDPROC
3550:
3560:
3570:
3580DEFPROCrelax(A$)
3590LOCALR$,X%,Y%,T$
3600R$=LEFT$(A$,1)
3610X%=EVAL(MID$(A$,2,4))
3620Y%=EVAL(MID$(A$,8,4))
3630T$=MID$(A$,12)
3640VDU5
3650MOVEX%,Y%
3660IFR$="T"PROCprint(T$)
3670IFR$="I"PROCicon(VALT$,0,0)
3680VDU4:ENDPROC
3690:
3700:
3710:
3720DEFPROCfilename(A%)
3730*FX15
3740IFA%=0:PROCinverse(1,1,5,1):ELSEPROCinverse(8,1,6,1)
3750PROCwindow(15,20,37,15)
3760PRINT'"  ";
3770PROCprint("ENTER FILENAME")
3780INPUT'"    "A$
3790IFA%=0:PROCsave:ELSEPROCload
3800IFA%=0:PROCinverse(1,1,5,1):ELSEPROCinverse(8,1,6,1)
3810VDU26,28,9,30,38,3,12
3820PROCmap:PROCredraw
3830VDU26
3840ENDPROC
3850:
3860:
3870:
3880DEFPROCinitdump
3890DIMDUMP%512
3900FORPASS=0TO2STEP2
3910P%=DUMP%
3920[OPTPASS
3930LDA#135:JSR&FFF4:CPY#6:BMIOK:.ERW:LDX#11:.ERW1:LDAErMes1,X:STA&100,X:DEX:BPLERW1:JMP&100:.ErMes1:BRK:EQUB25:EQUS"Bad Mode":BRK:.OK:CPY#3:BEQERW
3940LDA#2:JSR&FFEE
3950LDA#29:JSR&FFEE
3960LDA#-16 AND&FF:STA&72:LDA#3:STA&73:LDA#0:JSR&FFEE:JSR&FFEE:JSR&FFEE:JSR&FFEE
3970LDA#30:JSR&FFEE:JSR&FFE7
3980.LOOP1:LDX#0:.PLSL:LDA#1:JSR&FFEE:LDAPTD,X:JSR&FFEE:INX:CPX#9:BNEPLSL
3990LDA#0:STA&70:STA&71
4000.LOOP2:LDX#8:LDA#3:STA&78:AND#0:STA&79:STA&84:STA&85:.LOOPK
4010JSRPOIN:STX&8F
4020ASLA:ASLA:TAX:LDADA,X:JSRDOTOUT:LDA&79:ADC&8E:STA&79:LDADA+1,X:JSRDOTOUT:LDA&84:ADC&8E:STA&84:LDADA+2,X:JSRDOTOUT:LDA&85:ADC&8E:STA&85
4030LDX&8F
4040LDA&72:ADC#4:STA&72:ASL&78:ASL&78:DEX:CPX#0:BNELOOPK:LDA&72:SEC:SBC#32:STA&72
4050LDA#1:JSR&FFEE:LDA&79:JSR&FFEE:LDA#1:JSR&FFEE:LDA&84:JSR&FFEE:LDA#1:JSR&FFEE:LDA&85:JSR&FFEE:.RN:CLC
4060LDA&70:ADC#4:STA&70:BCCKO:INC&71:.KO
4070LDA&71:CMP#5:BEQFID:JMPLOOP2:.FID
4080LDA&FF:CMP#0:BPLKK:LDX#11:.ERW2:LDAErMes2,X:STA&100,X:DEX:BPLERW2:JMP&100:.ErMes2:BRK:EQUB17:EQUB3:EQUS"Escape":BRK:.KK
4090SEC
4100LDA&72:SBC#2*8:STA&72:LDA&73:SBC#0:STA&73
4110LDA&73:CMP#&FF:BEQnLOOP1:JMPLOOP1:.nLOOP1
4120JSR&FFE7:LDA#3:JMP&FFEE
4130.POUT:LDA&70:JSR&FFEE:LDA&71:JSR&FFEE:LDA&72:JSR&FFEE:LDA&73:JSR&FFEE:RTS
4140.POIN:TXA:PHA:LDA#9:LDX#&70:LDY#0:JSR&FFF1:LDA&74:STA&90:LDA#&B:LDX#&90:LDY#0:JSR&FFF1:LDY&91:PLA:TAX:TYA:AND#7:RTS
4150.DOTOUT:AND&78:STA&8E:CLC:RTS
4160.PTD:EQUB0:EQUB27:EQUS"3":EQUB23:EQUB0:EQUB27:EQUS"L":EQUB64*3+1:EQUB3
4170EQUB0
4180.DA:EQUB&FF:EQUB&FF:EQUW&FF
4190EQUB&AA:EQUB&55:EQUW0
4200EQUB&FF:EQUB&55:EQUW0
4210EQUB&0:EQUB&55:EQUW0
4220EQUB&FF:EQUB&55:EQUW&FF
4230EQUB&AA:EQUB&FF:EQUW&55
4240EQUB&AA:EQUB&55:EQUW&AA
4250EQUB0:EQUB0:EQUW0
4260]NEXT
4270ENDPROC
4280:
4290:
```

```
4300:
4310DEFPROCsave
4320LOCALR%
4330IFCT%=0THENENDPROC
4340X%=OPENOUT(A$)
4350PRINT#X%,CT%
4360FORR%=0TOCT%-1
4370PRINT#X%,T$(R%)
4380NEXT
4390CLOSE#0
4400ENDPROC
4410:
4420:
4430:
4440DEFPROCload
4450LOCALR%
4460X%=OPENIN(A$)
4470INPUT#X%,CT%
4480FORR%=0TOCT%-1
4490INPUT#X%,T$(R%)
4500NEXT
4510ENDPROC
```

MBasic VAT Accounting

by Leslie Fahidy

VAT Accounting, as its name suggests, is a program to carry out VAT accounting for retail establishments using Scheme D. The program is written in Microsoft Basic in a simple enough form to allow potential users to re-write for other Basic dialects.

VAT accounting is not difficult but tedious, particularly for the owner/manager of small retail concerns, so this program should significantly cut the amount of time spent on this task. It is written for Scheme D as specified by the Inland Revenue, and will generate both monthly and quarterly reports. The program itself occupies about 12k, leaving sufficient room for data even on small machines.

In order to operate it, you must enter details of daily takings and invoices — all of them prompted for — and the computer will display on the screen or printer the figures necessary to complete your VAT return form. Even though you are only required to submit a VAT return once a quarter, the program does also produce monthly figures.

There are two practical reasons for this: firstly, three months' worth of data is a lot to answer in one chunk — one month is manageable; and secondly, should the VAT man call (and sooner or later he will) it's good to impress him with up-to-date records.

The listing is liberally sprinkled with REM statements so if you're struggling, don't forget to use these for help. Before you embark on typing in the program, I suggest you take a look at the example printouts at the end of the listing to confirm that they will be useful.

```
10 REM*****************************************
20 REM*************VAT ACCOUNTING*************
30 REM***************SCHEME D****************
40 REM*************L.L. FAHIDY.***************
50 REM************58 CASTLE DRIVE*************
60 REM*********HORLEY SURREY RH6 9DE**********
70 REM*************(02934) 76683**************
80 REM**************JULY 1984****************
90 REM*****************************************
100 REM
110 A$="£££££.££":REM FORMAT DEFINITION FOR PRINTING
120 REM FIND OUT IF PRINTER IS OPERATIONAL
130 PRINT CHR$(26):REM CLEAR SCREEN FIRST
140 INPUT"Is printer connected? (Y/N)";PRINTER$
150 PRINT CHR$(26):PRINT"                       M e n u"
160 PRINT              "                       *******"
170 PRINT:PRINT:PRINT
180 PRINT"For monthly statement .... press 1 and RETURN"
190 PRINT"For quarterly statement .. press 2 and RETURN"
200 INPUT Q:ON Q GOTO 210,1580 :REM FIND CHOICE
210 REM BEGINNING OF MONTHLY STATEMENT ROUTINE
220 REM DIMENSION VARIABLES FIRST
230 DIM TAKING(31),ZERORATED(60),STANDARDRATED(60)
240 DIM VATPAID(60),TOTAL(60),DAY(60),SUPPLIER$(60)
250 PRINT CHR$(26)
260 INPUT"Enter month and year, separated by comma";MONTH$,YEAR
270 REM FIND OUT NUMBER OF DAYS IN MONTH
280 IF MONTH$="APRIL" OR MONTH$="JUNE" THEN 320
290 IF MONTH$="SEPTEMBER" OR MONTH$="NOVEMBER" THEN 320
300 IF MONTH$="FEBRUARY" THEN 330
310 DAY=31:GOTO 340
320 DAY=30:GOTO 340
330 IF YEAR/4=INT(YEAR/4) THEN DAY=29 ELSE DAY=28
340 PRINT CHR$(26):TOTALTAKING=0:REM ENTERING TAKINGS
350 FOR COUNTER=1 TO DAY
360  PRINT"Enter taking on ";MONTH$;" ";COUNTER:INPUT TAKING(COUNTER)
370  TOTALTAKING=TOTALTAKING+TAKING(COUNTER)
380 NEXT COUNTER
390 PRINT"Do you wish to correct any entry? (Y/N)":INPUT ANSWER$
400 IF LEFT$(ANSWERS,1)<>"Y" THEN 440
410 INPUT"Enter date (day only) for correction. ";DATE:TOTALTAKING=TOTALTAKING-TAKING(DATE)
420 PRINT"Enter new value of taking for ";DATE;"  of ";MONTH$
430 INPUT TAKING(DATE):TOTALTAKING=TOTALTAKING+TAKING(DATE):GOTO 390
440 PRINT CHR$(26):REM ENTERING INVOICES
450 PRINT"Enter all invoices. When no more,"
460 PRINT"answer '0' to date."
470 PRINT"Program accomodates a maximum of"
480 PRINT"60 invoices per month."
490 COUNTER=0
500 COUNTER = COUNTER + 1
510 INPUT"Date (day only) of invoice: ";DAY(COUNTER)
520.IF DAY(COUNTER)=0 THEN 640
530 INPUT"Name of supplier: ";SUPPLIER$(COUNTER)
```

MICROMART

PROGRAM FILE

```
540 INPUT"Standard rated sum (without VAT): ";STANDARDRATED(COUNTER)
550 INPUT"Zero rated sum :";ZERORATED(COUNTER)
560 VATPAID(COUNTER)=STANDARDRATED(COUNTER)*.15
570 VATPAID(COUNTER)=(INT(100*VATPAID(COUNTER)+.5)/100)
580 REM LINE ABOVE ROUNDS VAT TO EXACT PENNY
590 TOTAL(COUNTER)=STANDARDRATED(COUNTER)+ZERORATED(COUNTER)
600 TOTAL(COUNTER)=TOTAL(COUNTER)+VATPAID(COUNTER)
610 TOTAL(COUNTER)=(INT(100*TOTAL(COUNTER)+.5)/100)
620 REM LINE ABOVE ROUNDS TOTAL OF INVOICE TO EXACT PENNY
630 GOTO 500
640 REM JUST IN CASE...
650 TEMPORARY=COUNTER
660 INPUT"Do you wish to correct any entry? (Y/N)";ANSWER$
670 IF LEFT$(ANSWER$,1)<>"Y" THEN COUNTER=TEMPORARY:GOTO 700
680 INPUT"Enter the rank order of the invoice to be corrected.";COUNTER
690 GOTO 510
700 REM START CALCULATING ROUTINE
710 ZEROTOTAL=0:STANDARDTOTAL=0:TOTALTOTAL=0:VATTOTAL=0
720 FOR J=1 TO COUNTER
730  ZEROTOTAL=ZEROTOTAL+ZERORATED(J)
740  STANDARDTOTAL=STANDARDTOTAL+STANDARDRATED(J)
750  VATTOTAL=VATTOTAL+VATPAID(J)
760  TOTALTOTAL=TOTALTOTAL+TOTAL(J)
770 NEXT J
780 INPUTTAX=VATTOTAL
790 OUTPUTTAX=STANDARDTOTAL*TOTALTAKING/TOTALTOTAL*3/23
800 IF INPUTTAX>OUTPUTTAX THEN VATREFUND=INPUTTAX-OUTPUTTAX ELSE VATREFUND=0
810 IF OUTPUTTAX>INPUTTAX THEN VATTOPAY=OUTPUTTAX-INPUTTAX ELSE VATTOPAY=0
820 IF INPUTTAX=OUTPUTTAX THEN VATREFUND=0:VATTOPAY=0
830 INPUTTAX=(INT(100*INPUTTAX+.5))/100
840 OUTPUTTAX=(INT(100*OUTPUTTAX+.5))/100
850 VATREFUND=(INT(100*VATREFUND))/100
860 VATTOPAY=(INT(100*VATTOPAY+.5))/100
870 PRINT CHR$(26)
880 PRINT"Monthly statement for ";MONTH$;" ";YEAR:PRINT:PRINT:PRINT
890 PRINT"Total takings:";
900 PRINT TAB(40); USING A$;TOTALTAKING
910 PRINT"Total zero-rated goods:";
920 PRINT TAB(40);USING A$;ZEROTOTAL
930 PRINT"Total standard-rated goods:";
940 PRINT TAB(40);USING A$;STANDARDTOTAL
950 PRINT"Total VAT paid:";
960 PRINT TAB(40);USING A$;VATTOTAL
970 PRINT"Total of invoices:";
980 PRINT TAB(40);USING A$;TOTALTOTAL
990 PRINT"Input Tax:";
1000 PRINT TAB(40);USING A$;INPUTTAX
1010 PRINT"Output Tax:";
1020 PRINT TAB(40);USING A$;OUTPUTTAX
1030 PRINT"VAT refund:";
1040 PRINT TAB(40);USING A$;VATREFUND
1050 PRINT"VAT to pay:";
1060 PRINT TAB(40);USING A$;VATTOPAY
1070 IF LEFT$(PRINTER$,1)<>"Y" THEN 2600
1080 PRINT:PRINT:INPUT"Press enter to continue.";A
1090 REM BEGINNING OF PRINTER ROUTINE.
1100 LPRINT"                    ";
1110 LPRINT"Monthly VAT report for ";MONTH$;YEAR
1120 LPRINT"                    ";
1130 LPRINT"**********************************************"
1140 LPRINT:LPRINT:LPRINT
1150 LPRINT"Takings:";TAB(18);"Invoices:"
1160 LPRINT"*********";TAB(15);"*";TAB(18);"**********"
1170 LPRINT TAB(15);"*":LPRINT TAB(15);"*"
1180 LPRINT"Date:";TAB(7);"Taking:";TAB(15);"*";TAB(18);"Date;";
1190 LPRINT TAB(26);"Supplier:";TAB(50);"Standard";
1200 LPRINT TAB(62);"Zero";TAB(71);"Total:";
1210 LPRINT TAB(82);"VAT paid"
1220 LPRINT TAB(15);"*";TAB(50);"Rated:";TAB(62);"Rated:"
1230 LPRINT TAB(15);"*"
1240 FOR J=1 TO DAY
1250  LPRINT J;TAB(7);TAKING(J);TAB(15);"*";TAB(18);DAY(J);
1260  LPRINT ;TAB(26);SUPPLIER$(J);
1270  LPRINT;TAB(50);USING A$;STANDARDRATED(J);
1280  LPRINT;TAB(62);USING A$;ZERORATED(J);
1290  LPRINT; TAB(71);USING A$;TOTAL(J);
1300  LPRINT; TAB(82);USING A$;VATPAID(J)
1310 NEXT J
1320 IF COUNTER =DAY THEN 1410
1330 FOR J=DAY TO COUNTER-1
1340  LPRINT TAB(15);"*";TAB(18);DAY(J);
1350  LPRINT TAB(26);SUPPLIER$(J);
1360  LPRINT TAB(50);USING A$;STANDARDRATED(J);
1370  LPRINT TAB(62);USING A$;ZERORATED(J);
1380  LPRINT TAB(71);USING A$;TOTAL(J);
1390  LPRINT TAB(82);USING A$;VATPAID(J)
1400 NEXT J
1410 LPRINT TAB(26);"Totals:";
1420 LPRINT;TAB(50);USING A$;STANDARDTOTAL;
1430 LPRINT;TAB(62);USING A$;ZEROTOTAL;
1440 LPRINT;TAB(71);USING A$;TOTALTOTAL;
1450 LPRINT;TAB(82);USING A$;VATTOTAL
1460 LPRINT
1470 LPRINT"Total taking:";
1480 LPRINT;TAB(20);USING A$;TOTALTAKING
1490 LPRINT"Input Tax:";
1500 LPRINT;TAB(20);USING A$;INPUTTAX;
1510 LPRINT;TAB(35);"Output tax:";
1520 LPRINT;TAB(65);USING A$;OUTPUTTAX
1530 LPRINT"VAT refund:";
1540 LPRINT;TAB(20);USING A$;VATREFUND;
1550 LPRINT TAB(35);"VAT to pay:";
1560 LPRINT;TAB(65);USING A$;VATTOPAY
1570 GOTO 2600
1580 REM BEGINNING OF QUARTERLY REPORT
1590 PRINT CHR$(26)
1600 PRINT"Enter year1, month1, month2, month3,year3"
1610 PRINT"of the report, in that order, separated by"
1620 PRINT"commas. In this context: month1, 2 and 3 "
1630 PRINT"mean the three months which are the subject"
1640 PRINT"of this report. If all three months fall in"
1650 PRINT"the same year then year1 is that year. If not,"
1660 PRINT"then year2 is the following year."
1670 INPUT YEAR1,MONTH1$,MONTH2$,MONTH3$,YEAR2$
1680 PRINT"Enter total takings for ";MONTH1$;" ";MONTH2$;" "MONTH3$
1690 PRINT"in that order, separated by commas."
1700 INPUT TAKING(1),TAKING(2),TAKING(3)
```

```
1710 PRINT"Enter total zero-rated invoices for these three"
1720 PRINT"months, in the same order, separated by commas."
1730 INPUT ZERO(1),ZERO(2),ZERO(3)
1740 PRINT"Enter total standard-rated invoices for these months,"
1750 PRINT"in the same order, separated by commas."
1760 INPUT STANDARD(1),STANDARD(2),STANDARD(3)
1770 TOTALTAKING=TAKING(1)+TAKING(2)+TAKING(3)
1780 TOTALZERO=ZERO(1)+ZERO(2)+ZERO(3)
1790 TOTALSTANDARD=STANDARD(1)+STANDARD(2)+STANDARD(3)
1800 TOTALVAT=0
1810 FOR J=1 TO 3
1820  VAT(J)=STANDARD(J)*.15
1830  TOTALVAT=TOTALVAT+VAT(J):INPUTTAX=TOTALVAT
1840 NEXT J
1850 TOTALVAT=VAT(1)+VAT(2)+VAT(3):INPUTTAX=TOTALVAT
1860 OUTPUTTAX=TOTALSTANDARD*TOTALTAKING/(TOTALZERO+TOTALSTANDARD+TOTALVAT)*3/23
1870 VATTOPAY=(INT(100*VATTOPAY+.5))/100
1880 TOTALVAT=(INT(100*TOTALVAT+.5))/100
1890 INPUTTAX=(INT(100*INPUTTAX+.5))/100
1900 OUTPUTTAX=(INT(100*OUTPUTTAX+.5))/100
1910 IF INPUTTAX>OUTPUTTAX THEN VATREFUND=INPUTTAX-OUTPUTTAX ELSE VATREFUND=0
1920 IF OUTPUTTAX>INPUTTAX THEN VATTOPAY=OUTPUTTAX-INPUTTAX ELSE VATTOPAY=0
1930 PRINT CHR$(26)
1940 PRINT"VAT report for ";YEAR1;" "MONTH1S;" ";MONTH2S;" "MONTH3S;" "YEAR2S
1950 PRINT"------------------------------------------------"
1960 PRINT:PRINT:PRINT
1970 PRINT"Total takings:";
1980 PRINT TAB(40);USING A$;TOTALTAKING
1990 PRINT"Total zero-rated invoices:";
2000 PRINT TAB(40);USING A$;TOTALZERO
2010 PRINT"Total standard-rated invoices:";
2020 PRINT TAB(40);USING A$;TOTALSTANDARD
2030 PRINT"Total of invoices:";
2040 PRINT TAB(40);USING A$;TOTALZERO+TOTALSTANDARD+TOTALVAT
2050 PRINT"Input Tax:";
2060 PRINT TAB(40);USING A$;INPUTTAX
2070 PRINT"Output Tax:";
2080 PRINT TAB(40);USING A$;OUTPUTTAX
2090 PRINT"VAT paid:";
2100 PRINT TAB(40);USING A$;TOTALVAT
2110 PRINT
2120 PRINT"VAT refund:";
2130 PRINT TAB(40);USING A$;VATREFUND
2140 PRINT"VAT to pay:";
2150 PRINT TAB(40);USING A$;VATTOPAY
2160 IF LEFT$(PRINTER$,1)<>"Y" THEN 2600
2170 PRINT:PRINT:INPUT"Press enter to continue.";A
2180 REM PRINTING-OUT ROUTINE STARTS HERE
2190 LPRINT"        .";
2200 LPRINT"Quarterly report for ";YEAR1;" ";MONTH1$;" ";MONTH2$;" "MONTH3$;
2210 LPRINT" ";YEAR2$
2220 LPRINT"        ";"*******************************************"
2230 LPRINT:LPRINT:LPRINT:LPRINT:LPRINT
2240 LPRINT TAB(30);MONTH1$;TAB(45);MONTH2$;TAB(60);MONTH3$;TAB(75)"Total"
2250 LPRINT "Takings:";
2260 LPRINT TAB(30);USING A$;TAKING(1);
2270 LPRINT TAB(45);USING A$;TAKING(2);
2280 LPRINT TAB(60);USING A$;TAKING(3);
2290 LPRINT TAB(75);USING A$;TOTALTAKING
2300 LPRINT"Zero-rated supplies:";
2310 LPRINT TAB(30);USING A$;ZERO(1);
2320 LPRINT TAB(45);USING A$;ZERO(2);
2330 LPRINT TAB(60);USING A$;ZERO(3);
2340 LPRINT TAB(75);USING A$;TOTALZERO
2350 LPRINT "Standard-rated supplies:";
2360 LPRINT TAB(30);USING A$;STANDARD(1);
2370 LPRINT TAB(45);USING A$;STANDARD(2);
2380 LPRINT TAB(60);USING A$;STANDARD(3);
2390 LPRINT TAB(75);USING A$;TOTALSTANDARD
2400 LPRINT"VAT paid";
2410 LPRINT TAB(30);USING A$;VAT(1);
2420 LPRINT TAB(45);USING A$;VAT(2);
2430 LPRINT TAB(60);USING A$;VAT(3);
2440 LPRINT TAB(75);USING A$;TOTALVAT
2450 LPRINT "Total invoices:";
2460 LPRINT TAB(30);USING A$;STANDARD(1)+ZERO(1)+VAT(1);
2470 LPRINT TAB(45);USING A$;STANDARD(2)+ZERO(2)+VAT(2);
2480 LPRINT TAB(60);USING A$;STANDARD(3)+ZERO(3)+VAT(3);
2490 ITEM=STANDARD(1)+STANDARD(2)+STANDARD(3)+ZERO(1)+ZERO(2)+ZERO(3)
2500 ITEM=ITEM+VAT(1)+VAT(2)+VAT(3)
2510 LPRINT TAB(75);USING A$;ITEM
2520 LPRINT:LPRINT:LPRINT:LPRINT
2530 LPRINT"Input tax:";TAB(15);USING A$;INPUTTAX;
2540 LPRINT TAB(40);"Output Tax:";
2550 LPRINT TAB(65);USING A$;OUTPUTTAX
2560 LPRINT"VAT to pay:";
2570 LPRINT TAB(15);USING A$;VATTOPAY;
2580 LPRINT TAB(40);"VAT refund:";
2590 LPRINT TAB(65);USING A$;VATREFUND
2600 END
```

Monthly VAT report for MARCH 1984
****

Takings: ********   Invoices: *********

Date:	Taking:		Date;	Supplier:	Standard Rated:	Zero Rated:	Total:	VAT paid
1	555.49	*	1	SUPPLIER1	0.00	16.47	16.47	0.00
2	550.55	*	1	SUPPLIER2	0.00	146.28	146.28	0.00
3	366.05	*	3	SUPPLIER3	0.00	126.00	126.00	0.00
4	649.08	*	3	SUPPLIER4	191.69	53.24	273.68	28.75
5	559.68	*	3	SUPPLIER5	0.00	76.80	76.80	0.00
6	447.64	*	7	SUPPLIER1	0.00	198.80	198.80	0.00
7	576.45	*	6	SUPPLIER2	985.85	660.34	1794.07	147.88
8	744.63	*	7	SUPPLIER3	277.10	109.05	427.72	41.57
9	380.07	*	8	SUPPLIER4	72.75	0.00	83.66	10.91
10	0	*	8	SUPPLIER5	0.00	111.63	111.63	0.00
11	0	*	10	SUPPLIER1	164.91	33.42	223.07	24.74
12	639.08	*	10	SUPPLIER2	0.00	76.60	76.60	0.00

PROGRAM FILE

```
13    455.72 *  12   SUPPLIER3        0.00     40.04    40.04     0.00
14    529.61 *  13   SUPPLIER4      985.85    670.80  1804.53   147.88
15    486.37 *  13   SUPPLIER5        0.00    211.29   211.29     0.00
16    585.63 *  14   SUPPLIER1      200.00     74.91   304.91    30.00
17    294.17 *  15   SUPPLIER2        0.00     24.71    24.71     0.00
18    0      *  15   SUPPLIER3        0.00    108.82   108.82     0.00
19    669.18 *  17   SUPPLIER4        0.00    '66.52    66.52     0.00
20    464.87 *  17   SUPPLIER5        0.00    193.35   193.35     0.00
21    720.69 *  19   SUPPLIER1      326.76     19.97   395.74    49.01
22    550.94 *  22   SUPPLIER2        0.00     78.10    78.10     0.00
23    562.18 *  22   SUPPLIER3        0.00     45.60    45.60     0.00
24    274.69 *  22   SUPPLIER4        0.00    114.18   114.18     0.00
25    0      *  20   SUPPLIER5      875.57    709.63  1716.54   131.34
26    669.05 *  23   SUPPLIER1        0.00     31.75    31.75     0.00
27    445.05 *  24   SUPPLIER2        0.00     70.40    70.40     0.00
28    476.95 *  27   SUPPLIER3      807.50    917.65  1846.28   121.13
29    598.35 *  26   SUPPLIER4      348.92     65.03   466.29    52.34
30    587.08 *  28   SUPPLIER5      143.41     53.25   218.17    21.51
31    373.14 *  29   SUPPLIER1        0.00     26.64    26.64     0.00
             *  29   SUPPLIER1        0.00     26.64    26.64     0.00
             *  29   SUPPLIER2        0.00    110.51   110.51     0.00
             *  30   SUPPLIER3        0.00    224.00   224.00     0.00
             *  31   SUPPLIER4        0.00     70.40    70.40     0.00
                     Totals:       5380.31   5536.18 11723.60   807.06

Total taking:      14212.40
Input Tax:           807.06     Output tax:            850.76
VAT refund:            0.00     VAT to pay:             43.70


      Quarterly report for  1984  MARCH APRIL MAY
      ******************************************



                           MARCH       APRIL        MAY        Total
Takings:                  14212.40    13987.30    14526.20    42725.90
Zero-rated supplies:       5536.18     5124.92     5987.22    16648.30
Standard-rated supplies:   5380.31     5329.24     5647.12    16356.70
VAT paid                    807.05      799.39      847.07     2453.50
Total invoices:           11723.50    11253.50    12481.40    35458.50


Input tax:     2453.50            Output Tax:           2570.75
VAT to pay:     117.25            VAT refund:              0.00
```

Spectrum Triplets

by Nick Phillips

Spectrum Triplets for the 48k Sinclair Spectrum is a trio of logic puzzles of the kind that give you the feeling you're very close to solving them even if you're hours away. While struggling to solve them, see if you can see a rather curious relationship between the three puzzles. Unless you can figure it out, this relationship will only be revealed upon solving all three puzzles.

Very little is needed in the way of instructions as these are included within the program. Your aim in each game should be either, if the computer has first go, to draw with it, or, if you have first go, to beat it.

