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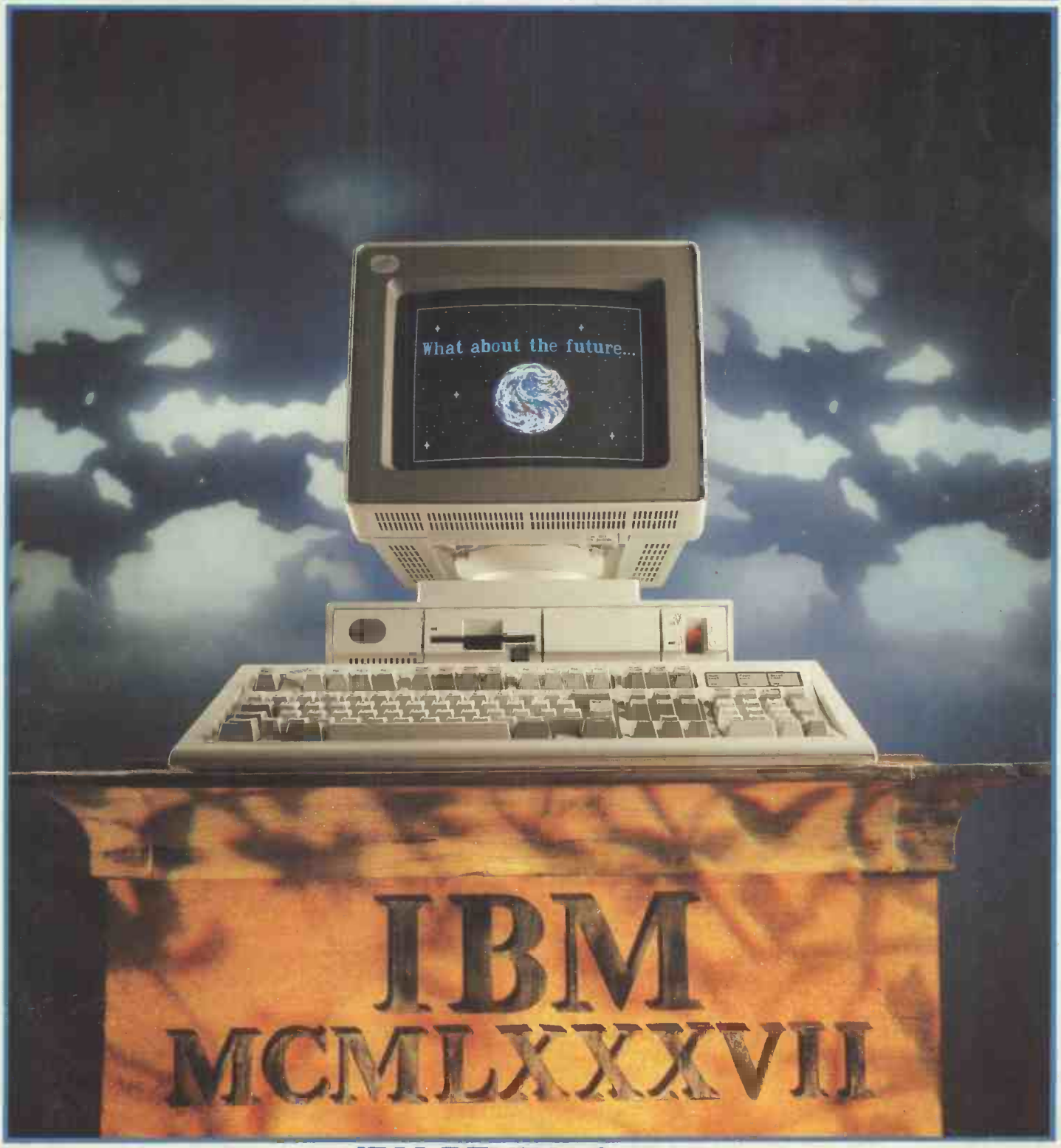

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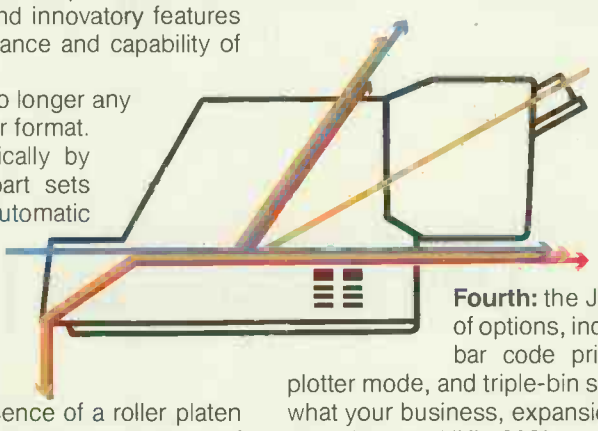

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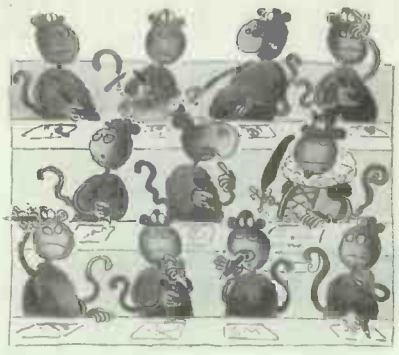

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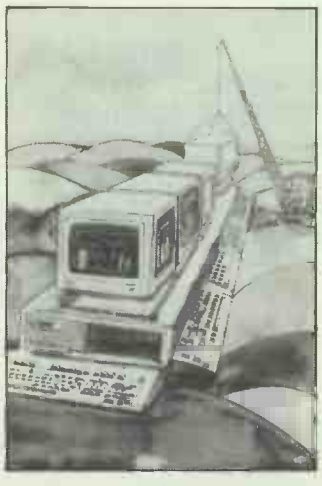

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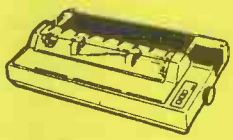

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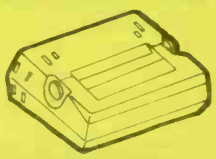

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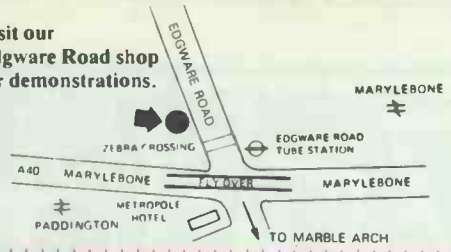

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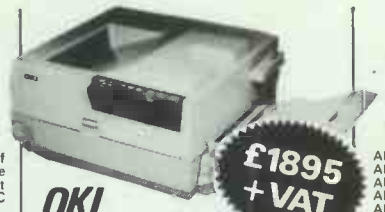

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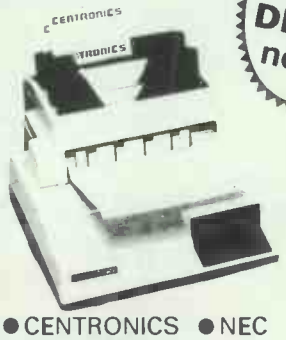

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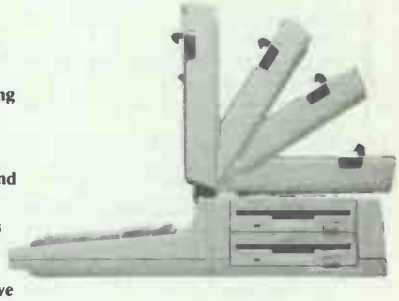

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U125. LAST LINES. Types the last specified number of lines in a file.

U126. FAST LISTING. Fast listing of files by extension.

U127. SQUEEZE LIST. Lists squeezed library files.

U128. COUNT. Counts characters, words, lines, pages in a textfile.

U129. PRINTER PATCHES. Extensive collection of printer patches for wordstar.

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U201. SMALL FILE FINDER. Locates files in subdirectories. Small tightly coded.

U203. FILE SEARCH. Memory-resident. Locates files in subdirectories.

U204. CHARACTER SEARCH Searches disk for character or string.

U205. FILE FINDER. Locates and lists files, allows deletion of unwanted files. Act from within programme.

U206. NEW GREP. Matches file patterns. Has 'C' source.

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U301. TEXT READER. Excellent text display utility with many features. Scrolls, reads one page at time, goes to end, beginning, etc.

U302. READ SQUEEZE. Read squeezed files without physically unsqueezing.

U303. READ BACKUPS. Read backup disks of your hard disk. Needs Basic.

U304. TREE DIRECTORY. Displays a tree directory of files, including sub-directories.

U305. TRACK READER. Reads sectors and tracks in hex and ASCII.

U306. BROWSE. Examine files with 4 way scrolling.

U307. DUMP. Gives an ASCII/HEX display of any file.

U308. DIRECTORY READER. Read a directory from or to a certain point.

U309. KEYBOARD BUFFER. Keyboard buffer of 160 characters.

U310. SYSTEM SHELL. Operating system shell that interfaces with Crosstalk, 1-2-3, and Multimate.

EQUIPMENT HANDLING

U401. DRIVE CLEANER. Runs the drive for head cleaning disk.

U402. CORELOOK. Gives memory content in HEX and ASCII.

U403. SCREEN SAVE. Blanks screen if not used for several minutes. Saves screen wear.

U404. DISKPARK. Positions the hard disk head key for safety when travelling or moving computer.

U405. COLOUR CONVERTER. Displays colours as shades of grey.

FILE MOVING

U501. SWEEP. Famous file-handler. Reads, mass copies, deletes, etc.

U502. REDIRECTS output to a disk file.

U503. NIMBLE DISK. Helps you move more easily around a hard disk.

U504. SECTOR RETURN. Recovers deleted first sectors.

U505. SELECTIVE COPYING. Copy programme using menu system.

U506. SELECTIVE DELETION. Programme delete using menu system.

U507. ENHANCED COPYING. Copy several unrelated programmes with the same command.

U508. NEW MOVE. Rename and move programme to another directory without copying.

U509. TOTAL ERASURE. Totally erases disk, including format.

U510. NEW DISKCOPY. Good diskcopy with extra features. Copies whole disk. Sidesteps and signals faulty sectors.

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U601. ARCHIVER. Superior file compressor and library creator.

U602. FILE CORRUPTION. Fast checker for detecting corrupted files.

U603. DISK SQUEEZE/UNSQUEEZE Squeezes and unsqueezes all files on a disk.

U604. PROTECT/UNPROTECT. Avoids accidental erasure of important files..

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U607. LIBRARY CREATOR. Combines files into libraries. Adds to, deletes, extracts files.

U608. LIBRARY DISPLAY. Displays the directory of a library. Related to above programme.

U609. NEW NAME. Changes volume name of a disk.

U610. FILE COMPARISON. Intelligent file comparison programme which detects differences between files.

SPECIAL FEATURES

U701. CALENDAR. Display of any month or year.

U702. NEW DATE. Changes date of file entry in disk directory.

U703. BYTE CONVERTER. Converts all bytes to 2 byte (7 bit) for serial transfer.

U704. COMPILING AID. Simplifies, automates compiling and linking.

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U706. NEW TIME. Sets system time and clock.

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Omnis III £350
Paradox/Informix ..... £420/£750
Q & A £195
R:Base 5000 ..... £225
R:Base System V £395
Revelation (Single User) £525
Sage Retrieve £99
Sensible Solution (Su/Mu) ..... £595/£895
Turbo Database £49
Delta 4 Prof £350

SPREADSHEET PACKAGES
Access IV £250
Javelin £295
Lotus 123 ..... £235
Sage PC Planner £99
Sideways £45
Statgraphics £395
Supercalc 4 ..... £215

WORD PROCESSING SOFTWARE
MS Word III £295
MS Word with Mouse £355
Multimate Advantage £280
Manuscript £250
Samma III/IV ..... £275/£495
Volkswriter Scientific £250
Volkswriter Deluxe £89
Word Three £275
Wordstar 2000 Rel.2 ..... £265
Wordstar + ... £280
Wordstar Four £205
Wordcraft £325
Wordcraft Elite £485
Wordcraft Imagemaster £450
Wordperfect £250
Wordstar/Professional ..... £165/£245

INTEGRATED PACKAGES
Ability/Ability Two ..... £95/£165
Jazz/Desq ..... £295/£290
Logistix £395
Open Access II £235
Psion Xchange (4int Package) £295
Samna + ... £199
Smart Integrated package £350
Symphony £330
Framework II £299

UTILITYS SOFTWARE
Carbon Copy £159
CopyIIPC/Spotlight ..... £30/£95
Copywrite/Zero Disk ..... £50/£75
Crosstalk £99
Eureka: The Solver £69
Fastback £130
Lattice-C £299
Norton Utilities £55
Sideways £45
Sidekick (NCP) £45
Top View £110
Turbo Editor Toolbox £65
Turbo Lightning £75
Turbo Pascal with 8087/Tutor ..... £75/£28
Tutbo C £65
Xtree £50

Call if you don't see the software you want.

MICRO MEDIA Computer Supplies

0707 52698 or 0707 50913

Rydal Mount, Baker Street,
Potters Bar, Herts EN6 2BP
Dept. PCW,

Printer Ribbons

Mixed types for quantity breaks

	2+	5+	12+
Atari XMM & SMM	3.80	3.00	2.80
1029	3.70	3.10	2.90
Red Brown Blue Green	4.90	4.60	4.20
Amstrad 8512/8256	3.90	3.60	3.30
OMP 2000	4.10	3.80	3.50
Anadex 8000/9000	4.70	4.20	3.90
Brother M1009	3.50	3.00	2.80
Red Brown Blue Green	4.95	4.65	4.25
HR 15/25 MS	3.30	2.90	2.60
Fabric	3.40	3.00	2.70
Canon PW1156/1080	3.20	2.70	2.50
Red Brown Blue Green	4.70	4.20	3.90
Centronics GLP	3.50	3.00	2.80
Red Brown Blue Green	4.95	4.65	4.25
700 Zip Pack	2.40	2.10	1.90
C Itoh 8510	3.60	3.00	2.80
Commodore 1516/1526/4023			
MPS 802	3.80	3.00	2.80
2022/4022	2.80	2.40	2.20
Red Brown Blue Green	4.00	3.30	3.10
MPS 801	3.70	3.10	2.90
Red Brown Blue Green	4.90	4.60	4.20
Vic 1515/1525	2.80	2.30	2.10
DPS 1101	2.30	1.90	1.70
MPS 1000	2.80	2.40	2.20
Red Brown Blue Green	4.00	3.30	3.10
MPS 803	3.50	3.00	2.80
Red Brown Blue Green	4.95	4.65	4.25
Diablo Hytype 11 MS	1.90	1.70	1.50
Fabric	2.70	2.40	2.10
Epson FX MX RX 80 FX85	2.80	2.40	2.20
Red Blue Brown Green	4.00	3.30	3.10
LX/GX 80	2.80	2.40	2.20
Red Brown Blue Green	4.00	3.30	3.10
MX FX 100 FX 105	3.80	3.40	3.10
LQ 800	3.80	3.40	3.20
LQ 1500	3.00	2.50	2.20
IBM PC 1512	2.80	2.40	2.20
Red Brown Blue Green	4.00	3.30	3.10
Juki 6100 MS	2.30	1.90	1.70
SS	1.40	1.10	1.00
5510	2.80	2.40	2.20
Red Brown Blue Green	4.00	3.30	3.10
Kaga KP 810/910	3.20	2.70	2.50
Red Brown Blue Green	4.70	4.20	3.90
M/Tally MT 80 M/S	3.80	3.00	2.80
NEC PC 8023 Spinwriter	3.60	3.00	2.80
5500, 7700MS	2.50	2.20	2.00
Fabric	4.70	4.30	3.90
3500 MS	3.60	3.40	3.10
Fabric	3.70	3.30	3.00
Pinwriter 2	4.90	4.40	4.10
3/7	5.50	4.90	4.50
Oki 80/82/83	1.50	1.20	1.10
Red Brown Blue Green	2.40	2.00	1.80
Olivetti ET 121 231 TES 4/5 MS	3.10	2.70	2.30
Panasonic KXP 110	3.90	3.40	2.90
Qume IV MS	2.90	2.40	2.20
Fabric	4.10	3.80	3.50
Richo 16,15,13, & 1200 MS	2.40	2.10	1.80
Fabric	4.90	4.20	3.80
Seikosha GP 80	2.70	2.30	2.10
GP100/250	2.70	2.30	2.10
Shinwa CP80 M/S	3.80	3.00	2.80
Silver Reed EXP 500 MS	3.10	2.70	2.40
Smith Corona D100/200	4.90	4.50	4.00
Star Gemini 10x,15x	1.50	1.20	1.10
Red Brown Blue Green	2.40	2.00	1.80
NL 10	5.50	4.80	4.50

If the ribbon you require is not listed ring 0707 52698 and let us quote

Computer Labels

Continuous fanfold, sprocket fed

Price per 1000	1,000	3,000+	5,000+
70 x 36	4.20	3.80	3.40
89 x 36	4.30	3.90	3.50
89 x 49	5.90	5.30	4.80
102 x 36	4.50	4.20	3.80

Please state no. of labels across the sheet (1, 2 or 3).

Computer paper

Plain fanfold, micro perfed edges except*

Size	Weight gsm	1000's per bx	Price per box 1 box	3 bxs+	5 bxs+
11x9½	60	2	14.40	13.60	11.40
	80	2	17.80	16.30	14.40
EXACT A4	70	2	24.00	21.30	18.20
	90	1	15.20	12.70	11.00
11x14½					
Plain or ruled	60	2	20.10	17.10	15.50

Swivel Bases

for Monitors

Pan tilt revolves around 360° 12.5° tiltable up and down adjustable by front mechanism.

12" Monitors **£12.00**
14" Monitors **£15.00**

Adjustable Copy Holders

A4 Adjustable desk clamping. Magnifying cursor line paper height adjustable clip, paper thickness adjustment.

£20.90

Printer Stands

5mm clear perspex
405 x 325 x 100mm

80 column printers £19.90
132 column printers £24.90

The Space Saver

Paper feed and refold positioned one above the other. Dial controlled paper feed with adjustable deflectors ensures smooth flow and automatic refolding.

80 column
415 x 380 x 460mm **£41.90**

Micro Media Brand Universal 5¼" Discs

Reversible with 2 notches and index holes. Lifetime guarantee, hub rings, envelopes, labels. Suitable for 40 or 80 track. Packed in plastic library case.

10+	50+	100+
9.40	**8.50**	**7.60**

Unbranded 5¼" Discs

Certified lifetime warranty
hub rings, envelopes, labels

Prices per 10 Discs

SS/DD 40	6.50	5.50	4.90
DS/DD 40	7.50	6.50	5.90
DS/DD 80	8.50	7.50	6.90

Unbranded 3½" Discs

Lifetime Guarantee/label sets

SS/DD	17.00	16.00	15.00
DS/DD	19.00	18.00	17.00

3M 5¼" Lifetime Guarantee

SS/DD 40	10.30	9.60	9.30
DS/DD 40	12.50	11.90	11.60
DS/DD 80	15.50	14.90	14.60
HD IBM PC AT	29.70	27.90	26.70

3M 3½" Lifetime Guarantee

SS/DD	20.50	20.00	19.70
DS/DD	25.50	25.00	24.70

Verbatim Datalife 5¼"

SS/DD 40	11.70	11.10	10.70
DS/DD 40	14.90	14.10	13.70
DS/DD 80	19.70	19.10	18.70

3" Maxell Discs CF2/CF2D

Reversible
or DS 34.70 33.00 29.50

3M Data Cartridges

For tape streamers

3M Code	Storage Capacity MB	1+	5+	10+
DC 1000	10-20	17.80	15.70	14.80
DC 300XL	43	21.50	20.00	19.10
DC 300XLP	45	26.00	25.00	23.90
DC 600A	60	27.00	25.50	24.30

Head Cleaners

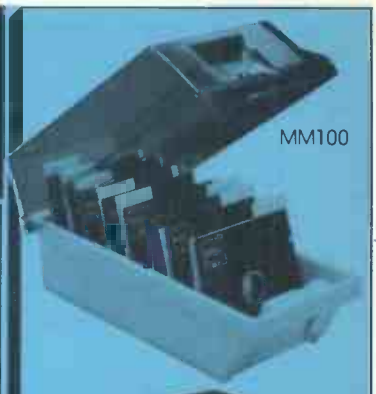
Discs with 15ml cleaning solution

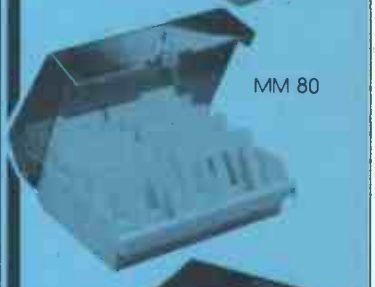
5¼" Head Cleaner 4.00
3½" Head Cleaner 5.00

Printout Binders

Adjustable hardback ring binder for 11x9½ to 12x9½ cont paper 40mm paper capacity

BLUE RED or BLACK £4.90 each
Set of 5 indexes £2.30





Disc Boxes

	1	3+
MM 100 5¼x100	11.70	10.00
MD 100 5¼x100	11.70	10.00
MM 80 3½x80	11.90	10.30
MD 50 5¼x50	8.70	7.90
MM 40 3½x40	8.50	7.40
Rexel Mini Box 5¼x30	5.00	
Plastic Library Case	3 for 4.00	

All MM/MD boxes anti-static with lock

● Educational and HMG orders accepted. ● Trade enquires. ● Personal callers welcome. ● Open Sat 10am - 4pm

Orders despatched. 24 hrs. Please allow 5 days for delivery. For next day delivery please ring for details. Postage covers UK only.