```
   0>REM TRIPLETS                         NICK PHILLIPS 1985
   1 REM Nick Phillips,                       49,Wellesley Park,
 Wellington,                        Somerset.                    TA21 8P
Z                          (Tel:082-347-2907)
  10 INK 0: PAPER 7: BORDER 7: FLASH 0: BRIGHT 0
  20 DIM r(4)
  30 DEF FN p(a$)=INT ((32-LEN a$)/2): REM CENTRE PRINTING
  40 POKE 23658,0
  50 GO SUB 100: REM INTRODUCT'N
  60 GO SUB 200: REM MENU
  70 GO SUB 300: REM PLAY GAME
  80 GO TO 60
  90 REM
 100 REM INTRODUCTION
 110 CLS : LET t$="TRIPLETS": GO SUB 9000
 120 PRINT ''"     HERE IS A TRIO OF SIMPLE    GAMES THAT ARE RELATED TO
EACH  OTHER IN AN AMUSING AND PERHAPS SUPRISING WAY."
 130 PRINT '"    YOUR AIM IN EACH GAME SHOULDBE EITHER, IF THE COMPUTER
HAS  FIRST GO, TO DRAW WITH IT, OR IFYOU HAVE FIRST GO, TO BEAT IT."
 140 PRINT '"    IF YOU MANAGE TO SUCCEED AT LEAST ONCE IN EACH OF THE G
AMES,THEN THE RELATIONSHIP BETWEEN   THEM WILL BE REVEALED!"
 150 PRINT )0;"     NICK PHILLIPS 1985"
 160 GO SUB 9200
 170 RETURN
 180 REM
 200 REM MENU
 210 GO SUB 7000: IF i$="Y" THEN  LET line=4000: RETURN
 220 IF i$="N" THEN  DIM r(4)
 230 CLS : LET t$="MENU": GO SUB 9000
 240 PRINT AT 4,10;"1/ FIFTEEN";AT 6,10;"2/ JAM";AT 8,10;"3/ HOT"
 250 LET p$="CHOOSE A GAME (1-3)": GO SUB 9100
 260 GO SUB 9300: IF CODE i$<49 OR CODE i$>51 THEN  GO TO 260
 270 LET line=1000*VAL i$
 280 RETURN
 290 REM
 300 REM PLAY GAME
 310 REM line=LINE NO OF GAME
 320 CLS : GO SUB line: REM INSTRUCTIONS
 330 GO SUB 560: REM LOAD ARRAYS
```

```
340 GO SUB 9200
350 LET i win=0: LET you win=0
360 GO SUB 730: REM DRAW GAME
370 LET p$="DO YOU WANT FIRST GO? (Y/N)": GO SUB 9100
380 GO SUB 9400
390 LET you first=(i$="Y"): LET your move=1-you first
400 REM START GAME
410 PRINT )0;AT 0,6;"PRESS ""X"" TO ESCAPE"
420 DIM g(9): REM HOLDS MOVES
430 FOR m=1 TO 9: REM MOVE COUNTER
440 LET your move=1-your move
450 GO SUB 5000*your move+6000*NOT your move
460 IF i$="X" THEN  LET m=9: NEXT m: GO TO 510
470 GO SUB 820: REM PRINT MOVE
480 IF i win OR you win THEN  LET m=9
490 NEXT m
500 GO SUB 890: REM END GAME
510 PRINT )0;AT 0,2;"DO YOU WANT ANOTHER GO? (Y/N)": GO SUB 9400
520 IF i$="Y" THEN  GO TO 350
530 IF line=4000 THEN  DIM r(4)
540 RETURN
550 REM
560 REM LOAD ARRAYS
570 LET x=1+(line=3000)*3
580 DIM g(9): DIM a(9): DIM b(9): DIM a$(9,x)
590 RESTORE 660+30*(line=3000)
600 FOR n=1 TO 9
610 IF line=1000 OR line=3000 THEN  READ a(n),b(n): LET a$(n)=STR$ a(n)
620 IF line=3000 THEN  READ a$(n)
630 IF line=2000 OR line=4000 THEN  LET a(n)=n: LET b(n)=n: LET a$(n)=S
TR$ n
640 NEXT n: RETURN
650 REM
660 DATA 2,8,9,1,4,6
670 DATA 7,3,5,5,3,7
680 DATA 6,4,1,9,8,2
690 DATA 8,4,"HOT",2,2,"FORM",7,7,"WOES"
700 DATA 1,9,"TANK",9,6,"HEAR",5,8,"WASP"
710 DATA 3,3,"TIED",6,1,"BRIM",4,5,"SHIP"
720 REM
730 REM DRAW GAME
740 CLS : GO SUB 9000
750 GO SUB line+100
760 FOR n=1 TO 9: LET move=n
770 GO SUB line+300
780 NEXT n
790 INK 0: PAPER 7: BRIGHT 0
800 RETURN
810 REM
820 REM PRINT MOVES
830 FLASH 1: BRIGHT 1: GO SUB line+300
840 FOR n=1 TO 200: NEXT n
850 FLASH 0: BRIGHT 0: INK 7: GO SUB line+300
860 INK 0: GO TO line+400
870 RETURN
880 REM
890 REM END OF GAME
900 LET p$="WE'VE DRAWN!!!"
910 IF NOT i win AND NOT you first THEN  LET r(line/1000)=1
920 IF i win THEN  LET p$="I'VE WON!!!"
930 IF you win THEN  LET p$="WELL DONE-YOU'VE WON!!": LET r(line/1000)=
1
940 IF you win OR i win THEN  GO SUB 8300: REM PRINT WIN
950 GO SUB 9100
960 RETURN
970 REM
1000 REM FIFTEEN
1010 LET t$="FIFTEEN": GO SUB 9000
1020 PRINT ''"    NINE PLAYING CARDS, WITH    VALUES FROM ACE TO NINE, A
RE    DISPLAYED."
1030 PRINT '"    YOU TAKE IT IN TURNS WITH   THE COMPUTER TO PICK A CARD
."
1040 PRINT '"    THE WINNER IS THE FIRST TO  OBTAIN THREE CARDS THAT ADD
 UP  TO FIFTEEN."
1050 RETURN
1060 REM
1100 REM DRAW FIFTEEN
1110 PAPER 1: INK 7: BRIGHT 1
1130 FOR n=4 TO 7: PRINT AT n,2;"                              ": NEXT n
1140 FOR n=0 TO 192 STEP 24
1150 PLOT n+23,119: DRAW 0,17: PLOT n+23,119: DRAW 9,0
1160 PLOT n+23,136: DRAW 9,0: PLOT n+32,119: DRAW 0,17
1170 PLOT n+21,117: DRAW 0,21: PLOT n+21,117: DRAW 13,0
1180 PLOT n+21,138: DRAW 13,0: PLOT n+34,117: DRAW 0,21
1190 NEXT n
1200 LET r=9: GO SUB 7900
1220 RETURN
1300 REM PRINT MOVES
1310 PRINT AT 5,3*a(move);a$(move);AT 6,3*a(move);" "
1320 RETURN
1400 REM PRINT MOVE
1410 PRINT AT 10+INT ((m-1)/2),8+14*(your move);a$(move)
1420 RETURN
2000 REM JAM
2010 LET t$="JAM": GO SUB 9000
2020 PRINT ''"    YOU ARE SHOWN A ROAD MAP IN REPRESENTATIONAL FORM, ON
WHICH ARE SHOWN NINE NUMBERED ROADS."
2030 PRINT '"    YOU TAKE TURNS WITH THE     COMPUTER TO CHOOSE ONE OF T
HESE NUMBERED ROADS."
2040 PRINT '"    THE WINNER IS THE FIRST     PLAYER TO HAVE THREE ROADS
WHICHENTER THE SAME TOWN."
2050 RETURN
2100 REM DRAW JAM
2110 DIM j(9,6): REM HOLDS DATA TO DRAW JAM
2120 RESTORE 2210
2130 FOR n=1 TO 9: FOR m=1 TO 6
2140 READ j(n,m): NEXT m
2150 INK 6-(n>3)-(n>5)
2160 PLOT j(n,1),j(n,2): DRAW j(n,3),j(n,4)
2170 NEXT n: INK 0
2180 FOR n=1 TO 8: READ r,c: PRINT AT r,c; INK 3;" ": NEXT n
2190 PRINT AT 3,25; INK 1;"YOU__";AT 5,25; INK 2;"ME__"
2200 RETURN
2210 REM JAM DATA
2215 DATA 44,140,64,-87,8,9
```

MICROMART

```
2220 DATA 108,53,32,31,12,15
2225 DATA 44,28,144,56,14,18
2230 DATA 20,84,24,56,6,3
2235 DATA 20,84,168,0,10,6
2240 DATA 20,84,24,-56,14,2
2245 DATA 44,140,144,-56,5,10
2250 DATA 108,115,32,-31,9,14
2255 DATA 44,28,64,87,14,9
2260 DATA 11,2,11,23,4,5,18,5,15,13,7,13,11,17,11,10
2270 REM
2300 REM PRINT MOVES
2310 PRINT AT j(move,5),j(move,6);a$(move)
2320 RETURN
2330 REM
2400 REM PRINT MOVE
2410 PLOT j(move,1),j(move,2): DRAW  INK 2-your move;j(move,3),j(move,4)
2420 RETURN
3000 REM HOT
3010 LET t$="HOT": GO SUB 9000
3020 PRINT ''"     YOU ARE PRESENTED WITH A    LIST OF NINE WORDS."
3030 PRINT '"    YOU TAKE IT IN TURNS WITH   THE COMPUTER TO PICK A WORD
."
3040 PRINT '"    THE FIRST PLAYER TO HAVE    THREE WORDS WHICH BEAR THE
SAME LETTER IS THE WINNER."
3050 RETURN
3100 REM DRAW HOT
3110 PAPER 1: INK 7
3130 FOR n=3 TO 10: PRINT AT n,0;"                                ": NEX
T n
3140 FOR n=0 TO 2: PLOT 8,96+n*24: DRAW 239,0: NEXT n
3150 FOR n=0 TO 5: PLOT 8+48*n,96: DRAW 0,48: NEXT n
3170 LET r=12: GO SUB 7900
3180 FOR n=1 TO 9: PRINT AT 4+INT (n/6)*3,-3+6*(n-5*INT (n/6));n: NEXT n
3190 INK 0: PAPER 5
3200 RETURN
3300 REM PRINT MOVES
3310 PRINT AT 5+INT (a(move)/6)*3,-4+6*(a(move)-5*INT (a(move)/6));a$(mo
ve)
3320 RETURN
3410 PRINT AT 13+INT ((m-1)/2),6+13*(your move);a$(move)
3420 RETURN
4000 REM
4010 GO SUB 7500
4020 READ y,c: LET y$=CHR$ y: LET c$=CHR$ c
4030 RETURN
4100 REM
4110 INK 1: PLOT 104,64: DRAW 0,72: PLOT 128,64: DRAW 0,72
4120 PLOT 80,88: DRAW 72,0: PLOT 80,112: DRAW 72,0
4140 PRINT AT 12,0; INK 2;"ME...";c$;AT 14,0;"YOU..";y$
4150 DEF FN r(n)=6+3*INT ((n-1)/3): DEF FN c(n)=8+3*(n-3*INT ((n-1)/3))
4160 INK 4: RETURN
4300 REM
4320 IF you win OR i win THEN  GO TO 4400
4330 PRINT AT FN r(move),FN c(move);a$(move)
4340 RETURN
4400 REM
4410 LET m$=c$: IF your move THEN  LET m$=y$
4430 PRINT AT FN r(move),FN c(move);m$
4440 RETURN
4450 REM
5000 REM YOUR MOVE
5010 LET p$="ENTER YOUR MOVE (1-9)": GO SUB 9100
5020 GO SUB 9300: IF CODE i$<49 OR CODE i$>57 AND i$<>"X" THEN  GO TO 50
20
5030 IF i$="X" THEN  RETURN
5040 LET move=b(VAL i$)
5050 IF g(move)<>0 THEN  BEEP 1,-20: GO TO 5020
5060 LET g(move)=2
5070 REM CHECK FOR YOU WIN
5080 FOR l=1 TO 8: GO SUB 8000
5090 IF g(l1)+g(l2)+g(l3)=6 THEN  LET you win=1: LET win=1: LET l=8
5100 NEXT l: RETURN
5110 REM
6000 REM MY MOVE
6010 DIM s(9): REM SCORE FOR EACH MOVE
6020 LET p$="MY MOVE": GO SUB 9100
6030 IF m=1 THEN  LET r=INT (RND*4): LET move=1*(r=0)+3*(r=1)+7*(r=2)+9*
(r=3): LET g(move)=1: RETURN : REM RANDOM FIRST MOVE
6040 IF m=2 AND g(5)=0 THEN  LET move=5: LET g(move)=1: RETURN
6050 IF m=3 AND g(5)=0 AND move=2*INT (move/2) THEN  LET move=5: LET g(m
ove)=1: RETURN
6060 FOR l=1 TO 8
6070 LET i$=INKEY$: IF i$="X" THEN  LET l=8: NEXT l: RETURN
6080 GO SUB 8000: REM POSSIBLE WINNING COMBINATIONS
6090 LET me=(g(l1)=1)+(g(l2)=1)+(g(l3)=1)
6100 LET you=(g(l1)=2)+(g(l2)=2)+(g(l3)=2)
6110 GO SUB 8100: REM ASSESS MOVES
6120 NEXT l
6130 REM SCORE POSSIBLE MOVES
6140 LET score=0
6150 FOR n=1 TO 9
6160 IF s(n)>score THEN  LET score=s(n): LET move=n
6170 NEXT n
6180 LET g(move)=1
6190 RETURN
7000 REM
7005 LET end=0
7010 FOR n=1 TO 3: LET end=end+r(n): NEXT n
7020 IF end<3 THEN  LET i$="": RETURN
7030 CLS : PRINT AT 7,8; PAPER 2; INK 7;" WELL DONE!!!";AT 10,3; INVERSE
 1;"YOU HAVE NOW SUCCEDED IN        EACH OF THE THREE GAMES!";AT 16,0;"A
RE YOU READY TO LEARN THE TRUE  NATURE OF THESE GAMES? (Y/N)"
7040 GO SUB 9400
7050 RETURN
7500 REM
7510 RESTORE 8380
7520 LET t$=""
7530 FOR n=1 TO 19: READ t: LET t$=t$+CHR$ t: NEXT n
7600 REM
7610 RESTORE 7700
7620 FOR n=4 TO 12: READ length
7630 PRINT AT n,INT ((32-length)/2);
7640 FOR j=1 TO length: GO SUB 7800: NEXT j
7650 NEXT n
7660 GO SUB 9000: PRINT AT 6,6;t$;"!";AT 10,1;t$;" GRID, THEN"
7670 RETURN
```

```
7690 REM
7700 DATA 22,65;76,76,32,79,70,32,84,72,69,83,69,32,71,65,77,69,83,32,65
,82,69
7710 DATA 15,73,83,79,77,79,82,80,72,73,67,32,87,73,84,72
7720 DATA 1,32,1,32
7730 DATA 31,73,70,32,89,79,85,32,67,65,78,32,80,73,67,84,85,82,69,32,84
,72,69,32,69,76,69,77,69,78,84,83
7740 DATA 27,79,70,32,69,65,67,72,32,71,65,77,69,32,68,73,83,80,76,65,89
,69,68,32,79,78,32,65
7750 DATA 1,32
7760 DATA 29,89,79,85,32,83,72,79,85,76,68,32,72,65,86,69,32,78,79,32,68
,73,70,70,73,67,85,76,84,89
7770 DATA 24,87,73,84,72,32,65,78,89,32,79,70,32,84,72,69,32,71,65,77,69
,83,33,33,33,79,88
7800 REM
7810 READ q: LET q$=CHR$ q: PRINT q$;
7820 RETURN
7830 REM
7900 REM PRINT ME:- & YOU:-
7910 PRINT  BRIGHT 0; INK 2; PAPER 7;AT r,5;"ME:-";AT r,18;"YOU:-"
7920 RETURN
7930 REM
8000 REM POSSIBLE WINNING COMBINATIONS
8010 RESTORE 8040+1
8020 READ 11,12,13
8030 RETURN
8040 REM
8041 DATA 1,2,3
8042 DATA 4,5,6
8043 DATA 7,8,9
8044 DATA 1,4,7
8045 DATA 2,5,8
8046 DATA 3,6,9
8047 DATA 1,5,9
8048 DATA 7,5,3
8050 REM
8100 REM ASSESS MOVES
8110 IF me+you=3 THEN  RETURN
8120 GO SUB 8130: GO TO 8200
8130 IF me=2 THEN  LET score=1000: LET i win=1: LET win=1: RETURN
8140 IF you=2 THEN  LET score=500: RETURN
8150 IF m=3 AND g(5)<>0 AND you AND me THEN  LET score=500: RETURN
8160 IF you AND me OR NOT you+me THEN  LET score=10: RETURN
8170 IF me THEN  LET score=50: RETURN
8180 IF you THEN  LET score=25: RETURN
8190 REM
8200 REM SCORE MOVES
8210 IF g(11)=0 THEN  LET s(11)=s(11)+score
8220 IF g(12)=0 THEN  LET s(12)=s(12)+score/1.3
8230 IF g(13)=0 THEN  LET s(13)=s(13)+score
8240 RETURN
8250 REM
8300 REM PRINT WIN
8310 LET l=win: GO SUB 8000
8320 BRIGHT 1: FLASH 1: PAPER 6
8330 LET move=11: GO SUB line+300
8340 LET move=12: GO SUB line+300
8350 LET move=13: GO SUB line+300
8360 BRIGHT 0: FLASH 0: PAPER 7
8370 RETURN
8380 DATA 78,79,85,71,72,84,83,32,65,78,68,32,67,82,79,83,83,69,83
8390 REM
9000 REM PRINT TITLE
9010 LET u$=""
9020 FOR n=1 TO LEN t$: LET u$=u$+"-": NEXT n
9030 PRINT  INK 1;AT 0,FN p(t$);t$;AT 1,FN p(t$);u$
9040 RETURN
9100 REM PRINT PROMPT
9110 PRINT  BRIGHT 1; INK 2;AT 20,0;TAB FN p(p$);p$;
9120 FOR n=FN p(p$)+LEN p$ TO 31: PRINT  BRIGHT 1;" ";: NEXT n
9130 RETURN
9200 REM PRESS ANY KEY
9210 LET p$="PRESS ANY KEY...": GO SUB 9100
9220 GO SUB 9300
9230 RETURN
9300 REM READ INKEYS
9310 IF INKEY$="" THEN  GO TO 9310
9320 LET i$=INKEY$
9330 RETURN
9400 REM ANSWER Y/N
9410 GO SUB 9300
9420 IF i$<>"Y" AND i$<>"N" THEN  GO TO 9410
9430 RETURN
```

Atari Error Message Reporter

by Paul Lay

Although Atari 8-bit computers can differentiate between a large range of Basic errors, these are unfortunately all of the form 'Line 1350 Error 143' which send you scurrying to a manual to find the corresponding text. This program for all Atari machines (including XLs) will generate a full textual error message each time an error occurs.

I've included the assembly listing purely for the interest of readers with a knowledge of machine code. You need only type the first listing to use the program.

```
10 GRAPHICS 2
20 POKE 752,1
30 SETCOLOR 3,4,8
40 ? #6:? #6:? #6;"  ERROR"
50 ? #6;"     message"
```

PROGRAM FILE

```
60 ? #6;"            reporter"
70 ? #6:? #6
80 ? #6;"  (C)1985 paul lay"
90 COLOR ASC("*")
100 PLOT 0,0:DRAWTO 19,0
110 DRAWTO 19,9:DRAWTO 0,9
120 DRAWTO 0,0
130 ? :? "          INITIALISING "
140 K=0:FOR I=1552 TO 1668
150 READ J:POKE I,J
160 K=K+J:NEXT I
170 IF K=16277 THEN 230
180 ? :? "       DATA VALUES INCORRECT"
190 ? "       IN LINES 720->880"
200 FOR I=1 TO 800:NEXT I
210 GRAPHICS 0:LIST 720,880
220 END
230 ? :? "       READING ERROR MESSAGES ":?
240 IF PEEK(9)<>0 THEN 290
250 POKE 9,2
260 POKE 2,16:POKE 3,6
270 POKE 12,16:POKE 13,6
280 GOTO 330
290 POKE 9,1
300 POKE 1553,PEEK(12)
310 POKE 1554,PEEK(13)
320 POKE 12,16:POKE 13,6
330 FOR I=0 TO 15
340 POKE 1536+I,PEEK(58368+I)
350 NEXT I
360 POKE 1542,34:POKE 1543,6
370 POKE 838,34:POKE 839,6
380 V=1+PEEK(58374)+256*PEEK(58375)
390 HI=INT(V/256):LO=V-256*HI
400 POKE 1667,LO:POKE 1668,HI
410 DIM MESS$(100)
420 MESSLO=256*(PEEK(106)-32)-2048
430 HI=INT(MESSLO/256)
440 LO=MESSLO-256*HI
450 POKE 1617,LO:POKE 1618,HI
460 MESSHI=MESSLO+66
470 HI=INT(MESSHI/256)
480 LO=MESSHI-256*HI
490 POKE 1623,LO:POKE 1624,HI
500 LENGTH=MESSHI+66
510 HI=INT(LENGTH/256)
520 LO=LENGTH-256*HI
530 POKE 1629,LO:POKE 1630,HI
540 CURRENT=LENGTH+66
550 FOR ERR=2 TO 65
560 READ MESS$
570 IF MESS$="+" THEN 690
580 ? MESS$
590 HI=INT(CURRENT/256)
600 LO=CURRENT-256*HI
610 POKE MESSLO+ERR,LO
620 POKE MESSHI+ERR,HI
630 SIZE=LEN(MESS$)
640 POKE LENGTH+ERR,SIZE
650 FOR I=1 TO SIZE
660 POKE CURRENT,ASC(MESS$(I))
670 CURRENT=CURRENT+1
680 NEXT I
690 NEXT ERR
700 GRAPHICS 0
710 NEW
720 DATA 32,34,6,169,6,141,34,3
730 DATA 169,34,141,70,3,169,6
740 DATA 141,71,3,96,133,203,165
750 DATA 185,240,14,165,203,201,69
760 DATA 240,13,201,155,208,4,169
770 DATA 0,133,205,165,203,76,130
780 DATA 6,165,205,208,247,230,205
790 DATA 134,206,132,207,165,185,201
800 DATA 128,48,3,56,233,106,170
810 DATA 189,255,255,141,103,6,189
820 DATA 255,255,141,104,6,189,255
830 DATA 255,141,113,6,162,0,134
840 DATA 204,189,255,255,32,130,6
```

```
850 DATA 230,204,166,204,224,255,208
860 DATA 242,169,155,32,130,6,169
870 DATA 69,166,206,164,207,76,130
880 DATA 6,76,255,255
890 DATA Memory Insufficient
900 DATA Value Error
910 DATA Too Many Variables
920 DATA String Length Error
930 DATA Out of Data Error
940 DATA Number greater than 32767
950 DATA Input Statement Error
960 DATA Array or String DIM Error
970 DATA Argument Stack Overflow
980 DATA Floating Point Overflow/Underflow     Error
990 DATA Line Not Found
1000 DATA No Matching FOR Statement
1010 DATA Line Too Long Error
1020 DATA GOSUB or FOR Line Deleted
1030 DATA RETURN Error
1040 DATA Garbage Error
1050 DATA Invalid String Character
1060 DATA LOAD program Too Long
1070 DATA Device Number Larger
1080 DATA LOAD File Error
1090 DATA BREAK Abort
1100 DATA IOCB
1110 DATA Nonexistent Device
1120 DATA IOCB Write Only
1130 DATA Invalid Command
1140 DATA Device or File not Open
1150 DATA BAD IOCB Number
1160 DATA IOCB Read Only Error
1170 DATA EOF
1180 DATA Truncated Record
1190 DATA Device Timeout
1200 DATA Device NAK
1210 DATA Serial Bus
1220 DATA Cursor Out of Range
1230 DATA Serial Bus Data Frame Overrun
1240 DATA Serial bus data frame checksum error
1250 DATA Device done error
1260 DATA Read after write compare error
1270 DATA Function not implemented
1280 DATA Insufficient RAM
1290 DATA +,+,+,+,+,+,+,+,+,+,+,+
1300 DATA Drive number error
1310 DATA Too many OPEN files
1320 DATA Disk full
1330 DATA Unrecoverable system data I/O error
1340 DATA File number mismatch
1350 DATA File name error
1360 DATA POINT data length error
1370 DATA File locked
1380 DATA Command invalid
1390 DATA Directory full
1400 DATA File not found
1410 DATA POINT invalid


0000          1000        *=    $0600
              1010 ;
              1020 ; PUT THE NEW 'E' DRIVER TABLE
              1030 ; AT PAGE 6
              1040 ;
              1050 TABLE
              1060 ;
0600          1070        *=    *+$10
              1080 ;
              1090 ; WARM START CODE
              1100 ; NOTE THAT 'EXIT' CHANGES FOR
              1110 ; DISK BASED SYSTEMS
              1120 ;
              1130 WARMST
              1140 ;
0610 202206   1150        JSR   EXIT
0613 A906     1160        LDA   #TABLE/$0100
0615 8D2203   1170        STA   $0322
0618 A922     1180        LDA   #NEWPUT&$00FF
```

PROGRAM FILE

```
061A 8D4603 1190        STA  $0346     ; IOCB#0 PUT CHARACTER
POINTER (LOW)
061D A906   1200        LDA  #NEWPUT/$0100
061F 8D4703 1210        STA  $0347     ; IOCB#0 PUT CHARACTER
POINTER (HIGH)
0622 60     1220 EXIT   RTS
            1230 ;
            1240 ; THE AMMENDED 'E' PUT ROUTINE
            1250 ;
            1260 MYPUT
            1270 ;
00CB        1280 CHAR    =   $CB
00CC        1290 COUNT   =   $CC
00CD        1300 FLAG    =   $CD
00CE        1310 TEMP    =   $CE
00CF        1320 TEMP2   =   $CF
00B9        1330 ERROR   =   $B9
            1340 ;
0623 85CB   1350        STA  CHAR
0625 A5B9   1360        LDA  ERROR
0627 F00E   1370        BEQ  EXIT2
0629 A5CB   1380        LDA  CHAR
062B C945   1390        CMP  #'E
062D F00D   1400        BEQ  MESSAGE
062F C99B   1410        CMP  #$9B
0631 D004   1420        BNE  EXIT2
0633 A900   1430        LDA  #$00
0635 85CD   1440        STA  FLAG
0637 A5CB   1450 EXIT2  LDA  CHAR
0639 4C8206 1460        JMP  OLDROUTINE
            1470 ;
            1480 MESSAGE
            1490 ;
063C A5CD   1500        LDA  FLAG
063E D0F7   1510        BNE  EXIT2
0640 E6CD   1520        INC  FLAG
0642 86CE   1530        STX  TEMP
0644 84CF   1540        STY  TEMP2
0646 A5B9   1550        LDA  ERROR
0648 C980   1560        CMP  #$80
064A 3003   1570        BMI  SKIP
064C 38     1580        SEC
064D E96A   1590        SBC  #$6A
064F AA     1600 SKIP   TAX
0650 BDFFFF 1610        LDA  MESSLO,X
0653 8D6706 1620        STA  LOOP+1
0656 BDFFFF 1630        LDA  MESSHI,X
0659 8D6806 1640        STA  LOOP+2
065C BDFFFF 1650        LDA  LENGTH,X
065F 8D7106 1660        STA  ATEND+1
0662 A200   1670        LDX  #$00
0664 86CC   1680        STX  COUNT
0666 BDFFFF 1690 LOOP   LDA  $FFFF,X
0669 208206 1700        JSR  OLDROUTINE
066C E6CC   1710        INC  COUNT
066E A6CC   1720        LDX  COUNT
0670 E0FF   1730 ATEND  CPX  #$FF
0672 D0F2   1740        BNE  LOOP
0674 A99B   1750        LDA  #$9B
0676 208206 1760        JSR  OLDROUTINE
0679 A945   1770        LDA  #'E
067B A6CE   1780        LDX  TEMP
067D A4CF   1790        LDY  TEMP2
067F 4C8206 1800        JMP  OLDROUTINE
            1810 ;
0622        1820 NEWPUT =    MYPUT-1
            1830 ;
            1840 OLDROUTINE
            1850 ;
0682 4CFFFF 1860        JMP  $FFFF
            1870 ;
FFFF        1880 MESSLO =    $FFFF
FFFF        1890 MESSHI =    $FFFF
FFFF        1900 LENGTH =    $FFFF
```

BBC Format 40/80

by Sean D Kelly

Format 40/80 is a program designed to format disks in a special format; programs properly saved on these disks can be read by both 40 and 80-track drives. This enables BBC owners to exchange programs between others with different drives. A master disk, once created, can be read by any 5¼in BBC Micro disk drive.

The following is a technical explanation of the method used, and refers to disk tracks as for an 80-track disk. Track 0 is reserved for the catalogue (sectors 0 and 1) and a boot file (!BOOT — sectors 2 to 9). The next 19 tracks (1 to 19) are not used: a dummy file name is created for tracks 1 to 19. The following 20 tracks (20 to 39) are numbered 20 to 39 and are read by 80-track drives. The rest (40 to 79) are similarly numbered but in pairs (20,20,21,21, and so on) for reading by a 40-track drive.

The system means that the disk capacity is effectively reduced to 50k, which should be adequate for program exchange. To create a dual format disk, CHAIN or RUN the program and follow the instructions.

```
 10 REM Dual format disc formatter
 20 REM Written by Sean D Kelly (c) 20th September 1984
 30 REM Formats discs in the special 'dual-format' which allows them
 40 REM to be read by 40 or 80 track drives
 50 REM Formatting program to be used only on 80 track drives
 60 REM To save programs on dual format discs, use a 40/80 switchable
 70 REM drive, save programs with the drive set to 40 tracks and then
 80 REM with it set to 80 tracks (or vice-versa)
 90
100 REM Error handling
110 ON ERROR MODE 7: REPORT: PRINT " at line ";ERL: @%=&A0A: END
120
130 REM Main program
140 DIM idfield% 40, command% 20, track% 79, sector% 9,directory% 511
150 osword=&FFF1
160 @%=4
170 VDU 15
180 PROCreadtracks
190 PROCreadsectors
200 PROCdrive
210 PRINT"Set drive ";D%;" to 80 tracks"
220 PROCcheck
230 PRINT '"Formatting drive ";D%'
240 PROCseek
250 PROCformat
260 PROCdirectory
270 @%=&A0A
280 PRINT
290 END
300
310 REM Order of tracks on disc
320 DATA 0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19
330 DATA 20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39
340 DATA 20,20,21,21,22,22,23,23,24,24,25,25,26,26,27,27,28,28,29,29
350 DATA 30,30,31,31,32,32,33,33,34,34,35,35,36,36,37,37,38,38,39,39
360
370 REM Order of sectors on track
380 DATA 0,5,1,6,2,7,3,8,4,9
390
400 DEF PROCosword
410 X%=command% MOD 256
420 Y%=command% DIV 256
430 A%=&7F
440 CALL &FFF1
450 ENDPROC
460
470 DEF PROCreadtracks
480 FOR T%=0 TO 79
490   READ track%?T%
500   NEXT
510 ENDPROC
520
530 DEF PROCreadsectors
540 FOR S%=0 TO 9
550   READ sector%?S%
560   NEXT
570 ENDPROC
580
590 DEF PROCdrive
600 REM Check on drive
610 PRINT "Drive? ";
620 *FX 15 1
630 REPEAT
640   D%=GET
650   UNTIL D%>47 AND D%<52
660 D%=D%-48
670 PRINT ;D%
680 ENDPROC
690
700 DEF PROCcheck
710 REM Confirm before formatting
720 PRINT "Are you ready (Y/N)? ";
730 *FX 15 1
740 S%=GET
750 IF S%<>89 AND S%<>121 STOP
760 ENDPROC
```

```
770
780 DEF PROCseek
790 REM Tell 8271 to seek track 0 on the disc
800 ?command%=D%
810 command%!4=&C000
820 command%?5=1
830 command%?6=&69
840 command%?7=0
850 PROCosword
860 ENDPROC
870
880 DEF PROCformat
890 REM Format tracks from 0 to 79
900 FOR T%=0 TO 79
910   PRINT,T%;
920   REM Set up ID field
930   FOR I%=0 TO 36 STEP 4
940     idfield%?I%=track%?T%
950     idfield%?(I%+1)=D%
960     idfield%?(I%+2)=sector%?(I%/4)
970     idfield%?(I%+3)=1
980     NEXT
990   REM Tell 8271 to format track with ID field just set up
1000  ?command%=D%
1010  command%!1=idfield%
1020  command%?5=5
1030  command%?6=&63
1040  command%?7=T%
1050  command%?8=16
1060  command%?9=42
1070  command%?10=0
1080  command%?11=16
1090  PROCosword
1100  NEXT
1110 ENDPROC
1120
1130 DEF PROCdirectory
1140 REM Write directory information in sectors 0 and 1
1150 FOR I%=0 TO 511 STEP 4: directory%!I%=0: NEXT
1160 REM Reserve track 0 for catalogue and boot file
1170 REM Then create dummy file, to occupy all space up to sector &C7
1180 REM (i.e. first free sector is C8)
1190 $(directory%+&8)="        $": REM Dummy file
1200 $(directory%+&10)="!BOOT  $": REM Boot file
1210 directory%?&18=32
1220 directory%?&10D=&BE: REM length of dummy file
1230 directory%?&115=&8: REM length of boot file
1240 directory%?&10E=&CC
1250 directory%?&116=&CC
1260 directory%?&10F=10: REM Start sector of dummy file
1270 directory%?&117=2: REM Start sector of boot file
1280 directory%?&104=0: REM Number of writes to disc
1290 directory%?&105=16: REM Position in sector of last catalogue item
1300 directory%?&106=1: directory%?&107=&90:
     REM Space on disc=&190 sectors
1310 command%?0=D%
1320 command%!1=directory%
1330 command%?5=3
1340 command%?6=&4B
1350 command%?7=0
1360 command%?8=0
1370 command%?9=34
1380 REM Tell 8271 to write directory to sectors 0 and 1
1390 PROCosword
1400 ENDPROC
1410
```

Atari Multi-Mode Text

by Garry Whitaker

This program wasn't meant to be published in two parts, but somewhere along the road to publication the second listing of Multi-Mode Text was lost. For those readers struggling to type the machine code strings in lines 550 to 580 of Multi-Mode Text, March *PCW*, this program will create them for you.

For full instructions as to the use of this program, see the March issue.

```
90 REM I WOULD ADVISE YOU TO SAVE THIS BEFORE RUNNING
100 DIM MC$(185):TRAP 120:I=0:HASH=0
110 READ A:I=I+1:HASH=HASH+A*I:GOTO 110
120 RESTORE :IF HASH<>2498273 THEN ? "YOU HAVE A DATA ERROR ":END
550 ? " ":? :? "NEW":? :? :? :? "550 MC$=";CHR$(34);:POKE 766,1:FOR I=1 TO 55:RE
AD A:? CHR$(A);:NEXT I:? CHR$(34)
560 ? "560 MC$(LEN(MC$)+1)=";CHR$(34);:FOR I=1 TO 76:READ A:? CHR$(A);:NEXT I:?
CHR$(34)
570 ? "570 MC$(LEN(MC$)+1)=";CHR$(34);:FOR I=1 TO 21:READ A:? CHR$(A);:NEXT I:?
CHR$(34)
580 ? "580 MC$(LEN(MC$)+1)=";CHR$(34);:FOR I=1 TO 33:READ A:? CHR$(A);:NEXT I:?
CHR$(34):POKE 766,0:? "POKE 842,12"
590 POSITION 0,0:POKE 842,13:END
1990 POSITION 0,0:POKE 842,13:STOP
2000 DATA 104,104,133,213,104,133,212,104,104,133,214,104,133,216,104,133,215,10
4,104,133,217,104,133,219,104
```

```
2010 DATA 133,218,104,104,133,175,104,104,133,226,169,255,133,221,169,0,56,101,2
21,133,221,168,192,255,240
2020 DATA 6,177,218,201,253,208,1,96,24,201,32,48,10,201,96,176,6,56,233,32,56,1
76,7,201,32
2030 DATA 176,3,24,105,64,56,176,2,176,210,133,225,165,215,133,222,165,216,133,2
23,162,0,165,225,24
2040 DATA 101,222,133,222,169,0,101,223,133,223,232,224,8,208,238,160,0,165,212,
133,85,165,213,133,86
2050 DATA 177,222,162,0,152,72,24,101,214,133,84,177,222,24,42,133,225,165,226,1
44,2,165,175,133,224
2060 DATA 138,72,165,224,32,183,245,104,170,24,165,225,232,228,217,208,228,104,1
68,200,192,8,208,199,165
2070 DATA 85,133,212,165,86,133,213,56,176,154
```

BBC Asmlist

by Mark Clegg

Asmlist is a utility program designed to format the output from the Beeb's built-in assembler. The routine is implemented by CHAINing in the program listed below.

The program is installed via the OS vector WRCHV.

Once installed a program may be assembled by using the function key 0 or, if printer output is required, function key 1. For the disk user the program is best called in the !BOOT file.

```
 10 REM ********************************
 20 REM ***** Assembly Formatter *****
 30 REM ********************************
 40 REM Produces Formatted assembly listings
 50 REM at run time.
 60 REM
 70 REM F0 - Runs current program
 80 REM F1 - Runs current program with printer enabled.
 90 REM
100 REM WARNING! Do not use it on itself.
110
120 *KEY0?&20E=0:?&20F=12|MRUN|M?&20E=&A4:?&20F=&E0|M
130 *KEY1?&20E=0:?&20F=12|MRUN|B|M|C?&20E=&A4:?&20F=&E0|M
140
150 FOR I=0 TO 2 STEP 2
160   P%=&C00
170   [ OPT I
180   STA &CFF \ Push registers
190   TYA : PHA : TXA : PHA
200   LDA £&86 \ Get cursor position
210   JSR &FFF4 \ and check for column 14
220   CPX £14
230   BEQ pos14
240   .nogo   LDA &CFF \ Not column 14
250   CMP £&5C \ Check for comments
260   BNE nogo2 \ Goto 'nogo2' if none.
270   LDA £&86 \ Get cursor position
280   JSR &FFF4 \ and subtract from 40
290   STX &CFE \ to get number of
300   SEC \ spaces required
310   LDA £&28 \ for correct alignment.
320   SBC &CFE
330   TAX
340   .loop2  LDA £&20 \ Output comment alignment
350   JSR &E0A4 \ spaces.
360   DEX
370   BNE loop2
380   .nogo2  PLA \ Done. Output original char.
390   TAX : PLA : TAY : LDA &CFF
400   JMP &E0A4
410   .pos14  LDA &CFF \ Column 14. Test for a '.'
420   CMP £&2E
430   BEQ nogo \ If it is, no action
440   LDX £8 \ Else output 8 spaces.
450   .loop   LDA £&20
460   JSR &E0A4
470   DEX
480   BNE loop
490   JMP nogo \ And finally exit.
500   ]
510   NEXT
```

Amstrad Database

by Stephen Devine

This comprehensive database for the Amstrad CPC 464 allows the user to define the format of a file. It provides a variety of search operations as well as enabling files to be printed out or saved to tape or disk.

On running the program you are presented with a menu containing the following options —

1) Create new file: this allows you to set up a new file by defining the number of fields in each record and the size and title of each field.

2) Enter data: this option allows you to

PROGRAM FILE

add data to the next free record in a file. The maximum number of records is determined by the chosen format.

3) Alter data: you are prompted for the record number (which can be found using the search option) which can then be deleted or altered.

4) Alter field names: this option allows you to alter any of the field names which were specified when the file was created.

5) Search file: you will be prompted to enter some parameters to enable a search to be carried out.

6) Save file: this allows the current file to be saved to tape or disk.

7) Load file: this will load a previously saved file from tape or disk into the database.

8) End program: this will clear the screen and end the program. If you wish to restart it, this can be done by typing GOTO 120.

When typing in the program all REM lines can be omitted, since none are called directly from the main program.

```
10 REM ##########################
20 REM #      Amstrad Database    #
30 REM # (C) 1985 Stephen Devine #
40 REM ##########################
50 REM
60 REM Initialisation
70 OPENOUT"dummy":MEMORY HIMEM-1:CLOSEOUT
80 KEY 139,CHR$(6)+CHR$(13)
90 MODE 2:BORDER 13:INK 1,0:INK 0,12
100 DIM field$(16),search$(16),m(16),neg(16)
110 DIM record$(100,16)
120 ok=-1
130 REM Main Program
140 WHILE ok
150   GOSUB 3510
160   ON in GOSUB 230,710,1010,1470,1670,2510,2860,3220,3390
170 WEND
180 CLS:END
190 REM
200 REM ##################
210 REM # Create New File #
220 REM ##################
230 h$=" New File ":GOSUB 3720
240 IF nf=0 THEN 400
250 LOCATE 16,12
260 PRINT"Are you sure you want to create a new file (y/n)?";
270 in$=INKEY$:IF in$="" THEN 270
280 in$=UPPER$(in$)
290 IF in$="N" THEN RETURN
300 IF in$<>"Y" THEN 270
310 GOSUB 3800:LOCATE 19,12
320 PRINT"Do you wish to save the current file (y/n)?";
330 in$=INKEY$:IF in$="" THEN 330
340 in$=UPPER$(in$)
350 IF in$="N" THEN 390
360 IF in$<>"Y" THEN 340
370 GOSUB 2510
380 RETURN
390 GOSUB 3800
400 LOCATE 28,12:PRINT"How many fields (1-16):";
410 LINE INPUT in$:IF in$="" THEN 400
420 nf=VAL(in$)
430 IF nf<1 OR nf>16 OR nf<>INT(nf) THEN LOCATE 51,12:PRINT USING "&";SPACE$(LEN
(in$)):LOCATE 51,12:GOTO 410
440 GOSUB 3720
450 LOCATE 20,12:PRINT"Maximum field length (10-60 characters):";
460 LINE INPUT in$:IF in$="" THEN 400
470 fl=VAL(in$)
480 IF fl<10 OR fl>60 OR fl<>INT(fl) THEN LOCATE 60,12:PRINT USING "&";SPACE$(LE
N(in$)):LOCATE 60,12:GOTO 460
490 GOSUB 3720
500 PRINT:PRINT TAB(15);"Enter a name for each field - e.g. Name, Address etc."
510 PRINT TAB(28);"(Maximum 10 characters)"
520 FOR i=1 TO nf
530   LOCATE 1,i+5
540   PRINT"Field ";:IF i>9 THEN PRINT CHR$(8);
550   PRINT i;CHR$(8);":";
560   LINE INPUT name$
570   LOCATE 10,i+5
580   PRINT USING "&";SPACE$(LEN(name$))
590   WHILE LEN(name$)>0:IF ASC(name$)=32 THEN name$=RIGHT$(name$,LEN(name$)-1):
WEND
600   IF name$="" THEN 530
610   IF LEN(name$)>10 THEN name$=LEFT$(name$,10)
620   IF name$=SPACE$(LEN(name$)) THEN 530
630   LOCATE 10,i+5:PRINT name$
640   field$(i)=name$
650 NEXT i
660 tr=0:RETURN
670 REM
680 REM ##############
690 REM # Enter Data #
700 REM ##############
710 IF nf=0 THEN RETURN
720 h$=" Data Entry ":GOSUB 3720
730 tf=20000/nf/fl-1:IF tf>100 THEN tf=100
740 IF tr<tf THEN 820
750 LOCATE 29,10:PRINT"NO ROOM FOR MORE DATA"
760 LOCATE 19,12:PRINT"Do you want to delete any records (y/n)?";
770 in$=INKEY$:IF in$="" THEN 770
780 in$=UPPER$(in$)
790 IF in$="Y" THEN GOSUB 1010:RETURN
800 IF in$<>"N" THEN 770
810 RETURN
820 tr=tr+1
830 LOCATE 1,1:PRINT"Record Number";tr
840 PRINT:PRINT TAB(30);"Enter data for each field"
850 PRINT TAB(31);"(Maximum";fl;"characters)"
860 FOR i=1 TO nf
870   LOCATE 1,i+5
880   PRINT TAB(11-LEN(field$(i)));field$(i);":";
890   LINE INPUT file$
900   LOCATE 12,i+5
910   PRINT USING "&";SPACE$(LEN(file$))
920   IF LEN(file$)>fl THEN file$=LEFT$(file$,fl)
930   LOCATE 12,i+5:PRINT file$
940   record$(tr,i)=file$
950 NEXT i
960 RETURN
970 REM
980 REM ##############
990 REM # Alter Data #
```

```
1000 REM ##############
1010 IF tr=0 THEN RETURN
1020 h$=" Alter Data ":GOSUB 3720
1030 IF tr=1 THEN rn=1:GOTO 1090
1040 LOCATE 17,12:PRINT"Enter number of record to be altered ( 1 -";tr;"):";TAB(
65);
1050 LINE INPUT rn$:IF rn$="" THEN 1040
1060 rn=VAL(rn$)
1070 IF rn<1 OR rn>tr OR rn<>INT(rn) THEN LOCATE 65,12:PRINT USING "&";SPACE$(LE
N(rn$)):LOCATE 65,12:GOTO 1050
1080 GOSUB 3720
1090 LOCATE 1,1:PRINT"Record Number";rn
1100 PRINT:PRINT
1110 FOR i=1 TO nf
1120   PRINT TAB(11-LEN(field$(i)));field$(i);":";
1130   PRINT record$(rn,i)
1140 NEXT i
1150 LOCATE 9,23:PRINT"Press A to alter, D to delete or any other key to return
to menu"
1160 in$=INKEY$:IF in$="" THEN 1160
1170 in$=UPPER$(in$)
1180 IF in$="A" THEN 1280
1190 IF in$<>"D" THEN RETURN
1200 IF rn=tr THEN tr=tr-1:RETURN
1210 FOR i=rn+1 TO tr
1220   FOR j=1 TO nf
1230     record$(i-1,j)=record$(i,j)
1240   NEXT j
1250 NEXT i
1260 tr=tr-1
1270 RETURN
1280 GOSUB 3720
1290 LOCATE 1,1:PRINT"Record Number";rn
1300 PRINT:PRINT TAB(5);"Enter new data for each field or hit small ENTER key to
 leave unchanged"
1310 FOR i=1 TO nf
1320   LOCATE 1,i+4
1330   PRINT TAB(11-LEN(field$(i)));field$(i);":";record$(rn,i)
1340   LOCATE 12,i+5:LINE INPUT file$
1350   LOCATE 12,i+5:PRINT USING "&";SPACE$(LEN(file$))
1360   LOCATE 12,i+4:PRINT USING "&";SPACE$(LEN(record$(rn,i)))
1370   IF LEN(file$)>fl THEN file$=LEFT$(file$,fl)
1380   IF LEN(file$)>0 THEN IF ASC(file$)=6 THEN 1400
1390   record$(rn,i)=file$
1400   LOCATE 12,i+4:PRINT record$(rn,i)
1410 NEXT i
1420 RETURN
1430 REM
1440 REM #####################
1450 REM # Alter Field Names #
1460 REM #####################
1470 IF nf=0 THEN RETURN
1480 h$=" Alter Field Names ":GOSUB 3720
1490 PRINT:PRINT TAB(5);"Enter new names for each field or hit small ENTER key t
o leave unchanged"
1500 FOR i=1 TO nf
1510   LOCATE 1,i+4
1520   PRINT TAB(11-LEN(field$(i)));field$(i);":";
1530   LOCATE 12,i+4:LINE INPUT name$:IF name$="" THEN 1530
1540   LOCATE 12,i+4:PRINT USING "&";SPACE$(LEN(name$))
1550   WHILE LEN(name$)>0:IF ASC(name$)=32 THEN name$=RIGHT$(name$,LEN(name$)-1)
:WEND
1560   IF name$="" THEN 1530
1570   IF LEN(name$)>10 THEN name$=LEFT$(name$,10)
1580   IF LEN(name$)>0 THEN IF ASC(name$)=6 THEN 1600
1590   field$(i)=name$
1600   LOCATE 12,i+4:PRINT field$(i)
1610 NEXT i
1620 RETURN
1630 REM
1640 REM ###############
1650 REM # Search File #
1660 REM ###############
1670 IF tr=0 THEN RETURN
1680 h$=" Data Search ":GOSUB 3720
1690 IF tr=1 THEN 1950
1700 PRINT:PRINT"    Enter search parameters for each field, using =, >, <, #, \
, with data,                         or press ENTER alone if no parameters."
1710 FOR i=1 TO nf
1720   LOCATE 1,i+5
1730   PRINT TAB(11-LEN(field$(i)));field$(i);":";
1740   LINE INPUT file$:IF file$="" THEN 1920
1750   LOCATE 12,i+5
1760   PRINT USING "&";SPACE$(LEN(file$))
1770   IF ASC(file$)=6 THEN file$="":GOTO 1920
1780   temp$=file$
1790   neg(i)=0:l$=LEFT$(file$,1):IF l$="\" THEN IF LEN(file$)<3 THEN 1720 ELSE
neg(i)=-1:file$=RIGHT$(file$,LEN(file$)-1):l$=LEFT$(file$,1)
1800   r$=RIGHT$(file$,1):IF r$="#" THEN file$=LEFT$(file$,LEN(file$)-1)
1810   IF l$="#" AND r$="#" THEN m(i)=6:GOTO 1880
1820   IF l$="#" THEN m(i)=8:GOTO 1880
1830   IF r$="#" THEN m(i)=7:GOTO 1880
1840   IF l$="=" THEN m(i)=1:GOTO 1880
1850   IF l$="<" THEN IF MID$(file$,2,1)="=" THEN m(i)=4:file$=RIGHT$(file$,LEN(
file$)-1):GOTO 1880 ELSE m(i)=2:GOTO 1880
1860   IF l$=">" THEN IF MID$(file$,2,1)="=" THEN m(i)=5:file$=RIGHT$(file$,LEN(
file$)-1):GOTO 1880 ELSE m(i)=3:GOTO 1880
1870   m(i)=1:file$="="+file$
1880   IF LEN(file$)<2 THEN 1720
1890   IF LEN(file$)>fl+1 THEN file$=LEFT$(file$,fl+1)
1900   LOCATE 12,i+5:PRINT temp$
1910   file$=RIGHT$(file$,LEN(file$)-1)
1920   search$(i)=UPPER$(file$)
1930 NEXT i
1940 flag=0
1950 FOR i=1 TO tr
1960   IF tr=1 THEN 2230
1970   match=0
1980   FOR j=1 TO nf
1990     IF search$(j)="" THEN 2200
2000     IF m(j)=1 AND ((neg(j)=0 AND UPPER$(record$(i,j))=search$(j)) OR (neg(j
)=-1 AND UPPER$(record$(i,j))<>search$(j))) THEN 2200
2010     IF m(j)=2 AND ((neg(j)=0 AND UPPER$(record$(i,j))<search$(j)) OR (neg(j
)=-1 AND UPPER$(record$(i,j))>=search$(j))) THEN 2200
2020     IF m(j)=3 AND ((neg(j)=0 AND UPPER$(record$(i,j))>search$(j)) OR (neg(j
)=-1 AND UPPER$(record$(i,j))<=search$(j))) THEN 2200
2030     IF m(j)=4 AND ((neg(j)=0 AND UPPER$(record$(i,j))<=search$(j)) OR (neg(
j)=-1 AND UPPER$(record$(i,j))>search$(j))) THEN 2200
2040     IF m(j)=5 AND ((neg(j)=0 AND UPPER$(record$(i,j))>=search$(j)) OR (neg(
j)=-1 AND UPPER$(record$(i,j))<search$(j))) THEN 2200
2050     IF m(j)=6 AND ((neg(j)=0 AND INSTR(UPPER$(record$(i,j)),search$(j))>0)
OR (neg(j)=-1 AND INSTR(UPPER$(record$(i,j)),search$(j))=0)) THEN 2200
2060     IF m(j)<>7 THEN 2130
2070     IF neg(j)=-1 THEN 2110
```

PROGRAM FILE

```
2080      IF m(j)=7 THEN IF LEN(record$(i,j))>=LEN(search$(j)) THEN IF LEFT$(UPPE
R$(record$(i,j)),LEN(search$(j)))=search$(j) THEN 2200
2090      IF LEN(record$(i,j))>=LEN(search$(j)) THEN IF LEFT$(UPPER$(record$(i,j)
),LEN(search$(j)))=search$(j) THEN 2200
2100      GOTO 2210
2110      IF LEN(record$(i,j))<LEN(search$(j)) THEN 2200
2120      IF LEFT$(UPPER$(record$(i,j)),LEN(search$(j)))<>search$(j) THEN 2200
2130      IF m(j)<>8 THEN 2210
2140      IF neg(j)=-1 THEN 2170
2150      IF LEN(record$(i,j))>=LEN(search$(j)) THEN IF RIGHT$(UPPER$(record$(i,j
)),LEN(search$(j)))=search$(j) THEN 2200
2160      GOTO 2210
2170      IF LEN(record$(i,j))<LEN(search$(j)) THEN 2200
2180      IF RIGHT$(UPPER$(record$(i,j)),LEN(search$(j)))<>search$(j) THEN 2200
2190      GOTO 2210
2200      match=match+1
2210    NEXT j
2220    IF match<nf THEN 2410
2230    flag=-1:GOSUB 3720
2240    LOCATE 1,1:PRINT"Record number";i
2250    PRINT:PRINT
2260    FOR j=1 TO nf
2270      PRINT TAB(11-LEN(field$(j)));field$(j);":";
2280      PRINT record$(i,j)
2290    NEXT j
2300    LOCATE 8,23:PRINT"Press C to continue, P to print or any other key to ret
urn to menu"
2310    in$=INKEY$:IF in$="" THEN 2310
2320    in$=UPPER$(in$)
2330    LOCATE 8,23:PRINT SPACE$(66)
2340    IF UPPER$(in$)="C" THEN 2410
2350    IF UPPER$(in$)<>"P" THEN RETURN
2360    FOR j=1 TO nf
2370      PRINT#8,TAB(11-LEN(field$(j)));field$(j);":";
2380      PRINT#8,record$(i,j)
2390    NEXT j
2400    GOTO 2300
2410 NEXT i
2420 IF flag THEN 1950
2430 LOCATE 1,23:PRINT"No matching records - press A to alter search parameters,
 any other key for menu"
2440 in$=INKEY$:IF in$="" THEN 2440
2450 IF UPPER$(in$)="A" THEN 1680
2460 RETURN
2470 REM
2480 REM #############
2490 REM # Save File #
2500 REM #############
2510 IF tr=0 THEN RETURN
2520 h$=" Save File ":GOSUB 3720
2530 LOCATE 14,12:PRINT"Are you sure you wish to save the current file (y/n)?";
2540 in$=INKEY$:IF in$="" THEN 2540
2550 in$=UPPER$(in$)
2560 IF in$="Y" THEN 2590
2570 IF in$<>"N" THEN 2540
2580 RETURN
2590 GOSUB 3800
2600 LOCATE 29,12:PRINT"Enter Filename:";
2610 LINE INPUT name$
2620 LOCATE 44,12
2630 PRINT USING "&";SPACE$(LEN(name$))
2640 WHILE LEN(name$)>0:IF ASC(name$)=32 THEN name$=RIGHT$(name$,LEN(name$)-1):W
END
2650 IF name$="" THEN 2600
2660 IF LEN(name$)>8 THEN name$=LEFT$(name$,8)
2670 GOSUB 3800
2680 name$=UPPER$(name$)
2690 LOCATE 24,12:PRINT"Saving ";name$;" ... please wait"
2700 OPENOUT "!"+name$
2710 PRINT#9,nf,tr
2720 FOR i=1 TO nf
2730   PRINT#9,field$(i)
2740 NEXT i
2750 FOR i=1 TO tr
2760   FOR j=1 TO nf
2770     PRINT#9,record$(i,j)
2780   NEXT j
2790 NEXT i
2800 CLOSEOUT
2810 RETURN
2820 REM
2830 REM #############
2840 REM # Load File #
2850 REM #############
2860 h$=" Load File ":GOSUB 3720
2870 IF tr=0 THEN LOCATE 17,12:PRINT"Are you sure you want to load a new file (y
/n)?";:GOTO 2900
2880 LOCATE 12,10:PRINT"WARNING - Loading a new file will destroy the current fi
le."
2890 LOCATE 25,12:PRINT"Do you wish to continue (y/n)?";
2900 in$=INKEY$:IF in$="" THEN 2900
2910 in$=UPPER$(in$)
2920 IF in$="Y" THEN 2950
2930 IF in$<>"N" THEN 2900
2940 RETURN
2950 CLS:GOSUB 3720
2960 LOCATE 29,12:PRINT"Enter Filename:";
2970 LINE INPUT name$
2980 LOCATE 44,12
2990 PRINT USING "&";SPACE$(LEN(name$))
3000 WHILE LEN(name$)>0:IF ASC(name$)=32 THEN name$=RIGHT$(name$,LEN(name$)-1):W
END
3010 IF name$="" THEN 2960
3020 IF LEN(name$)>8 THEN name$=LEFT$(name$,8)
3030 GOSUB 3800
3040 name$=UPPER$(name$)
3050 LOCATE 24,12:PRINT"Loading ";name$;" ... please wait"
3060 OPENIN "!"+name$
3070 INPUT#9,nf,tr
3080 FOR i=1 TO nf
3090   INPUT#9,field$(i)
3100 NEXT i
3110 FOR i=1 TO tr
3120   FOR j=1 TO nf
3130     INPUT#9,record$(i,j)
3140   NEXT j
3150 NEXT i
3160 CLOSEIN
3170 RETURN
3180 REM
3190 REM ###############
3200 REM # Information #
3210 REM ###############
3220 h$=" INFORMATION ":GOSUB 3720
```