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Please add VAT at 15%

VISA

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-MICRO MEDIA-MICRO MEDIA-MICRO MEDIA-MICRO MEDIA-

Computers by Post

LOWEST U.K. PRICES GUARANTEED

PRINTER RIBBONS

		2+	5+	12+
ACORN	AP80	£2.70	£2.20	£2.00
	AP100	£2.70	£2.20	£2.00
AMSTRAD	DMP1	£3.90	£3.30	£3.10
	DMP2000/3000	£4.40	£4.10	£4.00
	PCW8256/8512	£4.30	£4.00	£3.80
BROTHER	HR5	£3.00	£2.80	£2.60
	HR15 Corr	£2.90	£2.50	£2.30
	HR15 FAB	£3.30	£2.90	£2.60
	HR15 MS	£3.20	£2.80	£2.50
	HR15 also for HR25/HR35			
	EP44	£2.90	£2.50	£2.30
	M1009	£3.40	£2.90	£2.70
CANON	PW1080A Black	£3.10	£2.60	£2.40
	PW1080A Red or Blue	£4.50	£4.10	£3.80
	PJ1080 Ink Jet Colour. One Off			£10.90
	PJ1080 Ink Jet Black. One Off			£8.90
CBM	1515	£2.70	£2.20	£2.00
	1525	£2.70	£2.20	£2.00
	MPS801	£3.60	£3.00	£2.80
	802/1526	£3.70	£2.90	£2.70
	803	£3.40	£2.90	£2.70
	MPS1000	£2.70	£2.30	£2.10
	4022	£2.70	£2.30	£2.10
	MSC801 Colour. One Off			£18.50
	DPS1101 SS	£2.40	£1.90	£1.75
	DPS1101 MS	£2.90	£2.50	£2.30
	DPS1101 Corr	£1.80	£1.50	£1.40
CENTRONICS	GLP	£3.40	£2.90	£2.70
CITIZEN	120D	£5.00	£4.60	£4.30
DAISYSTEP	2000 MS	£3.10	£2.60	£2.40
	2000 FAB	£4.90	£4.20	£4.00
EPSON	MX/FX/RX80 Black	£2.70	£2.30	£2.10
	MX/FX/RX80 Red or Blue	£3.90	£3.20	£3.00
	100 Series	£3.70	£3.30	£3.00
	LX80/LX86	£2.70	£2.30	£2.10
	JX80 Colour. One Off			£18.50
	LQ800	£3.70	£3.30	£3.10
	LQ1000	£4.50	£3.90	£3.60
JUKI	6000/2200 MS	£4.00	£3.60	£3.40
	6000/2200 Corr	£3.10	£2.70	£2.50
	6100 MS	£2.90	£2.50	£2.30
	6100 SS	£2.40	£1.90	£1.75
	6100 Corr	£1.80	£1.50	£1.40
KAGA	KP810 Black	£3.10	£2.60	£2.40
	KP810 Red or Blue	£4.50	£4.10	£3.80
M/TALLY	MT80	£3.70	£2.90	£2.70
OKI	80/82	£1.40	£1.10	£1.00
	84	£3.90	£3.40	£3.20
	Mate 20 Colour	£7.00	£6.50	£6.20
	Mate 20 Black	£6.60	£6.20	£6.00
PANASONIC	Dot Matrix	£5.00	£4.60	£4.30
QUENDATA	DWP1120 MS	£3.10	£2.60	£2.40
	DWP1120 FAB	£4.90	£4.20	£4.00
QUME	Sprint 7/9 MS	£2.80	£2.30	£2.10
	Sprint 7/9 FAB	£4.00	£3.70	£3.40
SEIKOSHA	GP50	£6.00	£5.50	£5.20
	GP80	£2.70	£2.20	£2.00
	GP100/250	£2.60	£2.20	£2.00
	GP500/550	£3.90	£3.30	£3.10
	GP700 Colour. One Off			£18.50
	SP1000	£6.00	£5.50	£5.20
SHINWA	CP80	£3.70	£2.90	£2.70
	Fastext 80 (Twinpack)	£11.70	£11.20	£10.90
SMITH CORONA (originals)	TPI M/S	£8.50	£7.90	£7.20
	TPI Fabric	£3.90	£3.60	£3.40
	TPI Corr	£5.00	£4.70	£4.50
	D100/200	£4.80	£4.40	£3.90
	D300	£6.00	£5.50	£5.30
STAR	DP/GEMINI/SG	£1.40	£1.10	£1.00
	SR15	£4.90	£4.50	£4.30
	NL10	£5.40	£4.70	£4.40

FLOPPY DISKS

5¼"		BOXES OF 10 DISKS 1-2	3-9	10+
JVC inc Plastic Case				
MD-1D	S/side D/dens 40TR	£9.99	£9.50	£9.25
MD-2D	D/side D/dens 40TR	£11.99	£11.50	£11.25
MD-2DD	D/side Q/dens 80TR	£15.99	£15.50	£15.25
MD-2HD	D/side H/dens 1.6MB	£26.99	£25.99	£25.49
VERBATIM – DATALIFE				
MD525	S/side D/dens 40TR	£11.60	£11.00	£10.60
MD550	D/side D/dens 40TR	£14.80	£14.00	£13.60
MD577	S/side Q/dens 80TR	£14.99	£14.75	£14.49
MD557	D/side Q/dens 80TR	£19.50	£19.00	£18.60
MD HD	D/side H/dens 1.6MB	£27.99	£26.99	£25.99
FUJI	*S/side D/dens 40TR	£10.99	£10.50	£10.25
	*D/side D/dens 40TR	£13.49	£12.99	£12.75
	D/side D/dens 80TR	£17.99	£17.50	£17.25

*Coloured Disks – red, green, blue, beige, grey £1.00 per box extra.

3½"		BOXES OF 10 DISKS
JVC/TDK	S/side D/dens	£17.99 £17.25 £16.99
SONY/FUJI	S/side D/dens	£18.99 £18.25 £17.99
FUJI/TDK	D/side D/dens	£26.99 £26.50 £25.99
SONY	D/side D/dens	£27.99 £27.50 £26.99

BULK 3½" D/SIDE D/DENS DISKS BY VERBATIM

10 x Disks	£1.99 each	£19.90 pack
20 x Disks	£1.89 each	£37.80 pack

3" DISKS

CF2 5 Disks	£2.99 each	£14.95 pack
CF2 10 Disks	£2.89 each	£28.90 pack

LASER PRINTER CONSUMABLES

TONER CARTRIDGES

Oki Laserline 6	£18.50	Canon A1/A2	£74.95
HP Laserjets	£74.95	QMS K8	£74.95
		Citizen Overture	£22.95

DISK STORAGE

LOCKABLE DISK BOXES

MODEL	SIZE	CAPACITY	PRICE
DD40L	3"/3.5"	40	£8.50
GS100	3.5"	100	£13.90
DD50	5¼"	50	£8.90
DD100	5¼"	100	£11.70
LIBRARY CASE	5¼"	10	£1.50
NON-LOCKABLE DISK BOXES			
MD12/30	3"/3.5"	24	£7.20
MF50	5¼"	50	£8.00
MICRODRIVE HOLDERS			
WALLET		4	£1.75
WALLET		20	£4.50

PRINTER CABLES & INTERFACES

AMSTRAD	Parallel	£8.90
ATARI ST	Parallel	£14.50
BBC	Parallel	£6.50
IBM	Parallel	£14.50
MSX	Parallel	£10.90
CBM 64/128	Parallel I/F	£59.90
SINCLAIR QL/SPEC 128	Parallel I/F	£26.50
SINCLAIR SPECTRUM	Parallel I/F	£32.50
AMSTRAD PCW	Parallel/Serial I/F	£49.90

COMPUTER STATIONERY

PLAIN WHITE WITH MICRO-PERF EDGES SIZE	GSM	QUANTITY	PRICE 1 BOX	2 BOXES
11 x 9½	60	2000	£12.50	£12.00
11 x 9½	70	2000	£15.50	£14.50
EXACT A4	70	2000	£20.90	£18.75
11¾ x 9½	90	1000	£13.20	£11.25

COMPUTER LABELS

	Price per thousand in brackets 1000	2000	4000
70 x 36mm	£5.40	£8.80 (£4.40)	£16.00 (£4.00)
89 x 36mm	£5.50	£9.00 (£4.50)	£16.40 (£4.10)
89 x 49mm			
3 across only	£7.20	£12.40 (£6.20)	£22.80 (£5.70)
102 x 36mm	£5.70	£9.40 (£4.70)	£17.60 (£4.40)

Please state number of labels across sheets (1, 2 or 3).

PRINTERS

Epson LX86	£199.95
Epson FX800	£319.95
Epson FX1000	£409.95
Epson EX800	£415.95
Epson LQ800	£469.95
Citizen 120D	£155.95
Amstrad DMP2000	£139.95
Amstrad DMP3000	£165.95
Amstrad DMP4000	£342.95
Panasonic KXP1080	£149.95
Oki-mate 20 Colour	£169.95
Micro P MP165	£199.95
Star NL10 inc I/F	£199.95
Star NX15	£299.95
Star NR15	£429.95
Star NB24-10	£429.95
Star NB24-15	£549.95
Juki 6100	£259.95

COMPUTERS

HP Laserjet Laser Printer	£1549.95
Canon A-1 Laser Printer	£1629.95
Oki Laserline 6	£1559.95
QMS K8	£1659.95
Citizen Overture	£1529.95
Amstrad PCW8256	£379.95
Amstrad PCW8512	£475.95
Amstrad CPC6128 Green	£239.95
Atari 520STM	£213.95
Atari 520STFM	£327.95
Atari 520STFM+mono monitor	£409.95
Atari 1040STF	£489.95
Atari 1040STF+mono monitor	£572.95
20 Meg Hard Disk	£579.95
Mono monitor	£122.95
Colour monitor	£329.95
Commodore C64	£139.95
Commodore C64C compend.	£204.95
Commodore C128D	£429.95
CBM 1541C Disk Drive	£168.95
CBM Amigo 512K Syst 1	£995.95
Sinclair Spectrum 128K + 2 inc Joystick + Software	£126.95

AMSTRAD PC1512

Single Drive Mono Monitor	£435.95
Double Drive Mono Monitor	£539.95
Single Drive Colour Monitor	£599.95
Double Drive Colour Monitor	£709.95
HD10 Meg Mono Monitor	£779.95
HD20 Meg Mono Monitor	£879.95
HD10 Meg Colour Monitor	£949.95
HD20 Meg Colour Monitor	£1049.95

Maxell 5¼" MD1D
S/side D/dens 40TR
Box of 10 (min. 2 boxes)
£9.99

TDK 5¼"
S/side D/dens 40TR
Box of 10 (min. 2 boxes)
£8.99

SONY 3½"
D/side D/dens
Box of 10
£27.99

CF2 3" Disks
Box of 10
£29.90

DELIVERY All consumables and software post free Hardware £5 + VAT 4 Day Delivery £9 + VAT 24 Hour Delivery

COMPUTERS BY POST GUARANTEE If after buying any of the hardware or software in this advertisement, you find the same item offered at a lower price locally within one week, we will refund the difference.

All prices exclude VAT

CREDIT CARD HOT-LINE

01-760 0014

Computers by Post, 30 Bayford Rd, Littlehampton, West Sussex.

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To: **Computers by Post, 30 Bayford Road, Littlehampton, West Sussex.**

I wish to order_____

My computer is_____

I enclose cheque/PO for £_____ inc VAT

or charge my Access/Visa No:

Name_____

Signature_____

Address_____

Postcode_____ Tel No:_____

P.C.W. 5/87

By Order of the Receiver, E Joseph Esq FCA of Messrs Jeffreys Henry Rudolf & Marks
Re; **Adamson Business Microsystems Limited and Evans Informatic Limited both T/a Entre Computer Centre**

SALE BY TENDER

54a St Pancras Way (off Camden Road), London, NW1

COMPUTERS: 'IBM' PC AT, with Enhanced Coloured Monitors
'COMPAQ' Deskpro, Deskpro 286 and Portable 'ALTOS' 486

PRINTERS: 'IBM' Quietriter 5301; 'EPSON' LQ 1000 & JX 80, 'BROTHER', 'MICROLYNE' 84 and 93, 'DYNEER' DW20, 'FIJITSU'

GRAPHICS PLOTTER — 'HEWLETT-PACKARD'
LASER JETS — 'HEWLETT-PACKARD', 'CANON'
Monitors, Disk Drives, Keyboards, Software

PROJECTORS — Kodak Carousel, 3M and Nobo Overhead Nobo Screens, Kroy 80 Editor Keyboard Lettering System BT Merlin Pentara Telephone System and Handsets
Vodafone Telephone Battery

ALSO INCLUDED FROM OTHER RECEIVERS, LIQUIDATORS & VENDORS:
'HEWLETT-PACKARD' Computer with Power Supply, Mass Memory, Controller, Printer and Disks
'DATA TRANSFER' Microcomputer 1020 Series
'FORTUNE' System EXP 50 Computer, Central Processor with Integral Twin Disk Drive and Expansion Unit, CPU Control VDU's with Keyboards
'ANADEX' Rapidscribe DP 6500 Dot Matrix Printers
'CENTRONICS' 152-154 Dot Matrix Printer
'WYSE' Model WY50 VDU's with Keyboard
'VIDEOTON' VDN 52500 VDU with Keyboard
'PERKIN ELVNER' 1251 Computer with Keyboard
'ZYTEC' RSD/FSD Power Supply
'MAGNETIC PERIPHERALS' Fixed Storage Drive
NSOMP 1 Neopost Franking Machines, Olivetti ET121 Electric Typewriter, Semotex Bindomatic 2000 Leaflet binder
'VIDEOSCAN' Closed Circuit Television and Video System

Viewing: Tuesday, 12th May 1987 from 09.30 to 16.30 hours

Tenders due by 12 NOON of FRIDAY 15th May 1987

Tender Forms from:

HENRY BUTCHER

50/51 High Holborn, London WC1V 6EG
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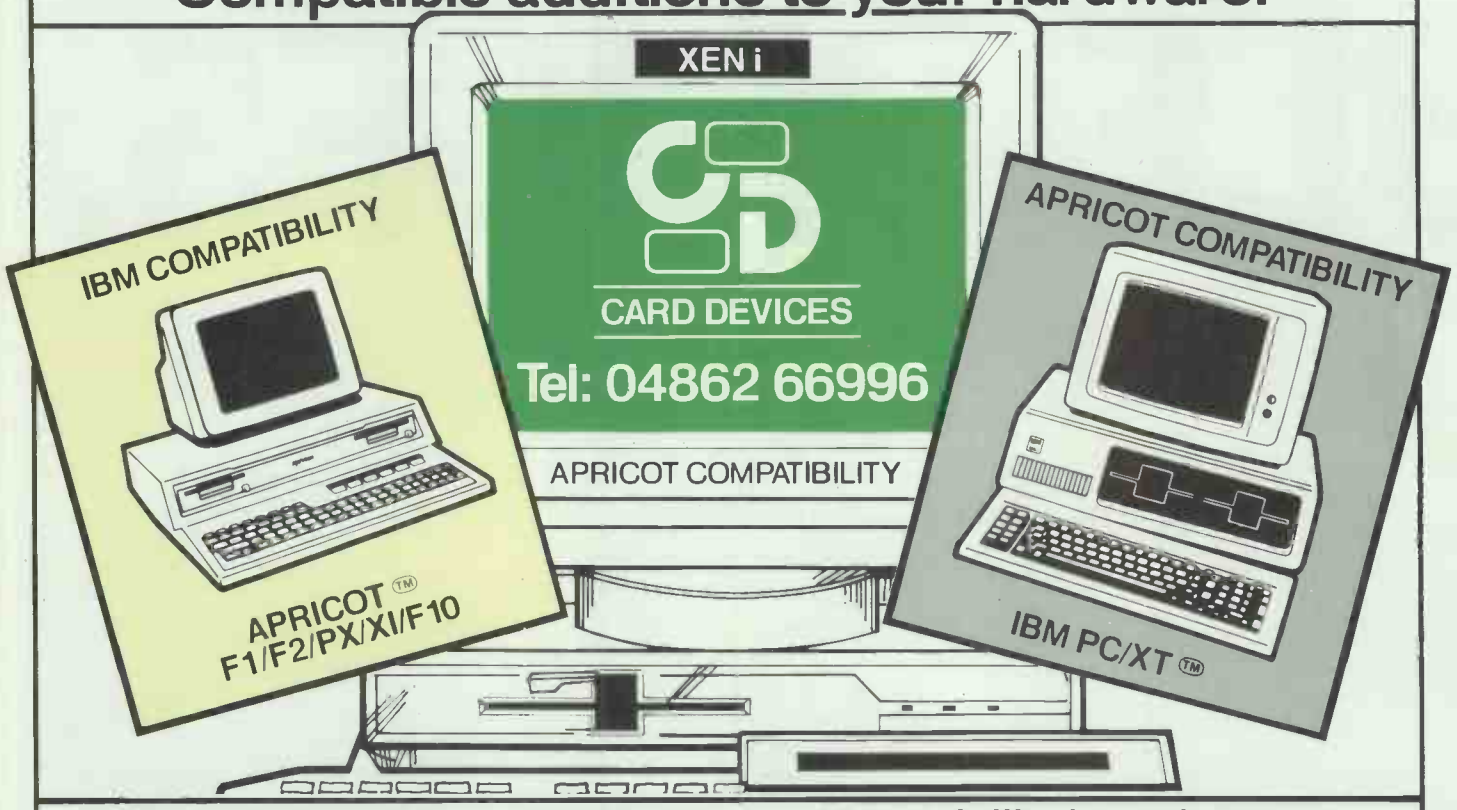

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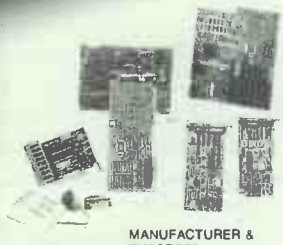

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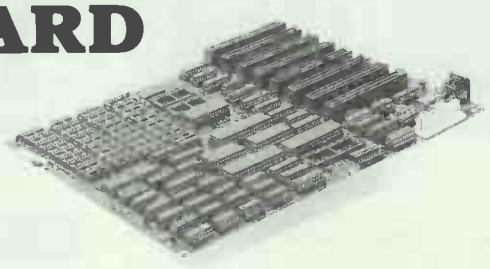

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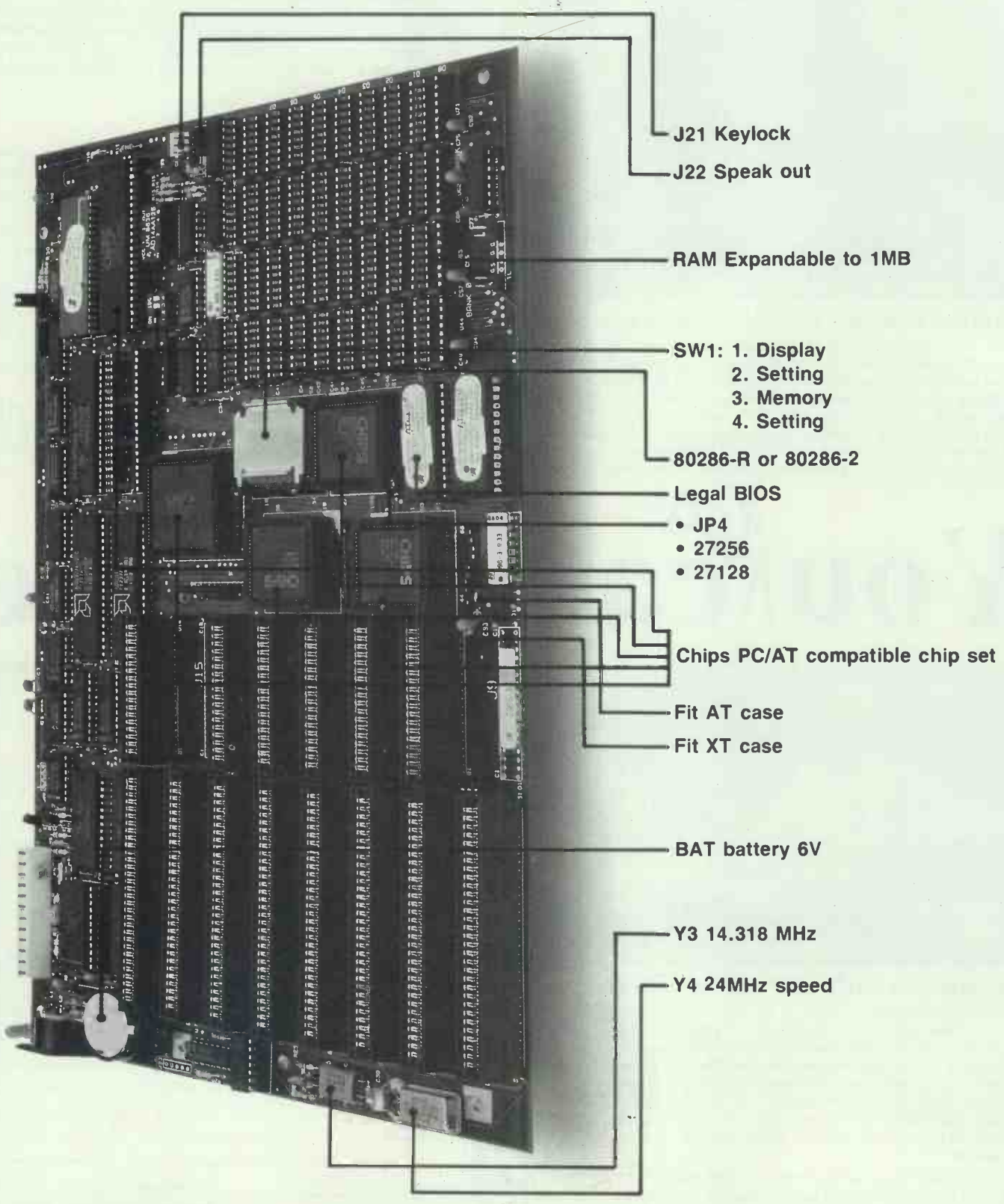

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DACOM	PC123	V21, V22, V23	Latest IBM multispeed internal	Y		HAYES	Y & EPAD	Y	Y	BOTH		499	**399**
DACOM	PC123 BIS	V21, V22, V22BIS, V23	Latest IBM high speed internal	Y		HAYES	Y & EPAD	Y	Y	BOTH		699	**549**
INTERLEKT	PORTMAN	V21, V23	Reliable no frills modem	Y					OPT			173	**139**
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MIRACLE	WS2000	V21, V23	Low cost manual modem	OPT		OPT						108	**89**
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PACE	SERIES 4 2123S	V21, V23	Latest multispeed (Space Age)	Y	Y	HAYES		Y	Y	BOTH		265	**224**
PACE	SERIES 4 1200S	V21, V22, V23	Latest multispeed (Space Age)	Y	Y	HAYES		Y	Y	BOTH		399	**339**
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RACAL	V12422	V21, V22, V22BIS	High spec PSTN multispeed	Y		Y	OPT	Y		AUTO		865	**819**
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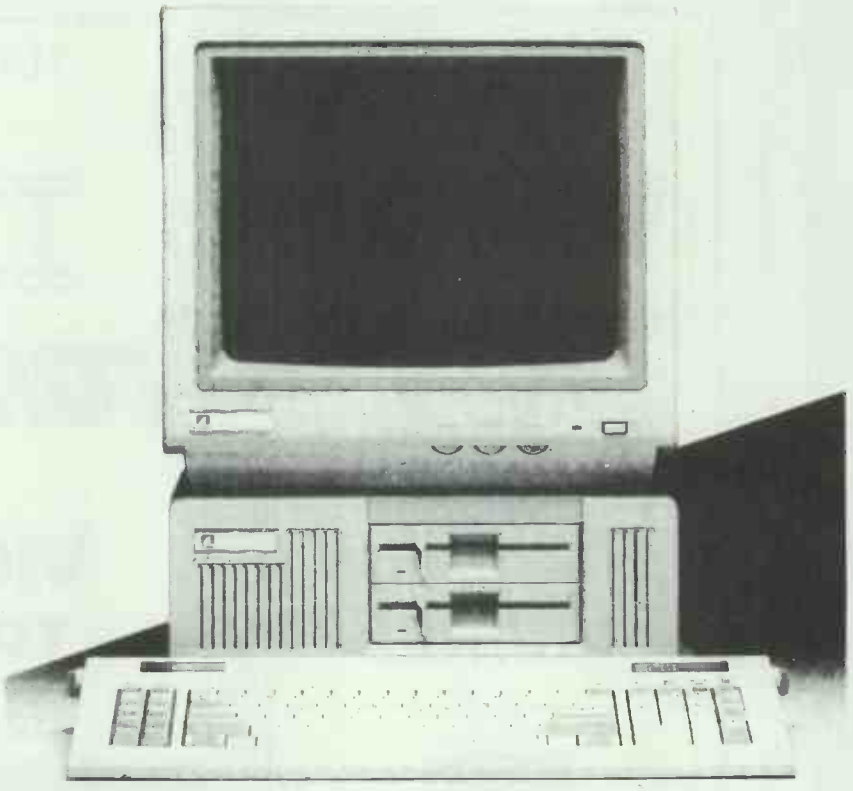

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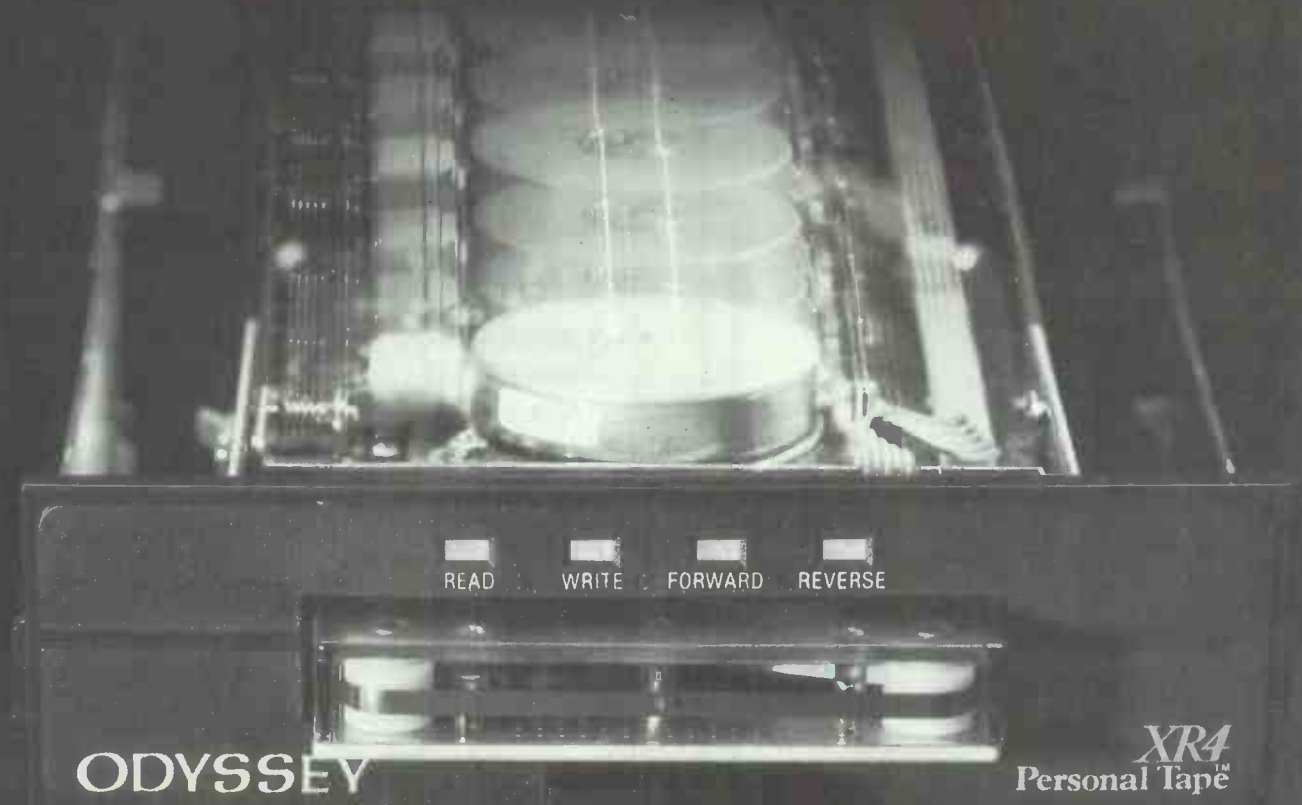

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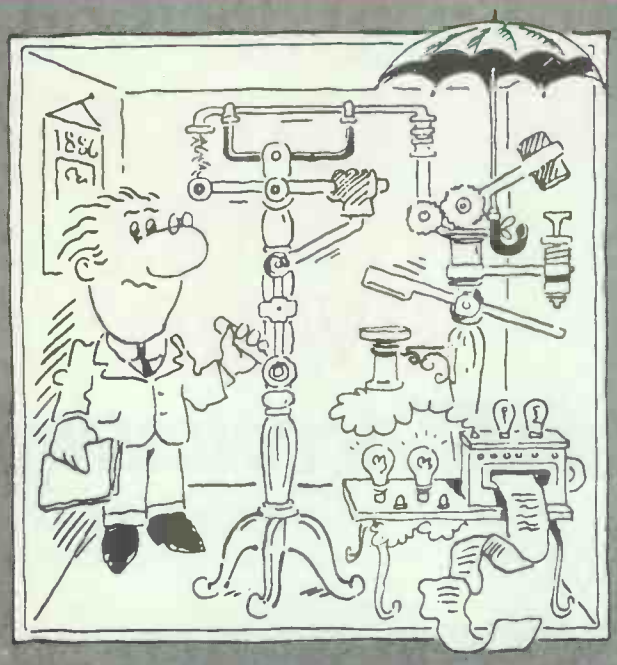

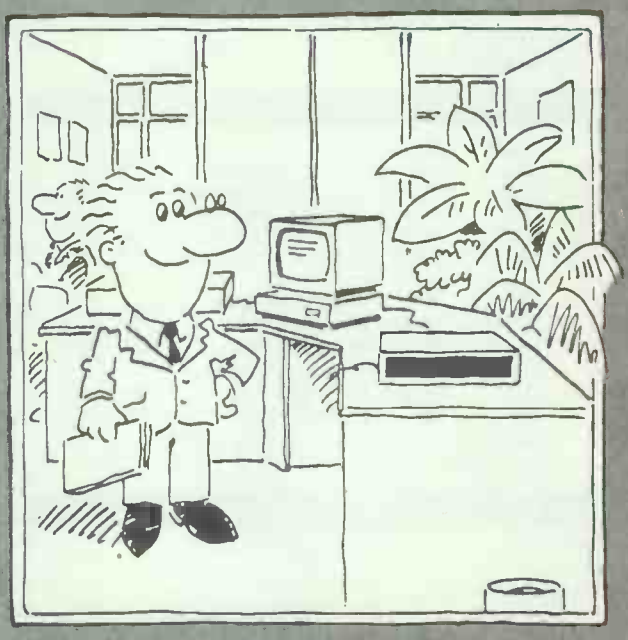

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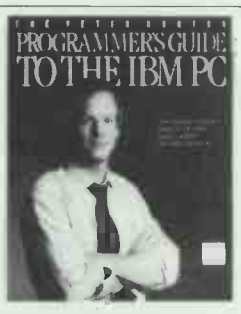

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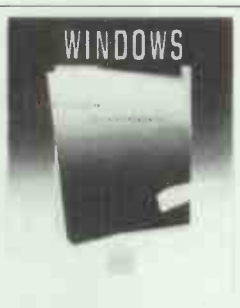

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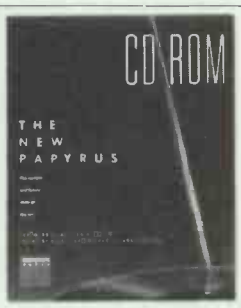

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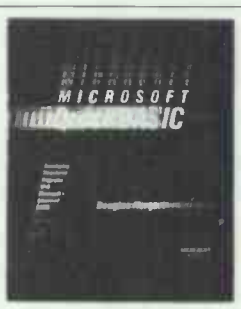

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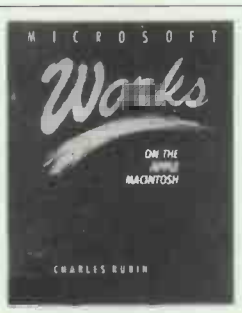

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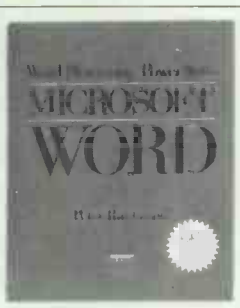

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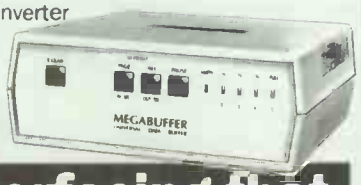

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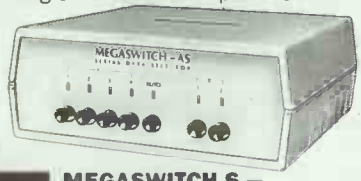

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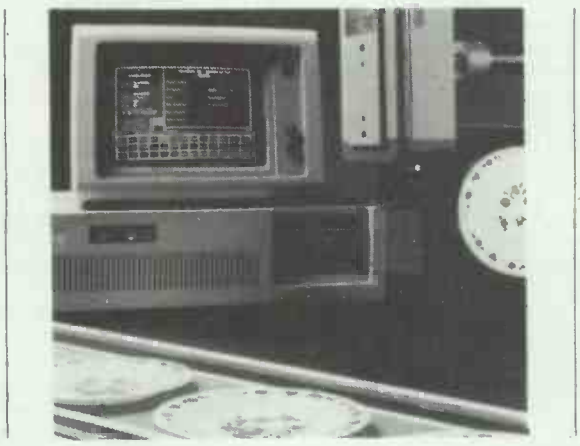

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The 10th Personal Computer World Show

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The 1987 PCW Show celebrates its tenth anniversary this year and the product line-up is beginning to look impressive. Here's a preview of some of the attractions and special events.

The main event, ten years on

Ten years old and the PCW Show continues to grow. It is now the pre-eminent show of its kind in the world.

The first show played host to historic machines like the Nascom, the SOL and the Altair, not to mention those of survivors like Apple, Commodore, Comart and Research Machines. Other old-timers, like Computer Bookshop, still turn up year after year for this major fixture in the personal computing calendar.

Nineteen-eighty saw the switch to the Cunard International Hotel in Hammersmith, before it became the nouveau Novotel. These were the days of the Sinclair ZX80, the Transam Tuscan and the ill-fated Apple III. The following year saw the debut of a number of machines, including a prototype BBC, the Osborne 1, and the Atari 400 and 800 series.

In 1982 the show moved to the Barbican and a huge audience of 47,000. This was the show that hosted DEC's Rainbow, Commodore's 64, Camputers' Lynx and Jupiter's Ace. The next year saw the new Apricots and Sinclair's long-awaited microdrives. Lotus and Softsel appeared on the scene for the first time, and Llamasoft launched its Hover Bovver game.

By 1984 we were in Olympia 2 where Apricot showed off its FI, FIE and Portable machines. Acorn launched its ABC business systems and Enterprise, variously known as Flan and Elan, finally showed its face in public. Symphony was launched and Sinclair flogged QLs off its stand.

The next year we took both the National Hall and Olympia 2. Over 60,000 people turned up to witness Apricot's almost terminal plunge into low-cost PCs while Amstrad showed its PCW8256 for the first time. Atari took an enormous stand for the debut of its ST, and sneak previews of the Amiga were given in the Metacomco hospitality suite. MSX made its first, and probably last, determined effort to be noticed.

Last year Amstrad launched its much-rumoured PC while the BBC Master Compact bowed in on the adjacent stand. In the business hall, Comart's Quad made its first appearance too.

Commodore 'had massed Amigas on show and a stunning line in colour printers'. The huge Atari village, with some 80 exhibitors, lay between the two halls.

As you may have gathered by now, every year the PCW Show gives its visitors a wonderful opportunity to assess the options available, all in a single location. Why don't you give it a try?

LBC plans to broadcast to London from the General Hall at this year's event

No-go areas

Unlike most other exhibitors, PST has had a stand specially designed to keep the public out. But PST is not entirely alone in wanting to discourage end-user contact, as fellow distributors are also anxious to reassure their dealers that they are at The PCW Show to meet the trade and not sell products direct.

PST specialises in exporting, mainly discontinued and surplus, hardware to over 80 different countries. The public is not allowed to buy any of the stock on the stand or in the UK generally, and PST is only interested in high-volume sales. So why does the company bother to come to the PCW Show?

'Last year we were very successful in making new contacts, and in meeting the people we usually deal with by telephone face to face,' said Howard Strowman, managing director of PST (Trading) and chairman of PST (Holdings). Another success was the sale of home computers bought in a clear-out deal when Sinclair was taken over. Strowman expects to have more sophisticated machines on his books by the autumn.

'1987 should see a fall-out among the PC clones because of price cutting by Amstrad, so I expect to have greater stocks of PCs at the PCW Show than I've had in the past,' he explained, striking a sombre note for PC manufacturers.

Equally reluctant to meet the public is Lightning Distribution, one of the companies heavily involved in low-cost software for the Amstrad launch last year, and which expects to be featuring mainly PC business packages again this autumn. The company has taken a similarly large stand, but has moved to a more favourable position in Olympia 2. Even so, Lightning only intends to be at PCW for the trade-only first three days: once the show is open to the public, Lightning hands over the stand to its dealers.

'We keep one rep on the stand in case there are any trade enquiries, but we don't believe it is ethical for distributors to sell direct to end-users,' explained Loretta Cohen, director of Lightning's Consumer Electronics Division. 'PCW is really a good opportunity for us to talk to our customers and get their ideas on what we should be doing next — and of course we open new accounts and make overseas contacts.'

Atari expects ST software back-up

Jack Tramiel recently advised prospective buyers: 'Don't buy a clone, they're inferior quality. Buy an ST instead,' and Atari is hoping the public will take his advice. Having already built up a user base of 25,000, Atari still plans to sell a further 75,000 STs this year. A key element in achieving this figure will be back-up from software developers, many of whom are launching their new ST products at this year's PCW Show.

On the business front, Precision Software is bringing out a version of Superbase for the ST running under GEM, and Sagesoft is extending its existing range of accounting and financial packages. Most of the leisure software houses will also have new games out for the ST this year. Activision will have seven more titles including Championship Baseball, Golf and Football, while Beyond is launching Star Trek to coincide with the film premiere of *Star Trek IV: The Journey Home.*

Inside Information

For details of PCW Show '87, contact Mike Blackman and the PCW Show team on (01) 486 1951 or (01) 487 5831, or write to PCW Show, 11 Manchester Square, London W1M 5AB. END

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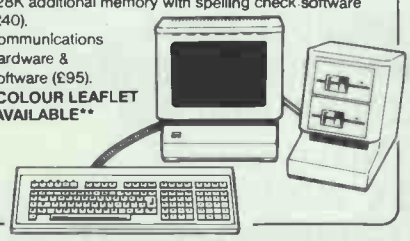

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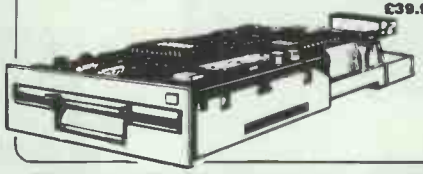

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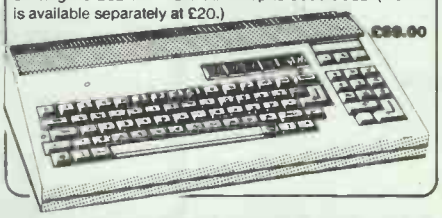

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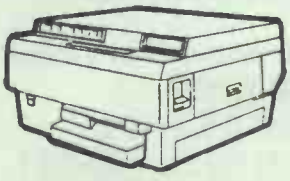

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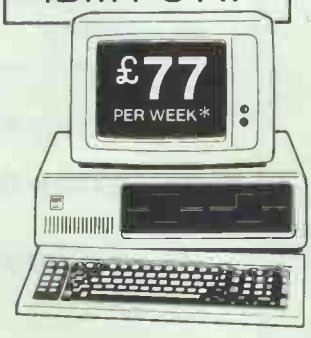

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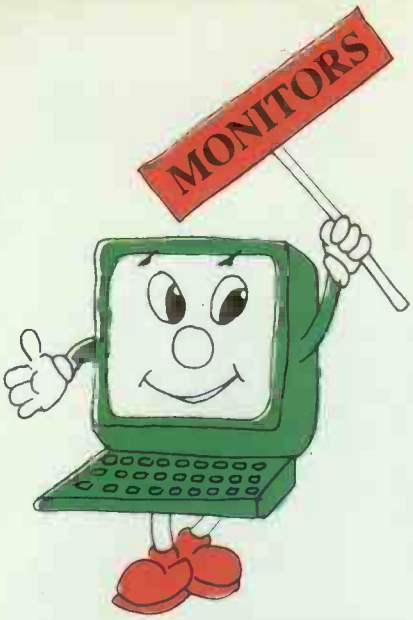

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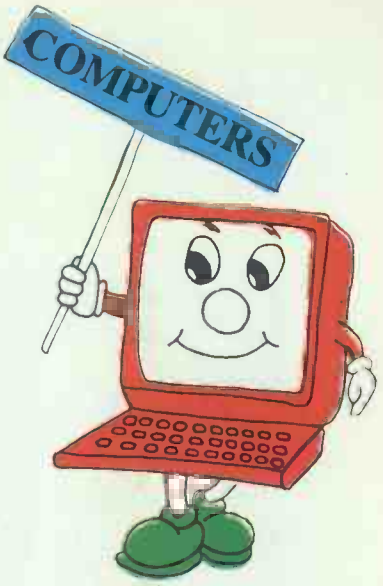

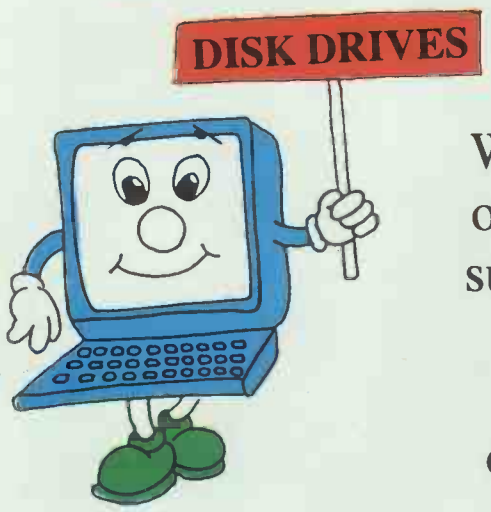

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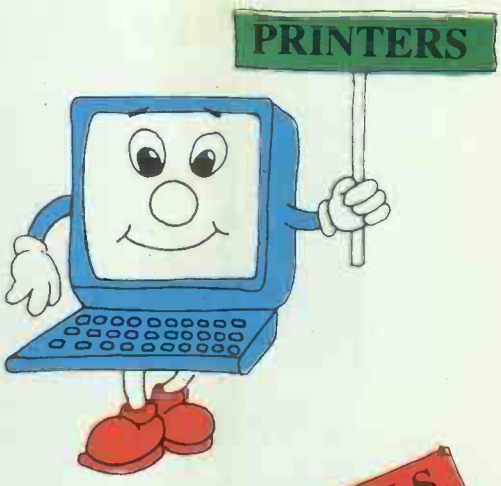

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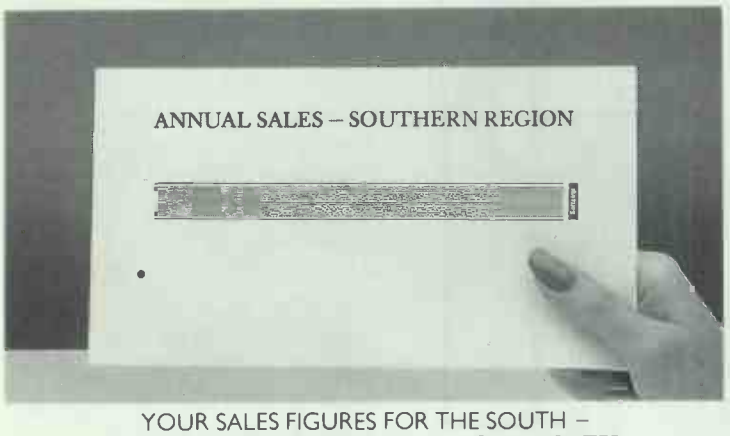
A remarkable new computer technology is now available in Britain.

A technology that could increase the effectiveness of paper used by every business, every establishment in the country.



YOUR SALES FIGURES FOR THE SOUTH –
READ THEM STRAIGHT INTO YOUR COMPUTER.

A technology that could have a profound effect on the way people store, retrieve and distribute information.

It's called Softstrip. And it's print computers can read.

What precisely is a Softstrip?

Softstrip is a revolutionary method of encoding software, data, graphics – even music – onto paper.

The printed 'data strips', like the ones on this page, can then be read directly into a computer.

A single strip can hold up to 5,500 bytes of information (about four pages of double-spaced typewritten text) and can be read in about 30 seconds.

In fact, wherever data is to be stored, retrieved or distributed, Softstrip can be used.

For instance, a Softstrip containing a new price list or a parts list could be sent out to wholesalers and distributors and immediately read into their computers.

A company's confidential personnel records could be coded onto strips – making them safe from unwelcome eyes.

Even the strip printed on this page is computer-readable.

How do you read a Softstrip?

All you need to read these remarkable strips is a Softstrip Reader. A low cost piece of hardware that plugs into most popular personal computers.

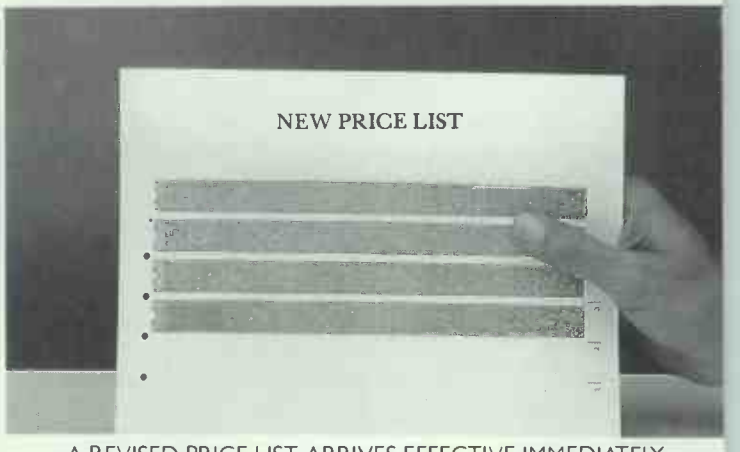
When placed over a strip, the Reader scans the data and transmits it to the computer.

Even if the paper is folded up, the strip can still be read. The Reader will also scan through colours, dirt – even coffee stains.

If you find that hard to believe, fold up the page opposite and take it to your nearest Softstrip dealer. He'll read the strip for you.

The benefits of paper.

As Softstrip is on plain paper, a major advantage is the price. Merely compare the cost of paper to a floppy disc to see the difference.



A REVISED PRICE LIST ARRIVES EFFECTIVE IMMEDIATELY.
HOW QUICKLY CAN YOU RESPOND?

The strips can be posted like normal letters, at a fraction of the cost and the risk of sending data on floppy discs.

ppened to paper an't ignore.

THE SOFTSTRIP READER COSTS £200 + VAT SRP.*

What's more, there's no need to spend hours slaving over a keyboard. Not only can Softstrip data be read in seconds, but the chances of entering invalid data are less than one in 10,000,000,000.

To prevent a strip from being copied, you simply add another colour across the strip.

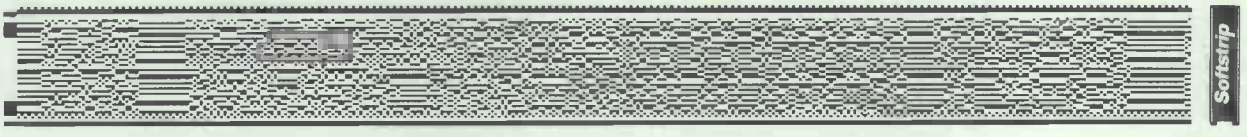
Strips can also be protected from being read with a security code.

Can your business use the Softstrip technology?

That's entirely up to you. In five minutes you could probably come up with half a dozen uses of your own.

For further information on the Softstrip technology and why your business should not ignore it, cut the coupon or take this page to your nearest dealer.

You'll find there's a great deal more to Softstrip than meets the eye.



THIS STRIP CONTAINS AN IBM BASIC PROGRAM THAT LETS YOU USE YOUR P.C. AS A SKETCH PAD.

● **Softstrip bridges the gap between computers.**

Another major benefit of the Softstrip technology is that it enables incompatible computers to communicate.

A strip containing unformatted ASCII text produced on an IBM PC, for example, can be read by a Macintosh and vice versa.

So, copies of data strips can be distributed and read into computers of different makes.

Print and photocopy your own Softstrips.

Softstrips can be printed by most popular dot matrix or laser printers.

You can even photocopy original strips, which can make your data distribution costs lower still.

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NEWSPRINT

The poisonous side of data processing and the real meaning of personal computers — as always Guy Kewney's news covers a lot of ground.

Dark thoughts from above

'Guy,' said a colleague in the aeroplane on our way back from the Hanover Fair, 'could you do me a favour?'

'Of course, what?'

'Could you stop standing on my foot?'

I hadn't known. Naturally, I apologised, explained, hoped no serious damage was done, and (most important) got off his foot.

Computing is the sort of business where such thoughtfulness is natural. Computing harms no-one. It provides services which the world absolutely couldn't manage without, and computing people are dedicated to sympathy — trying to understand their fellow humans, and to provide what they need to help them. And if there are some people who feel that computer games are wicked, well, it's probably a healthy sign — a sign of lively debate amongst intelligent philanthropists.