```
3230 PRINT
3240 PRINT"This is a general purpose filing program which allows the user to cre
ate files  of up to 100 records.  Each record may consist of up to 16 fields (i.
e. Name,   Address etc) and each field may be up to 60 characters in length."
3250 PRINT"Field names and record contents may be altered at any time and whole
files may  be saved to or loaded from tape (or disc if connected)."
3260 PRINT"Files may be searched for records which match a specified format and
the        following conditions can be used to assist in the search:"
3270 PRINT:PRINT"  =name    will search for all entries which are the same as th
e specified entry  #name    will search for all entries ending in the specified
entry              name#    will search for all entries beginning with the speci
fied entry"
3280 PRINT"  #name#   will search for all entries containing the specified entry
             <name    will search for all entries less than the specified entry
             >name    will search for all entries greater than the specified ent
ry"
3290 PRINT"           (these last two can be used in conjunction with = to
                       provide searches for entries >= or <= the specified entry).
"
3300 PRINT:PRINT"If any of these are preceded with \ then they will have the opp
osite effect to  that stated, so that \=name will search for all entries which a
re different fromthe specified entry."
3310 PRINT"Note that when no name is specified then any entry will match."
3320 PRINT:PRINT TAB(25);"PRESS ANY KEY TO RETURN TO MENU"
3330 WHILE INKEY$="":WEND
3340 RETURN
3350 REM
3360 REM ###############
3370 REM # End Program #
3380 REM ###############
3390 CLS
3400 LOCATE 22,12:PRINT"Are you sure you wish to QUIT (y/n)?";
3410 in$=INKEY$:IF in$="" THEN 3410
3420 in$=UPPER$(in$)
3430 IF in$="N" THEN RETURN
3440 IF in$<>"Y" THEN 3410
3450 ok=0
3460 RETURN
3470 REM
3480 REM ########
3490 REM # Menu #
3500 REM ########
3510 CLS
3520 LOCATE 1,5
3530 PRINT TAB(37);"OPTIONS"
3540 PRINT TAB(37);"======="
3550 PRINT
3560 PRINT TAB(32);"1) Create New File"
3570 PRINT TAB(32);"2) Enter Data"
3580 PRINT TAB(32);"3) Alter Data"
3590 PRINT TAB(32);"4) Alter Field Names"
3600 PRINT TAB(32);"5) Search File"
3610 PRINT TAB(32);"6) Save File"
3620 PRINT TAB(32);"7) Load File"
3630 PRINT TAB(32);"8) Information"
3640 PRINT TAB(32);"9) End Program"
3650 PRINT:PRINT TAB(31);"Enter Choice (1-8)";
3660 in$=INKEY$:IF in$="" THEN 3660
3670 in=ASC(in$)-ASC("0")
3680 IF in<1 OR in>9 THEN 3660
3690 RETURN
3700 REM
3710 REM Print inverse heading
3720 CLS
3730 LOCATE 40-(LEN(h$)/2),1
3740 PEN 0:PAPER 1
3750 PRINT h$
3760 PEN 1:PAPER 0
3770 RETURN
3780 REM
3790 REM Delete input prompt
3800 LOCATE 1,12:PRINT SPACE$(80):RETURN
```

PCW *is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer. Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.*

All programs should be fully debugged and your own original, unpublished work.

We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

Please keep a copy of everything.

Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month. Send your contributions to Nick Walker, PCW Programs, 62 Oxford St, London W1A 2HG.

END

 MICROMART MICROMART

EDUCATION EDUCATION EDUCATION

OPEN HOUSE TUITION FOR NOVICES AND OTHERS

Choose your time — day or evening. Learn at your own pace.

BASIC programming	£60
BUSINESS Packages	£70
Word-Processing introduction	£25
30-hour introduction for small businesses	
Subject to MSC training grants	£100

Brochure from:

MICROCOMPUTER ADVISORY CENTRE
Polytechnic of the South Bank
Borough Road
London SE1 0AA

or ring:

01-928 8989 ext. 2468

FULL-TIME TRAINING COURSES

(FULL TIME COURSES APPROVED BY THE BUSINESS & TECHNICIAN EDUCATION COUNCIL)

2 YEAR
BTEC National Diploma (OND)
ELECTRONIC & COMMUNICATIONS ENGINEERING
(Electronics, Computing, Television, Video, Testing & Fault Diagnosis)

15 MONTHS
BTEC National Certificate (ONC)
ELECTRONIC EQUIPMENT SERVICING
(Electronics, Television, Video Cassette Recorders, CCTV, Testing & Fault Diagnosis)

15 MONTHS
BTEC National Certificate (ONC)
COMPUTING TECHNOLOGY
(Electronics, Computing Software/Hardware, Microelectronic Testing Methods)

9 MONTHS
BTEC Higher National Certificate (HNC)
COMPUTING TECHNOLOGY & ROBOTICS
(Microprocessor Based Systems, Fault Diagnosis, ATE, Robotics)

THESE COURSES INCLUDE A HIGH PERCENTAGE OF COLLEGE BASED PRACTICAL WORK TO ENHANCE FUTURE EMPLOYMENT PROSPECTS

SHORTENED COURSES OF FROM 3 TO 6 MONTHS CAN BE ARRANGED FOR APPLICANTS WITH PREVIOUS ELECTRONICS KNOWLEDGE

NEXT TWO SESSIONS COMMENCE ON APRIL 22nd & SEPTEMBER 16th

FULL PROSPECTUS FROM:

LONDON ELECTRONICS COLLEGE

Dept PCW, 20 Penywern Road
London SW5 9SU. Tel: 01-373 8721

O'LEVELS

not just revision but also tuition

MATHS 8 programs TOTAL 150k	fractions square roots decimals logarithms, areas, sets, accuracy, [illegible], interest volumes, indices standard form, modulo, number sets, pie charts histograms simultaneous equations bar charts, averages, probability, algebraic laws, quadratics matrices vectors transformational geometry, trigonometry differentiation, integration factors angles.	Spectrum 48k / BBC model B / Commodore 64	
PHYSICS 7 programs TOTAL 140k	reflection wavelength and frequency, refraction lenses, the eye and its defects, diffraction, colour, magnetism, motors, Ohm's law, amps, volts, series, parallel electronics, heat, gas laws energy forms, specific heat kinetic energy, half-lives, atomic structure radiation, isotopes, Newton's laws.	Spectrum 48k / BBC model B / Commodore 64	
BIOLOGY 6 programs TOTAL 120k	plant and animal cells genetics, inheritance reproduction in man, asexual and sexual reproduction, flowering plants, photosynthesis osmosis, transpiration, transport, bacteria food classes, diet, alimentary canal, respiration, excretion eye, skin, nervous system ecosystem, food cycles, fungi earthworm, amphibians, birds, mammals, response.	Spectrum 48k / BBC model B / Commodore 64	
COMP ST 7 programs TOTAL 140k	data collection, coding, storage, processing presentation validation, e.g. systems privacy, security, hardware, I/O devices software, low and high level languages, machine code, assemblers, interpreters compilers, errors in programming, aids to debugging, microcode, machine organisation.	Spectrum 48k / BBC model B / Commodore 64	

each subject only £12.95 inc. p/p
also Electronics, Chemistry and French

LOGO, FORTH PASCAL & C

Languages 1 program Each 30k	Teaching versions of these languages including a full text editor (screen editor) and a 48 page tutorial manual. Saving and loading of programs is a screen editor function. Trace facilities are provided for easy turtle and debugging. Availability: Pascal now, C now, Logo now, Forth soon	Spectrum 48k / BBC model B / Commodore 64	

each language only £7.95 inc. p/p

GCE TUTORING DEPT.b

40 BRIMMERS HILL, WIDMER END, HIGH WYCOMBE, BUCKS. HP15 6NP

please send me: | my name and address:

my computer is: | I enclose a cheque / P.O. for £.

MITECMAIL

SELF-TUITION SOFTWARE BY MAIL ORDER

Books	Games
Incuding	*inc. P&P*
IBM PC DOS Handbook	17.50
MS-DOS Handbook	17.50
The Apricot P.C	10.45
The ACT Sirius Computer	11.45
Inside Concurrent CP/M86	16.50
Understanding C	18.95
Accounting with Lotus 1-2-3	21.45
Complete Guid to Multimate	16.50
Wordstar Made Easy	16.55
Using Symphony	19.85
Framework, a Programers Ref.	20.55
Evermans dBase 111 Primer	15.50
Multiplan. Home/Office Companion	15.95
Knuths Art of Programming (3 vols.)	61.50
SELF-TUITION S.W.	
e.g. CDEX TRAINING DBase11	66.50
MAC Workshop — Wordstar	66.50
Microcal Level 11Cobol	330.00
GAMES	
e.g. Flight Simulator	56.50
Sargon 111 (chess)	45.50
Hitch Hikers Guide to Galaxy	36.15

Prices, subject to fluctuation, include P&P (UK). Current lists available. State interest.

MITEC MAIL (Dept. C.W.)
15 Sandy Lane, Hightown, Liverpool
L38 3RP. U.K. Telephone: 051-929 2764

COMPUTER BOOKS MAIL ORDER

Quick delivery, lots of new titles

FREE send for our comprehensive list of computer books and software.

Rickmansworth 779129 (24 hours)

Or write:

Computer Books Ltd.
Freepost
Rickmansworth
Herts. WD3 6FP

Telephone orders ring Eileen or Josie

Rickmansworth (0923) 777652

We aim to please so send off now

JP Magnetics

SPECIALISTS IN THE SUPPLY OF BULK CUSTOM WOUND AUDIO/COMPUTER CASSETTES TO TRADE AND EDUCATION

NEW! TURBO LOAD FOR CBM 64 WITH 'ON SCREEN DISPLAY'

DUPLICATION FACILITIES FOR MOST POPULAR HOME COMPUTERS
16 TRACK RECORDING STUDIO

COMPETITIVE RATES. CONTACT US FOR PRICE LIST/QUOTATIONS NOW.

JP MAGNETICS LTD
UNIT 4, 7 MARY ST, BRADFORD BD4 8SW
TEL: (0274) 731651

MICROTEACH

Glasgow's first independent Micro training centre. Computer Programming Course.

The course is designed for people who want to keep abreast of the computer age, for anyone who realises that understanding computers is a key to future success, at BUSINESS, at SCHOOL, and as a PARENT.

The course provides an understanding of micro computer hardware, software and peripherals. Whether your interest lies in graphics, education or business, the course teaches you the use of BASIC language programming to produce your own programmes on your micro computer.

Enrol now for the Microteach BASIC course and teach your micro how to be useful.

Parent/child learn together special rate.

CONTACT:

MICROTEACH
205 Buchanan Street, Glasgow
Telephone: 041-332 0666

BBC LEVEL II ECOKNOTTED?

"DISKOVERY II" will retrieve programs and data from scrambled Level II disks and copy files to normal DFS.

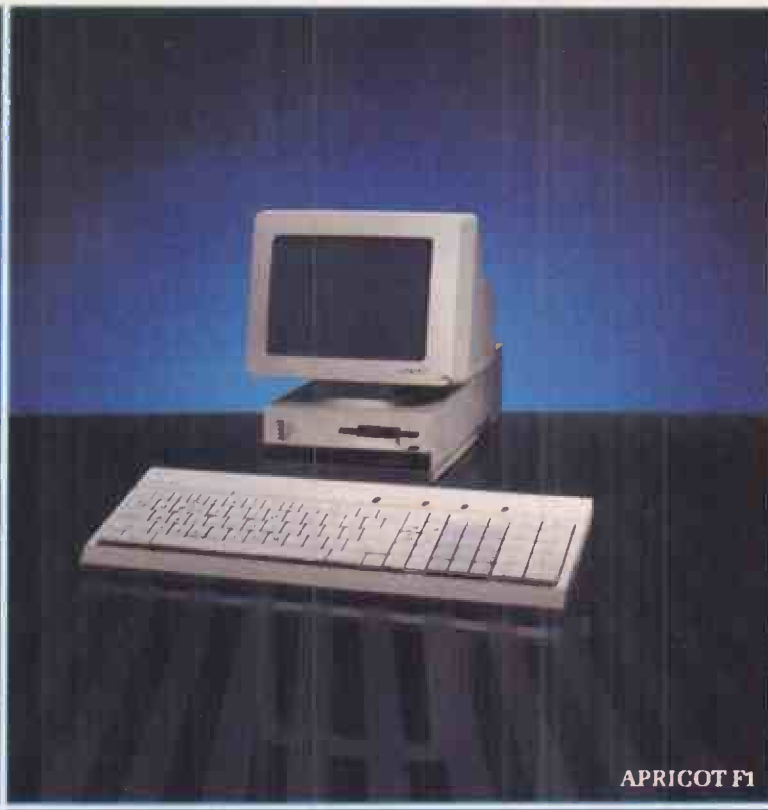
Price £39.95 incl VAT includes detailed manual.

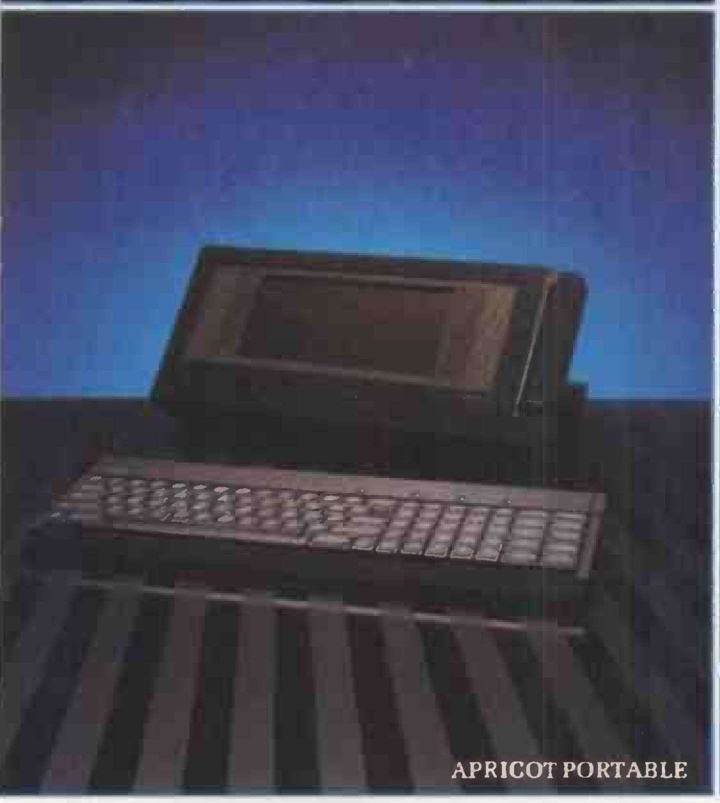
For special utilities and troubleshooting for Econet telephone (0705) 812466

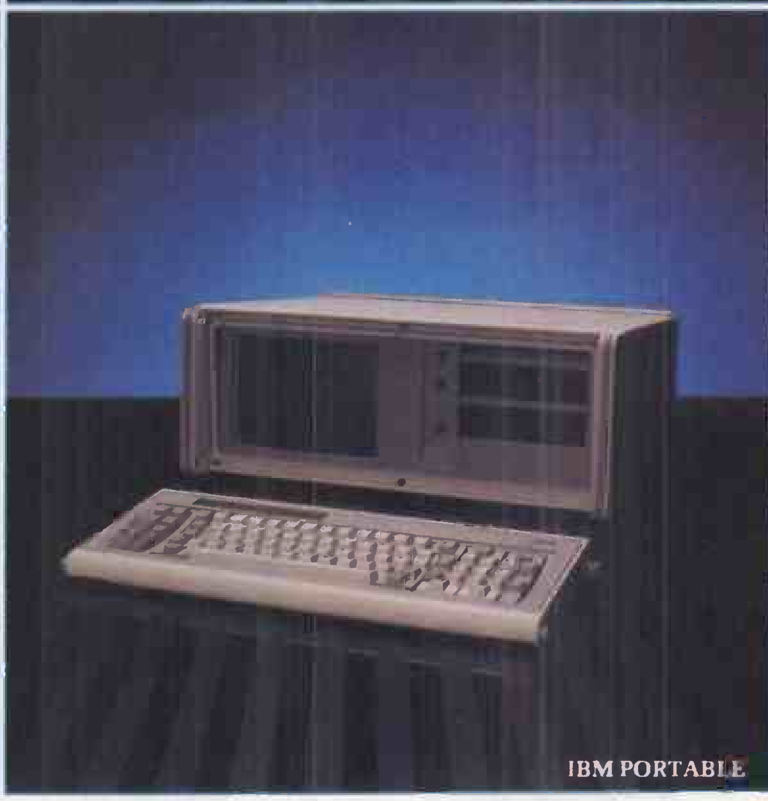
2 Queen's Place, Southsea PO5 3HF

John Billingsley Associates Ltd


APRICOT XI


APRICOT F1


APRICOT PORTABLE


IBM PORTABLE

e right answers.

Plymouth Syntax Business Computers Armada House, 170 Armada Way, Plymouth, Devon PL1 1LB Tel: (0752) 23190	**Dudley** Central Computers 35 Churchill Precinct, Dudley, W Midlands DY2 7BL Tel: (0384) 238169	**London W1** Pilot Software Ltd. 32 Rathbone Place, London W1P 1AD Tel:01-636-2666	**Lancaster** Mipac Services 63 King St., Lancaster Tel: (0524) 62033	**Cardiff** Unique Solutions Ltd. 17-21 Castle St., Cardiff CF1 2BT Tel: (0222) 390714	**Oxford** Oxford Data Systems 29 Pound Way, Cowley Centre, Oxford OX4 3XX Tel: (0865) 717720 IBM Appointed Dealer
Coventry Adelphi Business Computers Ltd 25 Trinity Street, Coventry, West Midlands CV1 1FJ Tel: (0203) 553944 IBM Appointed Dealer	**Hull** SBC (Humberside) Ltd 56/58 Anlaby Road, Hull, Humberside HU1 2PA Tel: (0482) 24346 IBM Appointed Dealer	**Herts.** Spectrum Business Centre Hunting Gate, Hitchin, Herts. SG4 0TJ Tel: (0462) 37171 IBM Appointed Dealer	**London W1** Computers of Wigmore Street 104 Wigmore Street, London W1 Tel: (01) 935 2452 IBM Appointed Dealer	**Leeds** Lieb System Ltd Kings House, 3 King Street, Leeds LS1 2HG Tel: (0532) 455545 IBM Appointed Dealer	**DEALERS** For more information contact Nick Ray or Andrew Doxsey at SBC Hitchin **(0462) 37171**

MPORTANT:- ONLY THOSE DEALERS MARKED CAN OFFER IBM PRODUCTS.

Please clip this coupon and send to:(No stamp required)
FREEPOST SBC, HITCHIN, HERTS, SGA 0YA

Name..

Position...

Co. Name...

Address...

....

Tel.. PCW585

SPECTRUM BUSINESS CENTRES
(A division of Spectrum PLC)
Hunting Gate, Hitchin, Hertfordshire SG4 0TJ
Tel: Hitchin (0462) 37171

sbc

CUT PRICE MICROS

PLUS

PEGASUS
BUSINESS
SOFTWARE

APRICOT MICROCOMPUTERS

ACT Xi 10 MEG £(VERY LOW!!)
ACT Xi 5 MEG £(EVEN LOWER!!)
ACT 2x720K £(LOWER THAN MAYFAIR)
ACT 2x315K £(LOW-LO-LO)
12" MONITORS AVAILABLE

See us at the Business to Business Exhibition The Barbican, Stand 334 May 12th-15th

THE PEGASUS SYSTEMS

SYSTEM 1

APRICOT WITH 2 x 720K PLUS 12" MONITOR
PLUS SUPERWRITER WORDPROCESSING PROGRAM
PLUS SUPERCALC FINANCIAL FORECASTING PROGRAM
PLUS SUPERPLANNER ELECTRONIC DIARY AND CARDBOX SYSTEM

PLUS PEGASUS SALES ORDER PROCESSING/INVOICING
PLUS PEGASUS SALES LEDGER
PLUS PEGASUS PURCHASE LEDGER
PLUS PEGASUS NOMINAL LEDGER

PLUS DATA CABLE TO LINK PRINTER TO COMPUTER
PLUS 20 3.5" DISKS
PLUS BROTHER HR15 DAISY WHEEL QUALITY PRINTER

SYSTEM PRICE £2796.00

SYSTEM 2

APRICOT WITH 10 MEGABYTE HARD DISK DRIVE AND 12" MONITOR
WITH SUPERWRITER FOR WORD PROCESSING
WITH SUPERCALC FINANCIAL FORECASTING SPREADSHEET
WITH SUPERPLANNER ELECTRONIC DIARY SYSTEM

PLUS EPSON FX80 PRINTER
PLUS DATA CABLE TO LINK PRINTER TO COMPUTER
PLUS 10 3.5" DISKS
PLUS 1 BOX OF FANFOLD PAPER

PLUS ANY 4 MODULES OF PEGASUS ACCOUNTING SOFTWARE

SYSTEM PRICE £3596.00

WE CAN RECONFIGURE ANY PACKAGE TO SUIT YOUR INDIVIDUAL NEEDS. WE PROVIDE HOT-LINE SUPPORT, SERVICE, DATA INSURANCE & ON-SITE MAINTENANCE

THE APRICOT SYSTEMS

APRICOT Xi 10 MEG
SUPERWRITER
SUPERCALC
SUPER PLANNER
BASIC/MS-DOS/CPM-86
FX100 PRINTER & CABLE
BOX OF DISKS
BOX OF PAPER
£2800

APRICOT 2x720
12" MONITOR
SUPERWRITER
SUPERCALC
SUPER PLANNER
ANY PRINTER
WORTH UP TO £400

£1996

SOFTWARE – UP TO 30% DISCOUNTS

WORDSTAR
FRIDAY
DBASE II
OPEN ACCESS

CARDBOX
DBASE III
AUTOCODE
LOTUS 1-2-3

SYMPHONY
TOUCH & GO TYPING TUTOR
SUPERCALC III

SUPERCALC II
MULTIPLAN
FRAMEWORK

OUR FULL SOFTWARE RANGE IS FAR TOO LARGE TO INCLUDE HERE PLEASE CALL US FOR CURRENT PRICES ON ANY SOFTWARE PRODUCT

ALL ITEMS ARE FULLY SUPPORTED AND GUARANTEED. CALL NOW FOR FREE ADVICE FROM OUR APPLICATIONS EXPERT. TRAINING IS ALSO AVAILABLE ON ANY PROGRAM OR COMPUTER.

WE OFFER FREE TRAINING WITH ANY TOTAL PEGASUS SYSTEM BOUGHT FROM US. OUR SYSTEMS ARE SOLD ON AN INSTALLED AND WORKING BASIS. WE CAN DELIVER TO ANY PART OF THE U.K. OR COURIER TO ANY TRADING COUNTRY IN THE WORLD.
VAT NOT INCLUDED IN ABOVE PRICES.

BUY RENT OR LEASE FROM THE PROFESSIONALS

We are authorised dealers for the above

TEL: 01-800 8182
78-82 KIRKTON ROAD
LONDON N15

MCS

spectrum

NEWS!

FLORIDA HOLIDAY COMPETITION WINNERS!

We are pleased to announce the happy winners of our holiday of a lifetime competition. The Haley family of Coventry are seen receiving a cheque for £2,500 spending money from David Pleasance of Commodore Computers, as part of their prize of a 14 day holiday in Florida. The prize holiday also included Disneyworld and a visit to the Kennedy Space Centre.
Also shown are Bob Cleaver, of Spectrum and John Greetham, Manager of the Computer Department of Greens of Coventry where the Haleys collected their entry form for the competition. Congratulations again to the Haley family.

New Products!

Mitsui Quick Data Drive for MSX Computers	£139.95
Mitsui Quick Data Diskette	£3.99
Cumana Electron Interface	£149.95 inc. VAT
Commodore Business Package	£549.95
Quendata DMP1100 Printer	£269.99
Juki 2200 Portable Typewriter/Daisywheel Printer	£343.83
Canon PW1080A Printer	£399.00
Elephant 5¼" Diskette (10 Pack) from	£22.50
System 2000 Computer Desk and Monitor Bridge	£49.95

Added Value FREE! Offer Coupon

Please complete this coupon in full and ask your local participating authorised Spectrum Group plc dealer to stamp it before sending it to:-
Roger Anthony,
Spectrum Group PLC, Hunting Gate, Hitchin, Herts. SE4 0TJ

I have purchased .... from my local Spectrum Group PLC authorised dealer listed in your advertisement.

Please forward the following FREE item(s) offered in your advertisement with the item already purchased ....

I attach herewith my sales receipt as proof of purchase and have had this coupon stamped at the shop where the purchase was made. I understand that this receipt will be returned along with my free offer product.

My Name and Address for postage is: (Complete in Block Capitals)

....

....

....

SPECTRUM GROUP PLC AUTHORISED DEALER STAMP

SAVE OVER £150

NEW!

Commodore 64 Business Package

- Commodore 64 Computer
- Commodore 1541 disc drive
- Commodore MSP 801 printer
- Plus "Future Finance" & "Easy File"

Send for FREE! "High Flyer" games diskette worth £14.95

£549.95

Only £23 with Spectrum Chargecard*. APR 29.8% (variable)

Pack 1

£129.99

Atari 800XL Starter Kit

Includes:
- Atari 1010 data recorder
- Introduction to programming software
- Pole position game cassette
- Demonstration cassette

PLUS! send for 5 FREE! blank data cassettes worth £2.50

Only £8 monthly with Spectrum Chargecard*. APR 29.8% (variable).

Pack 2

£149.99

Atari 800XL plus Disc Drive

Includes:
- Atari 1050 disc drive
- Home filing manager
- The payoff disc software
- Demonstration disc

PLUS! send for 2 FREE! blank diskettes worth £4.95