It would be batty to start looking for ways in which computers are harmful.

Compared with driving cars, for example, computers don't generate fumes. Compared with building motorways, they don't destroy homes. They use trivial amounts of electricity. And they sit on desks, for years, generating almost undetectable radiation. With all this going for computers, well, why look for trouble? Obviously, you can't make omelettes without breaking eggs, and there must be some drawbacks . . .

The interesting thing about all this self-satisfying drivel, is that we don't know what the drawbacks are.

We use nickel-cadmium batteries. How do you extract cadmium? What pollution does a nickel mine cause? I don't know — I've never been to a nickel mine.

Then there's the semiconductor process. Galium arsenide . . . a strange compound of arsenic. Poisonous, a heavy metal. I wonder where they get galium. Do you know? And the various photo-sensitive chemicals used to make chips — I seem to vaguely recall that several Silicon Valley companies turned out to have poisoned the wells for years, with waste products. Wonder where those wastes are going now?

And the plastics industry, without which we'd have no disks, no circuit boards, no cheap cases, produces some of the most persistently toxic chemicals known. Who disposes of those? And how much? Do you know?

And then take the whole business of buying and selling computers. I travel thousands of miles, by air, each year. I encourage others to do the same, and so do a lot of other computer industry people.

In 50 years' time, most of us will be ancestors — grandparents, probably. It's quite probable that by then, the world will be in a pitiful state.

You want scare pictures? OK, imagine pesticides which no longer kill insects (immune) but have built up in the soil, and are poisoning us. Imagine a plague affecting wheat, making bread a luxury item, rice a food for the rich. Imagine a human race infected by bacteria, all immune to antibiotics. Imagine a climate changed so that Britain is mostly under sea-water, but the rest is desert.

All these things you will find, if you check, are not just vague possibilities, but strong probabilities. It's just a question of how long.

Will our grandchildren say: 'Oh, my grandparents were in the computer business in the '80s. It wasn't their fault.' Or will they keep quiet about how the family used to earn its living? Perhaps you have a theory about this — but have you done any research?

The trouble is that this planet of ours doesn't speak. It doesn't say: 'Could you get off my foot?' You have to look, very carefully, to make sure you aren't causing permanent damage.

But of course, that's no business of mine, is it? I should get on with my job — describing hardware, software and industry gossip — and stop bothering our readers with irrelevant ecological politics.

Right?

Toshiba and Sharp responded to the introduction of the Compaq Portable III (see Benchtest in this issue) with new portable AT clones, launched at the recent Hanover fair in Germany.

Toshiba has announced a 20Mbyte version of its T3100 laptop AT clone and claims to have increased the disk access times by 50 per cent. The T3100 is 80286-based with 640k of RAM — internally expandable to 2.6Mbytes — and a 720k 3½in disk drive. It has a full-size (12 inch) CGA compatible gas-plasma display.

Standard features include a battery-backed real-time clock, international switching power supply and an optional expansion box which can take five IBM PC/AT expansion cards. Even with the 20Mbyte hard disk it is still lighter and smaller than either the Compaq Portable III or the Sharp 7200.

The 10Mbyte Toshiba 3100 will still be produced and sold at £3695, and the new 20Mbyte version will retail for £4350. The new machines should be available from early April 1987.

The Sharp 7200 is an 80286-based version of the existing 7000 and 7100. Competitively priced at £2995, including a 20Mbyte hard disk, the Sharp is the heaviest and largest of the three but does include one expansion slot as standard.

I suspect that Compaq and Sharp will have a hard time competing against the well-established and beautifully designed Toshiba, especially with machines that are both bigger and heavier. Further details from Toshiba on (0932) 785666 and Sharp on (061) 205 2333.

Measuring IBM's impact

Hopefully, our exclusive coverage of IBM's latest announcements contains all the information you need. Here are a few pointers to measure that data by.

First, acceptance must be measurable.

People will tell you that IBM automatically sets a standard which others follow.

This is false. IBM set a standard in mainframe computing by introducing the 360 range, because nobody else could do it. Nobody else could offer a whole range of machines which obeyed the same instruction set — ran the same programs.

IBM set a standard in micros because micros were new, and dangerous, and rebellious. IBM made micros respectable. It can't do that twice.

Second, time for acceptance must be measured.

Measure this by comparing IBM with Apple. IBM and Apple have very comparable status in the micro industry today.

It took Apple three years to establish the Macintosh standard. The Macintosh was a startling improvement on existing technology, and was backed by all the big producers of software, and was taken up by buyers at a rate far, far greater than the IBM PC was, when it appeared.

Public domain pricing

Responding to criticisms levelled at it through the pages of *PCW*, PC-SIG has clarified its position on public domain software and its catalogue. It's also setting up a European distribution centre in Ireland which must be good news for UK users and authors.

Rick Petersen, one of the founders of PC-SIG, told

Chuck Peddle handed me a hard disk. 'That piece of rubbish on your lap isn't a portable computer,' he said. 'This is.'

Fortunately for posterity, the piece of rubbish wasn't rubbish, but a fully functioning Tandy 100 laptop, which I used to transcribe his remarks. That apart, I have to agree with Peddle. The thing which makes a computer 'mine' is not the keyboard or the display, but the way I have it set up.

My hard disk has my start-up routines, my choice of operating system, several programs of my own choice in directories set up by me, and most of the data I normally use in a day.

If I could take that essence away from the computer at the end of the day and plug it into another computer at home, I would truly have a portable environment. Especially if it weighed a mere two pounds.

Peddle is selling exactly that: a removable data pack, which just happens to contain 30 megabytes of hard disk capacity. He's calling it a breakthrough in computing.

It's a hard disk which is protected against shocks and jolts, and costs about £200 — very little — but which can be plugged into a different machine in about three seconds.

The little box contains the spinning disks, and movable magnetic read-write heads, and electronics. The computer into which you load it has a socket which sucks in the box, plugs it in and starts the disks spinning. Then it moves the heads into position. When you take it out, it parks the heads safely away. It's very like an automatic video tape loader.

Peddle sells a computer, an AT-compatible, which can hold two of these data packs, and he also sells a £400 add-on which you can plug into your own PC, so that you can use these data packs. He calls them Data Pacs, because PAC is short for Personal Advanced Computer.

'We decided that what was personal about a computer wasn't the keyboard or the monitor,' said Peddle. 'We decided that it was the disk, the way the data is arranged.'

He added: 'It just happens that Jugi (Tandon's founder, Jugi Tandon) has gone through a whole design process to make it able to be chucked around. That means, we have created a truly portable environment. This is your personal computer. It has your own serial number, like a credit card. You can run up to any computer in the world and it will recognise you.'

Tandon will sell two computers and one removable disk (Data Pac) for about £3000. 'Jugi believes we can go to 120Mbytes per Pac,' remarked Peddle, 'with existing technology.'

Provided his agents don't screw up the price, this will cause a revolution in computing, in the same way as personal computers caused a revolution, purely because they were cheaper than minis.

What's new is the price (£200) the weight (two pounds) the capacity (up to 120Mbytes) and the ruggedness, plus the serial number.

For example, the serial number means that stores

can now install software directly onto your hard disk, and make sure that it will be recognised as your software, even if you give it to somebody else.

The portability means that you can have complex programs directly installed onto your system, using your interfaces, without having to run 16 floppy disks in an install routine.

The price means that it becomes a serious option to buy two machines and a single Data Pac. £3600 is less than some people spend on a single AT compatible machine.

But even if all that were not true, I'd still recommend buying a Data Pac drive for your existing machine.

Consider the problem of data back-up. If you have 20Mbytes of hard disk on your system today, you can make copies of it onto floppy disks. You need three floppies per megabyte, so, with luck, the whole lot will go onto 60 floppies. It takes a couple of minutes per floppy, so a couple of hours for the whole back-up.

A week later, you copy all the files that have been changed since last week. A week later, you repeat it. After your catalogue of diskettes gets to about 100, you probably start again — say every three months — with a complete 60-floppy copy. If your system uses high density floppies, you divide all this by three, but it's still a hassle.

Most people with hard disks have run them for two years without doing any of this, and still haven't had an accident to the hard disk. Frankly, the disaster doesn't bear thinking of, and it seems unlikely, so they postpone the decision.

The ideal way to back-up a hard disk, of course, is another hard disk. Normally, this is too complex and too expensive.

But with a 30 megabyte Data Pac costing £200, and the 'back-up unit' which holds two Pacs costing £400, even normal PC users will be very seriously tempted to use this as the standard means of upgrading to hard disk.

Expect the Pac in May, and the add-on unit about the same time.

The secret of Borland's success is "Quality, Speed, Power, & Price"

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SuperKey®
Turns 1000 Keystrokes Into 1!

If you use SideKick, you need SuperKey. They're designed to work together—and work for you. SuperKey's an amazing keyboard enhancer for your IBM PC and compatibles. With easy-to-write macros, you and SuperKey can turn 1000 keystrokes into 1. Minimum memory: 128K.

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Powerful desktop management program and the #1 best seller for the IBM PC. SideKick includes notepad, calendar, calculator, appointment scheduler, telephone directory, autodialer, and ASCII table. It's RAM-resident—which means SideKick is always there ready to react when you need to do something, call someone, or find out something in a hurry. And it does all this *while you run* other programs. Minimum memory: 128K.

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It's the electronic organizer for this electronic age. Neither you nor your secretary need to face 1987 with old-fashioned 1887 diaries. Traveling SideKick has everything they have—and a lot more. (Unlike dusty old diaries, Traveling SideKick doesn't "expire" at the end of '87, because it's electronic and good for '88, '89, '90 and on and on and on.) It's a professional binder, a software program, and a report generator—a modern business tool that prints your ever-changing appointments in daily/weekly/monthly/yearly form. (If your schedule changes *hourly* Traveling SideKick handles the changes instantly.) Whether you use your own personal computer or have someone's help with that, Traveling SideKick is the smart new way to take your computer with you—without taking your computer with you. Minimum memory: 256K.

Turbo Lightning®
Solves All Your Spelling Problems!

While you use SideKick, Reflex, Lotus 1-2-3,® and most popular programs, Turbo Lightning proofreads *as you write!* If you misspell a word, Turbo Lightning will beep at you instantly, and suggest a correction for the word you just misspelled. Press one key, and the misspelled word is immediately replaced by the correct word. And if you're ever stuck for a word, Turbo Lightning's thesaurus is there with instant alternatives. Minimum memory: 256K.

Lightning Word Wizard™
Technical Reference Manual For Turbo Lightning!

An important addition to Turbo Lightning, Lightning Word Wizard includes fascinating and challenging word games like "Akerue" (try reading that backwards), "That's Rite," "CodeCracker," "CrossSolver," "MixUp," and "FixUp," to name some of them. Lightning Word Wizard introduces you to the "nuts and bolts" of Turbo Lightning technology, and gives you more than 20 different calls to the Lightning engine. Minimum memory: 256K.

Turbo Pascal, the worldwide standard in high-speed compilers, and Family.

Turbo Database Toolbox®

A perfect complement to Turbo Pascal, because it contains a complete library of Pascal procedures that allows you to search and sort data and build powerful database applications. It comes with source code for a free sample database—right on disk. Minimum memory: 128K.

Turbo Editor Toolbox®

Recently released, we call our new Turbo Editor Toolbox a "construction set to write your own word processor." Source code is included, and we also include MicroStar, a full-blown text editor with pull-down menus and windowing. It interfaces directly with Turbo Lightning to let you spell-check your MicroStar files. Minimum memory: 192K.

Turbo GameWorks®

Turbo GameWorks is what you think it is: "Games" and "Works." Games you can play right away (like Chess, Bridge and Go-Moku), plus the Works—which is how computer games work. All the secrets and strategies of game theory are there for you to learn. You can play the games "as is" or modify them any which way you want. Source code is included to let you do that. Minimum memory: 192K.

Turbo Tutor® 2.0

The new Turbo Tutor can take you from "What's a computer?" through complex data structures, assembly languages, trees, tips on writing long programs in Turbo Pascal, and a high level of expertise. Source code for everything is included. New split screens allow you to put source text in the bottom half of the screen and run the examples in the top half. There are quizzes that ask you, show you, tell you, teach you. Minimum memory: 192K.

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Includes a library of graphics routines for Turbo Pascal programs. Lets even beginning programmers create high-resolution graphics with an IBM,® Hercules,™ or compatible graphics adapter. Our Turbo Graphix Toolbox includes all the tools you'll ever need for complex business graphics, easy windowing, and storing screen images to memory. It comes complete with source code, ready to compile. Minimum memory: 192K.

Introducing Turbo Basic, the high-speed BASIC you'd expect from Borland !

Turbo Basic is the BASIC compiler you've been waiting for. And it's so fast that you'll never have to wait again.
Turbo Basic is a complete development environment; it includes an amazingly fast compiler, an interactive editor, and a trace debugging system. Because Turbo Basic is compatible with BASICA, chances are that you already know how to use Turbo Basic.

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With Turbo Basic your only speed is « Full Speed Ahead »!

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> « Borland has created the most powerful version of BASIC ever... Turbo Basic compiles faster than anything I have seen. What's more, the programs it creates execute faster than those produced by other compilers
> ***Ethan Winer, PC Magazine***
> Borland's Turbo Basic has advantage over the Microsoft product, including support of the high speed 8087 math chip.
> ***John C. Dvorak*** »

Turbo Basic ends the basic confusion

There's now one standard: Turbo Basic. It's fast, BASICA-compatible, and because Turbo Basic is a Borland product, the price is right, the quality is there, and the power is at your fingertips. You see, Turbo Basic's part of the fast-growing Borland family of programming languages — we call it the "Turbo Family". Hundreds of thousands of users are already using Borland's languages, so you can't go wrong. So join a whole new generation of smart IBM PC users — get your copy of Turbo Basic today. You get an easy-to-read 300+page manual, two discs, a free MicroCalc spreadsheet and Nanostar editor, and an instant start in the fast new world of Turbo Basic. All of this for only £ 69.95... Order your copy of Turbo Basic today!

Free spreadsheet and editor included, complete with source code!

Yes, we've included Nanocalc, our sample spreadsheet and Nanostar, our sample editor, complete with source code, so that you can get started right away with a "real program". You can compile and run it "as is," or modify it.

A technical look at Turbo Basic

- ☑ Full recursion supported
- ☑ Standard IEEE floating-point format
- ☑ Floating-point support, with full 8087 (math co-processor) integration. Software emulation if no 8087 present
- ☑ Program size limited only by available memory (no 64K limitation)
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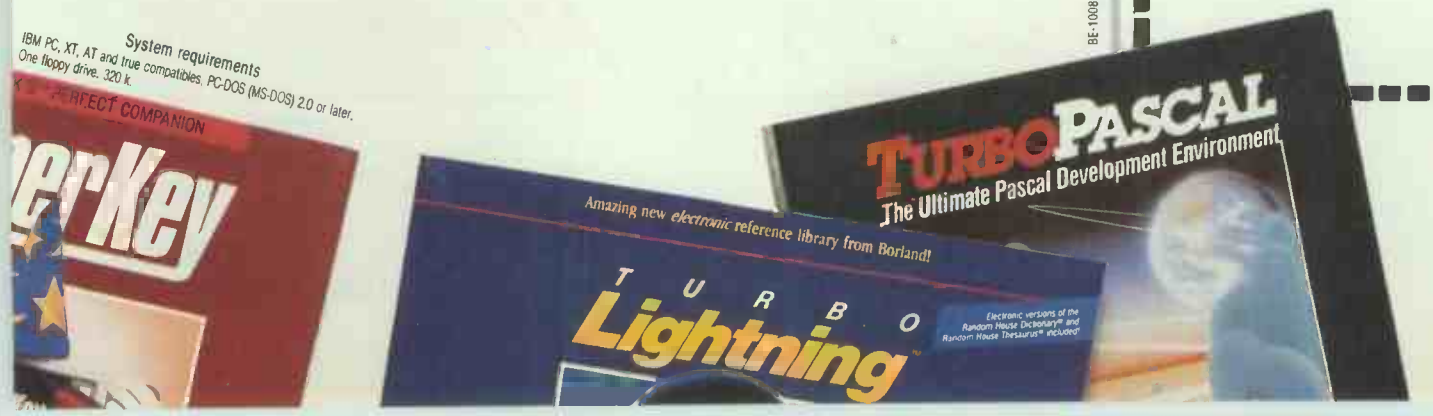

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PCW that PC-SIG has never claimed copyright of the programs in its library, only of the 10,000 strong catalogue itself.

To its credit, PC-SIG does more than just catalogue programs and stick them on disks. According to Petersen, PC-SIG's own programmers clean up programs and often modify their user interfaces. In addition, PC-SIG uses very sophisticated duplicating equipment which gives it a one per cent failure rate on its disks.

This work is reflected in the cost of the disks. But the price of PC-SIG disks has fallen: ISD, PC-SIG's UK distributor, now charges £6 per disk, a drop from the previous £10. And when manufacturing for Europe moves to Ireland prices are likely to fall further.

The move into Europe should be good news for UK software authors wanting to distribute their programs. Petersen quotes the case of New York Software, which was making $2000 per month selling through normal retail channels. Through PC-SIG it now rakes in $20,000 per month.

And as a footnote, Petersen showed *PCW* the CD-ROM version of the PC-SIG library. 10,000 programs on one disk for $295. An annual subscription of $495 gets you a revised disk every quarter.

ISD is on (0734) 585923. PC-SIG in California is on (408) 730 9291.

Derek Cohen

Sinclair's pig in a poke

The Advertising Standards Authority has complained about Sinclair's latest advertising campaign.

If I were to complain about Sir Clive Sinclair's latest advertising campaign, I would produce a list of statements to which I object.

It would include: the suggestion that Eprom is usable for permanent storage (it is, but only if you can create your own Eproms); the implication that the 'revolutionary' super-twist LCD screen is somehow a breakthrough by Sinclair's own design team; the suggestion that the built-in software has database capabilities; and of course, the inevitable advertising man's gloss over the shortcomings of the machine.

The Advertising Standards Authority, however, has received (when we went to press) one complaint.

This, as far as I can find out, is from somebody who reckons that it is impossible to attach three megabytes of RAM to a Z80. For the record, the Z80 will directly address only 64k of RAM. But it is trivially simple to run a little program to switch off the first 64k 'page' and switch on another — and another, and another, up to three megabytes. So the complainant was unjustified.

This didn't bother the ASA, however, which jumped heavily on Sinclair's Cambridge Computer Ltd, on the grounds that it was a mail-order ad, and didn't offer delivery within 28 days.

The ASA is actually a club designed to protect unscrupulous ad-men from control by politicians. Its main aim, then, is to create the appearance of a well-regulated advertising industry, in which everything is legal, decent, honest and truthful.

You can say what you like about the ethics of offering a product for sale when it isn't complete, and you won't get much disagreement from me, however harsh you are. I think it's shortsighted, at best. At worst, it allows people to advertise non-existent products, collect the money, and run.

But the Sinclair ad is pretty honest about that. It says: 'Your order will be acknowledged, with information on the likely despatch date.' And as Sir Clive put it: 'Until I know how many orders I'm getting, how can I predict delivery dates?'

The rule about buying computer hardware is: wait until you can see one, try one out, and be sure it works and you like the way it works, before you part with money. Don't be a pioneer — leave that to journalists, who acquire the hardware on exceptional terms (free).

For those determined to buy a pig in a poke, and determined to pay good money for an early place in the queue for the pig, the ASA's insistance on 28-day delivery clauses is irrelevant.

And of course, the ASA can't start picking holes in Sinclair's ad for failing to make it clear that 'talks and listens to your IBM' is a feature which costs extra, or for not warning users that

There are people who want a portable computer that is lighter than 10 pounds, and people who want a portable computer that will take IBM expansion cards. Those are the only ones who won't be interested in the new MultiSpeed machine from NEC.

First, it's fast. The chip inside is two steps up on the standard 8088 used in the original PC. It's the 16-bit bus version, which from Intel would be the 8086 and it uses the NEC version, the V30, which is considerably faster in its on-chip operations. On top of that, the clock speed is 9.54MHz, exactly twice the PC's 4.77MHz.

Taken all together, NEC can claim that it runs nearly five times faster than the standard machine, so it is around AT speed.

Next, the display is good. It's not as good as the Zenith 181— nothing is — but as standard supertwist LCDs go, it's pretty clear. And it can be replaced, at the office, with a standard colour monitor.

The keyboard is standard PC layout, the only difference being the positions of the cursor pad above the qwerty keys, rather than on the right of them. Bitter experience has taught me that portables with some of the qwerty keys doubling as numeric keys are just not right, and just don't run a lot of software correctly.

Price, at £1600, is not the cheapest in the UK, but is substantially below Zenith's 181, and below the Goupil Club and the new Olivetti M15. It's faster than all three.

Finally, NEC has come up with a dream of a scheme for getting data on and off those 3½in diskettes. You plug the MultiSpeed into your standard PC, as an external disk drive. The PC then uses the MultiSpeed's diskettes as if they were its own.

And it has a handle.

To compete, Zenith is shortly going to release a Mk II of the 181, with a built-in 10 or 20Mbyte hard disk. This one, available in May, will probably cost closer to £2200, and will have a handle.

Zenith's 171 is the cheapest PC battery portable on the market. That's the old Morrow Pivot, and is now under £1000 in its minimum state (one diskette).

Funny, isn't it: all these portables and transportables, and yet Compaq remains the only supplier of a proper PC XT with expansion slots, and a carrying handle.

And Sinclair's Z88 will be the only one under £200. Now, if only somebody could interface the Cambridge Z88 to Chuck Peddle's new Data Pacs . . .

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the supertwist display isn't back-lit.

Well, of course it can't. If it did, it would then have to pick off Kelloggs, for failing to note that corn flakes contain significantly below the standard balance of fibre for a cereal product and that the added vitamins are not supplied in the form that corn normally contains them, and that no research has been done into the long-term effects of such additives. Or it would have to expose Ford for advertising a special model of Escort with a host of luxury features, without observing that most Escorts don't have them.

Back to the Z88 portable computer: if you ordered one a month ago, with the expectation of getting it today, you will be disappointed unless sales are very, very poor.

Sinclair is producing them with the software (not completed at press time) in Eprom form. There is no way of mass-producing ready-programmed Eprom chips. The data has to be loaded into each one, electrically.

That means there is no chance of seeing 10,000 ready-built machines sitting on a production line, just waiting for a batch of 10,000 program chips to plug in.

On the other hand, the first few machines will be available very quickly — virtually the same day that Sinclair himself has a working sample. After that, things will depend on how many people are waiting, and how many bugs the first users discover.

When Cambridge Computer does switch to ordinary Proms, pre-programmed on the mask, be sure I'll let you know.

RAMming home the point

Well, OK, this month's little anecdote about Gem: I installed the RAM disk on my Gem Desktop on the PC 1512. There is a program to set it up, called NVR — non-volatile RAM — and then you tell Gem that you have it, and tell it to save this new drive to the standard Desktop.

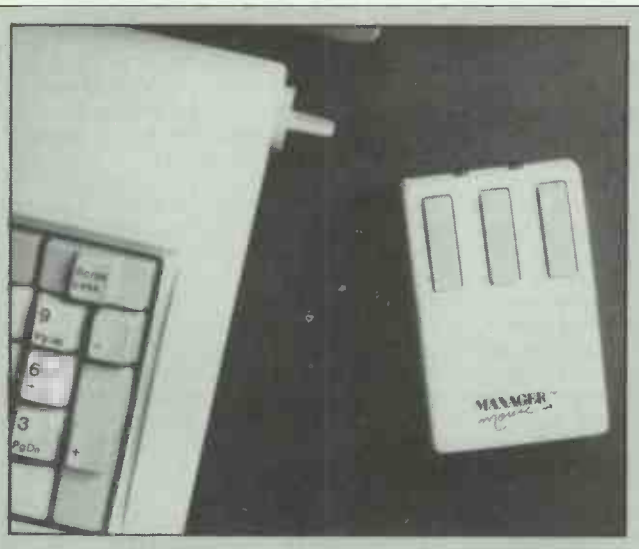
Next time I ran Gem, guess what? No RAM disk. I installed it again as drive D: and got a little message from Gem: 'Your path name is too long!'