Only £11 monthly with Spectrum Chargecard*. APR 29.8% (variable).

Super Computer Offers from Spectrum

£349.95

BBC Model B

with built in Speech Synthesiser worth £50

Plus send for FREE!
Omega data recorder & Azimuth tape worth £24.95
AND FREE! Acorn games cassette worth over £6

Only £15 monthly with Spectrum Chargecard*. APR 29.8% (variable).

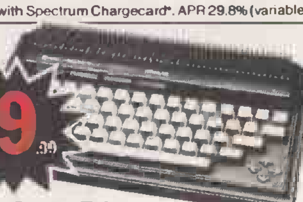
£199.95

Goldstar MSX

- Full MSX compatability
- 64K RAM
- 32K ROM
- 16K Video RAM
- 16 colour display
- 8 octaves x channels sound

PLUS send for FREE!
Omega data recorder with azimuth tape worth £24.95

Only £9 monthly with Spectrum Chargecard*. APR 29.8% (variable).



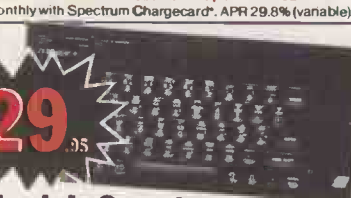
£149.99

Commodore Plus 4

- Powerful 64K RAM
- Built in graphics
- 4 programmable function keys

PLUS Send for FREE!
Commodore compatible data recorder complete with lead worth £34.95

Only £8 monthly with Spectrum Chargecard*. APR 29.8% (variable).



£129.95

Sinclair Spectrum +

"Fantastic Value for Money"

- 48K RAM
- 8 colours
- 10 octave sound
- Professional keyboard

Only £8 monthly with Spectrum Chargecard*. APR 29.8% (variable).

Not all stores carry every advertised item, please phone before making a journey • prices correct at time of going to press E&OE

spectrum CHARGE CARD

Up to £1000 Instant Credit

*There's up to £1,000 worth of Instant Credit available on a Spectrum Chargecard. See your local SPECTRUM dealer for written details (UK mainland only). Typical APR 29.8%.

Latest News

for up to date, information & offers from SPECTRUM - see PRESTEL page 600181 for details.

Your Computer Specialist Nationwide
There's one near you!

AVON

BATH Software Plus, 12 York St Tel: (0225) 61676
WESTON-S-MARE K & K Computers, 32 Alfred St Tel: (0934)419324

BEDFORDSHIRE

DUNSTABLE Dormans 7-11 Broad Walk Tel: (0582) 65515
LUTON Terry-More, 49 George St. Tel: (0582) 23391/2

BERKSHIRE

BRACKNELL Computer Centre, 44 The Broadway. Tel: (0344) 427317
SLOUGH MU Games and Computers 245 High St Tel: (0753) 21594
WINDSOR Gadgets 30 Peascod St., Tel: (07535) 67211

BUCKINGHAMSHIRE

CHESHAM Reed Photography & Computers, 113 High St. Tel: (0494) 783373

CAMBRIDGESHIRE

HUNTINGDON T.S.C. Electronics, 3 All Saints Passage, High St. Tel: (0480) 411579
PETERBOROUGH Logic Sales, 6 Midgate Tel: (0733) 49696

CHANNEL ISLANDS

GUERNSEY Gruts, 3-5 The Pollett, St. Peter Port Tel: (0481) 24682
JERSEY Audio & Computer Centre, 7 Peter St, St Helier. Tel: (0534) 74000

CHESHIRE

ALTRINCHAM Mr Micro 28 High St Tel: (061) 941 6213
CHESTER Computer Link, 21 St. Werburgh St. Tel: (0244) 316516
CREWE Microman Unit 2, 128 Nantwich Rd. Tel: (0270) 216014

CLEVELAND

MIDDLESBOROUGH McKenna & Brown, 206 Linthorpe Rd. Tel: (0642) 222368

CORNWALL

ST AUSTELL A B & C Computers, Duchy House, 6 Lower Aylmer Sq. Tel: (0726) 67337

CUMBRIA

PENRITH Penrith Communications, 14 Castlegate. Tel: (0768) 67146 Open Mon-Fri till 8pm
WHITEHAVEN P D Hendren 15 King St. Tel: (0946) 2063

DERBYSHIRE

ALFRETON Gordon Harwood 69-71 High St. Tel: (0773) 832078
HEANOR Logic Electrical Engineers, Godfrey St. Heanor Derby Tel: (0773) 76980

DEVON

BRIXHAM Discus Computers, Beach Approach, Tel: (08045) 55532
EXETER Seven Counties (Computers) Ltd., 7 Paris Street. Tel: (0392) 211211
EXMOUTH Open Channel, 30 The Strand. Tel: (0395) 264408

PLYMOUTH Syntax Ltd., 76 Cornwall St. Tel: (0752) 28705
TIVERTON Actron Micro Computers, 37 Bampton St. Tel: (0884) 252854

DORSET

DORCHESTER Seven Counties Cptrs. 20 High Street East Tel: (0305) 66022
POOLE Lansdowne Cptr Centre 14 Arndale Centre Tel: (0202) 670901

DURHAM

DARLINGTON McKenna & Brown, 102 Bondgate. Tel: (0325) 459744

ESSEX

BASILDON Godfrey's 28-32 East Walk. Tel: (0268) 289379
BASILDON Godfrey's Computer Centre, 5 Laindon Main Centre Laindon. Tel: (0268) 416747
CHELMSFORD Way-in Cptrs, 7 Village Square, Chelmer Village Tel: (0245) 467858
CHELMSFORD Maxton Hayman Ltd., 5 Broomfield Rd. Tel: (0245) 354595
GRAYS H Reynolds. 79 Orsett Rd. Tel: (0375) 5948
SOUTHEND Computer Centre 332 London Rd. Tel: (0702) 337161

HAMPSHIRE

BASINGSTOKE Fisher's, 2-3 Market Place. Tel: (0256) 22079
PORTSMOUTH (Waterlooville) G B Microland, London Rd., (Opp. Co-op) Tel: (0705) 259911
SOUTHAMPTON L.T.C. Ltd., 112 East St. Tel: (0703) 333958/24703

HEREFORD

HEREFORD Melgray Hi-Tech Ltd., 53/54 Commercial Str., Tel: (0432) 275737

HERTFORDSHIRE

POTTERS BAR The Computer Shop, 197 High St. Tel: (0707) 44417
STEVENAGE D J Computers, 11 Town Square. Tel: (0438) 65501
WATFORD SRS Microsystems Ltd., 94 The Parade, High St. Tel: (0923) 26602
WELWYN GARDEN CITY D J Computers, 40 Fretherne Rd., Tel (07073) 28435/28444

HUMBERSIDE

BEVERLEY Computing World. 10 Swaby's Yard Dyer Lane. Tel: (0482 881831
GRIMSBY RC Johnson Ltd., 22 Friargate, Riverhead Centre. Tel: (0472) 42031
HULL The Computer Centre, 26 Anlaby Rd Tel: (0482) 26297

ISLE OF MAN

DOUGLAS T H Colebourn Ltd., 57-61 Victoria St. Tel: (0624) 3482

ISLE OF WIGHT

COWES Beken & Son. 15 Bath Rd. Tel: (0983) 297181

KENT

BECKENHAM Supa Computers Ltd., 425 Croydon Rd., Tel: (01) 650 3569
BROADSTAIRS Video Vision 19/20 Willow Court. St Peters Park Road Tel: (0843) 63284 (No Early Closing Day)
BROMLEY Computers Today 31 Market Square Tel: (01) 290 5652
CANTERBURY Canterbury Computer Centre, 56-57 Palace Street, Tel: (0227) 62101
DOVER Kent Photos & Computers, 4 King St Tel: (0304) 202020
RAINHAM Microway Computers Ltd., 39 High St. Medway Towns., Kent Tel: (0634) 376702
SEVENOAKS Ernest Fielder Computers, Dorset Street, Tel: (0732) 456800
SITTINGBOURNE Computers Plus, 65 High St. Tel: (0795) 25677
TUNBRIDGE WELLS Modata Computers Ltd. 28-30 St Johns Rd Tel: (0892) 41555

LONDON

E6 Percivals, 85 High St. North, East Ham. Tel: (01) 472 8941
E17 Erol Computers Ltd., 125 High Street Walthamstow Tel: (01) 520 7763
EC2 Devron Computer Centre, 155 Moorgate Tel: (01) 638 3339/1830
N14 Logic Sales, 19 Broadway, The Bourne, Southgate. Tel: (01) 882 4942
N20 Castlehurst Ltd. 1291 High Rd. Tel: (01) 446 2280
NW11 Computers Inc., 86 Golders Green Rd. Tel: (01) 209 0401/0279
SE1 Vic Odden's 6 London Bridge Walk. Tel: (01) 403 1988
SE9 Square-Deal, 373-375 Footscray Rd., New Eltham Tel: (01) 859 1516
SE15 Castlehurst Ltd., 152 Rye Lane, Peckham. Tel: (01) 639 2205
W1 Computers of Wigmore St., 104 Wigmore St. Tel: (01) 935 2452
W1 Micro-Foto, 14-16 Quadrant Arcade. Regent Street Tel: (01) 437 5336/5471
W1 Sonic Foto & Micro Centre, 256 Tottenham Court Rd. Tel: (01) 580 5826
W1 Ramsons, 4 Edgeware Road. Tel: 01 724 2373

GREATER MANCHESTER

OLDHAM Home & Business Computers Ltd., 54 Yorkshire St. Tel: (061) 6331608
ROCHDALE Home & Business Computers, 75 Yorkshire Street. Tel: (0706) 344654
SWINTON Mr Micro Ltd. 69 Partington Lane. Tel: (061) 728 2282 . Late Night Friday
WIGAN Wilding Ltd., 11 Mesnes St. Tel: (0942) 44382

MERSEYSIDE

LIVERPOOL Home & Business Cptrs 31 Bold St. Tel: (051) 708 0428
LIVERPOOL Beaver Radio, 20-22 Whitechapel. Tel: (051) 709 9898
LIVERPOOL (Aintree) Hargreaves, 31-37 Warbreck Moor. Tel: (051) 525 1782

MIDDLESEX

TEDDINGTON Andrews, Broad St. Tel: (01) 977 4716
PINNER Spectrum 91 Field End Rd., Eastcote Tel: (01) 868 6830/6860
UXBRIDGE J K L Computers, 7 Windsor St. Tel: (0895) 51815

NORFOLK

KING'S LYNN Computer Plus, 40 Conduit St. Tel: (0553) 4550
NORWICH Norwich Camera Centre 20 White Lion Str. Tel: (0603) 612537
NORWICH Brainwave 11A Castle Meadow Tel: (0603) 663796
THETFORD C B & Micros, 21 Guildhall Street. Tel: (0842) 61645

NORTHAMPTONSHIRE

NORTHAMPTON Dormans, 22 Princes Walk Grosvenor Centre. Tel: (0604) 37031

NOTTINGHAMSHIRE

NOTTINGHAM Jacobs Computers, 13 Middlegate Newark. Tel: (0636) 72594
WORKSOP Computagrafix, 132 Bridge St. Tel: (0909) 472248

NORTHERN IRELAND

PORTADOWN Pedlows, 16 Market St., Craigavon, County Armagh Tel: (0762) 332265
NEWRY Newry Computer Centre. 34 Monaghan St. Tel: (0693) 66545

NORTHUMBERLAND

MORPETH Telerents 31 Newgate St. Tel: (0665) 513 537

OXFORDSHIRE

ABINGDON Ivor Fields Computers, 21 Stert St. Tel: (0235) 21207
BANBURY Computer Plus, 2 Church Lane Tel: (0295) 55890
OXFORD Ivor Fields, 7 St Ebbes St. Tel: (0865) 247082

SCOTLAND

ABERDEEN Dee Micro 278 George Street Tel: (0224) 644350
AYR Vennals, 6A New Bridge St. Tel: (0292) 264124
DUNDEE Micromania 60 Gray St., Boughty Ferry Tel: (0382) 77130
HAMILTON Tom Dickson Computers, 8-12 Cadzow St. Tel: (0698) 283193

SHROPSHIRE

SHREWSBURY Computerama, 13 Castlegate. Tel: (0743) 60528
TELFORD Computer Village, 4 Hazeldine House Telford Town Centre. Tel: (0952) 506771

SOMERSET

TAUNTON Grays, 1 St James St. Tel: (0823) 72986

STAFFORDSHIRE

STAFFORD Computerama, 59 Forgate St. Tel: (0785) 41899
STOKE-ON-TRENT Computerama, 11 Mkt Square Arcade Hanley. (0782) 268620
HEDNESFORD Disco's Ltd. East Cannock Rd Tel: (054) 382021

SUFFOLK

BURY ST EDMUNDS Guildhall Cptr Ctr, 11 Guildhall St. Tel: (0284) 705772
LOWESTOFT John Wells, 44 London Rd North Tel: (0502 3742

SURREY

CAMBERLEY Camera Arts (Micro Computer Division), 36 High St. Tel: (0276) 65848
CATERHAM Telecare, 35-37 Croydon Rd. Tel: (0883) 46209
EPSOM The Micro Workshop, 12 Station Approach Tel: (03727) 21533
WALLINGTON Surrey Micro Systems Ltd. 53 Woodcote Rd Tel: (01) 647 5636
WOKING Harpers, 71-73 Commercial Way. Tel: (04862) 25657

SUSSEX

BEXHILL-ON-SEA Computerware, 22 St Leonards Rd. Tel: (0424) 223340
BOGNOR REGIS Bits & Bytes High Str., Tel: (0243) 867143
BRIGHTON Gamer 71 East St. Tel: (0273) 728681
BURGESS HILL Weald Cptrs, 247-249 London Rd. Tel: (04446) 41381
LITTLEHAMPTON Alan Chase Ltd., 39 High St. Tel: (0903) 715674

WALES

ABERYSTWYTH AberData at Galloways, 23 Pier St. Tel: (0970) 615522
CARDIFF Randall Cox, 18-22 High St Arcade. Tel: (0222) 31960
NEWPORT (Gwent) Randall Cox, 118 Commercial St. Tel: (0633) 67378
PEMBROKE Randall Cox, 19 Main St. Tel: (064) 682876

WARWICKSHIRE

NUNEATON Micro City 1A Queens Road Tel: (0203) 382049

WEST MIDLANDS

BIRMINGHAM Software World 12 Ethel Street Tel. (021) 643 7559
COVENTRY Greens, 22 Market Way. Tel: (0203) 28342
DUDLEY Central Computers, 35 Church Hill Precinct. Tel: (0384) 238169
WALSALL New Horizon Computer Centres, 1 Goodall St. Tel: (0922) 24821
WEST BROMWICH Bell & Jones, 39 Queens Square. Tel: (021) 553 0820
WOLVERHAMPTON Wolverhampton Computer Centre 17/19 Litchfield St Tel (0902) 29907

WORCESTER

KIDDERMINSTER Central Computers, 20-21 Blackwell Street, Tel: (0562) 746941
WORCESTER David Waring Ltd., 1 Marmion House High St. Tel (0905) 27551

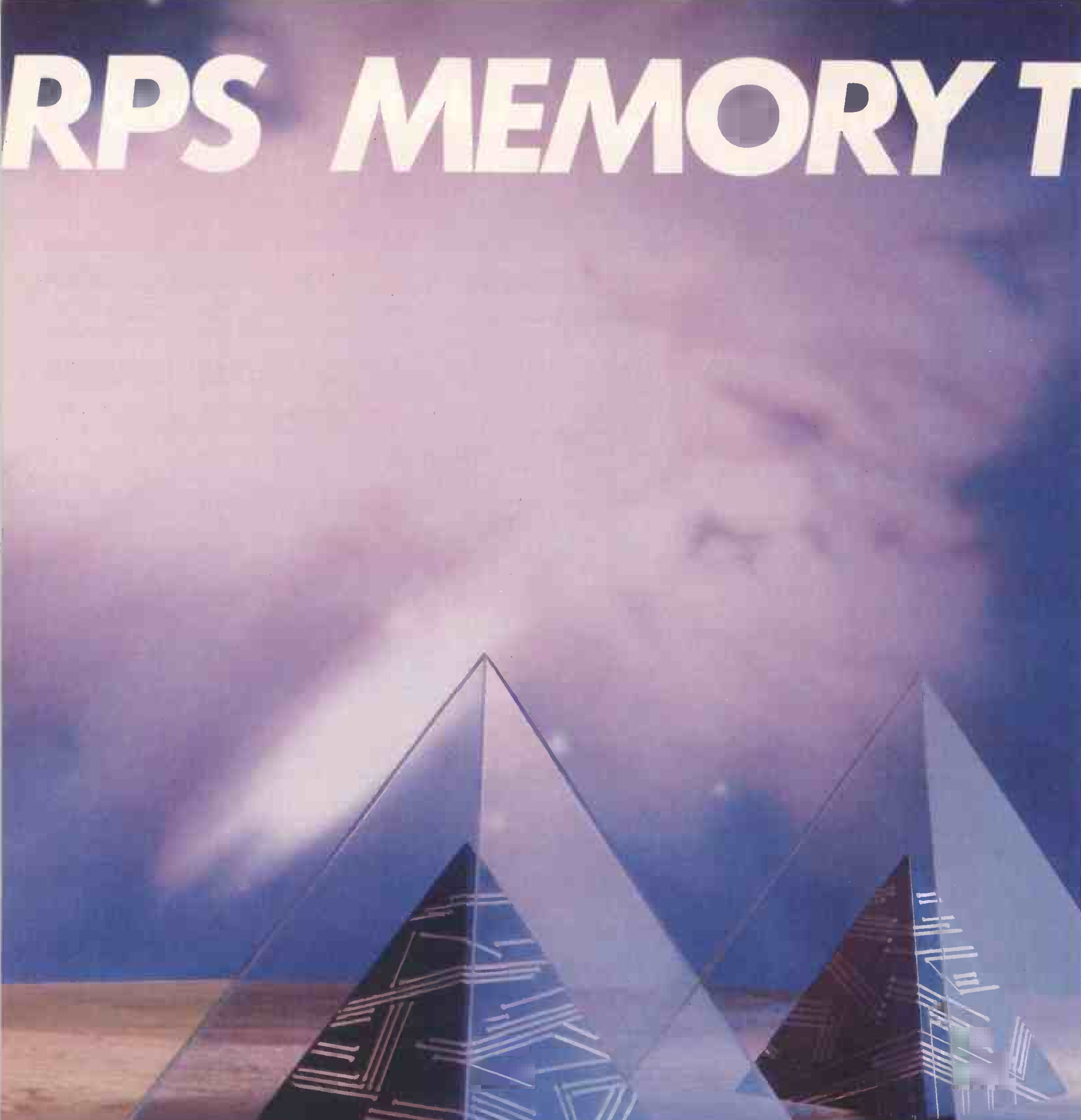
YORKSHIRE

BRADFORD Erricks, Fotosonic House Rawson Square. Tel: (0274) 309266
DONCASTER The Soft Centre 8 Queensgate Waterdale Centre Tel: (0302) 20088
ROTHERHAM GT Leisure-world Cascade Centre. Tel (0709) 67391
SHEFFIELD HVL Computers 812 Ecclesall Rd., Tel: (0742) 661328
YORK York Computer Centre 7 Stonegate Arcade. Tel: (0904) 641862

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

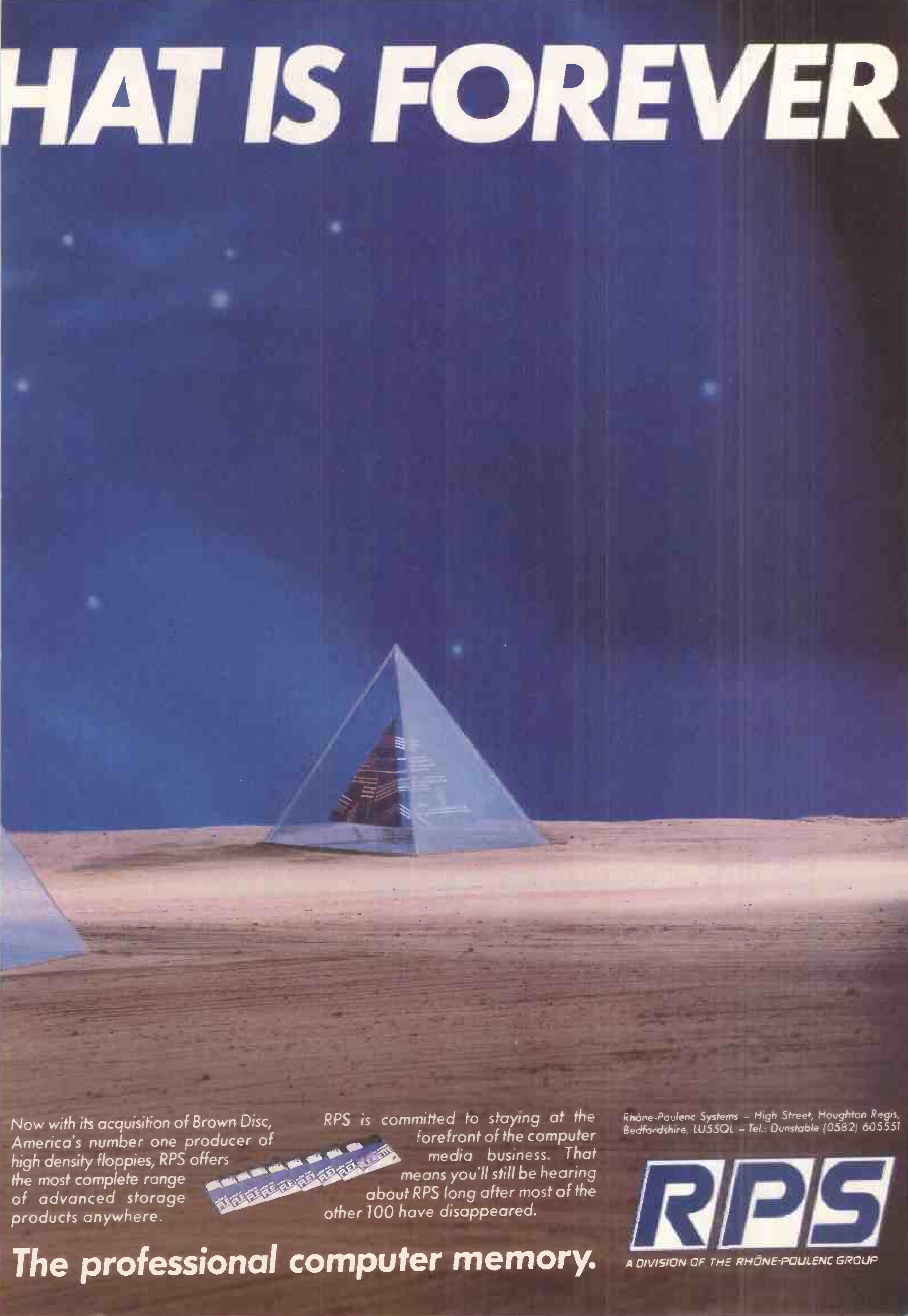
spectrum

See your local Spectrum Computer Specialist today!



RHÔNE-POULENC

"Lots of people are talking about RPS these days."
"Why – there are 100 other brands of floppy discs to choose from."
"Yes – but how many companies are actual manufacturers and how many totally control the production of their discs – from the base film to the crucial magnetic coating?"
"Only a handful."
"How many have the technology to produce the new generation of high density five and a quarter inch and micro-floppy discs?". We feel one can answer:
"Only one outside Japan – RPS". As the specialist computer media division of Rhône-Poulenc (one of Europe's largest chemical and pharmaceutical groups) RPS is already a world leader in coating technology and makes the most reliable discs, computer tapes and disc packs on the market.


HAT IS FOREVER
Now with its acquisition of Brown Disc, America's number one producer of high density floppies, RPS offers the most complete range of advanced storage products anywhere.
RPS is committed to staying at the forefront of the computer media business. That means you'll still be hearing about RPS long after most of the other 100 have disappeared.
The professional computer memory.
Rhône-Poulenc Systems – High Street, Houghton Regis, Bedfordshire, LU55QL – Tel.: Dunstable (0582) 605551
RPS
A DIVISION OF THE RHÔNE-POULENC GROUP

RITEMAN

Riteman F Plus with 80 column, 105 cps and Epson FX 80 compatibility

Riteman II features 80 column, 160 cps and Epson FX 80 compatibility
Riteman Blue Plus with 80 column, 140 cps and IBM® PC® compatibility

Riteman 15 with 136 column, 160 cps and Epson FX 100® compatibility

C. Itoh's Riteman range of printers – the Rite choice in low cost printers.

The Riteman range, available from C.Itoh, brings you big printer performance in units which set new standards for compact, reliable printers.

Whether you need a lightweight, full-featured or high-speed multi-mode commercial model, the Riteman range offers the print speed, quality and reliability you need.

Riteman F Plus low cost dot matrix printer with 105 cps print speed, is compatible with Epson FX 80, and with its unique paper handling and stacking system the Riteman F Plus uses the minimum of space in operation.

Riteman Blue Plus is specifically designed to complement the IBM® PC®, and is compatible with all three of the most popular modes of operation: IBM® Graphics Printer, Epson RX 80 FT®, and MX 80 FT®. You even get quad density mode for quality graphics.

Riteman II gives 160 cps performance in a unit small enough to fit in a 3 inch deep briefcase. Features include 2k buffer and expandable 8k buffer, 256 programmable character modes, proportional spacing, and Epson FX 80 compatibility.

The Riteman 15 is a 15 inch wide paper, 136 column printer which delivers 160 cps. Features include six graphics modes, 128 typestyles, and nine sets of foreign characters. The ideal business machine, it is also Epson FX 100® compatible.

All models, except Blue Plus, feature NLQ print-mode for word processing applications.

C.Itoh Electronics Co. Ltd.,
Beacon House, 26–28 Worple Road, London. SW19 4EE. Tel: 01-946 4960. Tlx: 8955616.

RITE FIRST TIME

INTERESTED IN APL?

...Get a free UP GRADE

UP GRADE is Cocking & Drury's new group newsletter.

UP GRADE will bring you APL news, in-depth case studies, up-to-date details of our activities, and regular technical information.

To start getting your free **UP GRADE's** write on your company letterhead or send your business card to:

COCKING & DRURY LTD
FREEPOST 34
LONDON W1E 7Q2

COCKING & DRURY
THE APL PROFESSIONALS

FORTH = TOTAL CONTROL

FORTH programs are instantly portable across the most popular microprocessors.

FORTH is interactive and 20 times faster than BASIC

FORTH programs are structured, modular, and easy to maintain.

FORTH gives control of all interrupts, memory locations, and i/o ports.

FORTH gives full access to DOS files and functions.

FORTH application programs can be converted to turnkey programs.

FORTH Cross Compilers can generate ROMmable code for: 6502, 6809, 68000, 8080, Z80, 8086, 6800, 6801/3, 1802, Z8, 8070, Z8000, 99xxx, LS-11.

LMI Application Development Systems include **FORTH** with virtual memory, multi-tasking, assembler, full-screen editor, decompiler, utilities, and full documentation.

Z80 or 8080 FORTH — CPM 2.2.	£95
8086 FORTH — CPM-86, MSDOS	£110
PC/FORTH — PC/DOS. CPM-86	£110
6809 FORTH — flex 059	£175
6800 FORTH — CPM-68K	£190

FORTH has 32-bit stacks and directly accessess the whole address space of the processor.

PC FORTH+	£190
8086 FORTH+	£190
6800 FORTH+	£290

Extension Packages include floating point, cross compilers, 8087 support, colour graphics, databases.

We are the **FORTH** specialists, we also stock a large range of books, listings, and implementations for machines ranging from Spectrums to VAXes.

MicroProcessor Engineering Ltd
21 Hanley Road, Shirley
Southampton SO1 5AP
Tel: (0703) 780084

MICRO MEDIA - MICRO MEDIA

SUPPLIES SAVE £££'s

SPECIAL OFFER

5¼" COC SSDD 48TPi in **FREE** SEE 10 BOX **£11.95**

All prices inclusive of postage and packing

3m -DISCS LIFETIME GUARANTEE
5¼" PRICE £ PER BOX OF TEN

TYPE TPI	1 BOX	2-4	5+
SS DD 48	15.50	14.20	13.50
DS DD 48	19.30	17.70	17.20
SS DD 96	23.10	20.90	20.20
DS DD 96	24.90	22.70	22.10

NASHUA -5¼" DISCS 5 YEAR WARRANTY

SS SD 48	13.95	12.80	12.30
SS DD 48	14.75	13.70	13.10
DS DD 48	17.60	16-15	15.65
SS DD 96	18.65	16-95	16.45
DS DD 96	20.55	18-80	18.15

3½" SONY -DISCS

SS DD 96	35.95	34.45	33.50
DS DD 96	49.85	45.40	43.90

All prices inclusive of postage and packing

DISK STORAGE BOXES

10×5¼" SEE 10	2.50	2.30	1.95
30×5¼" REXEL	6.85	6.50	6.10
40×5¼" ABA LOCK-LID	14.60	13.80	12.75
90×5¼" ABA LOCK-LID	17.50	15.90	15.30
60×3½" ABA LOCK-LID	15.50	14.50	12.70

LISTING PAPER
PRICE PER BOX OF 2000 SHEETS

11"×9½"	12.60	11.90	11.20
12"×9¼"	14.95	14.20	13.30
EXACT A4			
70 GSM	18.15	17.25	16.30
90 GSM	22.35	21.05	19.75

RING 0707 52698

ORDERS WITH CHEQUES PAYABLE TO
MICRO-MEDIA
RYDAL MOUNT
BAKER STREET
POTTERS BAR
HERTS EN6 2BP

BARCLAYCARD VISA

24 HOUR CREDIT CARD ORDERS 0707 50913

All prices please add VAT at 15%

MICRO-MEDIA RYDAL MOUNT BAKER ST. POTTERS BAR HERTS EN6 2BP

QTY — DESCRIPTION — PRICE

NAME — ADDRESS — CREDIT CARD No. — SIGNATURE

MICRO MEDIA - MICRO MEDIA

NOW an expansion system as versatile as the QL

All in one - one system, one cartridge

MEDIC takes up where others leave off. Why narrow down your choices? The Q.L. was intended as a versatile computer capable of fulfilling many roles. With our system cartridge, the choice is yours. As well as a disc interface including parallel port you can have any one of the following: memory upto 512K, modem, Eprom card (192K) experimental card including front interface. You can upgrade to any level in line with your needs. Our disc interface affords full Psion, versions 1 and 2, compatibility.

Ask your dealer for details or order direct:

medic datasystems limited

76 Grainger Close, Basingstoke, Hants. RG22 4EA
Telephone: 0256 460748

☐ Please send me further details on your products.

I wish to order the following: (please tick required items)

Individual Products

- ☐ 64K Memory £99.95
- ☐ 128K Memory £129.95
- ☐ 256K Memory £169.95
- ☐ 512K Memory† £259.95
- ☐ Eprom card socketed (192K – excluding Eproms) experimentation card with front interface £24.95
- ☐ Dust Cover that doubles up as a stand £14.95
- ☐ Modem* £79.95

†Can only be powered if Medic disc system connected
**Delivery beginning April*

Packages

- ☐ 1 Megabyte disc drive (cased, inc. PSU) disc interface and parallel interface, with cables £249.96
- ☐ 2 1 Megabyte disc drives, (cased, inc. PSU) disc interface parallel interface, with cable £399.95
- ☐ 1 megabyte disc drive, memory inc., disc interface and parallel interface.

	1 disc drive	2 disc drives
64K	☐ £299.95	☐ £449.95
128K	☐ £329.95	☐ £479.95
256K	☐ £359.95	☐ £509.95
512K	☐ £449.95	☐ £595.95

To order products please make cheques/P.O.'s payable to MEDIC DATASYSTEMS LTD. Allow 28 days for delivery. All prices include VAT. Please add £5 p&p.

NAME________________

ADDRESS________________

Signed________________

PCW5

DIGITASK BUSINESS SYSTEMS LTD

56, MAPLE DRIVE, EAST GRINSTEAD, WEST SUSSEX, RH19 3UR

APPLE COMPATIBLE PERIPHERALS

128k RAM Card with manual & disk	£139.95
SNAPSHOT (II & II+) — Dark Star	£ 52.00
SNAPSHOT IIe — Dark Star	£ 99.00
COPYKIT Software — Dark Star	£ 19.95
SHUTTLE MULTITASKING Software Dark Star	£ 19.95
Auto Dial/Auto Answer MODEM Card	£125.00
COMMS software for above	£ 25.00
PRESTEL Graphics ROM for Modem Card	£ 19.95
Disk Drive Controller Card	£ 34.95
16K RAM (language) Card	£ 39.95
80 Column Card (Videx Compatible) II+/e	£ 44.95
80 Col Card as above with Soft Control	£ 59.95
INVERSE Video ROM for above	£ 5.00
80/40 Column Hard Switch	£ 9.95
80 Column Card for IIe	£ 44.95
80 Column Card for IIe with 64K RAM	£ 84.95
Z80 CP/M Card for II+	£ 39.95
Z80 PLUS Card with Manual for II+	£ 49.95
CP/M Z80-B (6MHz) Card with 64K RAM II+	£169.95
Z80 Card for IIe	£ 44.95
CP/M Module for IIc	£ 86.00
Parallel Printer Card (Centronics)	£ 34.95
Parallel Printer Card (Epson)	£ 34.95
SUPER Parallel Card with manual	£ 89.95
Printer Buffer Card (64K dump)	£129.95
Grappler + Card	£ 84.95
Grappler + 16K Buffer	£149.95
CHAMPION Parallel Interface (with cable)	£ 45.00
CHAMPION + 16K Buffer (with cable)	£ 89.00
CHAMPION + 64K Buffer (with cable)	£125.00
CACHEBOX 64K Parallel Inline Buffer	£125.00
Communications Card	£ 32.95
RS-232 Serial Interface Card	£ 34.95
SUPER Serial Card with manual	£ 89.95
7710 Asynchronous Serial Interface	£ 79.95
NTSC to PAL Converter + UHF Mod	£ 44.95
RGB Card (TTL output)	£ 49.95
RGB Card (LINEAR output)	£ 49.95
IEEE-488 Controller, cable, dsk & manual	£149.95
Eprom Blower Card (2716, 2732, 2764)	£ 49.95
Mk2 Eprom Blower (2716, 2732, 2764, 27128)	£ 59.95
NEW EPROM controller/Parallel I/Face	£ 32.00
EPROM Blower for 2716, 32, 32a, 64, 128, 256	£ 53.00
8 BIT AD/DA Card (8-channel)	£ 59.95
12 BIT AD/DA Card	£119.95
8 BIT 16 Channel AD Card	£ 59.95
8 BIT 16 Channel AD/Da Card	£109.95
CLOCK CARD (TIME II) Card	£ 44.95
Music Card	£ 44.95
Wild Card	£ 69.95
Wild Card Plus	£ 99.95
Four Port Twin 6522 Card	£ 34.95
6809 Card	£119.95
Integar Basic Card	£ 32.95
CUMANA Drive for Apple	£145.00
ADF — 2 320KB Floppy drive	£249.00
AFD — 2 320KB Floppy drive	£249.00
AFD — 4 640KB floppy drive	£289.00
INTEC 5MB HARD DRIVE	£699.00
INTEC 10MB HARD DRIVE	£950.00
INTEC 10MB HARD DRIVE KIT	£875.00
(All INTEC DRIVES ARE UK BUILT & BACKED — prices include controller card, cables, power supplies, utility & diagnostic software together with 24-MONTH service warranty).	
10MB HARD DRIVE CONTROLLER CARD (ST-506)	£250.00
LOGO Card	£ 59.95
Joystick (2 control buttons)	£ 9.95
Joystick (self centering)	£ 14.95
Joystick (deluxe version)	£ 19.95
Joystick extension cord	£ 3.99
Apple Compatible Power Supply 5A	£ 49.95
ASC II Encoded Keyboard with l/c mod	£ 54.95
IBM STYLE keyboard for Apple	£ 89.95
A/C Cooling Fan (clip on) with suppress	£ 24.95
SpeEch Card	£ 79.95
Replay Card	£ 79.95
Forth Card	£ 89.95
8088 Card with 64K (capacity 128K)	£365.00
Light Pen system	£195.00
Graphics Table	£ 89.00

PRINTERS – DOT MATRIX

ANADEX — 100% DUTY CYCLE	
ALL MODELS	CALL
BROTHER	
HR-5 Portable thermal transfer (P or S)	£ 125
HR-5 for CMB64/VIC 20	£ 125
EP-44 Thermal transfer (KSR)	£ 189
M-1009 Dual interface	£ 167
M-1009 (IBM) 50cps	£ 163
2024L NLQ 190cps draft	£ 889
TC 600 — Typewriter —printer	£ 369
DISK DRIVE for TC 600	£ 169
CANON	
PW-1080 160cps (NLQ)	£ 289
PW-1156 160cps (NLQ)	£ 349
F-60 80cps Thermal DRAFT NLQ LQ GR 110col	£ 389
PJ-1080A Seven COLOUR 37cps	£ 430
DATAPRODUCTS — PAPER TIGER	
8010 80col 180cps draft NLQ both S&P	£ 393
8011 as above but IBM COMPATIBLE	£ 393
8020 132col 180cps draft both S&P	£ 545
8021 as above but IBM COMPATIBLE	£ 545
8050 132COL 200CPS + SSF both S&P	£1242
8050 COLOUR as above but colour printing	£1469
8070 132col 400cps draft LQ both P&S	£1619
8070 COLOUR as above but colour printing	£1859
EPSON	
RX-80 T 80col 100cps	£ 195
RX-80 F/T 80col 100cps	£ 220
RX-100 136col F/T 100cps	£ 339
FX-80 80col 160cps	£ 315
FX-100 F/T 136col 160cps	£ 420
LQ-1500 200cps (NLQ) 4 to 16" paper width	£ 855
EPSON 8143 Serial interface 0K	£ 29
EPSON 8145 Serial interface 2K buffered	£ 59
EPSON 8148 Serial interface 3K buffered	£ 65
XON/OFF Serial Interface 2K buffer	£ 65
EPSON/COMMODORE Interface 2K buffer	£ 53
EPSON 8165 PET IEEE 2K interface 2K buffer	£ 65
EPSON PET IEEE Cable 8260	£ 20
EPSON APPLE Card 8132	£ 59
EPSON APPLE Cable 8231	£ 20
8K Buffered parallel or serial interface	£ 79
16K Buffered parallel or serial interface	£ 95
32K Buffered parallel or serial interface	£ 125
64K Buffered parallel or serial interface	£ 159
HONEYWELL	
ALL MODELS	CALL
MANNESMANN TALLY	
MT-80 80cps	£ 183
MT-160 60cps	£ 395
MT-180 160cps (NLQ)	£ 575
NEC	
PINWRITER P3 132col	£ 599
Parallel interface for P3	£ 99
RS232 interface for P3	£ 155
IBM PC interface for P3	£ 99
Sheet feeder for P3	£ 289
Tractor unit for P3	£ 119
NEWBURY DATA — Heavy Duty	
DRE-8925 parallel 240cps 132col	£1355
DRE-8850 parallel 300LPM	£2055
OKI — MICROLINE	
OKI-82A P & S 120cps 80col	£ 239
OKI-84A 200cps	£ 619
OKI-92P 160cps	£ 359
OKI-83A 120cps	£ 385
OKI-2410P 350cps	£1519
PANASONIC	
KX-P1091 120cps NLQ	£ 269
RADIX	
10 F/T 200cps	£ 439
RITEMANN	
PLUS — (MX-80 FT compatible) 120cps 80col	£ 210
BLUE PLUS (RX-80 FT comp) 140cps 80col	£ 234
II — (FX-80 compatible) 160cps 80col NLQ	£ 259
15 — (FX-100 compatible) 160cps 136col	£ 399
SEIKOSHA	
GP-80 F/T	£ 162
GP-100 VIC 50cps	£ 159
GP-100 Parallel or Serial	£ 159
GP-500A 50cps	£ 169
GP-250X 50cps	£ 199
STAR	
GEMINI 10X F/T 120cps 80col	£ 195
DELTA 10X F/T 160cps 80col	£ 295
RADIX 10 F/T 200cps 80col	£ 410
GEMINI 15X F/T 120cps 132col	£ 279
DELTA 15 F/T 160cps 132col	£ 425
RADIX 15 F/T 200cps 132col	£ 319
TAXAN	
KP-810 140cps 80col NLQ	£ 286
KP-910 140cps 156col NLQ	£ 368
TEC	
1550 Parallel	£ 450
1550 Serial	£ 489
TOSHIBA — 24 Wire Head	
2100H Parallel 100cps LQ	£1354
2100 Serial 100cps (NLQ)	£1289
2100G Parallel	£1426
2100G Serial	£1359
Auto Sheet Feeder for 2100	£ 546
Bi-directional Tractor for 2100	£ 136

PRINTERS – DAISY WHEEL

BROTHER	
HR-15 Parallel 20cps	£ 319
HR-15 Serial 20cps	£ 349
HR-25 Parallel 25cps	£ 549
HR-25 Serial 25cps	£ 599
HR-35 Parallel 35cps	£ 729
HR-35 Serial	£ 779
HR-15 Keyboard	£ 129
HR-15 Sheet Feeder	£ 179
HR-15 Tractor Feed Unit	£ 60
HR 25/35 Sheet feeder	£ 185
HR 25/35 Tractor Unit	£ 75
"SPECIAL COMBI PRICE"	
HR-35 + SHEET FEEDER	£ 829
TOWA	
Daisy Junior 14cps 80col	£ 199
Daisystep 2000 18cps 132col	£ 219
DIABLO	
630-API 40cps	£1529
630-API Sheet Feeder	£ 375
EPSON	
DX-100 Parallel or Serial 20cps	£ 429
JUKI	
6100 18cps	£ 315
6300	£ 795
2200	£ 249
2100	£ 169
NEC SPINWRITER	
3510/30/15 Ser/P11/Diablo 35cps	£1035
7710/30/15 Ser/P11/Diablo 55cps	£1429
2000 Printer 20cps	£ 569
Ser/P11/Diablo I/face for 2000	£ 89
8800 Printer	£1299
Ser/P11/Diablo I/face for 8800	£ 99
Accessories for NEC printers	CALL
QUME	
11/40 RO (without interface)	£1165
9/45 RO full front panel	£1525
12/20 Letter Pro (S or P) 20cps	£ 445
9/55 RO full front panel 55cps	£1895
11/55 RO (without interface)	£1359
QUEN DATA/UCHIDA	
Daisy Wheel Parallel 18cps	£ 229
UCHIDA DAISY WHEEL 20cps parallel	£ 199
UCHIDA as above Serial version	£ 239
RICOH	
RP-1200 Parallel/Serial 20cps	£ 489
RP-1300S Parallel/Serial 30cps	£ 865
RP-1600S P11 or Ser 8K 60cps	£1399
FLOWRITER 1600 46K Multi I/face	£1235
FLOWRITER 1300 46K multi I/face	£1279
Elec/Mech Sheet Feeder RP-1600	£ 445
Tractor Unit for 1600 Models	£ 129
SILVER-REED	
EXP-400 Parallel 10cps	£ 219
EXP-400 Serial 10cps	£ 249
EXP-500 Parallel 16cps	£ 259
EXP-500 Serial 16cps	£ 291
EXP-550 Parallel 19cps	£ 399
EXP-550 Serial 19cps	£ 449
EXP-770 Parallel 36cps	£ 649
EXP-770 Serial 36cps	£ 665
ASTRON (SILVR REED EXP770) P11	£ 599
Tractor for 500	£ 84
Tractor for 550/700	£ 105
Cut Sheet Feeder for 500	£ 163
Cut Sheet Feeder for 550/770	£ 163
8K Buffer for 770	£ 55
16K Buffer for 770	£ 95
48K Buffer for 770	£ 259
TEC STARWRITER	
F10/40 Parallel 40cps	£ 830
F10 55 Parallel 55cps	£1229
Elec/Mech single Sheet Feeder	£ 445
Tractor for F10 units	£ 129

MONITORS

SANYO	
DM-2112 40col 15MHz + P31	£ 63
DM-8112CX 80col 18MHz + P31	£ 83
CD-3125 14" Normal Res RGB	£ 169
CD-3117 14" Medium Res RGB	£ 296
CD-3115 14" High Res RGB	£ 389
DMC 7650 IBM/APRICOT Colour Monitor	£ 349
YAN JEN	
GN-1211 12" Green or Amber 20MHz with tilt & swivel base	£ 83
ZENITH	
122E 12" 15MHz Amber	£ 84
123E 12" 15MHz Green	£ 79
Tilt base for above	£ 8
ZVM-133 13" Colour Hi Res (IBM-PC)	£ 329
Cable for ZVM-133/IBM-PC	£ 15
PHILIPS	
TP-200 12" 18MHz Green	£ 65
INDESIT	
APRICOT Display 12" (beige or black)	£ 159
PLOTTERS	
EPSON H180 Plotter	£ 349
ASTAR MCP-40 4-Colour 80 character	£ 105
ASTAR MCP-80 4-Colour full graphics	£ 165
"NEW" SILVER REED EB-50 typewriter/calculator/intelligent 4-colour plotter/printer	£ 199
COLOUR PRINTERS	
SEIKOSHA GP-700A	£ 345
EPSON JX-80 160cps Text	£ 469
DIABLO 150C	£ 799
ANADEX DP-9725B	£1299
CPP-40 4-Colour printer/plotter	£ 99
HARD DRIVES & CONTROLLER PACKAGES — All CSI/RODIME inc cable/host controller manual & support disk. Available for IBM-PC, APRICOT, PC-COMPATIBLES, SANYO 550/555:	
11MB WINCHESTER + CONTROLLER	£ 999
22MB WINCHESTER + CONTROLLER	£1259
33MB WINCHESTER + CONTROLLER	£1399
44MB WINCHESTER + CONTROLLER	£1599
HARD DRIVE + CONTROLLER + STREAMER — All CSI/RODIME/CIPHER supplied with cables, host controller, manuals & support disks. In versions for IBM-PC, APRICOT, PC-COMPATIBLES & SANYO:	
11MB WINCHESTER/CONTROLLER/STREAMER	£1749
22MB WINCHESTER/CONTROLLER/STREAMER	£1999
33MB WINCHESTER/CONTROLLER/STREAMER	£2159
44MB WINCHESTER/CONTROLLER/STREAMER	£2389

COMPUTERS

APRICOT	
F1	£ 910
PC 256K+2 × 315K + Monitor	£1389
PC 256K+2 × 720K + Monitor	£1529
XI 256K + 10MB + Monitor	£2189
SIRIUS	
128K + 1MB	£1695
256K + 10MB	£2845
BBC	
MODEL — B	£ 315
DFS KIT	£ 85
FULL RANGE CUMANA DRIVES FROM	£ 96
COMMODORE 64	£ 169
SANYO	
MBC 550 128K + 1 × 160K + software	£ 595
MBC 555 128K + 2 × 160K + software	£ 789
MBC 550-2 as 550 but 360K Drive	£ 789
MBC 555-2 as 555 but dual 360K dr	£1169
CRT 36 Hi Res 12" Green Monitor	£ 110
CRT 50 Med Res Colour Monitor	£ 279
CRT 70 Hi Res Colour Monitor	£ 419
MBC 232 — RS232 I/Face board	£ 49
64K RAM Plug In Module	£ 79
EPSON	
PX-8 Portable Computer	£ 669
120K RAM Disk for above	£ 249
PX8 + 120K RAM Disk	£ 889
QX-10 Desk Top Computer	£1569
ZENITH	
Z-150PC 2 × 320K + 128K RAM	£1545
Z-150PC with 10MB Hard Drive	£2799
Z-160PC Transportable 2 × 320K × 9" display	£1729
*** NEW CANON-IBM COMPATIBLE COMPUTER***	
A-200M 256K + 2 × 360K drives + mono display MS-DOS, GW-Basic	£1449
A-200C as above but COLOUR DISPLAY	£1549
OLIVETTI M24	£CALL
COMPAQ	£CALL

DRIVES — MEGABYTES FOR MICROPOUNDS!

5¼" ½ Height DS 80TR 500KB	£ 119
5¼" ½ Height DS 160TR 1MB	£ 125
5¼" ½ Height DS 154TR 1.6MB	£ 159
5¼" ½ Height DS 160TR 2MB	£ 199
3½" ½ Height SS 80TR 500KB	£ 119
3½" ½ Height DS 160TR 1MB	£ 125
8" Full Height DS 154TR 1.6MB	£ 309
8" ½ Height DS 154TR 1.6MB	£ 282
MR 521 5¼" ½ Height 12.75MB Hard Drive	£ 492
MR 522 5¼" ½ Height 26MB Hard Drive	£ 691
The above are sold brand new but uncased as replacement units. The drives have full electronics. Drive controller is included but not host controller or cables.	
RODIME HARD DISK DRIVES 5MB TO 42MB	£CALL
SINCLAIR QL HIGH QUALITY FLOPPY DRIVES	
1st Drive 1MB + interface + Power pack	£ 268
2nd Drive 1MB	£ 149
(Interface with 1st drive supports up to FOUR DRIVES)	

SOFTWARE

WORDSTAR	£ 189
DBASE II	£ 229
FRIDAY	£ 129
FRAMEWORK	£ 335
LOTUS 123	£ 289
SYMPHONY	£ 415
DMS — DELTA	£ 390
MULTIMATE	£ 235
OPEN ACCESS	£ 349
DBASE III	£ 355
SUPERCALC II	£ 179
SUPERCALC III	£ 199
MULTIPLAN	£ 130
PEACHTREE ACCOUNTS	£POA
PFS FILE	£ 75
PFS REPORT	£ 65

WE OFFER EXCELLENT DISCOUNTS ON JUST ABOUT EVERY MAJOR BRAND OF SOFTWARE — CALL FOR QUOTATION

REMEMBER! Even if you don't see it advertised here, we can probably supply it, AND FOR LESS. Problems with limited space means that we are only able to advertise a limited range of products. Additional prices on application. Consumables, paper, ribbons etc, supplied at exceptional prices. 24-HOUR DELIVERY on items ex-stock.

CARRIAGE WITHIN UK: Items which may be dispatched by POST (eg, peripheral cards etc) add £2.00 per order for any order under £50.00. ORDERS EXCEEDING £50.00 CARRIAGE FREE. SOFTWARE PACKAGES: CHARGED SEPARATELY, MINIMUM CHARGE £4.00. Items which must move by CARRIER (such as printers, monitors etc), will be delivered within 24 hours for a charge of £10.00, OR ALTERNATIVELY within 48 HOURS at a charge of £7.50. Add 15% VAT to all prices given. Remember, VAT is also applicable on carriage at 15%. Terms STRICTLY CWO. DEALER ENQUIRIES WELCOME. FOREIGN enquiries if possible by telex please. Favourable rates to most destinations. CALLERS BY APPOINTMENT ONLY.

BARCLAYCARD VISA

TEL: (0342) 24631 • 313427 TLX: 957547

At £1575 it's a portable you can take sitting down

At £1575, the Bondwell 2 is more than just a pleasant surprise. It's a true personal computer that's also a lap-held portable. A full-sized screen, integral disk drive and complete suite of software is only the start. Equivalent machines are twice the price (at least) or offer half the features.

Weighing in at 12 lbs, the Bondwell 2 fits in a briefcase. MicroPro word processing, database manager, report generator and electronic spreadsheet (worth up to £1000) are included in the price. As well as everything else you expect in a lap-held portable: rechargeable battery, qwerty keyboard, communications ports and an expansion slot.

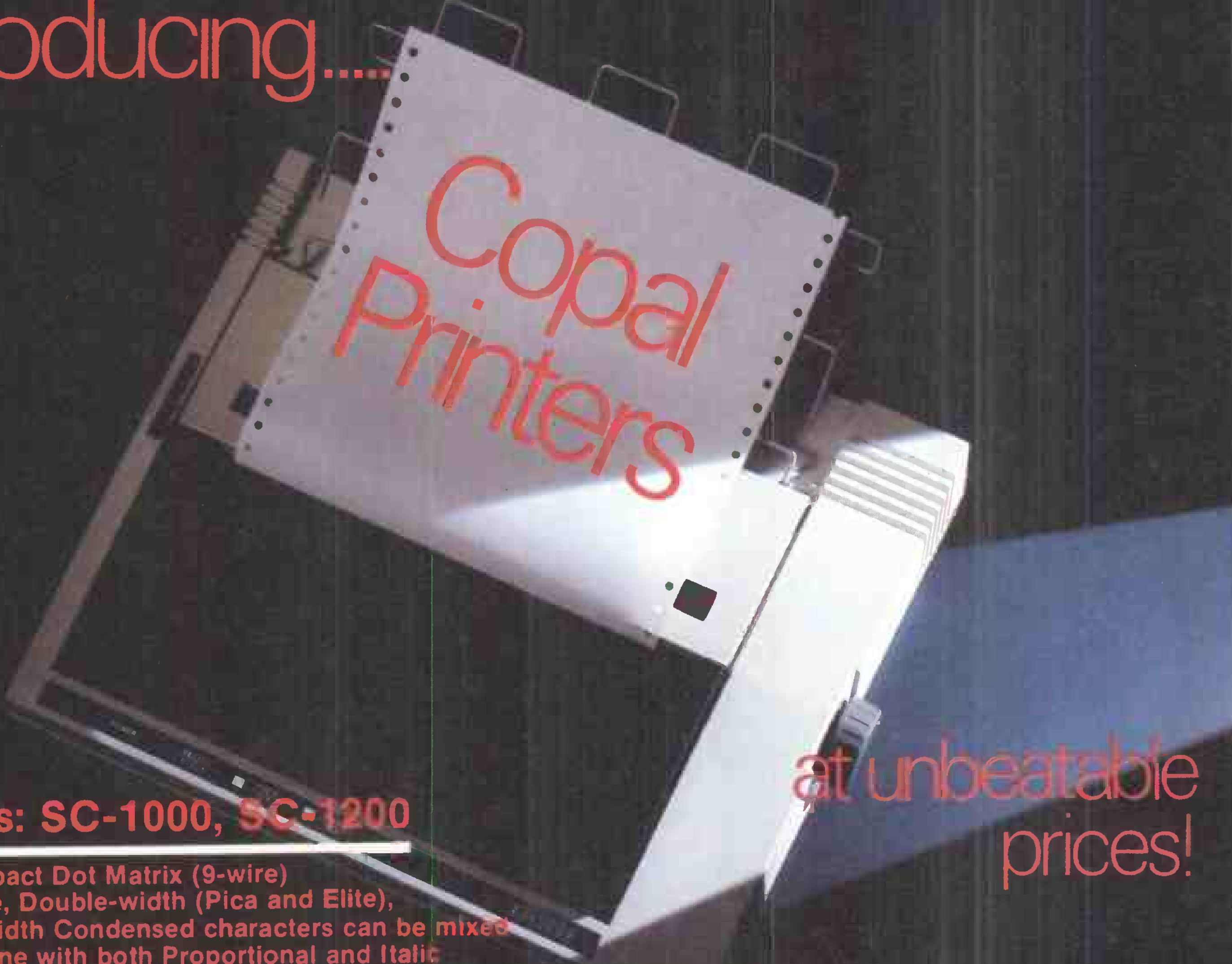
Complementing the lap-held is its big brother, the Bondwell 16. A transportable that includes a 10 Mb hard disc and integral modem (as well as full software) for £2250.

Barbatan Limited

35 – 38 High Street
Bristol BS1 2AW
Tel: Bristol (0272) 213928

Attractive trade discounts are available.
Dealer enquiries welcome.

Introducing.....



Copal Printers

at unbeatable prices!