What happened? Well, as part of the automation of the process of running your PC, Amstrad has decided that if you are running Gem, you won't want to lose valuable memory to RAM disks, and so the Gem start-up process automatically zaps any RAM disk you have set up.

So drive d: doesn't exist. So the Gem process of installing it decides that d: must be one parameter too many in the command it is creating for DOS. So it gives you that strange message.

Funny, I'm almost sure I remember Digital Research telling me I was being crudely malicious, for suggesting that Gem placed heavy demands on memory. I wonder why Amstrad thought it necessary to claw back memory from RAM disk?

And what chance for those Amstrad users who want to run Gem XM, which relies on a RAM disk for its program swapping?



I must admit to being sceptical when I first saw this cordless mouse from Torrington. My desk is pretty cluttered at the best of times and I doubted whether the infra-red beam would see its way through the assortment of disks, coffee cups and unread copy that sits between me and my Victor 286 computer.

But I was wrong. The sensor, which I have sitting on top of the system box, has a surprisingly large angle of view and even reads the mouse signals when they are reflected off neighbouring surfaces.

The main advantage I can see is that there isn't a cable to get tangled up with things on the desk. And I can sit well back and operate the computer from a distance. But as a colleague remarked, the mouse operates further away from the computer than I can read the screen.

Range is a claimed eight feet. The mouse itself contains a NiCad battery, which is rechargeable with a cable that draws power from the sensor and gives a full-day's charge in eight hours.

Price is £175 plus VAT and supplier is Xitan on (0703) 871211.

Picking Apples

When Apricot first got into desktop publishing, it was immediately clear that it wasn't totally happy with the laser printer it had found — the Kyocera model.

What Apricot wanted was a printer that understood the graphics language Post-Script, from Adobe.

Unfortunately, the best-selling PostScript printer is the Apple Laserwriter, sold as part of the best-selling Macintosh desktop publishing system, with Page-Maker.

Apricot has now bitten the bullet: it is buying Laserwriter printers from Apple, and reselling them for £5645 plus VAT.

This means that a complete PostScript system, including a Xen micro (80286-based) costs £8999 plus VAT.

Legal eagles swoop on Falcon

Several suppliers of low-cost clones have complained, in the past, of Microsoft's refusal to part with MS-DOS licences at similar low cost.

Some of these have found a way around the problem, and have supplied Falcon MS-DOS, which is supposedly a re-write by an American firm.

Microsoft has now jumped on this operating system, describing it as a simple copy of its own disks, and actually winning an injunction (in America) prohibiting the distribution of Falcon.

In the UK, suppliers of Falcon MS-DOS are bewildered, and are hiding from the world while they try to establish the full facts, before receiving a similar legal action from Microsoft UK.

Mark Plant, marketing manager in the UK, tells me he's pretty sure that people supplying the product 'know perfectly well it's a copy', and says that when he knows who is supplying them, he'll jump on the people concerned.

One's sympathy does go to Microsoft in this; but it would get more understanding if it would agree to supply MS-DOS to end-users.

In fact, the only way to get MS-DOS is to buy it from a manufacturer — somebody like IBM.

Microsoft does provide a 'packaged MS-DOS' which includes GW Basic — this is worth having, I might add — but only to manufacturers.

Microsoft's suggestion is that 'you go back to the person who sold you the software and demand a legal copy of MS-DOS.'

But the problem then is that a manufacturer who supplies Falcon MS-DOS and is in dispute with Microsoft over this, is unlikely to be able to buy packaged MS-DOS until the dispute is resolved.

Plant says he 'will consider' supplying the packaged system to people in difficulty, with the two products probably priced somewhat under £100 retail, if he has to do this.

Word scanning

Word searching is starting to become an obsession with today's hard disk users, and products are appearing from all quarters — with Lotus and Proximity under focus this month.

Proximity specialises in linguistic software and hardware — and at Hanover Fair, announced a package called Friendly Finder. It's designed to do the things that dBaseIII can't do with dBase files — that is, find information in it when you aren't sure what the information actually is.

To make the product really sing, you need a Proximity board, which analyses text off disk files at a fearsome rate. But it works without it, and although friendly isn't quite the word, it is amazing.

The demo I saw allowed you to set up an enquiry into a large database which didn't include Tip O'Neill, Speaker of the American Congress, but did include T ONeil, Jr. It found a request for Tip, however — it excels at fuzzy-matching problems like that.

Lotus has obviously spotted a similar problem for people using large hard disks, because it is taking over a software company, Computer Access Corporation, which specialiss in text search.

Bluefish is the product Lotus is buying. It can find any phrase within seconds from six years' worth of a well-known computer magazine on 18 megabytes of CD-ROM.

Watch this trend — there's a long way to go, and many people to get into the market, yet.

Making an impression

The much admired Megahaus desktop publishing package, First Impression, is now a sister product to Open Access, the integrated software system.

Publisher SPI has bought the company.

I saw a demo of First Impression at Hanover Fair. Its two most startling features were: first, it looked exactly like an Apple Macintosh; and second, it barely worked.

The problem has been that people keep changing the design spec, to the point where it now risks being dangerously late. Critics who have played with it have praised it — one described it as 'the only true WYSIWYG' desktop publisher, and singled it out for its excellent abilities to revise long documents on the page.

To me, it looks like an invitation for a lawsuit from Apple. It even uses Apple's 'Chicago' typeface for the pull-down menu bar — but SPI executives say they don't expect litigation, because they aren't competing with Apple.

Surprisingly, the windows and mouse operations are entirely proprietary, using neither GEM nor Windows environments.

Megahaus executive Keith Swenson said that one consideration delaying the launch was how to cope with font generation for new machines. 'We will probably use Gem as our graphics interface for new machines,' he said, 'but the decision has still to be finalised. The other option is to write new screen drivers for each machine.'

Price of the program is projected between £700 and £800, but it will only appear in beta-test versions in July, and might not hit the open market this year.

A-B-C in the Deli

Robin Bradbeer has closed down his robot-building company 'because of the teachers' dispute' and transferred his talents to a company called Digital Delicatessen, supplying (mainly) diskettes.

He's also sent me a piece of software from Robin Bradbeer Associates Limited, sold through Digital Delicatessen.

Alas! I haven't had the time to run it. It is called A-B-C, and claims to do everything.

Everything, according to Bradbeer, is write letters, produce estimates or quotations, calculate invoices, send out statements, add up petty cash, complete VAT 'and that's just the tip of the iceberg.'

That's to say, it offers simple text editing and a card-index database (with report generator and label printing) with capacity measured as: 50 fields, two screens, 30,000 records per file. It does a simple calc-sheet, a 26 by 60 cell spreadsheet. And it does bookkeeping.

When I find a small business with 300 customers, 100 suppliers, 200 analysis headings and 50 invoices per week, I will get them to test it on the Amstrad which Robin recommends.

At £150 plus VAT, it's not the sort of purchase you make on impulse. But Bradbeer says that the price includes three months' hot-line support, and the user club (including hotline support after those three months) costs £50 to join.

Give Digital Deli a call, on (01) 359 2536, and discuss it before buying.

Choice of CP/M on IBMs

The correct way to run 8-bit CP/M programs on an IBM family machine is to buy the NEC chip which runs both 8088 and 8080 instructions — the V20. Acceler-8, a piece of

VNU Publications, ATTN: Guy Kewney, Editor

PAGEmaster Sampler

Volume 1 Number 1. Las Vegas Comdex Special November, 1986

VNU Publications
Guy Kewney, Editor
PC Dealer Magazine

Here's a sample of output from our Mega-FAX & PAGEmaster systems. As you can see, the quality is significantly better than standard FAX output and still completely compatible with the Group III standard. Both systems are available and shipping now. Regards!
Bill Ferguson

PAGEmaster now in four flavors

Desktop publishing systems now come in four different configurations from Advanced Vision Research, Inc. with prices ranging from $990 for a startup system all the way up to $10,995 for the top of the line. By offering such a wide range of systems, the end user is offered a choice of what best meets his own particular requirements.

PAGEmaster Junior includes the basic software called MegaScan and the Mega-buffer, a 1.3 megabyte dual port memory card. The extensive image manipulation capabilities, along with the ability to set type either from the keyboard onto the page being displayed on the screen or input text from almost any word processor make page makeup very easy.

PAGEmaster I adds an image scanner which can scan a page in just 9 seconds at 300 dots per inch. The scanner reads text, line art, halftone pictures and photographs.

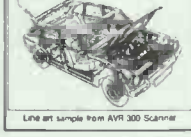
PAGEmaster II adds a laser printer which prints text and graphics at 300 dots per inch. The AVR-LPC can print a complete letter sized page and have the copy in the customers hand in only 18 seconds.

PAGEmaster III includes a high resolution WY700 monitor, a mouse and a PC/AT compatible computer with a 30 megabyte hard disk drive, a 1.2 mb

MegaRead OCR adds versatility to PAGEmaster

Optical Character Reading on the AVR PAGEmaster system offers users the option of using a software based program which converts images into ASCII codes. This gives the user the ability to scan typewriter/printer characters, update or change the copy on a word processor & to set the characters in a type font of the users choice - all on the same system.

AVR, by using the host computer for processing, ensures it's users of being able to take full advantage of the higher speed available in the newer computer systems.



Line art sample from AVR 300 Scanner

MegaFAX shown at COMDEX Fall

P.C. image transmission is now being shown at Las Vegas '86 COMDEX.

Telepublishing' on the AVR system PAGEmaster uses MegaFAX software along with the Gamma-Link Modem & utility software. Enthusiasm has been high for the ability to edit the image prior to sending or after receiving on FAX or on normal phone lines. Even halftone photographs can now be sent at a baud rate of 9600.

384 New Fonts now available from AVR

Eight full families of type were released at Fall COMDEX for use on all PAGEmaster systems. Each of the type families comes with a medium, italic, bold and bold italic. Each type face has fonts in 6, 7, 8, 9, 10, 11, 12, 14, 18, 24 & 30 point sizes. The families are similar to Avant Garde, Bookman, Century Schoolbook, Courier, Helvetica, Helvetica Condensed, Palatino & Times Roman. All AVR fonts are compatible with the H. P. LaserJet downloadable format.

Halftone sample from AVR 300 Scanner.

This page was created using the PAGEmaster system from Advanced Vision Research, Inc.

The above page, created by Pagemaster from Advanced Vision, arrived from California via facsimile. Apart from the fax machine's habit of dropping odd lines, you would never guess it came off a fax.

The trick is done with about £2500 to £3000-worth of scanning, modem and plug-in IBM card hardware, plus software. The advantage is not just that you can do very much better faxes, but that you can actually edit them.

Key to the system is the scanner, and that is what Advanced Vision mainly sells. Its personnel are ex-Dest, who set up on their own.

The equipment is now available through Christie in the UK, which recommends that you use it with Ventura Publisher, for desktop publishing.

What really looks promising, however, is the option (it costs) of actually getting the computer to read the text it scans, and create ASCII files. This gives the user the chance to update a scanned page, change the copy, and reset characters in a different font.

Christie can be contacted on (045 382) 3611.

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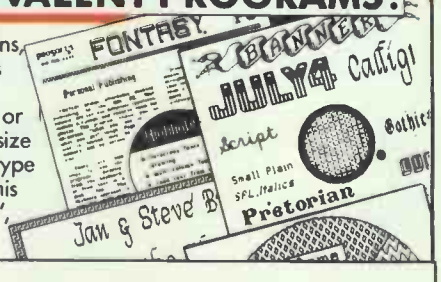

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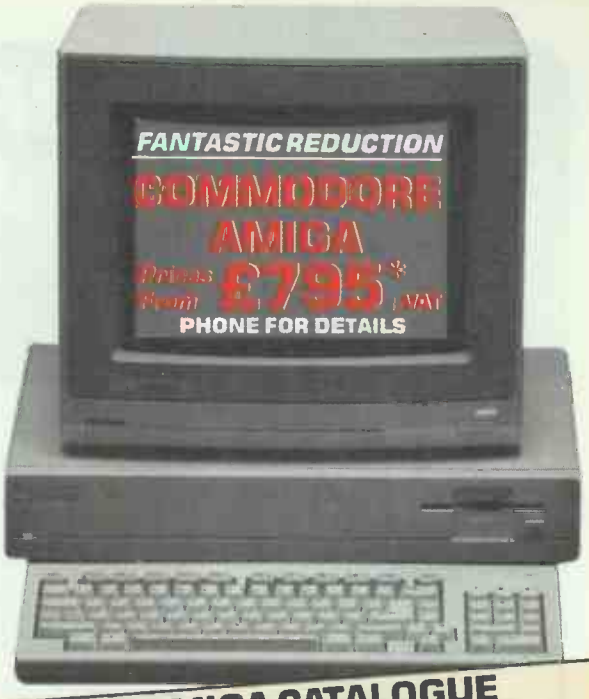

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You can type your programs in just like any interpreter, but when you type RUN your program is converted to fast, compact machine code. You can also compile from disc to disc and produce completely stand-alone programs.

ZBASIC includes graphics commands on most versions, and comes with an extensive 600 page manual.

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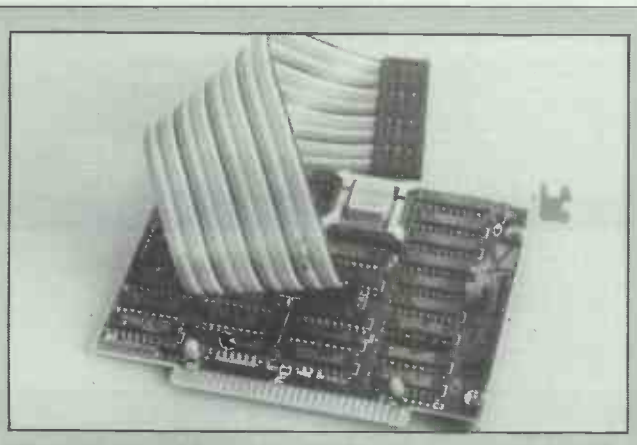
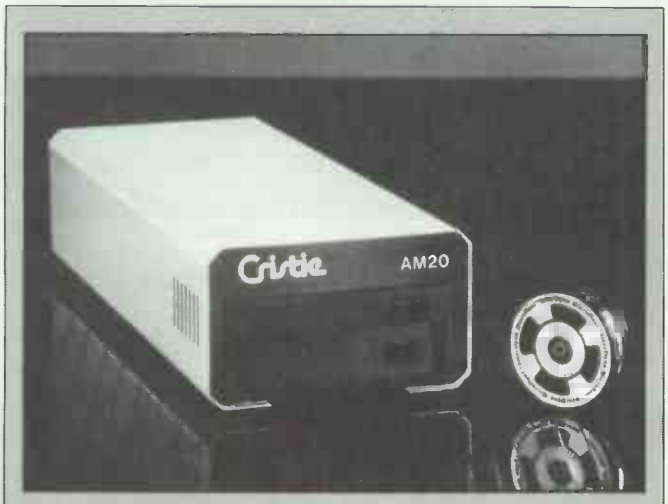


This card contains an Intel 80286 chip — though it isn't visible in the picture — and it is designed to speed up ordinary PCs. The cable plugs into the 8088 chip socket on your standard machine, and BFI Electronics claims it will then run faster than an AT.

Just don't imagine it turns your machine into an AT. It will still have PC or XT disk handling routines, 8-bit system bus, and PC BIOS. At £500 plus VAT recommended retail price, it's probably worth considering, however, if you just want a faster PC.

Phone BFI on (01) 941 4066.



For those who don't want to buy a Tandon Data Pac because they already have a computer, here's the alternative method of backing up hard disks: tape.

For £400, you get a 10Mbyte tape drive, for £500, a 20Mbyte drive. Why, you ask, can't you just put a longer tape in the 10Mbyte unit?

Good question: ask Christie, builder and supplier of the AM10 and AM20, on (045 382) 3611.

software, will run 8080 code on the IBM.

An alternative is an emulation package from Vertex Systems, called 80Mate. This costs £139 plus VAT.

People who have used this as a way of emulating an 8-bit machine say it works, and it is now available through MGA micro-systems, on (05806) 4278.

But the Acceler-8 system is faster, doing it all in hardware. That is now available with a new version of Menu Master, which allows PCs to read and write a vast number of 'foreign' disk formats, from Control-Alt-Deli on (0908) 662759.

Online offline

PCW Online, our telecommunications service for *PCW* readers, has gone offline permanently. The facilities we had hoped to make available couldn't be provided at a reasonable cost to the user. All subscribers have been informed and offered the opportunity to subscribe to MicroLink instead.

PCW is still committed to the idea of an online service and to supporting telecommunications in general. However, our priority must be that we and the readers are in control of such a service and that the price will be affordable. We will keep you informed.

Nit picking

For £4, Microsoft Press will supply you with a quick guide to MS-DOS commands. The little booklet contains a summary of what you will find in most DOS manuals, and is aimed at people who are new to the business.

At the price, it would seem silly to pick nits out of it, but I have to say I'm not altogether struck.

Not all the information is precisely accurate, for a start. Quite a few commands are described as being available 'only in PC-DOS' when in fact several (most) MS-DOS licensees seem to have acquired them — DISKCOMP, which compares two disks, for example.

And I do have my doubts about whether beginners will really find it that much more helpful — apart from the size and weight of this 45-page pamphlet — than the manual.

For example, what would you, as a beginner, make of:

path
[[drive:][path][[;[drive:][path]
. . .]]

if you met it on a dark night after a File Not Found? Apart from a sense that you had seen too many left brackets?

You need a clear, concise and correct explanation. And the explanation given is: 'Tells DOS to look for a command file in the specified drive and directory,' which is not quite right.

What it actually does is tell DOS which sub-directories to look in, next time you specify a file. Any file, that is, not just a command file (a program is a command file).

Microsoft does excellent books (published in the UK through Penguin) but this, I'm afraid, isn't one of them.

Tatung manual in dispute

Touted by many as a rival to the 8-bit Amstrad range, the Tatung Einstein models have come under a legal cloud, losing their licences for a programming language (Dr Logo) and an operating system (CP/M 2.2) in a dispute with Digital Research.

Tatung actually uses a CP/M lookalike, Xtal Dos, as its main operating system. However, the company decided that it needs to have the credibility of CP/M as well, and did a deal which permitted it to give away both products — Dr Logo and CP/M — with the Einstein.

What the deal didn't cover, however, was the Digital Research manual. Staff at DR say that such a deal is available to Tatung, but that the actual deal is different, and requires Tatung to write its own manual.

The breakdown of diplomatic relations came after Tatung produced its own manual. It turns out, say Digital Research officials, to be a simple rip-off of the original manual, and Digital Research has started proceedings for infringement of copyright.

Akhter and education

Akhter reckons it will get a lot of orders from education buyers for a £500 PC with single floppy, 256k high resolution monochrome screen, and all the usual necessary input and output slots. It also describes the machine as a 'challenge to Amstrad'.

Amstrad sales are now slowing down, as Alan Sugar predicted they would after the first boom, and he is advertising frequently and expensively on television, as he said he would when that happened. That will probably cause new sales.

If Akhter can anticipate spending money on that scale (over £10m a year) it can talk seriously about a challenge to Amstrad.

For the rest of us, however, who want a cheap PC but don't want to live with the Amstrad's restriction on video, the Akhter PC is worth considering. But it won't run as fast as the Amstrad, and it doesn't have a mouse and Gem. END

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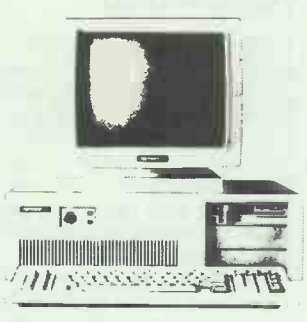

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THE WEST COAST CONNECTION

A hardware giant IBM may certainly be, but Microsoft continues to be the company at the heart of its software. All the latest news and gossip from our West Coast correspondent Tim Bajarin.

A new DOS from IBM and Microsoft

When IBM was looking into developing a personal computer in late 1979, it knew it could provide the hardware, but lacked the necessary experience to write microcomputer software. Microsoft won the contract to supply a personal computer operating system for IBM's PC, and MS-DOS became the operating system all IBM PCs and compatibles use today.

There are over nine million of these PCs around the world today, and over 70 per cent have the original Intel 8088 processors at the heart of the system. The original versions of Microsoft's operating system were designed specifically for this chip.

Intel has given us the 80286 and recently, the 80386 microprocessor, and, in late 1987 will deliver prototypes of its 80486 design. But while the engineers were making the chips more powerful, the operating system stayed basically the same.

Microsoft has been rewriting the operating system to begin to take advantage of the new chips' power but is very late considering these have been on the market for almost two years.

These two new chips from Intel have areas called protected modes that allow the PC to address memory beyond 640k RAM.

It is in this protected mode that the power of these new chips resides.

Once you can get into this protected mode and unleash its capabilities, you can do true multi-tasking (running many programs on the screen and in the computer at the same time) like existing large computers. This protected mode on the 80286 allows efficient management of available memory, dynamic allocation of memory requested by an application, and swapping memory segments between RAM and the disk. The 80386 protected mode has the same capabilities plus support for a larger physical memory, up to 16Mbytes RAM and up to 1 gigabyte of address space.

IBM and Microsoft are working together to provide a new DOS that works with the old DOS, as well as the new chips. It will take a very sophisticated software program.

The key technology that will drive this new operating system is in Microsoft's Application Program Interface.

This is a sort of bridge program that protects the integrity of programs written under the old DOS, and still gives them access to the protected mode of these chips. By summer, Microsoft is supposed to ship new DOS toolkits to developers so that they can begin adapting existing software programs for the new chips.

But, since many believe that IBM is developing a new computer controlled by its own proprietary chips, and wants to make the new system impossible or very difficult to clone, could IBM use this new DOS to prevent others from copying its new PC?

Engineers and developers close to IBM believe that IBM is planning to release by the end of this year, a proprietary PC. At the heart of its computer is something known as a 'PC on a chip'. They expect IBM to take a slab of silicon, and put an 80286 or an 80386 chip at the centre, attaching a graphics chip, video controller chip and maybe even a sound chip to this piece of silicon.

It would be designed in such a way that it could be both patented and copyrighted.

IBM would then go to Microsoft and use the Application Program Interface to access programs under the old DOS, but write its own version of the new DOS to tie it directly to this proprietary chip design.

The Application Program Interface is a subset of Microsoft's Windows, so these new machines will definitely have the look and feel of today's Macintosh with its icons and mouse.

The 8086 and 80286-based computers IBM introduced in April give us but a glimpse of what is possible.

The new EGA chips look good, but are probably nothing compared to the graphics IBM could give us in its proprietary designs. The QuickDraw-like approach to graphics is a forerunner of the type of graphics and chip integration that IBM will expand upon soon.

Watching for Steve Jobs' NExT move

Now that Apple has released its colour workstation computer, the Mac II, industry observers are straining their ears to pick up information about Steve Jobs and his NExT computer. When Jobs left Apple, he took with him one of the engineers who was in charge of developing the Mac II.

In fact, the hiring of this individual caused Jobs to be fired and eventually Apple sued him to keep him from competing with it in the future.

Although they have settled this suit out of court and Jobs has guaranteed not to compete directly with Apple for two years, many are watching closely the development of his computer, which he aims to sell at the high end of the education market.

The Mac II: competition in the education market?

What makes it even more interesting is that Apple's new Mac II is also an excellent machine for this market.

Speculation is running high that his machine will have better graphics, more power and, since he knows the Mac and its operating system, some even think he has found a way to get his machine to run Mac programs, without violating Apple's ROM copyrights.