features: SC-1000, SC-1200

- Serial Impact Dot Matrix (9-wire)
- Pica, Elite, Double-width (Pica and Elite), Double-width Condensed characters can be mixed in same line with both Proportional and Italic
- 96 character USASC11 plus selectable European sequences (Incl. Italic font)
- Tractor and friction fed; adjustable tractor by standard inclusion
- Print on fanfold; single sheet and roll paper; 10" width
- Simply replaceable Printhead
- Long ribbon life (2,5 million characters)

specifications

	SC-1200	SC-1000
PRINT SPEED	120 CPS (10 ch/in). 7560 dots/sec (image printing) 24 CPS letter quality (NLQ Model)	100 CPS (10 ch in). 5600 dots sec (image printing)
LINE FEED SPEED	112.8 M5/line (at 6 lpi)	78.5 m5 line (at 6 lpi)
CHARACTER FORMAT	1) Alphanumeric 9x9 plus 3 space 2) 18x20 (NLQ Model) 3) Graphic 8x480-1920 dots (by programmes): 8x576-720 dots (by programmes): 9x480: 9x960	1) Alphanumeric 9x11 plus 3 space 2) Graphic 8 x 576 dots, correspondence of dots for 1:1 graphics
CHARACTER PER LINE	Pica 80. Elite 96. Condensed 136. Double-width Pica 40. Double-width Elite 48. Double-width Condensed 68 Graphic 960 dots	Pica 80. Elite 96. Condensed 132. Double-width Pica 40. Double-width Elite 48. Double-width Condensed 66 Graphic 576 dots
DIMENSIONS	15.7" (W) x 13.3" (D) x 4.0" (H) 401mm (W) x 337 mm (D) x 104mm (H)	15.7" (W) x 13.3" (D) x 4.0" (H) 401mm (W) x 337 mm (D) x 104 mm (H)
INTERFACES	Centronics Parellel. Serial interface (optional)	Centronics Parallel. RS-232C Serial

- **Emphasized and Double-print, Superscript and Subscript modes**

SC-1000 — £218 **SC-1200 — £248** **NEAR LETTER QUALITY (NLQ) MODEL SC-1200 — £288**

All prices incl. VAT

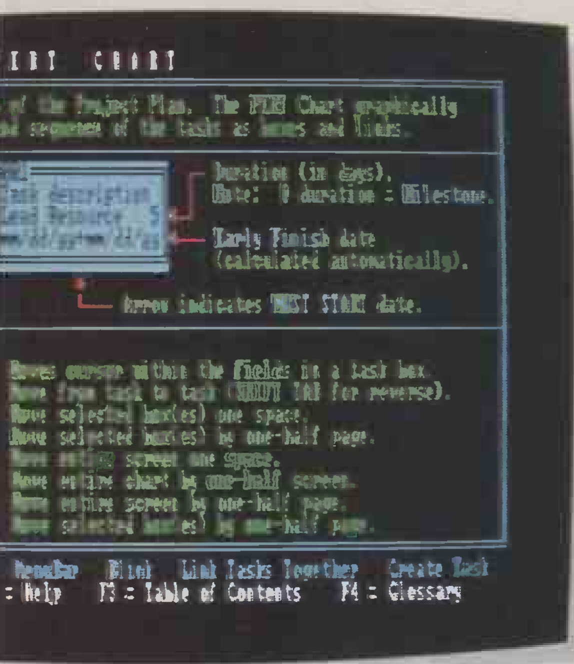
Dealer enquiries welcome
OEM enquires invited

GUARANTEE

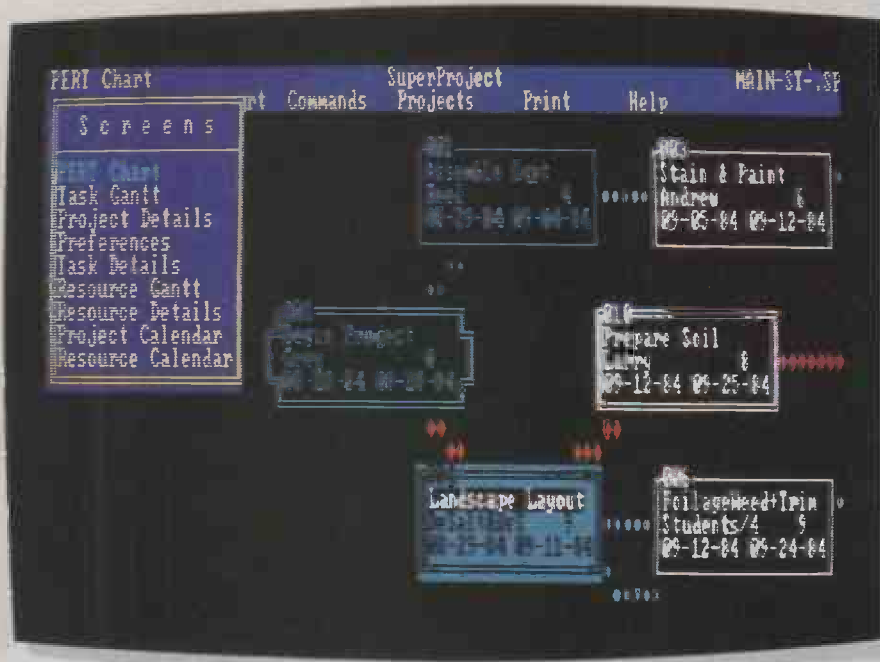
If any machine is found to be defective (other than through normal wear and tear) within six months of purchase, we will replace it free of charge.

Manufactured by:
COPAL CO., LTD.
of Tokyo, Japan

Sole U.K. Distributors
Cambridge Microcomputer Centre
153—54 East Road Cambridge CB1 1DD
Tel: (0223) 355404 Telex 817445



...screen help a keystroke away.



Create your entire project on screen.

...you see everything on every resource.

Schedule tasks over weeks, months, even years.

THE DIFFERENCE BETWEEN SUPERPROJECT AND OTHER PROJECT

It's not hard to see why SuperProject is becoming the new standard in project management software.

Bright colours and simple symbols let you know exactly where you stand, and its advanced graphics shine out even on monochrome screens.

But the real beauty of SuperProject lies in what it can do for you.

Like help you plan any project (from the smallest up to a planning problem the size of the Alaska Pipeline) right on the screen. And right to the last detail.

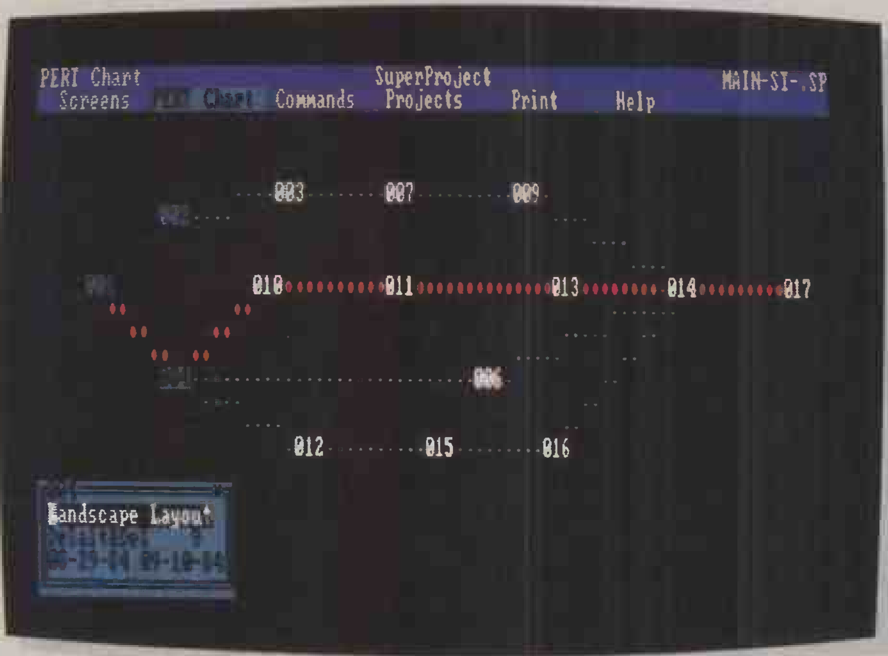
Schedule it seven ways to Sunday, including individual schedules and calendars for every resource.

Budget it down to the last penny, taking into account fixed, variable and total costs.

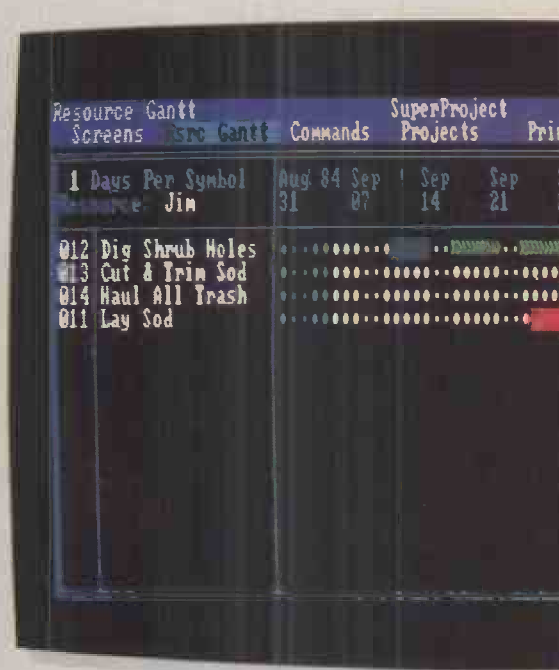
Have any change you make immediately reflected throughout the entire program.

Print every screen, even while you work.

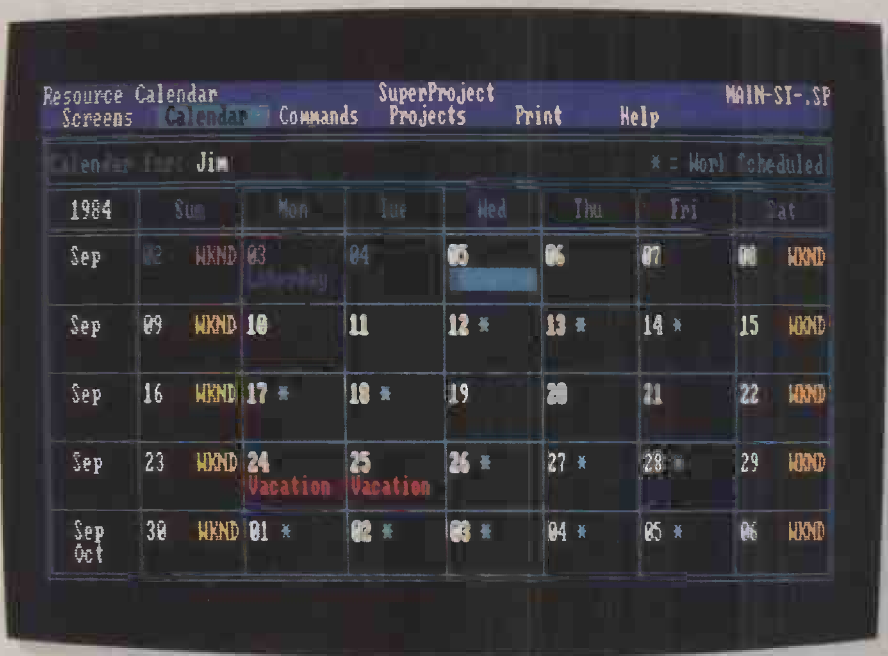
And do it all by following simple menus or by using fast command keystrokes.



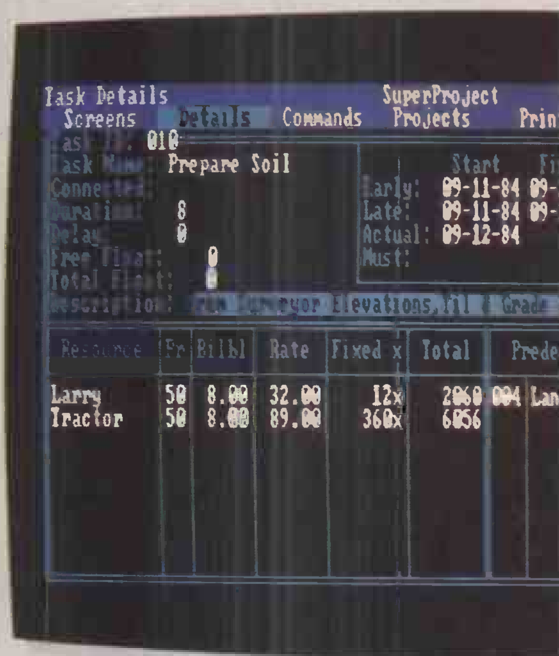
Unique project overview lets you see the big picture.



SuperProject automatically aler



SuperProject outdates other project calendars by also providing calendars for every resource.



Track fixed, variable, anc

MANAGEMENT SOFTWARE IS EVEN MORE GRAPHIC THAN THIS.

To take your planning and analysis even further, you can directly transfer project information into SuperCalc 3 Release 2 and other leading spreadsheets, and produce customized reports and charts.

To see how SuperProject can give your project management a clear advantage, visit your Sorcim/IUS dealer or send for a free demo disk. After one look, you'll find it's hard to see yourself using anything else.

SORCIM / IUS
MICRO SOFTWARE

A Division of Computer Associates International, Inc.

St. Mary's House, 16-20 High Street,
Maidenhead, Berkshire. SL6 1QH.

Telephone: (0628) 70911 Telex: 847268

For under £200 you can become your brother's keeper

With
Tractor Feed

In just a few days you could be using this amazing, new printer from Brother. It's small and neat but packed with more than its fair share of features.

THE BROTHER M-1009

TRAVELS AT A STEADY FIFTY

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

The M-1009 has bi-directional and logic seeking printing for normal characters and uni-directional printing for super script, sub script and graphics.

PRINTS ON ANY PAPER

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

It will even print two copies together with your original.

A GREAT CHARACTER REFERENCE

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

BIG BROTHER RELIABILITY

Built to the same exacting standards as Brother's elite office printers, the Brother M-1009 already has faultless credentials for reliability.

It's 9×9 dot matrix head, for example, has an astonishing 20 million character service life.

SUITABLE FOR ANY MACHINE

With IBM Centronic and the Epson dual serial/centronic interfaces fitted as standard the M-1009 is suitable for any home or business computer.

FULLY GUARANTEED 7 DAY DELIVERY

You can order in confidence, your Brother printer will arrive by courier within 7 days of your order complete with manual and full guarantee.

£199.95

NO MORE TO PAY!

Order your Brother M-1009 now! Access/Visa holders ring 01-482 1711 or fill in the coupon below, or write to:

RELATIVE MARKETING,
UNICOM HOUSE,
182 ROYAL COLLEGE STREET,
LONDON NW1 9NN.
(Personal callers welcome Monday-Friday 9-6, Sundays 10-1).

brother®

TO: RELATIVE MARKETING, UNICOM HOUSE, 182 ROYAL COLLEGE STREET, LONDON NW1 9NN.

Please send me by courier ______ (qnty) Brother M-1009 printer(s) ______ (qnty) Tractor Feed unit(s) at £17.25 (inc VAT). ______ (qnty.) Printer Cables at £9.95 (inc VAT). State make and model ______

I enclose a cheque for £ ______ or debit my Access/Visa card no ______

Name ______ Signature ______

Address ______

Postcode ______ Telephone ______ PCW5

Britain's no.1 microcomputing show

Britain's no. 1 microcomputing show is back at Olympia in September. More than 45,000 people visited the Personal Computer World Show in 1984 and this year's event will be even bigger.

For the first time, alongside all the household names you expect at the PCW Show, there's a separate hall for business computer buyers only.

That's where you can be sure to find help in solving your business problems. A wide selection of hardware, software and peripherals — from industry majors as well as smaller specialist suppliers — in every price bracket. Plus special features such as these:

- The advice centre and workshop sessions organised by the National Computing Centre.
- Our new applications software advisory service where you can find out exactly which software meets your specific business needs.
- The consultancy area with experts offering advice both on system selection and operational problems.
- And of course the PCW Show product locator service to help you find specific products at the show.

So whether you're a retailer or a builder, an accountant or a doctor — in fact, whatever your business or profession — you can be sure to profit from the Personal Computer World Show. Start planning your visit now.

Put the dates 4-8 September in your diary.

Tickets and further details from:
PCW Show 85, 11 Manchester Square, London W1M 5AB or phone 01-486 1951 today.

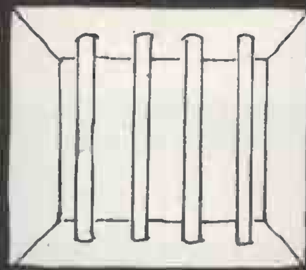
The 8th
Personal
Computer
World
Show

4-8 SEPTEMBER 1985
OLYMPIA, LONDON

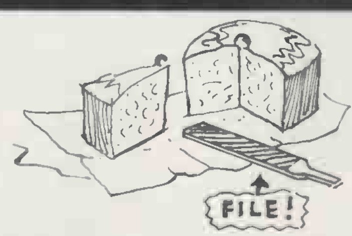
Sponsored by Personal Computer World

Put it in your diary now!

What use is 68000 power if you can't get at it?



You can with the U-MAN!



Look at these languages and tools available for the programmable 68000 power U-MAN Series 1000 supermicro

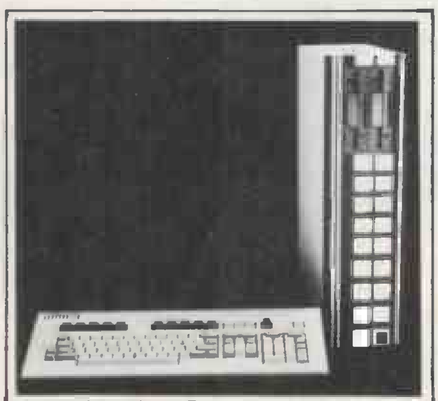
UCSD p-system with text editor, filer, many utilities.
- PASCAL
- FORTRAN 77
- BASIC
- Advanced Developers Tool Kit including 68000 Assembler

CP/M 68K with editor, many utilities, 68000 Assembler.
- 'C'
- CBASIC
- PASCAL MT Plus
- SVS FORTRAN
- Whitesmiths 'C'
- SVS Basic Plus
- SVS Pascal
- Cambridge LISP
- PROLOG
- FORTH
- VED 68K program editor
- XED screen editor

Where else can you get a 68000 based supermicro starting at £2500 for an extremely well-equipped system* expandable to 1MB RAM and Winchester?

*192K RAM
68000 (10MHz) and 6809
Dual 800K floppies
Clock & timers
Two serial ports
Centronics port
Sound generator
Speech synthesiser
10 bit A/D
16 parallel I/O lines
Keyboard and
4 slot expansion system.

Note that all the CP/M68K languages can use whatever RAM is installed – unlike CP/M86 and MS-DOS where the limit is usually only 64K.



Bench or Floor Mounting.

U-M LOVES HACKERS!

Although the big software houses have their parts to play we believe individuals can still make a big contribution to the software scene. If you've a program bursting to get made, needing 68000 power or U-MAN features, give us a call – we can offer up to 40% off for a bona fide project!

College or University – ask about educational discounts for Feb. & March.

Distributor, OEM and dealer enquiries welcomed.

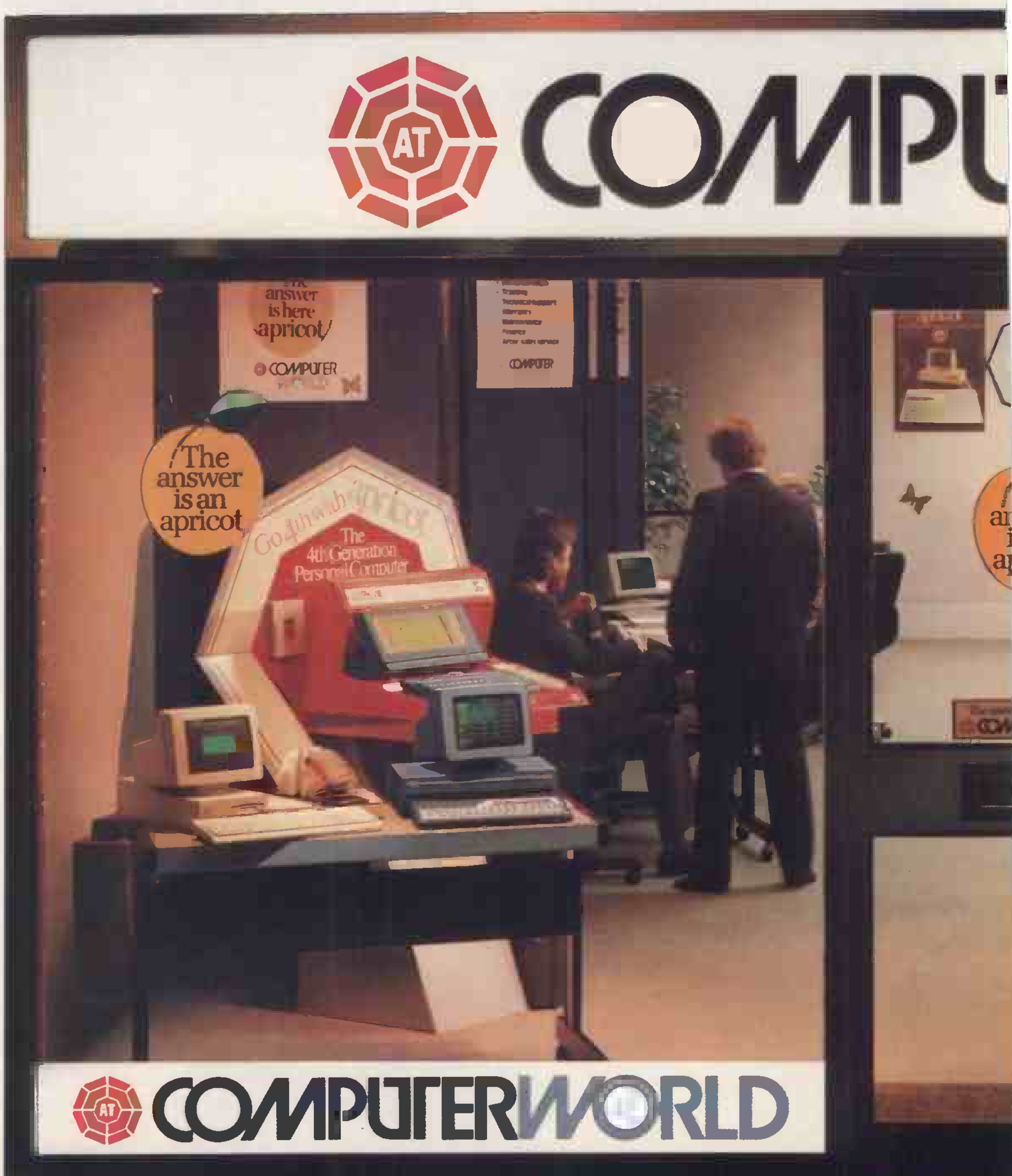
U-Microcomputers Limited
Winstanley Industrial Estate,
Long Lane, Warrington,
Cheshire, WA2 8PR, England.
Tel: 0925 54117
Telex: 629279 UMICRO G

U-MAN
SERIES 1000 SUPERMICRO

making it easy for programmers to make easy to use!

U-MICRO

There's mor



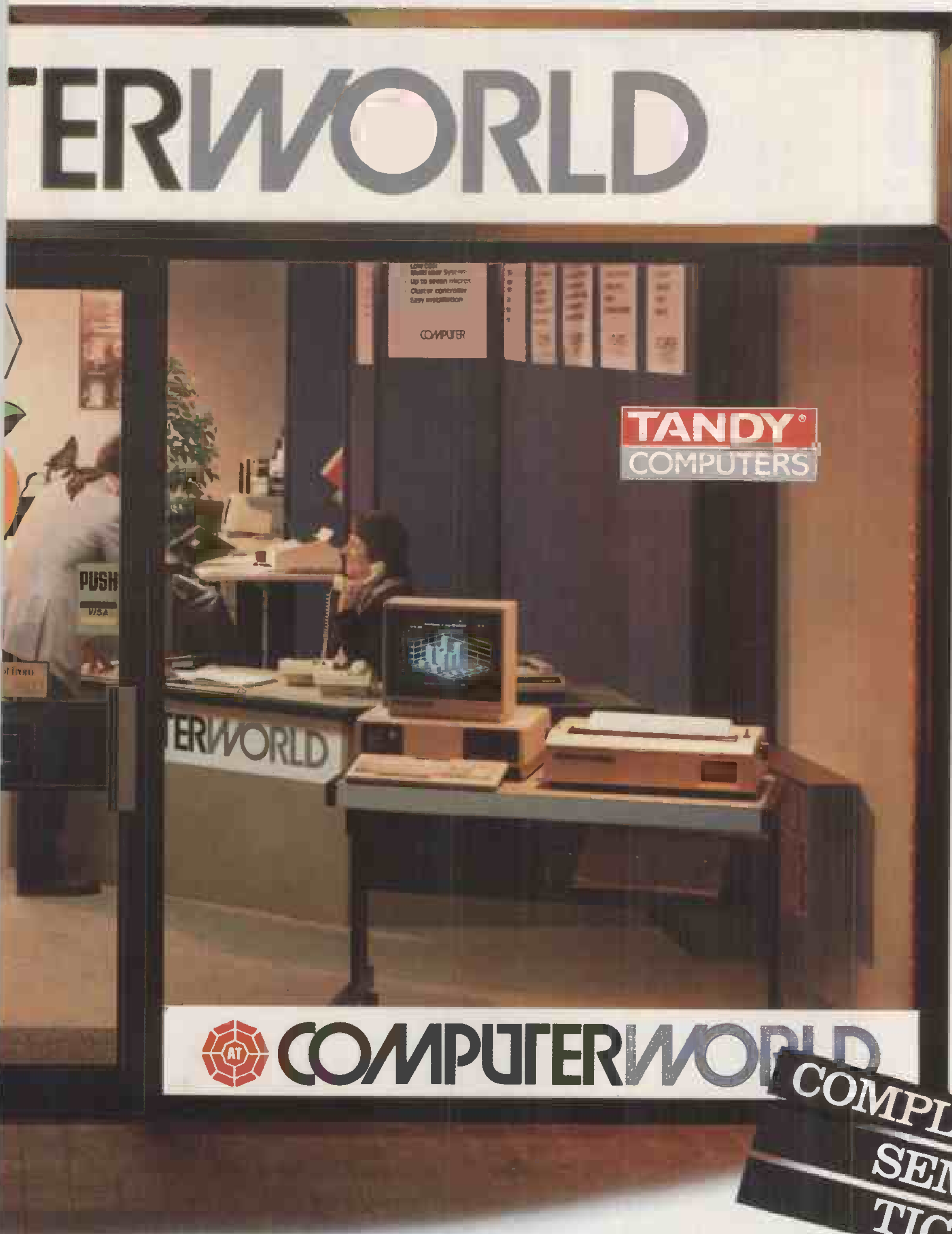
AT ComputerWorld – the UK's leading business computer chain – designed to help you and your business. With a pedigree like ours – we are a joint venture company owned by ACT (over 25,000 Apricots successfully installed) and the Tandy Corporation (the world's 3rd largest micro manufacturer) – you'd expect to find the best.

We don't think you'll be disappointed.

To find out how the superb Apricot and Tandy micro computers could benefit your business please join us at one of our major customer seminars being held over the coming weeks. This nationwide programme of business events is designed to provide progressive companies with free professional advice as to the best choice of system for their particular needs.To obtain your COMPLIMENTARY tickets simply fill in the coupon and return it to us immediately. Numbers must be restricted – so don't delay.

If you can't make any of the seminars, please call into one of our ComputerWorld business centres. Our experienced consultants are always on hand to discuss your computing requirements

e in store at



COMPLIMENTARY SEMINAR TICKETS

AT ComputerWorld Stores now open at:-

BIRMINGHAM	021-643 5368	LONDON EC2	01-283 9283
BRADFORD	0274-728431	LONDON WC2	01-836 1327
BRISTOL	0272-277104	LONDON NW1	01-388 8484
BRISTOL	0272-214721	LONDON EC4	01-248 5313
CAMBRIDGE	0223-66444	LONDON SW1	01-828 1423
CHELTENHAM	OPENING APRIL	MANCHESTER	061-832 8322
CARDIFF	0222-45859	NEWCASTLE	0632-615161
COVENTRY	0203-23582	NORWICH	0603-612553
CRAWLEY	0293-543301	NOTTINGHAM	0602-410479
CROYDON	01-680 1852	READING	0734-508787
EDINBURGH	031-337 9870	SHEFFIELD	0742-752848
GLASGOW	041-221 8413	SHREWSBURY	0743-68167
HULL	0482-28811	SOUTHAMPTON	0703-336344
LEEDS	0532-433411	SWINDON	0793-762449
LEICESTER	0533-550661	TELFORD	0952-506664
LIVERPOOL	051-236 1112	WILMSLOW	0625-584727
LIVERPOOL	051-708 0133	WOLVERHAMPTON	0902-712121

Please send me details of a customer seminar at a venue near to me.

PCW 5/85

NAME:________________

POSITION:________________

COMPANY:________________

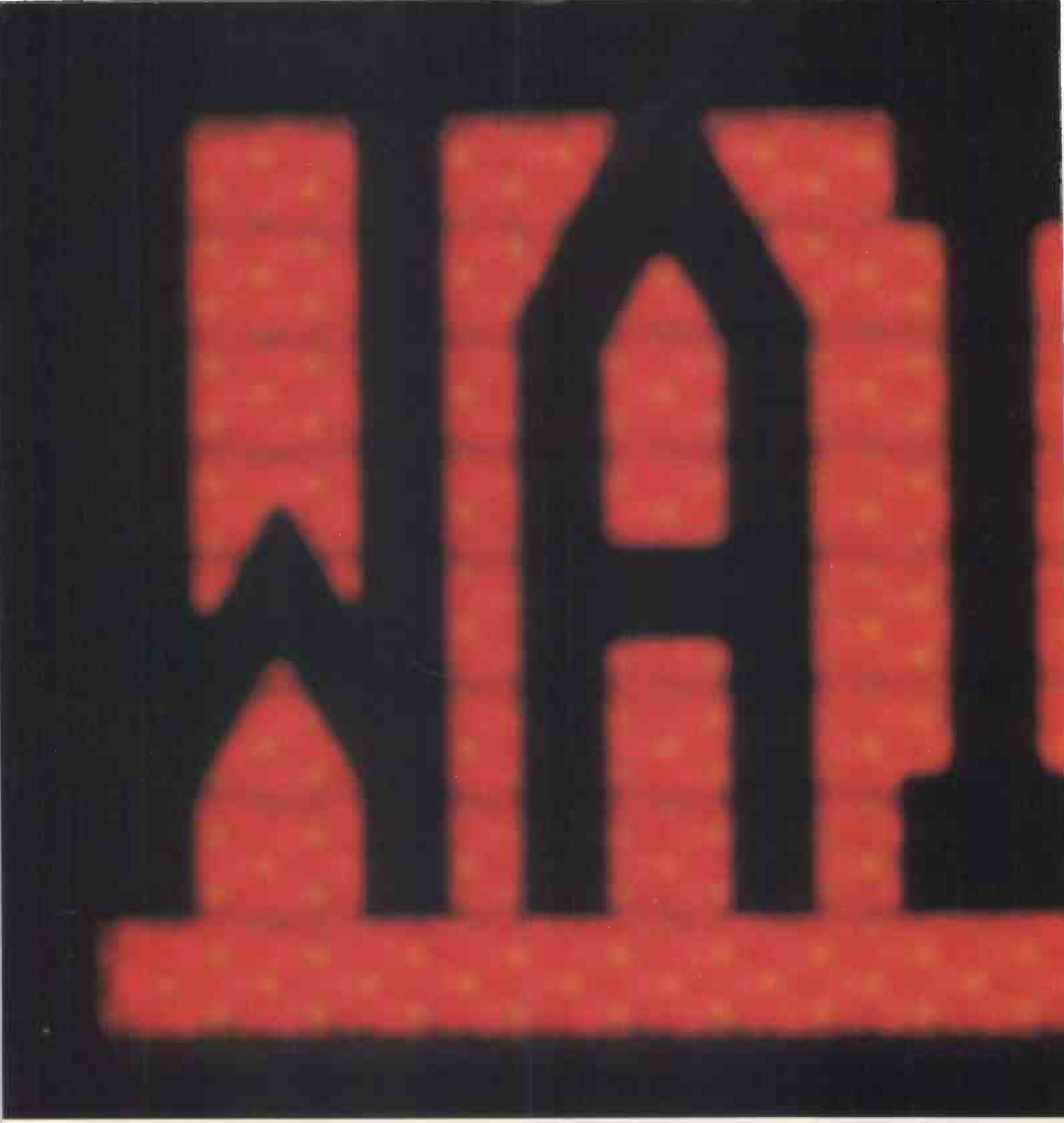
ADDRESS:________________

TEL. NO.________________

Return To: COMPUTERWORLD

AT ComputerWorld Ltd., 43 Calthorpe Road, Edgbaston, Birmingham B15 1TS.
Telephone: 021-455 8484.

BUYING A BASIC PRINTER WAS
THOUGHT HARGREAVES IN ONE OF



DOES WORKING ON LOTUS 1-2-3 MAKE YOU SEE RED?

Granted, Lotus 1-2-3™ can be a fast spreadsheet.

Except when you first buy it, take out the five floppy disks, study the manual to figure out which ones do what, put the plastic Thingymejig over the keyboard, and begin reading about all the installation procedures you need to get the thing up and running.

Or if you never make a circular calculation (any simultaneous equation, even something as simple as "bonus equals 10% of profit after bonus") when doing a complicated spreadsheet.

By the time 1-2-3 calculates it correctly, you may have retired.

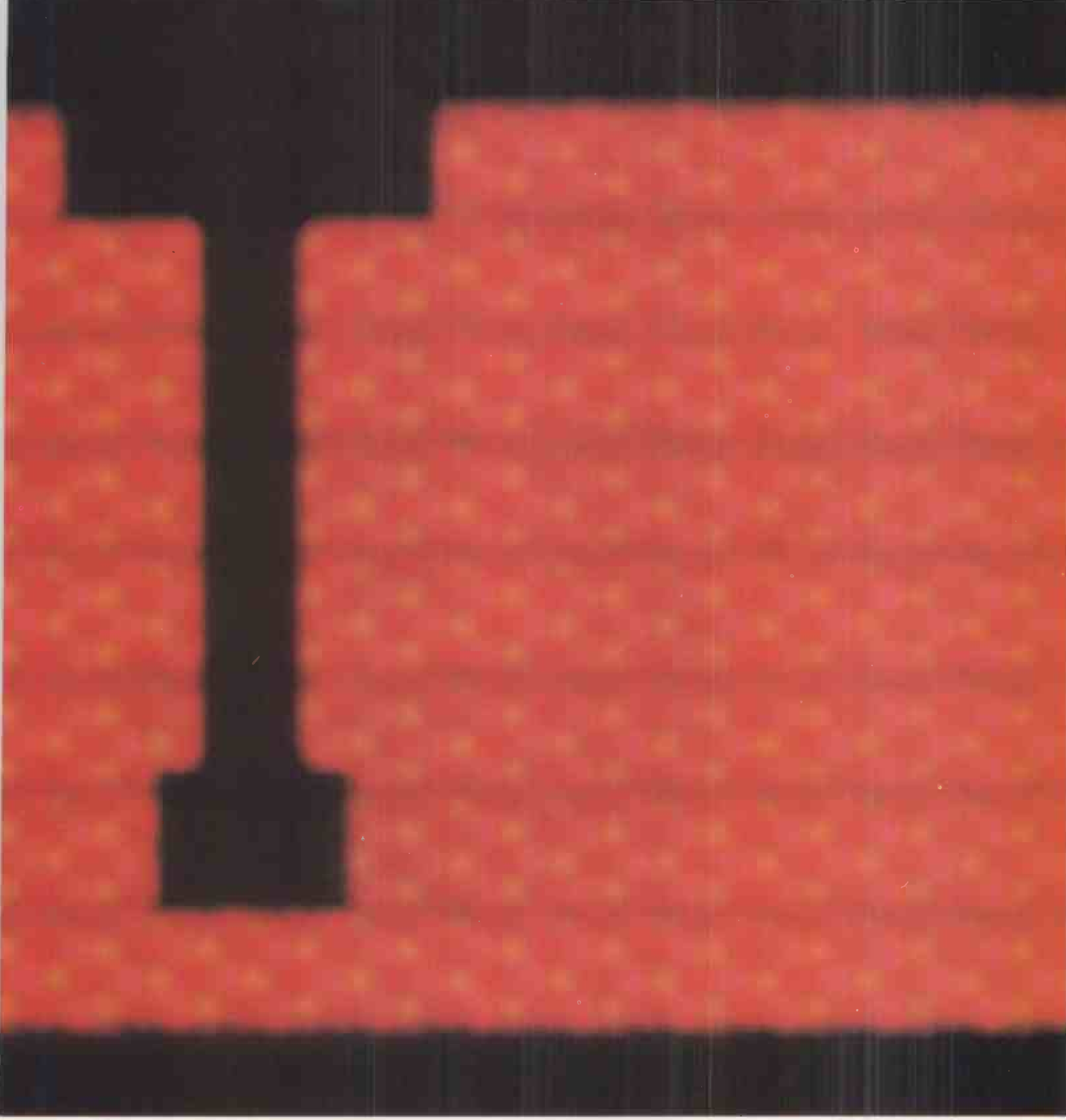
Or if you'd like to plot your data with a single keystroke, because it can take several minutes (including a disk change) just to start the process.

Or if you'd like to quickly create a file directory under program control. 1-2-3 can't do that at all.

What's the point of all this?

We'd like you to go down to your software dealer or send for a free demo-disk and see a new product called SuperCalc® 3 Release 2, which, unlike Lotus 1-2-3, does all of the above.

Along with a larger spreadsheet. Vastly superior graphics. Incredible speed (that becomes even faster when used with the 8087 or 80287 math co-



processors, which 1-2-3 doesn't support). And more.

For a lot less money.

All on one disk that you can run right out of the box. (Our lawers want you to know we include an additional file disk. Which also contains the popular printing program Sideways™, so you'll never have to cut and paste wide printed reports together again. Unless you use 1-2-3.)

But don't believe us about all this. Go take a look.

After you do, one thing should become obvious.

What are you waiting for?

SORCIM
SORCIM / IUS
MICRO SOFTWARE
A Division of Computer Associates International, Inc.
St. Mary's House, 16-20 High Street,
Maidenhead, Berkshire. SL6 1QH.
Telephone: (0628) 70911 Telex: 847268

Choosing the right computer is a good start — but can you find the right software?

At SUPERSOFT we're very conscious of the fact that people who spend several hundred pounds on computer equipment are looking to do rather more than play Space Invaders.

Financial planning is a rather grand name for something you've been doing all your life – making ends meet! Perhaps if Mr Micawber had used **BUSICALC** he would have been able to balance the books a little better.

For home, club or small business use BUSICALC 1 should pay for itself in no time at all; for larger companies we recommend BUSICALC 3, one of the few really valuable programs that you can learn to use in a day.

Although your Commodore 64 is a powerful musical instrument you need to be a pretty good programmer to understand how it all works. Unless, of course, you buy **MUSIC MASTER!**

To use MUSIC MASTER requires no prior musical knowledge, though in the hands of an experienced musician it will prove an invaluable tool. You don't need to know the first thing about programming either! MUSIC MASTER is the musical equivalent of a word processor, remembering the notes you play and allowing you to replay and edit them as you wish.

INTERDICTOR PILOT is a space flight simulator. Nowadays simulators are widely used to train pilots and astronauts because – to be frank – it's a lot cheaper (and safer) than the real thing!

Imagine, if you will, life in the 22nd century: space travel is commonplace, and on the outskirts of the galaxy the first war between civilizations is being fought. A shortage of trained pilots has prompted the Federation to develop a computer simulation that allows raw recruits to gain experience without paying for their mistakes with their lives. With the aid of your Commodore 64 you too can learn to pilot the Interdictor Mk 3 craft. But be warned – this is no game!

SUPERSOFT

SUPERSOFT, Winchester House, Canning Road, Wealdstone, Harrow, Middlesex HA3 7SJ
Telephone: 01-861 1166

Other SUPERSOFT products include the **MIKRO ASSEMBLER** cartridge, the only assembler that's ideal for beginners yet powerful enough for the professional (most of our competitors use it!). The **VICTREE** cartridge adds dozens of commands to Basic including toolkit aids and disk commands; or on disk there's **MASTER 64,** another comprehensive package for the keen programmer.

Of course, we do also publish games programs, and with classics like **STIX, QUINX** and **KAMI-KAZE** in our range we are one of the market leaders. But we most enjoy coming up with the sort of programs that are going to be in use for months and years, not hours and days – the sort of programs that make you glad that you bought a computer – and glad that you bought SUPERSOFT!

You won't find SUPERSOFT products on the shelves of your local supermarket. But most specialist shops stock titles from our extensive range (and are prepared to obtain other programs to order). However you can also buy direct by sending a cheque (pre-paid orders are post free!), by calling at our offices, or over the telephone using your ACCESS card.

Fifth Generation Programming using LPA PROLOG systems as featured in this issue

LPA micro-PROLOG

An interactive PROLOG system specially developed for use on micro computers. The powerful implementation is available for 16 bit 8088/86 micros using CP/M 86 or MS DOS/PC DOS such as the IBM PC or IBM compatibles and 8 bit Z80 micro computers using CP/M 80.

Prices from £95.00 + VAT

LPA sigma-PROLOG

A version of PROLOG specially developed for use on the larger memory 68000 machines as well as mini computers under the Unix operating system. Sharing many of the features found on LPA micro-PROLOG, this upward compatible language makes use of all the available memory and the power of Unix.

Prices from £495.00 + VAT

LPA PROLOG +apes

apes — Augmented PROLOG for Expert Systems — is an Expert System shell developed by Logic Based Systems in close association with Imperial College and Logic Programming Associates to complement LPA micro-PROLOG and LPA sigma-PROLOG. It greatly facilitates the development of Expert Systems.

Prices from £240.00 + VAT

For further information, please contact:–

Logic Programming Associates Ltd.
10 Burntwood Close, Dept.PCW/1
London SW18 3JU.
England. 01-874 0350 (24 Hours).

BACK ISSUES SERVICE

Here is a guide to PCW back issues. Hardware reviews/Benchtests are indexed by manufacturer, software by product name.

HARDWARE

A

MANUFACTURER	PRODUCT	ISSUE
Acorn	Speech System	January 1984
Acorn	Electron	October 1983
Acorn	BBC Micro	January 1982
Acorn	Teletext Adaptor	April 1984
Acorn	BBC Speech Chips	April 1983
ACT	Apricot	October 1983
ACT	Sirius 1	February 1982
Adman Electronics	Adman Speech Synthesiser	January 1984
AGF	Programmable Joystick	December 1983
AMS	Disc Drive: 3in	January 1984
Apple	Lisa	July 1983
Apple	III	May 1982
Apple	Macintosh	March 1984

B

British Micro	Mimi 801	July 1982
Brother	EP44	April 1984

C

C/WP	Cortex	December 1983
Camputers	Lynx	March 1983
Canon	AS-100	December 1983
Canon	CX-1	November 1982
Canon	X-07	March 1984
Casio	PB-100	May 1983
Casio	fx-9000p	February 1983
Casio	602p	May 1982
Casio	FP-10 Printer	April 1982
Coleco	Adam	April 1984
Commodore	715	January 1984
Commodore	64	May 1983
Compudata	Tulipsystem 1	October 1983
Conchess	Monarch/Ambassador/Escourter	March 1983
Corvus	Concept	March 1983
Currah	Microspeech Unit	January 1984

D

Dacom Systems	Buzzbox	January 1984
DCP Microdevelopments	Speech Pack	August 1982
Digihurst	Microsight 1	October 1983
Digital Equipment	Rainbow 100	November 1982
Dragon Data Ltd	Dragon 32	August 1982

E

Eaca International	Colour Genie	June 1983
Electroni-Kit	FX System	November 1983
Electroplay	My Talking Computer	November 1983
Epson	QX-10	July 1983
Epson	HX-20	December 1982
Epson	FX-80	July 1983
Epson	PX-8	June 1984

F

Ferranti	Argus PPC	November 1983
Fidelity	Prestige	February 1983
Fortune	Fortune 32:16	August 1983
Future	FX20	October 1983

G

Gavilan	Gavilan MC	February 1984
GCE	Vectrex System	August 1983
GCS	Ferrett	June 1984
Gemini	Multiboard	February 1982
GRiD	Compass	June 1984
Gulfstream	Hyperion	October 1983

H

Hewlett-Packard	HP-75C	November 1982
Hewlett-Packard	15C and 16C	September 1982
Hewlett-Packard	HP86	October 1982
Hewlett-Packard	HP-125	April 1982
Hewlett-Packard	HP-IL	March 1982
High Tech Electronics	Sid 1 Colour Board	April 1982
Hitachi	MB16001	June 1983
Hitachi	Peach	May 1982

I

IBM	9000 Instrumentation Computer	March 1983
IBM	PC Junior	March 1984
Ikon	Hobbit	January 1984
IO Research Ltd	Pluto	December 1982

J

Jonos	Jonos	April 1984
Jupiter Cantab	Ace	January 1983

L

LSI	M-Four	April 1983

M

Magus Computer Systems Ltd	Add-On Graphics Board	September 1983
Mannesmann Tally	MT160L Dot-Matrix Printer	August 1983
Mattel	Aquarius	November 1983
Microwriter Ltd	Microwriter	September 1982
Milton Bradley	Phantom	July 1983
Monroe	Monroe 8820	April 1982
Motorola	MC68000	December 1982
Multitech	Micro-Professor II	September 1983

N

NCR	Decision Mate V	August 1983
NEC	PC-8201A	December 1983
NEC	APC	September 1983
Notting Dale Itec	G007 Graphics Module	March 1983
Novag	Constellation	October 1983

O

Olivetti	M20	September 1982
Oric Products	Oric I	April 1983
Osborne	Executive	July 1983

P

Positron	9000	October 1982

R

Robocom Ltd	Bit Stik	November 1982

S

Sage	II	February 1983
Scisys	Chess Champion Mark 5	January 1983
Semi-Tech	Pied Piper	September 1983
Sharp	MZ-700	February 1984
Sharp	PC1251	February 1983
Sharp	PC1500	June 1982
Sharp	MZ-80A	June 1982
Sharp	MZ-80A	April 1984
Shelton Instruments	Sig/Net	April 1983
Sinclair	Microdrive	October 1983
Sinclair	ZX Spectrum	June 1982
Sinclair	ZX81 Printer	January 1982
SMT	Goupil-3	December 1983
Sord	M5	August 1983
Sord	Exleigh Expert	August 1982
Spectravideo	SV-318 and SV-328	March 1984

T

Tandata	Homedeck	April 1984

T

Tandy	MC-10	November 1983
Tandy	Model 100	August 1983
Texas Instruments	TI Professional	May 1983
Texas Instruments	TI-88	July 1982
Texas Instruments	TI-99/4A	March 1982
Texas Instruments	TI-59	January 1983
Torch Computers	Torch	January 1983
Tradecom	Newbrain AD	July 1982
Tycom	Microframe	January 1984

W X

Walters Microsystems	120 Printer	December 1982
Watanabe	Personal Plotter	February 1982
Wave Mate	Bullet	February 1984
William Stuart Systems	Chatterbox	January 1984
Wren Computers	Wren	April 1984
Xerox	16/8	February 1984
Xerox	820	January 1982

SOFTWARE

PROGRAM	ISSUE
1-2-3	April 1984
1-2-3	November 1983
1982 Database Roundup	December 1982
1983 Database Roundup	December 1983
1983 Spreadsheet Roundup	December 1983
A	
Accountancy Programs (General)	June 1983
Aquila	September 1982
B	
Benchmarks Explained (Reference Article)	January 1984
Beta	August 1983
Brainstorm	February 1984
Busifile	January 1984
Busipost	February 1983
C	
Cardbox	August 1982
Color Scarfman	December 1982
Condor Database	November 1982
D	
Databases (Choosing One)	March 1982
Dataplan	August 1983
Dataprism	March 1983
DBMS2	June 1982
Delta	October 1983
Desq	December 1983
DMS	March 1982
Dragon Disks	June 1984
E	
E40	September 1982
Ecalc	July 1983
Everyman	February 1984
Expert-Ease	June 1984
F	
Falc	January 1984
Financial Director	June 1983
FMS80	April 1982
Freqout	February 1982
H	
Homeword	February 1984
HP41-C Text Editor	November 1982
Home Accounts/Finance Manager	January 1984
I L	
Information Management	April 1984
Infostar	September 1983
Lisawrite	August 1983
M	
Master Planner	April 1984
Master Planner	October 1983
Mathemagic/Graphmagic	August 1983
Micro FCS	October 1983
Micropen	May 1983
Microscript	May 1983
Microtax	July 1983
MS-DOS & CP/M-86	October 1982
MS-DOS 2	May 1983
Moneywise	June 1984
Multiplan	April 1983
O	
Omnis	July 1983
Open Access	June 1984
Optimum	November 1983
P	
Peachcalc	March 1984
Pearl	October 1982
Perfect Calc	October 1983
Personal Data Base	March 1984
Petspeed	April 1983
Plannercall	May 1983
Prophet II	March 1983
R	
Rescue	April 1983
Revelation	April 1984
S	
Sage 400 (Accounting)	October 1983
Scred	August 1983
Scripsit 2.0	February 1982
Search and Find	December 1983
Select	September 1982
Silicon Office	July 1982
System Builder	June 1984
Software Various	April 1984
Superdeflex	January 1983
Superfile	January 1983
T	
The Financial Planner	December 1983
The Spreadsheet	September 1983
TK! Solver	February 1984
Tomorrow's Office	June 1983
V	
View	August 1983
Visi On	November 1983
Visi Calc	June 1983
Visuall	February 1984
Vu-Calc (for Spectrum)	September 1983
W	
Word Handler II	March 1983
Word	June 1984
Wordspell	March 1984
Workslate	January 1984
dBase II	May 1982

ADVERTISERS INDEX

MICROMART ADVERTISERS INDEX

Get your ACT™ together- with a high performance disc drive system

Alpha Disc Ltd are pleased to announce the launch of their exciting XF floppy drive sub-system, targetted for the Apricot PC, XI and F1 market.

The basic unit comprises a slim 80 track double sided 5.25" floppy disc drive, giving a formatted capacity of 800 Kb. The drive comes complete with MS-DOS driver software and interface/controller card, which locates in one of the expansion slots on the Apricot PC XI or F1. The sub-system is thus configured as a second or third drive, with a capacity exceeding that of the Apricot's own double sided micro-floppy.

FX-800 IBM-PC/Apricot compatible floppy disc drive.

Description. Add-on 5¼" floppy disc drive with plug-in interface/controller which allows software compatibility between the Apricot PC, Xi & F1 range and the IBM-PC computers running MS-DOS/PC-DOS.

- IBM-PC DOS compatibility
- Ability to format discs in IBM mode
- 800K formatted capacity 80 track double sided floppy disc drive
- 80 track/40 track switching on drive for maximum flexibility
- MS-DOS driver software
- Optional 2nd additional drive
- Independant power supply

Price £495 + VAT.

F1-800 Apricot F1 – floppy disc drive sub-system.

Description. Add-on 5¼" floppy or 3½" Sony micro floppy disc drive which allows you to considerably expand your on-line storage capacity by up to a massive 800K (1600K with 2 additional drives).

- 800K formatted capacity 80 track double sided floppy disc drive.
- Disc drive controller
- MS-DOS driver software
- Independant power supply
- Connects through expansion port
- Optional 2nd additional drive

Price £395 + VAT.

ALPHA DISC LTD

UNIT 2 CRABTREE ROAD THORPE INDUSTRIAL ESTATE EGHAM SURREY TW20 8RN

TELEPHONE (0784) 35357/8/9 TELEX 918886 ALPHAD G.

CHIP CHAT

Up a gum tree: Data general is very proud of its PC-compatible portable, the One. So proud in fact that it's run an advertisement for the micro depicting a happy user surrounded by branches and leaves, above a banner proclaiming 'the only IBM PC-compatible computer you can use up a tall tree'. An improvement on Epson's attempt to persuade users to try their lap-held in the bath — breaking your leg is slightly more attractive than electrocuting yourself.
Trigger-happy: if the exchange rate hasn't put you off visiting the States then rumours of robot guards should. Apparently the plan is to have robots standing sentry outside inter-continental missile sites. Not that there's any risk at all, of course, but we'd guess the insurance premiums would be high for any such sites.
IBM-speak: if IBM's PC takes over the business world, let's hope its jargon doesn't. Examples of the company's aggressive grasp of language include head counts for staffing levels and speak-up boxes where employees can leave any suggestions they care to make. There's also said to be a 100 per cent club for salesmen who hit their targets — they get an official certificate and an exotic holiday. Members of the unofficial — and more crowded — 99 per cent club get together in the pub instead.
The Hairy One: reading through the notes to Jeff Minter's Psychedelia brings back memories, and not all of them pleasant. The man behind some of the UK's best games turns out to be a heavy metal music freak: Deep Purple, Led Zeppelin and Rush are among the groups who 'inspired this creation'. Minter adds that Psychedelia provides a cure for 'air guitaring' and recommends users to 'blow minds with it' and 'freak out your granny'.

John Brown's body may lie a mould'ring in the grave, but his floppy disks go marching on. Down in East London, Chas White & Son have installed an Apricot in St Mary Magdelene's graveyard to log, among other things, the 'micro-organic composition of Thames mud'. Any suggestions as to what else might be recorded are welcome, as are any other comments on this particular piece of research.

Send your suggestions on the back of a postcard to ChipChat, PCW, 62 Oxford St, London W1, to reach us by the end of May. Remember to write your name and address on as well, in case you should win the £10 prize (which goes to RF Walker of Birmingham for his February entry).

Not to be outdone by Guy Kewney, ChipChat is proud to present an exclusive preview of the new Bushlitt micro. Developed by Paul Hardy and his dedicated team at Bushcat, the system went into limited field testing on 1 April. Remember, you saw it here first.

Bushcat has come up with a set of extra Basic extensions and constructs which are intended to increase the speed and accuracy of the Bushlitt's Basic.
REPEAT . . . UNTIL CORRECT: a very powerful construct. Execution repeats until the right answer is generated.
IF × CLOSE ENOUGH TO y: causes premature exit from the above if the answer is almost right.
DON'T CRASH: a rather more powerful version of the classic ON ERROR GOTO . . .
DON'T DO . . . UNTIL: omits a section of code until a condition has been met.
DON'T DO . . . AT ALL: a special version of the above, where execution speed is all-important.
FUDGE: a system command which can be used at the head of a program to tack on bits here and there where it looks as though there might be a zero-divide on the way, or something else that might lead to the wrong answer.
IF SHBT . . . THEN TOT . . . : IF should_have_been_this THEN tack_on_that. For experts. Requires prior knowledge of the answer. While in its simplest form it behaves very much like a simple assignment, its full power is realised if FUDGE has been previously specified.

The Bushlitt uses the Bushcat Virtual Time Operating System, the next-generation operating system. It does for time management what the virtual machine does for memory management. It has immense multi-tasking capability, where execution speed remains constant independent of the number of jobs in the system. BVTOS makes use of the fourth dimension (time) to achieve this. The user submits jobs, and the operating system carefully schedules them to maintain the optimum run time. To the user, all jobs appear to be running at once. In fact, the operating system has subtly rescheduled them and some of them may be running in the middle of next week.

Windows are, of course, an integral part of the operating system. The windowing software was written by Bushcat's French subsidiary.

The Bushlitt uses a local area network (LAN) which, while restricted to fairly short distances requires virtually no installation and retains the portability of the micro. With the Bushlitt LAN, the micro can quite happily be moved from desk to desk without expensive rewiring.

This Bushlitt ACOULINK (for ACOUstic LINK) plugs into the micro. It consists of a loudspeaker, microphone, and communications protocol software on ROM. The protocol includes message collision detection and the automatic retransmission of garbled data.

For example , user 1 wishes to transfer file to user 2:
User 1 types
> SEND filname. ext TO micro 2
System action:
"HELLO HELLO MICRO2 ARE YOU THERE?"
(this repeats, getting louder each time, until there is a reply)
"YES I'M HERE."
"ABOUT TO SEND filname. type"
"OK"
"LINE TEN CLEAR SCREEN COLON DEFINT A TO Z"
"OK LINE TEN CLEAR SCREEN COLON DEFINT A TO Z"
"LINE TWENTY INPUT QUOTE DO YOU WANT INSTRUCTIONS QUOTE SEMI-COLON N STRING"
"OK LINE TWENTY INPUT QUOTE DO YOU WANT INSTRUCTIONS QUOTE SEMI-COLON N STRING"
(and so on).

The system includes error correction by both transmitting and receiving micros:
"NO NO I SAID" (micro 1)
or
"WOT?" (micro 2)

With some of the longer-range LANs, Bushcat does, of course, provide earplugs.

Bushcat can also provide mass-storage devices suitable for any market. One of its Far Eastern clients required a system that could operate in a hot, humid climate, miles away from the nearest Inmac catalogue, to run a small business package for his string factory. While mass-storage was important, it would not be possible to obtain floppy disks.

Bushcat came up with the knotted string reader and writer, this used the client's own string surplus as the storage medium. An elegant solution.

And with each system purchased in April, Bushcat is giving away a free Swiss Army Knife with a Sinclair C5 remover: just right for those embarrassing occasions when you have been out shopping and return home to find a C5 embedded in the radiator grille. Leave it in the glove box and it's ready for use. END