Sources close to Jobs believe that he will use the Motorola 68020 as the main processor, but also say he will use the Inmos Transputer chip, as well as its 'paintbox chip' to handle the multi-tasking and extra graphics features he demands.

Sources claim the machine is to be announced in September and shipping is to begin early in 1988.

Getting a head start with technology

I bought a Texas Instruments 99/4A computer for my son when he was only three, and he learned his numbers and ABC on this machine before he even went to school.

He is nine now, and although he has classes on computing at his elementary school, he works as a 'computer tutor' helping other kids learn to use PCs. I know that this sounds like a proud father boasting about his son, and he did have an advantage since I have nine computers at home he can use if he wishes, but this example really underscores the fact that children can and do use computers even at early ages.

To help the kids in your life get a head start, take a good look at a package from Broderbund called Welcome Aboard. This is an exceptional learning tool that uses the Muppets to teach children all about computer literacy.

Captain Kermit the Frog teaches you about steering the ship. He does this by showing you the ship's navigation system. He teaches the child how to program the computer's steering mechanism by teaching them Slowgo, a programming language similar to Logo.

Fozzie Bear teaches them about databases by helping them develop a joke library.

In Miss Piggy's Salon de Beauté, they learn the basics of paint and draw programs with computer-aided design in mind.

Scooter is in charge of the communications room. He walks them through the principles of word processing and electronic mail.

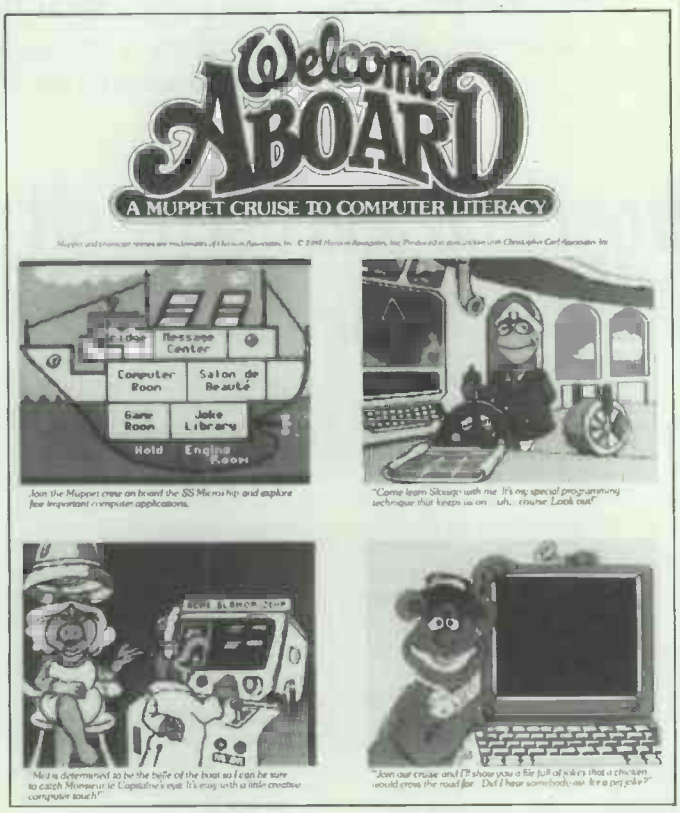
The program comes with a *Muppet Guide* to computerese that helps them understand all the terms related to computing.

It is one of the most creative educational packages I have run across. A version is just about to be released for the Apple IIGS and it is already available for the Commodore 64 and original Apple II series. This program should be shipped with each home computer.

A new colouring book from Electronic Arts teaches users about modern technology while painting electronic images. This is a simple, colour-by-number system that contains prepared images representing various scientific categories such as the body, the universe, lasers, computers, genetics, interstellar communication, and more.

As these images are coloured, either with the user's personal choice of colour or with guidelines from the computer, visual changes will occur to help the user understand and learn more about the technological topic being portrayed.

Available for the Atari and Amiga computers for around $19.95 it is a great gift for families who have students especially interested in science.



Cruising through computing with Kermit and friends

Extras

● Since Apple Computer is sitting on over $500 million in cash, rumours continue to abound that it is on the prowl either to acquire, or invest in, strategic companies that can further the Apple cause.

Alleged targets for takeover include Sun Microsystems (manufacturer of workstations), Adobe (the Postscript folks), and 3 Com Corporation (LANs). It has a sizeable amount of cash designated for venture capital investment as well, and insiders claim that Apple will announce its first such investments during the next few months.

● Ann Arbor Softworks, Inc (2393 Teller Rd. Ste 106, Newbury Park, CA 91320 tel (805) 375-1467) has debuted FullWrite, an advanced third generation word processor for the Mac. FullWrite combines power word processing and desktop publishing, in a full WYSIWYG environment.

Its special feature is a built-in MacDraw-like program that allows you to stop midstream in the document, pull out a palette and draw a graph, chart or design, and drop it directly into the area you are working on.

The program's features include: footnotes, end notes, table of contents and index generation, spelling checking, hyphenation, outlining, style sheets, multiple documents, and a browser. It is scheduled for release very soon.

Affordable slides from the Macintosh

Now that desktop publishing and laser printers are finding their way into all types of offices, and this type of system is used heavily for developing presentations, we are about to see a new market called desktop slide-making appear.

The DTP systems are good for giving us the hard copy and overhead transparencies, but a computer, with the right device, is a great way to turn this work into good colour slide presentations.

Most slides made today, although they are computer generated, are produced through professional service bureaux. These bureaux use products like a Genagraphics system to give multiple colour, shading and 8000-line resolution to 35mm slides.

A Genagraphics slide machine costs about $60,000. Unless a company does slides all day long, it very seldom brings this quality of machine in-house. That is until now. A new device called the ImageMaker, by Presentation Graphics, is a cost-effective way to produce high quality slides through a PC at your desktop. Priced at $4995, it allows for multiple colours, shading and 8000-line resolution.

Other devices in this price range use a technology that takes a picture from a CRT, and normally in three stages, allowing for shots of red, green and blue. But the ImageMaker has found a way to get the 35mm shot directly through a beam, thus allowing it to have this incredible resolution.

Although it is much, much slower than a Genagraphics professional system, at $4995 it is a great buy if you produce many slides for business presentations. Available just for the PC till now, Presentation Technologies has just announced a version that works with the Mac SE and the Mac II.

You can expect others to jump on this slide-making bandwagon and someday, perhaps, all the slides we see in business presentations will come directly from a desktop computer. END

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At £199.95+VAT, the Z88 is supplied with 32K resident RAM. Extra 32K costs under £20 – extra 128K under £50!

And heavy users will be able to expand the RAM to an astonishing 3 Mbytes, using plug-in RAM cartridges.

For printing text or data, the Z88 connects directly to most popular RS232-compatible printers, while for permanent storage the Z88 employs removable solid-state EPROM cartridges – no tape to break, no delicate disc to damage.

Though the Z88 is a powerful, full-facility, self-contained computer, it also acts as an extension of an office micro, connecting directly to allow exchange of text or data.

For every personal computer user, the Z88 offers a comprehensive specification in a package of unparalleled portability.

Robust, solid-state software and storage cartridges.

☐ THE FACILITIES OF THE Z88

RAM Resident 32K, around 15K available (enough for around 2,000 words). Extra RAM available in 32K or 128K cartridges, up to three of which can be plugged into the Z88 to give a total of 416K (enough for a 200-page novel). 1 Mbyte cartridges available shortly. A built-in capacitor or the mains adapter preserves data in RAM while batteries are changed.

Permanent storage Where other machines rely on cassette recorders or disc drives, the Z88 uses solid-state EPROM – Erasable Programmable Read-Only Memory – cartridges, with very rapid electronic access and absolute reliability. Up to three EPROM cartridges can be plugged in: 32K and 128K cartridges and ultra-violet eraser are available now. 1 Mbyte cartridges available shortly.

RS232-compatible port offers:
Printing RS232 cable connects the Z88 to popular printers. Cables can also be made up for virtually any RS232-compatible printer.
Text- and data-interchange Resident software formats data for IBM-compatible micros with 5¼" or 3½" disc-drives. If your micro can run such popular programs as Wordstar, Lotus 1-2-3 or WordPerfect, you can exchange text and data between it and the Z88. Cable and software available now.
Modem allows text- and data-transmission by telephone.

Power supply Optional mains adapter, or 4 AA batteries. (CMOS technology allows about 20 hours active computing – or about a year of life for RAM if machine is switched off).

Dimensions 11½" x 8¼" x ⅞"; weight: under 2 lb.

Full QWERTY keyboard offers 'silent', moving short-travel keys. Foldaway foot raises the Z88 12½° for comfortable viewing and typing.

☐ ADVANCED INTEGRATED SOFTWARE PACKAGE

The operating system of the Z88 is unique to Cambridge Computer Ltd, supporting as its main in-built software an advanced software package, adapted by Protechnic Ltd for the Z88.

The Z88 automatically preserves data in RAM when switched off.

The software is a set of spreadsheet and word processing applications, with a sophisticated help function, designed from the first as an integrated package which allows text to be run within a spreadsheet, or a spreadsheet to be run within text.

Word-processing facilities include multi-column layout, global search and replace, and embedded calculations, as well as all the normal word-processing activities. The display shows such commands as bold, italics, underlining, and page breaks. Spreadsheet includes text-handling and sorting.

Other built-in software includes database selection; calculator; free-form diary, calendar, real-time clock and alarm.

An outstanding feature of the Z88 is its ability to switch between tasks within an application, and between applications, without the need to save, exit the package, or restart on return.

While computing a spreadsheet, for example, it is easy to switch directly to the diary, and then go straight back to the spreadsheet – which immediately carries on from the point it had reached.

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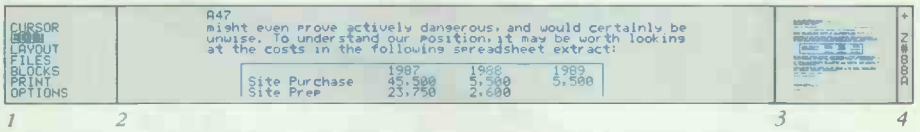

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☐ HOW TO ORDER

The Z88 is available only by mail order. The FREEPOST order form lists the components of the Z88 system currently available.

The Z88 comes supplied with 32K RAM built in, a comprehensive manual, sectionalised to suit both novices and computer experts, and a carrying case.

Please allow 28 days for delivery. If you are not happy with any item you receive, return it in original condition within 10 days of receipt for an immediate refund.

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If you would like more information on any aspect of the Z88 before placing your order, please call on the Z88 hot-line: Cambridge (0223) 323143. We shall be happy to answer any questions you may have.

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LETTERS

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Protext Protest

In the review of Protext by Diane Hamer in the March issue of *PCW*, Ms Hamer makes many references to our LocoScript word processor. Most of the review suggests that LocoScript is far easier to use than Protext, yet she concludes that LocoScript is like a typewriter compared with Protext.

She bases this seemingly contradictory conclusion on the lack of mailing facilities and a spelling checker. However, in the same issue you carry advertisements selling our products LocoMail and LocoSpell.

The most important point about LocoScript is that it is easy to use. Ms Hamer mentions the menus (for the new user), but fails to mention that for the experienced user LocoScript has shortcuts comparable in effect to Protext's stored commands, but rather easier to use. She goes on to praise Protext's visible rulers, condemning LocoScript for *not* showing rulers. But LocoScript *does* show rulers! The difference is that with LocoScript, if you don't like showing rulers on the screen, you can choose not to.

The rest of Ms Hamer's article is accurate, but rather selective. It is easy to pull out points from one product which don't exist in another, but perhaps unfair in what amounts to a comparative review. Why, for example, is there no mention of Protext's difficulty with actually printing anything out neatly formatted into pages?

Her main criticism of LocoScript is that it is slow on long documents. This is true, and is one of the reasons we shall soon have LocoScript 2 available. Other reasons for LocoScript 2 are to extend LocoScript to support printers other than the PCW's built-in printer and to allow a far wider range of characters (for example, Cyrillic) to be incorporated into documents.

Howard Fisher, director of marketing, Locomotive Software, Dorking

Testing times

Robert Schifreen's 24-pin printer review proved most interesting, especially about speed. He quotes the timings for printing a file but does not mention the file size, giving no indication of the printer's true speed.

Eric Bagshaw (of the Benchmark fame) has produced a set of timing tests for printers. These show that some of the manufacturers' claims for characters per second appear to be little more than fiction. A simpler test of a printer's full speed is to switch it on in test mode for, say, two minutes and then count the characters printed. For the Epson LX86 this gives 88 cps in draft and 16 cps NLQ (the same as produced by Bagshaw's tests). Since there seems to be no way of printing faster, these figures demonstrate that Epson is wrong when it quotes the printer as 120 cps (unless you know better!). Moreover, this test takes place under ideal conditions with no half-empty lines, and so on.

A more effective test is a standard letter. This gives the effective cps (draft) of the LX86 as 64, nearly half the quoted speed.

The moral seems to be that if you're buying a printer, run a test on the spot in front of the salesman. Then you can start haggling over price or finding one that really does give the cps you require.

SP Webber, Plymouth, Devon

Robert Schifreen replies: The size of the test file, as printed in the box with the results of the speed tests, was 73,500 bytes.

I agree that the times manufacturers quote are often misleading. It is not really surprising that methods of obtaining timings are adapted by different companies to put their particular model on the top of the table.

I deliberately wrote the review from the point of view of the average business user. All they want is a printer that will work with popular business software like Lotus and WordStar, and print the results fast and with little noise.

Such a user will be interested to know how long the average letter or spreadsheet takes, including any extra passes required to cope with IBM's special characters.

This is why I stand by my test file. It is long (73k), which makes timing easier. It also lets me test the printer's buffer in real conditions. It contains long and short lines, and lots of carriage returns.

As you rightly say, if you want to buy a printer, take to the shop a disk containing some work of the sort you normally produce and compare the results produced by different models.

Defending LocoScript

It seems unfortunately commonplace for LocoScript, the word processor thrown in free with the Amstrad PCW8256 and 8512, to be mildly rubbished by the computer press, with a special dig reserved for the manual. Diane Hamer, in her Screentest review of Protext (an'alternative' to LocoScript) in March's *PCW*, is no exception, and while not excessively unkind to LocoScript nevertheless does not accord it its proper due.

She starts with a general, rather sour, comment to the effect that LocoScript's dreamlike quality — whatever *that* is — soon tarnishes slightly for those used to more sophisticated software. Maybe — but most LocoScript users will be first-timers rather than sophisticates, and anyway I personally find LocoScript easier and nicer to use than WordStar, Word or Word Perfect, albeit more limited.

And yes, I admit that LocoScript is rather slow, particularly when scrolling through the file being edited, or prior to exiting. This is odd, for presumably Locomotive Software could correct it if it tried. After all, when selecting for printing only the last few pages of a long document, LocoScript (version 1.2) gets there pretty quickly!

Also on the debit side, LocoScript's Find and Find & Replace (the latter is called Exchange) rather surprisingly can't find control characters like the embedded Emphasis or Style commands (as, for example, those for italics on or off). Moreover, it doesn't count words, and you can't format a disk from within LocoScript itself.

On the other hand, it quite happily inserts one document into another (though the format of the inserted text takes on the characteristics of that text already there), and prints in the background while editing in the foreground.

Back on the minus side, LocoScript is always in 'insert' mode, with no 'overtype' facility at all, and it has no column mode that would allow text to be inserted alongside (or, contrarywise, deleted from alongside) some already there.

Perhaps the best feature of LocoScript is the superb way it caters both for the tyro and for the expert. At one extreme the function keys invoke pull-down menus, from which the inexperienced user can select the required item with the cursor and Enter keys while at the other almost all the layout, emphasis, style and line operations can be

LETTERS

switched on and off at touch-typing speed with the special '+' and '−' keys.

This adaptability is a real delight, but unfortunately is often ignored by the reviewer. Indeed, Diane herself seems to have fallen into this very trap (if trap it be) when she talks, erroneously, about the 'greatest difference' [between LocoScript and Protext] being the 'replacement of menus [in LocoScript] with a series of "stored commands" [in Protext] that are embedded in the text.' The truth is that, unlike Protext, LocoScript gives it to you both ways, to use at your choice.
John Hooper, Harlton, Cambridge

Amstrad has had great success with its PCW machines, drawing thousands of people away from typewriters to word processing. However, the fact that LocoScript comes with the PCW machines doesn't necessarily mean that it is the best word processor for all purposes, merely that it is a good beginning.

It is interesting to note that even a die-hard LocoScript fan like John Hooper spent much of his letter criticising LocoScript. Diane Hamer wrote as someone who had used both packages, and it was that experience which informed her review.

PCW *would be interested in hearing from other readers who had tried both products.*

Looking for Wafadrives

Being something of a fan of Sinclair Research, I purchased a ZX Spectrum which I still use. To expand its potential I bought a Rotronics Wafadrive. I program databases and wanted the greater flexibility that Wafadrives would offer.

I now find that Rotronics has ceased manufacturing and none of the dealers I have visited can supply me with blank Wafas.

How can companies get away with producing a storage device and then leaving users with no source of supply for the media? Imagine if there ceased to be a supply of cassette tapes.

Has anyone any idea of a source of supply for blank Wafas?

TT James, Port Talbot, W Glam
Anyone out there got any spare Wafas?

Political debate

Last January I considered taking out a subscription to *PCW*. I didn't because I was extremely irritated by a comment made by one of your correspondents in the 'Chip Chat' section concerning operations in South Africa (January issue).

Being a reasonable sort of person I decided to give you a second chance, and to my delight the February issue of your (excellent) magazine was of the expected high standard.

My hastily filled-in order form was nearly on its way to the letter box when I noticed another piece of run-of-the-mill wisdom in the form of a review by Stephen Applebaum of a piece of software called 'SDI' ('Screenplay'). As stated before, I'm fairly tolerant — but if there's one thing that really annoys me it's being given a quick, unwanted piece of someone else's political mind.

Please, don't let your great magazine be tarnished by politics. Apart from that, absolutely no criticisms . . .
Gerald Heinig, Kingston upon Thames, Surrey

It's amazing how people who argue for the status quo never consider themselves political, whereas those who question and challenge are.

Isn't it a political act for MindScape to published a game based on Reagan's Star Wars 'defence' policy?

If you're worried about political bias, how about writing a game called 'Thatcher' where the aim is to sell off all the nationalised industries. Of course, that's really happened so it can't be political.

Computer poetry

Rob Goodwin's letter dismissing computer poetry (*PCW*, March) has stirred me into action. For a start, one has only to look at a good program to see a well-structured poem.

And what about the potential that computer-generated poetry could have for seriously handicapped people? For those with brain damage, a poetic computer could offer them some hope of meaningful communication.
Allan Campbell, Camberwell, London SE5

Sinclair — champ or chimp?

Each of Uncle Sir Clive's new computers has appeared on the front cover of *PCW*, and quite rightly so. In June 1981 it was the ZX81; June 1982 featured the Spectrum; June 1984, the QL; and last month (March 1987) the new Z88. But on each occasion a chimpanzee has been featured with the product. What are you trying to tell us? Please tell.
Steve Rainey, London N8

Anyone who can sell one million computers can't be that much of a monkey. And few people have been able to ape his success. Maybe we're all chimps for hanging on his every venture . . .

If the cap fits

I have just finished reading Angie Brew's review of Degas Elite and Art Director in the February issue of for some months now in the hope of breaking into the already-crowded computer graphics market, I would like to offer some opinions.

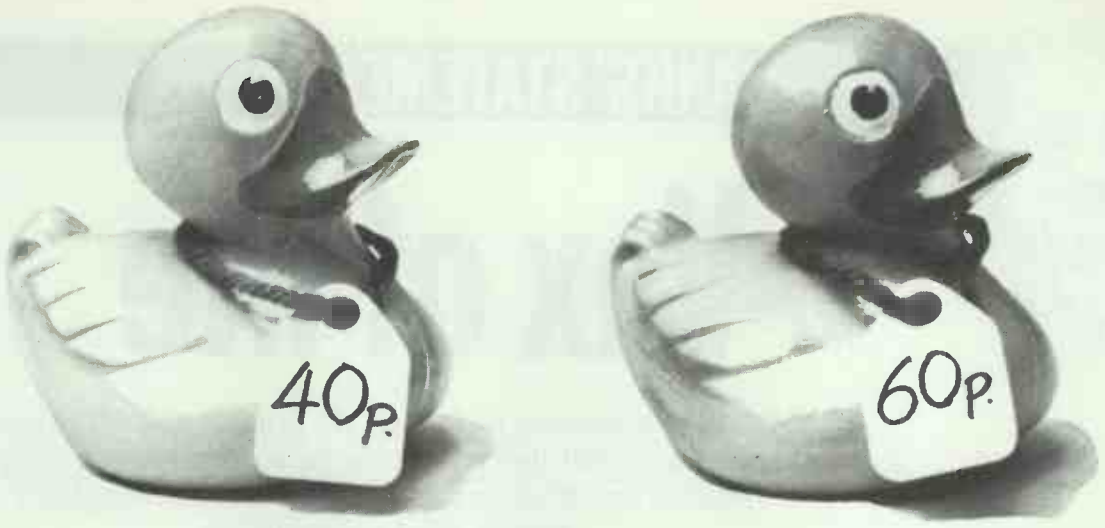
● Congratulations on having an artist review art packages! Too often I have read reviews by journalists who miss major flaws which an artist would spot immediately. An example is the Electric Studio Lightpen for the Amstrad 6128 which I bought having read a glowing review (not in *PCW*). The reviewer failed to mention that the palette colours could not be changed from within the program!

● Having congratulated you on the idea, I must say that Angie Brew does not seem to be a good choice. I can't comment on her talents as an artist with pen and paper, but she is a rotten computer artist. I can only think it is due (as she says herself) to her inexperience with the packages.

● Miss Brew says she had to adapt her style too much to the computer. I find this a very strange statement. Would she expect to use watercolour techniques on an oil painting? Different mediums require different techniques and *some* adaptation in an artist's style. A mouse is not a pen, and to expect to use it in exactly the same way is foolish. As can be seen from the screenshots, most of Miss Brew's drawing was done in freehand mode. Even with the slow-draw facility, this will only produce very jagged lines.

● Miss Brew implies that computer graphics packages are strictly for the amateur, or at best they can be used for rough working drawings by professional artists. Perhaps she changed her mind when she saw the Screenplay section in the same issue and saw the shots of the Defender of the Crown graphics which are neither rough nor, I suspect, produced by an amateur. I know they were taken on an Amiga with four times the screen resolution, but even the lower resolution of an ST can be used to produce excellent pictures. As with any form of art, computer graphics have advantages and disadvantages, and if you want to be any good at it you have to practice.
Paul McKinley, Dublin

PCW *welcomes offers from artists and other professionals interested in applying their trade to computer hardware and software.* END



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BANKS' STATEMENT

Vax of life

With IBM unwilling to loosen its grip on the PC market, one company that has had its fingers burned is making the most of its other assets to establish a stronghold. Martin Banks speculates.

I want you to imagine that it is the middle of February and that it is early in the morning; I am on my way to a press conference.

I can tell that you are probably getting quite excited at this point, so I won't hold you in suspense any longer. You see, I went to see the official announcement of something interesting from Digital Equipment. (What do you mean, who are they?)

Oh, you've remembered now, have you? That's right, Digital Equipment made an MS-DOS-based personal computer a few years ago that so stunned the world that the company sold . . . well, *hardly any at all.* With its corporate tail between its legs, DEC duly scuttled off back to the minicomputer business where it belonged and continued to do very nicely, thank you.

The thing is, what DEC announced back in February, so early in the morning, was the natural culmination of it doing just that. It took its minicomputer architecture, called 'VAX', and 'grew' it in all directions. Today you can get absolutely enormous VAX computers and, what is more, cluster them together to make even bigger ones. You can also get really quite dinky ones, and what is more, they don't really cost a lot: around £10,000 for the entry-level, four-user system.

Small multi-user systems are getting to be extremely popular, and with good reason. They fit nicely into the work group concept that most working people understand, and as the power and capabilities of the hardware, and to a lesser extent the software, increase while prices come down, so such systems become increasingly viable alternatives to either the traditional minicomputer or a random collection of PCs that may or may not be networked, at least some of the time.

It is the market that an increasing number of manufacturers have decided to have a go at, not least of which being our very own Apricot. Now there is a company that seems to have got itself back together after a near debacle at the low-end of the market. From making a loss out of trying to compete in a cut-throat sales war of cheap systems, it is looking like keeping managing director Roger Foster in snazzy ties for a good while yet. The reason — a decision to junk the cheap market and make expensive, 'real' multi-user machines.

What is interesting about the multi-user business is that most personal computer manufacturers and software producers have tended to dismiss it as a minority side issue. It might still seem like that to many, but I am starting to wonder whether it contains within it the seeds of the next evolution.

Even the short history of the PC has shown that users (whether they be right or not) always want to get more power and performance out of their systems. The history of the computer business generally has also shown that users are willing to leave a safe and cosy environment and jump into something new if the advantages are good enough.

So, in this apparently minority market-place, a company like DEC is reaching down to position a product like a juicily-baited fishing line, ready to tempt users into a new and potentially very powerful upgrade path based around the 57 varieties of VAX. The other competitors coming into this market are using the Intel 80386 processor as their engine, which is a fine step to take. They all have a potential weakness, however, to my way of thinking at least.

That weakness is their fundamental architecture, which is based on the ideas and concepts of the IBM PC family, which has a time and place that is completely different from where this market is going. In the same way, much of the underlying systems software technology is based around single-user, single-tasking technology that has been stretched and puffed up to fit the new applications.

Many of these manufacturers face a very specific problem. Everyone knows that IBM is going to do something, and that the 'something expected' will probably be at the upper reaches of the existing PC range. No-one, of course, really knows what this might be, mainly because IBM probably doesn't yet know itself. Both new hardware (probably 386-based) and new system software (probably Microsoft, but don't bet all your pocket money on it) are in the pot and until they appear, the rest of the manufacturers are 'stuck'.

IBM could, of course, keep the market in suspended animation like this for a year or more if it tried, and there is not too much that could be done about it. This is where DEC and, for the 147th consecutive year, Unix, could play a trump card.

With everyone waiting for IBM, there is scope for a new ball-game to be developed. As every manufacturer took the IBM PC as the start point and grew their systems from there, so DEC's newest baby, the MicroVAX 2000, offers a new start point, and one with a growth path for users already mapped out. The weak point in such a game is that DEC is not going to play the open architecture rules of the PC world, so there won't be any clones; but the applications software could become available.

The MicroVAX, you see, can run Unix, and most of the other contenders in this business run either Unix or Microsoft's Xenix, so, in theory at least, the same applications will run on all or any of these machines. In addition, Xenix has close compatibility with MS-DOS, so PC-created data could be transported across. DEC has the VAXMate, an MS-DOS/VAX combo system. In either case, existing PC users could have an upgrade path.

In the meantime, while the world and most of the manufacturers wait for IBM and/or Microsoft to get their acts together, a workable and working alternative could be 'discovered'. But then again, this has been said of Unix ever since the world began. END

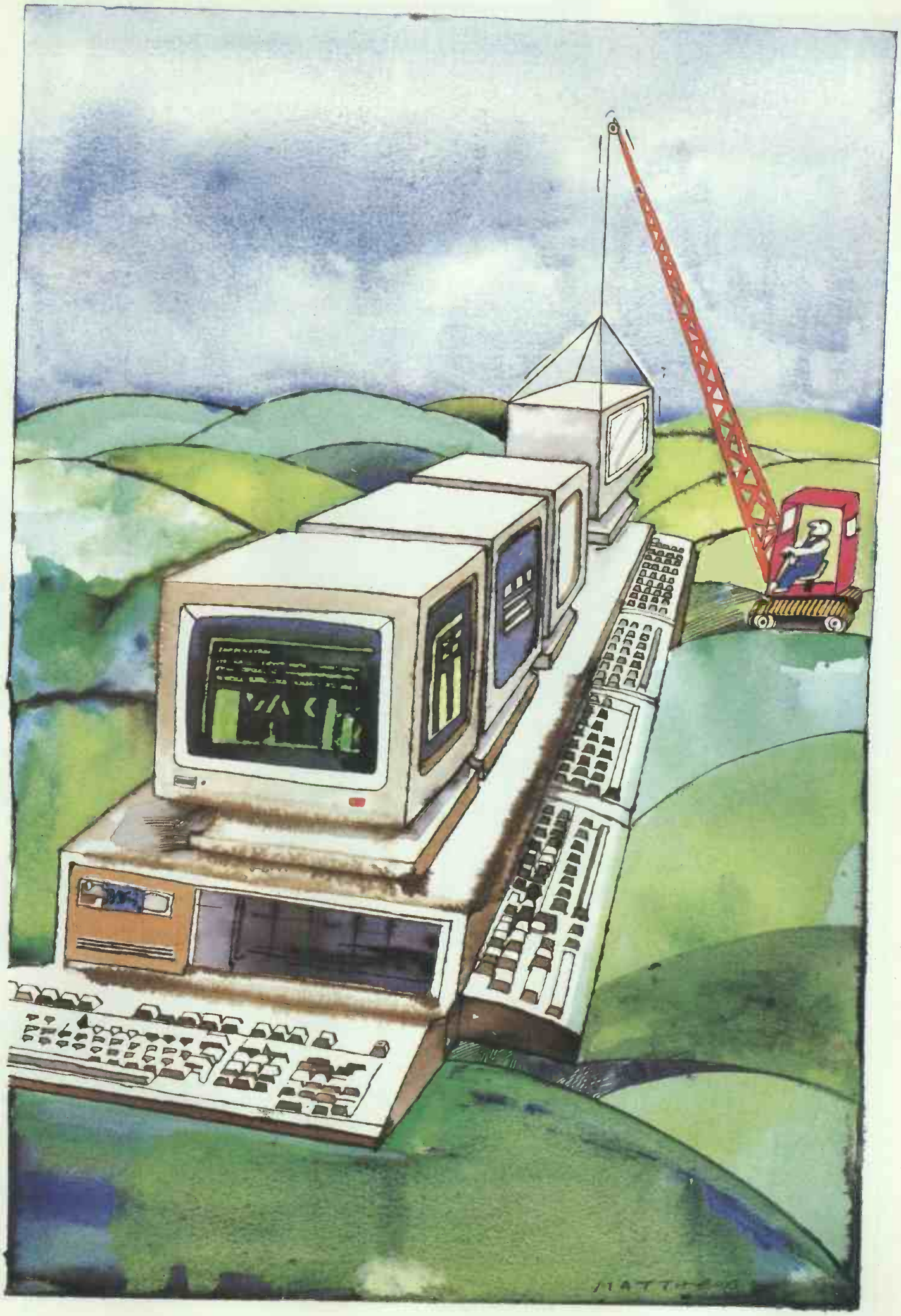


Illustration by Tony Matthews

RM Nimbus VX386

More machines based on Intel's 80386 chip are beginning to appear. Owen Linderholm looks at one of the first British 80386 machines, which aims to match the power of Compaq's DeskPro 386 but costs considerably less.

Intel's 80386 processor produced a great deal of speculation about new machines that would be produced to harness the power of the new chip. However, the chip proved to be a tougher proposition than most people thought, and until recently the only available 80386 machine was the Compaq DeskPro 386, introduced last year. Everyone else was waiting for IBM so that they could be compatible. But IBM didn't produce the goods, and suddenly, in February, there was a flurry of activity as several manufacturers, including Research Machines produced 80386-based machines.

RM has always had a policy of slow and steady growth. In the past seven years it has slowly taken a larger and larger share of the education market, first with the 380Z and 480Z ranges and then the Nimbus. The Nimbus also started the company off in new markets, such as networking and graphics workstations. The two new ranges are simply an extension of this policy.

As I write this, the news is that IBM is launching new products on 2 April. If these include a 386 machine and new IBM standards, then RM and all the other current 386 manufacturers might find themselves out on a limb which IBM is about to saw through.

Hardware

The VX386 is yet another machine in the standard PC style — a large box-shaped main unit, keyboard, and monitor to sit on top of the main box. The front has a cut-out panel for two fixed or removable half-height storage devices. A third drive, fixed only, can fit below these although there is no external indication of this. The machine I looked at had a 1.2Mbyte 5¼in floppy in the top space, with a 720k 3½in floppy and a 40Mbyte Winchester in the spaces below.

The VX386 has moulded corners and strips as well as the obligatory diagonal 'go-faster' stripes. There are also four LEDs, two green and two red to the left of the disk drives. These are power, network, fixed disk and high-speed (fast mode) indicators.

The back panel of the machine is almost exactly the same as all today's IBM-style machines. It has the power switch, ventilation slots for the fan, power-in and power-out sockets and six cover plates for the card slots, but there are two differences. First, the keyboard output and reset switch are mounted on a bus card rather than the main unit. Second, an extra slot is set off from the others and a bit wider. More on these anomalies later.

Along the bottom of the machine are, from left to right: a Microsoft mouse port (the new standard with a small 9-pin DIN in a square orientation), a standard 9-pin PC/AT RS232C serial port, a standard 25-pin D Centronics parallel port, a 9-pin D socket for a standard IBM colour video output, and a 6-pin DIN mono output.

The keyboard is a rebadged ALPS and is very much a standard old-style IBM AT lookalike. It has 84 keys, with the 10 function keys on the left and a numeric keypad set on the right which doubles up as a cursor control cluster. The keys have a very firm, sharp action, without a click. The keyboard is two-tone to match the main unit and is very slightly wider than the system box. The key locations follow the UK style, with the backslash key at the top left. A larger 102-key keyboard is an option.

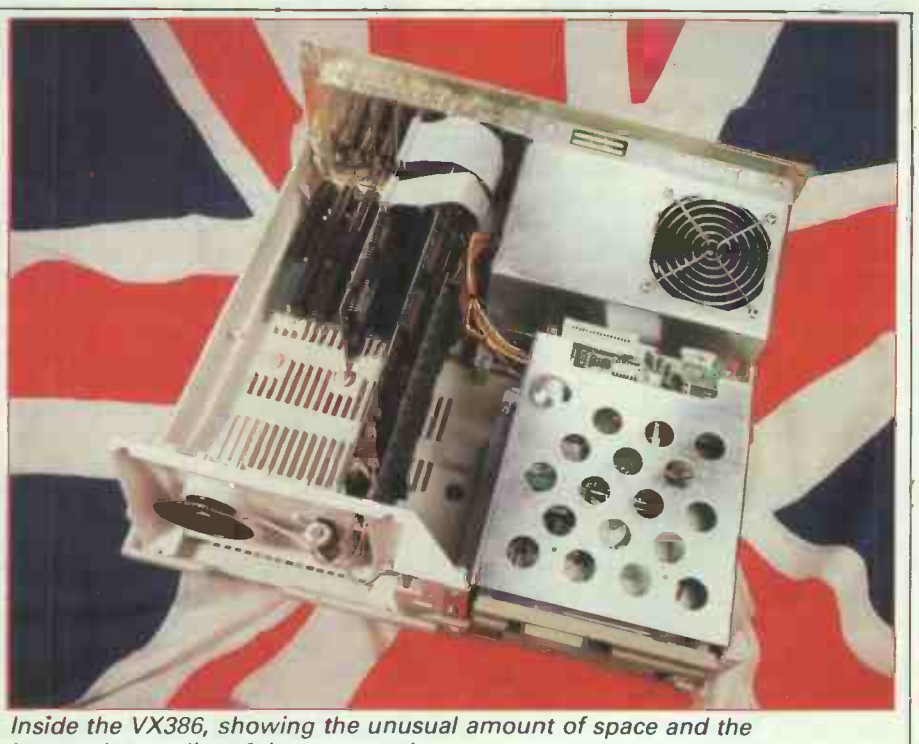
One of the nicest things for the novice user is that the VX386, like previous RM products, boots up to a welcoming colour screen which provides quite a lot of information about the machine. This gives way to the usual MS-DOS messages and, finally, the DOS prompt. This is because the BIOS is designed by RM rather than a third party such as Phoenix, which is more usual.

Opening up the machine involves unscrewing three screws at the back and sliding the cover of the system box forward. The inside is surprisingly empty, to leave room for AT-style expansion cards. The main surprise is that the CPU is not on the motherboard, but on a card plugged into one of the AT slots. Another AT slot is taken up by a hard disk controller card: the rest are free.

The motherboard is dedicated to I/O and holds the floppy disk controller, parallel and serial interfaces, a mouse interface and the 16-bit AT-style bus with room for two AT cards. This board is then extended by another 'clipped' onto the end, which holds four more AT slots and one PC slot.

The disk drives are held in a metal 'bookshelf' arrangement so that third-party disk drives can be easily slotted in. In front of them is a plastic wall that has the loudspeaker mounted on it and the LEDs. A long-life lithium battery is attached to this with velcro. The 3½in drive is a standard 720k drive, but it is possible that the drives finally fitted will be 1.44Mbytes and will be 720k compatible. IBM is thinking of using these 1.44Mbyte 3½in drives. The 5¼in floppy drive that comes as standard with the machine is made by YE-DATA and is a standard 1.2Mbyte/360k model.

The I/O board runs along the back of the machine and covers two-thirds



Inside the VX386, showing the unusual amount of space and the impressive quality of the construction

The AX286

The AX286 range of AT compatibles look exactly like the VX386 machines. Internally they are very similar too, except for the processor card. This is simply an 80286 card rather than an 80386 card, and makes the conversion between an AX286 and a VX386 so simple: just substitute one card for the other. The 80286 card gives much less memory management support, no 32-bit bus, and a few other chips are needed to support the 80386. The AX286 is similar in almost every respect to the VX386, except that it is slower. The processor is an 80286 at 12MHz, and I was unable to run Benchmark timings on one.

of the length and about half the depth of the machine. The piggy-backed card holding the expansion slots extends this to cover the full width of the machine. The I/O board is underneath the power supply and fan, which are fully shielded in a metal case with ventilation slots. This can be easily removed as a single unit to reveal the I/O board in its entirety. The largest chip on this board is one of the four RM-designed custom gate arrays in the machine. This is a multi-function chip and covers networking and I/O functions as well as the Microsoft mouse driver. The only other custom chip on this board is the Paradise PEGA-2 chip, acting as a video driver. This chip can produce a multitude of graphics modes, including IBM monochrome, CGA, EGA, Hercules, Nimbus PC and a high-resolution 'EGA' of 640 × 480 in 16 colours from 64.

RM's own low-cost expansion connector is also on this board. This is intended for miscellaneous future expansion such as connecting external Winchesters. It is a rectangular 16 × 3 pin socket that can take a ribbon cable or a small plug-in board.

The I/O board also holds the floppy disk controller and numerous miscellaneous chips for things like signal conversion. All the connectors for the external ports, 16-bit bus and floppy drives are present.

The 80386 CPU runs at 16MHz and is on a card plugged into the first free AT slot. This means the processor will only be able to communicate with the outside world (disk drives, monitor, other cards, and so on) over the 16-bit AT bus, despite being a 32-bit processor. That isn't to say that 32-bit communication is impossible. A proprietary 32-bit bus connector comes off the underside of the card at the back. The processor is on a card to give expandability — not for the VX range, but for the AX. Simply replace the 286 card with the RM VX386 card, and you will have a complete VX386 machine.

The VX386 card is probably the most complex circuit board I have ever seen. It is the first 8-layer PCB I have encountered and has an extremely high density of semiconductors. The 80386 is centrally placed next to a socket for the 80387 co-processor. Other chips include an 8042 keyboard controller at the back of the board near the keyboard socket; two gate array chips, made by Faraday (running at 12MHz), positioned above the 80386, which essentially replace most of the logic of an AT and significantly reduce the chip count; three RM-designed custom gate arrays for memory control and management including hardware EMS (expanded memory management), two empty EPROM sockets for compatibility with the AT, and several other chips to provide complete AT logic.

The BIOS, which is written by RM, is compatible with both the IBM BIOS and the Nimbus PC BIOS. This allows RM to look after existing users while attracting new ones.

Two sockets already hold a piggy-backed memory board with 2Mbytes of 2 wait state, 120 nanosecond access, 1Mbit DRAM chips as standard. Two further sockets on this card can hold a further one or two piggy-backed memory cards. The memory options are 2Mbyte or 8Mbyte boards, which are incredibly dense.

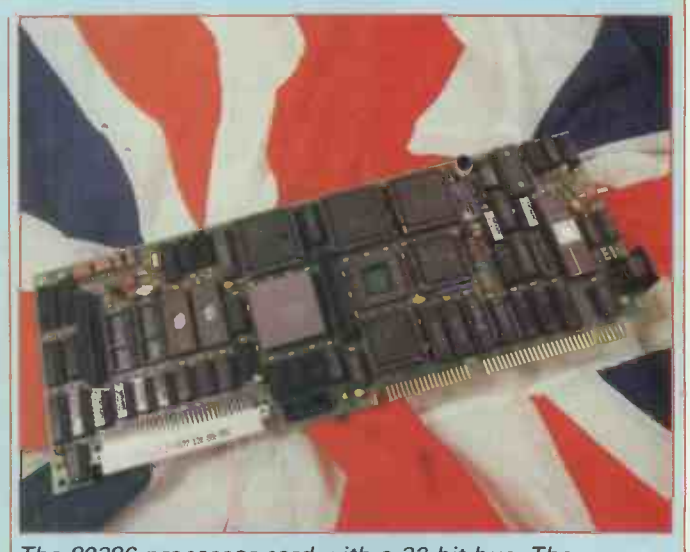
Not much information was available about the custom memory management chips, but an external source and some guesswork sug-

The 80386 processor

There are many misconceptions about Intel's 80386 and its significance. It is, in my opinion, Intel's first decently designed chip. The only design compromise is that Intel had to make it compatible with existing chips in the 80×86 and 8088 ranges. Basically, the 80386 has four operating modes. The first, the mode that the chip starts up in, is 'real mode'. This is essentially 8086 emulation, except that extra 80386 instructions are available. This mode is really what allows 80386-based machines to be IBM PC-compatible and is the unfortunate but necessary compromise that Intel had to make.

The second mode is already moving beyond the limits of current PCs. It is again an emulation, this time of the 80286 'protected mode'. Although PC/AT machines have this potential, it is not yet properly used — an example of how hardware is starting to get ahead of software. The essential difference between this mode and the first is that it allows the processor to access up to 16Mbytes of memory rather than the 8086's paltry 1Mbyte. Another difference is that memory access is organised so that multi-tasking is possible, by using segmenting, task descriptor tables and privilege levels to protect memory allocated for each task from the other tasks. Unlike the 80286, the address space and segment size on the 80386 are enlarged, so that any one task can access up to 4 gigabytes within a total memory space of 64 terabytes.

This extra memory addressing leads directly to the third mode of the 80386 — perhaps not truly another mode. This is access to virtual memory management. The 80286 also has virtual memory management and gives an operating system more memory than the processor can physically address. This is done by storing memory elsewhere, such as a fast hard disk, and swapping the contents of physical memory back and forth to the hard disk as needed. With this type of memory management, an 80286 can access up to 1 gigabyte of memory. An 80386 can access a phenomenal 64 tera-

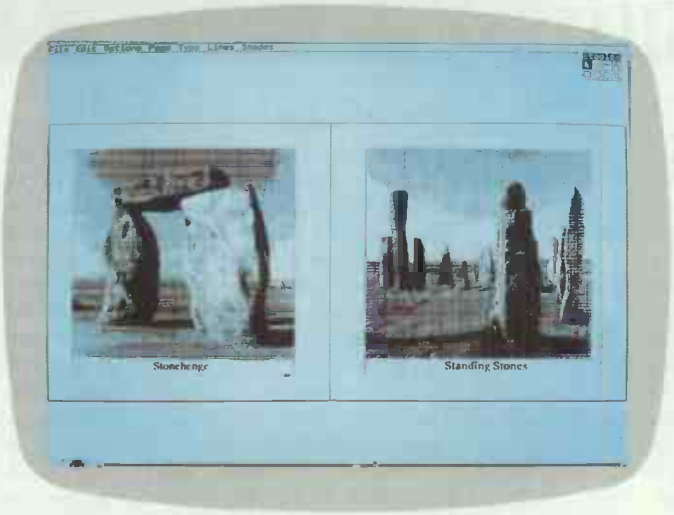


The 80386 processor card with a 32-bit bus. The square, empty socket is for an 80387 co-processor

bytes of memory. Just to give you an idea, 1 gigabyte is 1,073,741,824 bytes and 64 terabytes is 70,368,744,177,664 bytes.

The final mode of the 80386 is perhaps the really significant one. This is called 'virtual 8086' mode, where the 80386 acts as if it were lots and lots of 8086 machines, each running its own task. The processor can also avoid duplicating standard parts of these virtual 8086s by mapping all their I/O, ROM BIOS calls, and so on, to one place. This mode is best thought of as lots of different IBM PCs, all operating separately, that just happen to occupy the same physical space. What is more, all these IBM PCs can communicate directly with each other.

While the 80386 chip is extremely fast, with a clock speed of 16MHz other tricks to speed up processing,



The 19in 1280 × 960 pixel monochrome monitor showing off its advantages for desktop publishing programs with two full pages displayed

The standard colour monitor running Microsoft Windows in 640 × 480 pixels and 16 colours, and two full-powered applications

gests that they will support some of the as-yet unused facilities of the 80286 and 80386 chips.

RM says confidently that it is ready for all future developments. Some more detective work suggests that the new RM machines will be able to make full use of the features of new versions of DOS. These features should include the ability to address up to 16Mbytes of memory, and to allow proper multi-tasking by using the 286 and 386's ability to give hardware protection to each task. In other words, if you are running several tasks and one crashes, the others are safe and continue to operate.

The last board in the machine is the Winchester disk drive controller. This is basically a SD506 disk controller, but has other RM ROM chips since the machine uses RM's own BIOS. These were not completely finished when I looked at the machine.

Monitors

The VX range has many display options, reflecting RM's aim to market the VX386 heavily in the graphics design, workstation, CAD/CAM and desktop publishing markets. The graphics chip can produce a wide range of outputs, so much so that the machines' normal colour monitor will be an NEC Multisync, one of the new multi-display monitors coming on the market. The monitor does not come as standard, since a reasonably large number of purchasers will already have a monitor. However, the monitor should ideally support the EGA plus mode.

Two extra display modes are available for the VX range. These are a 1280 × 1024 pixel display, in either 16 or 256 colours, and a monochrome display of 1280 by 960 pixels. You will need to purchase a graphics expansion card. I saw both working and was very favourably impressed. The VX386 is fully capable of driving these at a decent speed. I

used for a long time in mini and mainframe computers, are moving into micros. Most of these involve ways to speed up fetching data for the processor.

The execution of one processor instruction is a long-winded process at the lowest electronic level. For the processor to operate correctly different parts of it need to obey instructions in synchronisation. The synchronisation is achieved by clock pulses — different parts of the processor only perform operations when they receive a clock pulse. This is why speeding up the clock speeds up the processor.

By careful organisation you can arrange for the next instruction or piece of data to be fetched halfway through the execution of the previous instruction — this is 'prefetch'. Prefetch is possible because most instructions are sequential. The address of the next instruction is easy to find since it is immediately after the current one. When jumps are needed this technique will not work. Speeds are increased because the processor doesn't need to ask for the next instruction to be fetched from memory — it is already there. The 80386 has a prefetch system built in.

The other technique, cacheing, involves a small amount of extremely high-speed memory. If the processor can guarantee to find the data it needs in the higher speed memory, then it can get it more quickly. If all the memory was automatically in the high-speed RAM, cacheing wouldn't be necessary, but extremely high-speed memory is also extremely expensive.

If you look at the organisation of processor instructions in a program in memory, you will find that most instructions are located near the current instruction; either immediately following, or a short way behind if a loop is being executed. Cacheing essentially involves some clever control techniques and circuitry that ensure that the correct part of memory has been copied to the high speed cache memory. Obviously this cannot always work, but if 80 per cent of the time the next instruction is in cache, then it can be fetched without delay. If it isn't in the cache, then some time is lost before you look in main memory, but this lost time is less than the time gained.

RM intends to introduce a cache memory add-on as an optional extra. The type of cache it intends to use is expected to produce a 26 per cent speed increase, according to Intel. This cache will use the RM proprietary 32-bit bus on the CPU card. For the technically-minded, it will use 24k of 25 nanosecond access tag RAM and 64k of 55 nanosecond access data RAM. It will also be a write-through cache.

The implications of the 80386 (and other advanced 32-bit processors) are phenomenal. One 80386 machine and a lot of cheap terminals could replace a network of full-powered PCs and actually do a better job.

There is one big hitch in all this. No 80286-based operating systems are on the market yet (although Microsoft's DOS 5 is rumoured to be a full 80286 DOS and available very shortly), let alone 80386-based ones. (This is not strictly true since some small independent 80386 DOSs have been announced, but I doubt that they properly harness the 80386.)

Since the software isn't yet available, many people have dismissed 80386 machines as nothing more than extra-fast AT clones and not worth the money or the fuss.

These people are wrong.

don't think an AT or clone could cope at a decent rate.

System software

The VX386 comes with MS-DOS 3.2 and all the usual DOS utility programs. It will run practically all the system software available for the IBM. The VX386 is also RM Nimbus compatible, which is why RM had to write its own BIOS. Commercial versions of the VX will not need any Nimbus software, but Educational systems will be bundled with a wide range of Nimbus software, including RM's Basic, Pascal and Logo. Hard disk systems will have the software already installed and ready to use.

Networking systems will include a network card for RM's Z-Net and network versions of DOS. Also available will be an RM-designed Ethernet card and a third party Token Ring card. The network will operate exactly as the RM Nimbus network, except that the VX will be able to run at 2Mbits/second as well as the Nimbus's 0.8Mbits/second.

There are also strong indications that Microsoft's DOS 5 will work immediately on the VX range. This could be very much to RM's advantage as there are also indications that some PC/AT machines won't work with DOS 5 because of hardware difficulties.

This is especially true of 80286/80386 plug-in boards. Microsoft DOS 5 will also be closely linked into Microsoft's Windows front-end. This will again be in RM's favour since Microsoft Windows is bundled with the VX range. Educational machines will also include Windows applications, such as a word processor, spreadsheet and database. The version of Windows being shipped is 1.03 and includes drivers for all the graphics modes. Windows looks much better in the EGA plus mode and 16 colours than in black and white on a CGA display.

Benchmarks

I used a VX386 with the high resolution colour display and an 80387 maths co-processor for a short while, and ran the realmath and triglog Benchmarks in Turbo Pascal once with the 80387 on and once with it off for comparison. Here are the figures:

Without 80387—	
realmath:	0.584secs
triglog:	4.02secs
With 80387—	
realmath:	0.130secs
triglog:	0.343secs

The full set of Benchmarks were run as normal with the Basic supplied with the machine — GW-Basic.

intmath:	0.89secs
realmath:	1.05secs
triglog:	8.09secs
textscrn:	35.89secs
grafscrn:	4.85secs
store:	2.58secs

In perspective

The RM VX386's performance is almost exactly the same as the Compaq DeskPro 386's. It is however, considerably cheaper. The new Apricot 386 machine is cheaper still, but as I have not seen one yet, I cannot compare it in value to the RM machine.

The machine has good potential, and should do well in RM's traditional markets. RM sells 80 per cent of its machines directly — to government, education and some private users. It hopes to break into corporate markets and should have reasonable success since the machines perform well and RM has a lot of experience in areas that corporate users will want, like networking. Overall, I expect the RM VX386 to succeed moderately well; enough to continue RM's slow but steady growth.

Technical specifications

Processor:	80386
RAM:	2Mbytes expandable to 16Mbytes
Mass storage:	40Mbyte hard disk; 5¼in, 1.2Mbyte floppy drive
Display:	Monochrome, CGA, EGA and EGA Plus standard; optional high res with 1280 × 1024 pixels in 16/256 colours, 1280 × 960 pixels in monochrome
Keyboard:	84 keys, optional 102 keys
Expansion:	Four PC/AT slots, one PC slot, custom expansion port, internal RAM
I/O:	RGBI, 6-pin monochrome, 9-pin serial, 25-pin parallel
Size:	440mm × 410mm × 158mm
Weight:	Approximately 12kg
O/S:	MS-DOS 3.2
Price:	£4995

Applications software

Naturally, a wide range of applications software is available. Everything I tested out worked fine, except for some 'naughty' public domain games which drive a lot of the hardware directly. Lotus 1-2-3, Flight Simulator, Procomm, PC-Outline, NewWord, Turbo Pascal and Xtree worked perfectly. I looked at the UK release version of Aldus Pagemaker running under Windows. This was a particularly impressive display of the speed of the VX386, since double A4 spreads were displayed in a couple of seconds. On a PC, this would have taken about a minute. Pagemaker seemed pretty easy to use, but not quite as powerful as Ventura.

Documentation

Only pre-release documentation (photocopies of computer-set and laser-printed A5 pages) was available, but this seemed pretty good by most standards.

Prices

The RM Nimbus VX1Z workstation with 80386 processor, one 3½in or 5¼in drive and Z-Net network interface costs £3595.

The RM Nimbus VX40 stand alone micro with 80386, 40Mbyte hard disk and one 5¼in floppy costs £4995.

The RM Nimbus VX40HM professional graphics system with 80386, 19in monochrome monitor (for 1280 × 960 pixels display mode), 40Mbyte hard disk and 5¼in floppy costs £7295.

The RM Nimbus AX20 standalone microcomputer with 80286 processor, 20Mbyte hard disk and 5¼in floppy costs £2695.

Discounts of 20 per cent to 30 per cent are available to educational purchasers.

Conclusion

The RM VX386 is especially significant only in that it is a British-made 80386 computer. Other than that, it is a very well-designed computer, with a lot of potential for expansion and future developments. It is an extremely good machine for high-powered graphics because of its extra speed, high-resolution graphics modes and displays.

However, it won't really come into its own until software has been written to exploit the 80386 properly. For users who know that they will want an 80386 computer, it is very good value. Others might consider the AX286 since it can easily be upgraded to a VX386 at a later stage.

Research Machines can be contacted on (0865) 249866.

END

Even Better Word Processing

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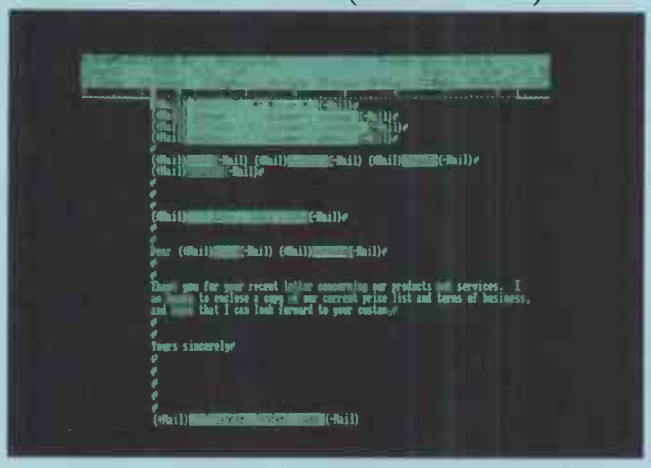
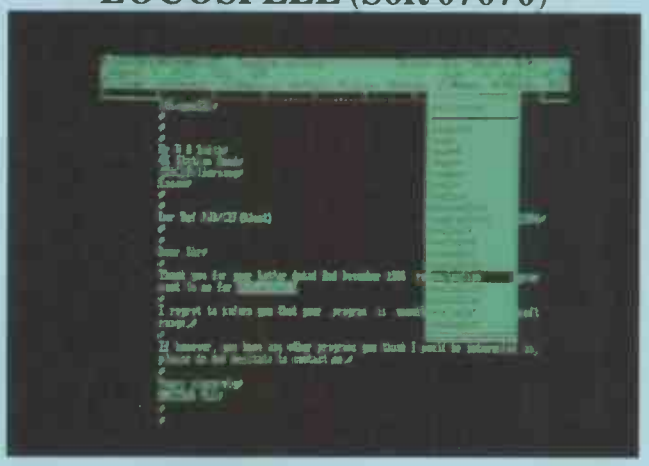
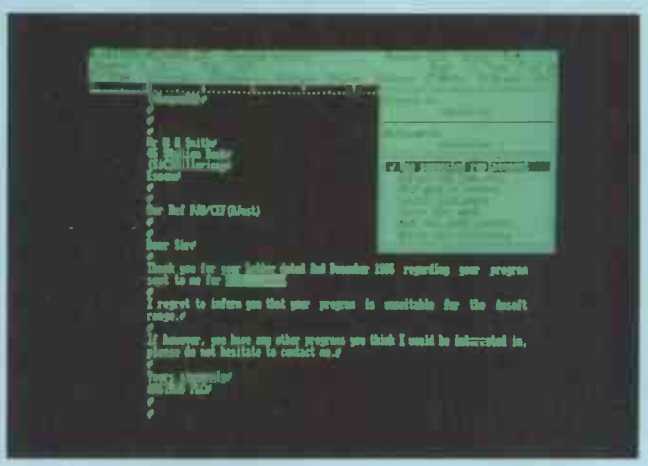


A powerful addition to your PCW enabling you to merge address lists and data with letters and forms to produce mailshots and personalised versions of standard letters. The many features of this software include, the ability to perform arithmetic functions.

LOCOSPELL (Soft 07070)





The only official spellchecker to use with Locoscript. This software is supplied with a 32,000 word dictionary for use with the PCW8256 and a massive 77,000 word dictionary which operates with speed on the PCW8512. You can produce and edit your own dictionary which operates in conjunction with the main dictionary.

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Compaq Portable III

The Compaq pedigree is first-class and well-established, so the company's latest luggable model, the Portable III, has every chance of succeeding in the portable PC/AT clone market. Nick Walker assesses the machine's performance.

Photography by Chris Bell

It wouldn't be unfair to say that Compaq Computer Corporation owes its existence to IBM. It started off by being the first company to dare to produce an 8086-based and therefore improved clone of the IBM PC, and shortly followed this with the highly successful Compaq Portable — the first transportable PC-compatible.

Since then the Compaq range has broadened to include both desktop and transportable PC and AT clones, all of which are technically superior to IBM products. This strategy has turned Compaq into the youngest company to enter the Fortune 500 list of high-flying companies.

Transportable computers have always formed a large proportion of Compaq sales — the original Portable I consistently outsold IBM's own transportable. Each Compaq portable has offered considerably more power than its predecessor in a smaller and lighter package. The Compaq Portable III is no exception. It boasts a 12MHz 80286 processor and up to 40Mbytes of hard disk storage in a package 40 per cent lighter and 35 per cent smaller than the Portable II.

One of the major reasons for the Compaq's 'larger-than-lapheld' design is the inclusion of a standard 5¼in disk drive

Hardware

While I have always had great admiration for Compaq machines *technically*, you could hardly describe them as works of art *aesthetically*. The Portable III is the first Compaq that looks as though some thought has gone into styling; unfortunately, the end result looks like a cross between a 1950s portable radio and a sewing machine. The power and disk access LEDs in particular could have come straight from a Wurlitzer juke-box.

When the original Compaq portable was launched, there was a clear distinction between lapheld and luggable computers. Luggable machines offered true computing power with hard disks, decent screens and expansion slots, whereas lapheld computers usually consisted of poor LCD screens and perhaps one floppy disk drive in return for true portability. However, as luggables have become smaller and laphelds more powerful, the distinction has blurred. At 16ins wide by 9.8ins high by 7.8ins deep and weighing 20lbs, the Compaq is best considered as a very small luggable. The upright design and small footprint make it unsuitable to sit on your lap.

When the machine is packed up for carrying, the only external evidence that it's a computer are three ports and a power input at the rear. On the top of the machine there is a nice, large, warm leatherette handle which makes the machine very comfortable to carry.

Setting up the Portable III when you have arrived at your destination couldn't be easier. Two clips on the front allow you to remove the keyboard to reveal the gas-plasma flat screen. An ingenious mechanism allows you to lift the screen away from the main body, and also provides some degree of tilt. This is a substantial improvement over machines such as the Sharp 7000 range or the Zenith 171 which can only be tilted. To the bottom right of the screen is a small rotary knob that controls the brightness, and below this is a hole into which the keyboard cable disappears. A trough running along the bottom of the machine houses this cable when the machine is rigged for carrying.

The rear of the Portable III houses three I/O ports, power input and an on/off switch. The three I/O ports consist of: a 25-pin Centronics parallel printer port; a 9-pin PC/AT standard RS232 serial port, usually used for a modem or mouse; and a 9-pin RGBI output giving IBM CGA colour graphic standard output. This to my mind represents the minimum acceptable collection of I/O ports, though many portables offer less. The worst case is the IBM Convertible which has none. However, I would also like to have seen a reset switch.

The Portable III operates off either 204 to 264-volt 50Hz or 102 to 132-volt 60Hz mains power, which covers most of the world's power supplies. The power supply automatically senses the incoming mains and switches accordingly, a feature I particularly appreciate after once destroying an American standard Apple Macintosh with the UK mains.

The right-hand side of the Portable III houses one or two half-height 5¼in storage devices. On the review machine these were filled with one 1.2Mbyte floppy and one hard-disk drive. The final area of interest on the outside of the machine is a hatch on the rear labelled 'expansion'. This conceals a customised version of the IBM PC/AT 16-bit expansion bus. An optional expansion unit plugged in here gives two IBM PC/AT-compatible expansion slots.

Getting inside the Portable III is relatively easy provided you possess a Torxdriver. After removing six Torx screws, the back lifts off. Inside things are, not surprisingly, quite cramped. The PCB, measuring approximately 14ins × 7ins, is the only thing visible once the back is removed. The power supply sits beneath it in the bottom right-hand corner. Rated at 145 watts with a peak loading of 175, this should more than adequately cope with any additional demands. In the bottom left there is an empty recess that can house an optional internal modem. The only other component that can be made out beneath the PCB is a storage cradle for the disk drives.

As you would expect in an IBM PC/AT-compatible, the main processor is an Intel 80286 true 16-bit processor. This is normally clocked at 12MHz, although it can be switched down to 8MHz presumably to be exactly compatible with the IBM PC/AT. Unless a software switch is activated to force it into either HIGH mode (12MHz) or

FAST mode (8MHz), the default AUTO mode is applied (12MHz changing to 8MHz when accessing the floppy disk drive).

By switching down to 8MHz when accessing the floppy disk drive, Compaq has alleviated any problems with copy-protected disks being accessed too fast. The speed of floppy data-transfer is too slow for this to affect performance. For those who require strong number-crunching ability, a socket is provided for an 8MHz 80287 maths co-processor.

The review machine was fitted with 640k of RAM made up of 256k by 1-bit DRAMS, which is both the standard and the maximum possible on the main PCB. Additional internal memory up to a maximum of 6.6Mbytes using 1MBit chips can be added by buying a memory/modem interface board and populating it with RAM chips. Like most PC-compatibles the Compaq contains very little ROM; two 8k ROMs contain the basic I/O procedures, though two empty sockets allow future releases to be up to 32k.

The PCB itself is beautifully designed with a high-level of customisation. The disk controller, display driver and I/O control function are each contained within large Compaq-commissioned ULAs (Uncommitted Logic Arrays). There are some patch wires to be found but these don't detract from the overall quality of the PCB. Considering that no surface-mounted technology is used, the denseness of chip is particularly impressive.

There are a number of DIP switches and jumpers on the PCB which allow you to: configure the system to recognise the memory expansion boards; configure the system for additional hard and floppy disk drives; set the CPU to power up at 8MHz or 12MHz speed; change the default display; and disable or reassign the serial (COM) ports.

The Compaq Portable III comes in three models determined by alternative disk drive configurations. The cheapest Portable III, the Model 1, offers a single 1.2Mbyte/360k floppy disk. This is supplemented by either a 20Mbyte or 40Mbyte hard disk in the Models 20 and 40 respectively. The floppy drive operates perfectly in 1.2Mbyte form but is extremely unreliable when used to create 360k disks for an IBM PC (not AT) compatible. Even disks that were formatted on the straight PC clone were sometimes unreadable after files had been added by the Compaq. This was a common problem with earlier AT clones but there is no excuse for it now. Hewlett-Packard, Olivetti and Tandon all produce high-density drives that reliably format and write 360k disks.

The review model was fitted with a 20Mbyte hard disk which is possibly the fastest hard disk I've seen on a PC/AT clone. I tried both the Bagshaw disk Benchmarks, *PC magazine*'s disk Benchmark and our own *PCW* 'Store' Benchmark. All three confirmed that it was indeed faster than any other PC/AT disk. The drive is manufactured by Conner Peripherals and officially rated with an access time of less than 30 milliseconds. My Benchmarks suggest it is nearer 25 milliseconds.

'For users of the existing Compaq Portable computers, the Portable III is a very desirable upgrade.'

Also of importance to users of portable machines is the shock resistance of the hard disk. On the Compaq this is achieved by the company's own shock-mounting cradle, which Compaq claims makes it capable of falling one yard without harm. I was, however, not allowed to test the validity of this claim. Two green LEDs on the top right of the machine repeat the disk drive LED so you can see when a disk is being accessed. One particularly nice touch is the floppy LED which glows green when accessing a 1.2Mbyte disk, and red when accessing a 360k disk.

One of the reasons for the Portable III's compact size is the use of a flat gas-plasma screen. Gas-plasma displays work on a concept similar to that of a fluorescent light tube. A low-pressure inert gas covers the entire screen which glows when a particular voltage is applied to it. In order to give a pixel graphics display a matrix of fine wires, one for every pixel horizontally and one for every pixel vertically is constructed behind the gas. To switch a pixel on, it is necessary to apply a voltage to both the horizontal and vertical wires. The sum of the two voltages causes the gas to glow — a process not dissimilar to the operation of the magnetic core store memory of the 1950s.

The end result is a screen that actually emits light in a similar way to a cathode ray tube but is less than one inch thick and weighs less than one pound. Unfortunately, gas-plasma screens are extremely power-hungry which means they are rarely used in battery-powered portables. All gas-plasma displays I've seen offer orange text on a dark red background; the Compaq is no exception but it does seem to offer greater contrast compared to Toshiba, Panasonic or Ericsson displays. Unlike cathode ray tubes there is no need to continually refresh the screen — once a pixel is on, it is *on* until you switch it off. This makes text very steady but fast-moving graphics tend to flicker terribly due to the time needed to switch pixels off.

One further problem with gas-plasma displays is that they offer only one level of contrast. Knowing this, I was particularly surprised to discover that the Portable III simulates both CGA colour graphics and MDA monochrome text. In order to give some degree of contrast, needed for CGA emulation, the Compaq screen has two pixels for every one of a normal CGA screen (640 × 400 pixels as opposed to 640 × 200). This gives three levels of contrast to every CGA pixel: both pixels on, one pixel on and both pixels off. Using 400 pixels vertically also gives text a particularly high-quality typeface and such features as true underlining.

The Compaq comes complete with three character sets and a utility for changing between fonts. Two of the fonts operate with the gas-plasma screen while the third is for use with an external monitor. The onboard CGA controller can be disabled via a jumper if you wanted to run an EGA monitor from a card in the expansion box.

The keyboard moulding is obviously smaller than that of a desktop machine. It's nice to see that Compaq has responded to the criticisms levelled at its earlier machines. Instead of the flimsy Keytronics keyboard used on the Portable I and II, the Portable III has the sturdiest keyboard I've seen on a luggable. Despite its size, the keyboard seemed to conform to the PC/AT format with ten function keys running along the top and a combined numeric keypad and cursor cluster to the right. The Caps Lock, Num Lock and Scroll Lock keys have green LEDs to indicate when they have been activated. The keys themselves are much the same as other Compaqs — light and rather dead, but perfectly usable.

The user manual lists a wide range of options that can be added to the Compaq Portable III and these should all be available by the time you read this. These include: 20 and 40Mbyte hard disks; a 360k-only floppy disk, suggesting that Compaq knows of the unreliability of writing 360k disks in a 1.2Mbyte floppy drive; an internal Hayes-compatible, 1200 baud modem (this is UK manufactured and hence approved); an expansion unit

An AT system board, colour graphics adaptor and hard disk controller are contained within this single PCB

for two IBM PC standard expansion cards; internal memory expansion boards; a Compaq colour monitor; a desktop pedestal to give more control over the display angle; and, finally, a choice of either black leather or black nylon carrying cases.

System software

As you might expect from a machine which uses an 80286 processor and professes to be a PC/AT clone, the Portable III runs MS-DOS 3.2. It seems that Compaq has modelled itself so closely on IBM that it has adopted the same silly pricing policy. MS-DOS 3.2 is not bundled with the machine but has to be purchased separately for £60. MS-DOS 3.0 was originally launched with the IBM PC/AT, and since then it has gone through two revisions: 3.1, which added a limited amount of networking capability; and 3.2, which supports 3½in disks.

MS-DOS is not without its problems. Its most basic shortcoming is that it forces the processor inside IBM PC/ATs and clones to behave as though it were a faster version of the 8088 or 8086 chip found inside the IBM PC and clones. This means that it is not possible to take advantage of some of the 80286's more advanced features.

The most bemoaned problem is that using MS-DOS 3.2 means you cannot access more than 640k of RAM. Therefore you could have a machine with 3 or 4Mbytes of RAM, but the operating system will only see 640k of it.

A number of solutions to this problem have been produced but they are only of use to the limited number of applications that support them. The problem has come to a head with the new 80386 processor which can theoretically access 4000Mbytes.

Hopefully Microsoft will soon release MS-DOS 5.0 which will certainly allow the 80286 to run in its unrestricted native mode while maintaining compatibility with the IBM PC's 8088/8086. Whether it will do the same for the 80386 is not certain, but it is a definite possibility.

As well as being supplied with all the usual MS-DOS utilities, the Portable III comes with some Compaq custom utilities and Compaq-modified utilities.

The most interesting of these utilities is a short memory-resident utility called Adapt. As described earlier, using a display which has only three levels of contrast to simulate a sixteen colour graphics display is not without its problems. Adapt allows you to modify the display to suit your particular applications. On the Adapt menu are: half-intensity for highlighted text; reverse video; underline highlighted text; select alternative character set and full-intensity for highlighted text. Being memory-resident you can see the effects of Adapt on the application while you are running it.

Also of interest is the MS-DOS MODE command which has been extended for use on the Compaq. In addition to its normal function the following have been added: the same display configuration abilities as Adapt; a switch for true underlining; and control over the screen save period. Compaq also supplies a comprehensive diagnostic program that can be used as a hard-disk manager.

Applications software

The review machine was supplied with some applications already installed on the hard disk. This included WordStar and IBM's Writing and Graphics Assistant software and some very flashy demo programs written in Microsoft Basic.

It never ceases to amaze me that manufacturers devote such a great deal of effort to producing pretty demo programs. In this case it was probably worth it, because interpreted Basic runs on the Portable III at a speed I would normally only associate with compiled languages.

In addition to the software supplied on the machine, I tried out my usual collection of applications software. This included Lotus 1-2-3, Windows, GEM, SideKick, Flight Simulator, Psion Chess, Procomm and many others. They all ran without problems, although the display did cause some readability problems with graphics applications such as Harvard Presentation Graphics.

I also tried my selection of specially selected public-domain and games programs on the Portable III. Public-domain programs are often a very good test of compatibility, as they

tend to be written in a quick and dirty fashion and are intolerant of hardware incompatibility. Over the years I have collected a number of the most incompatible of these programs.

Using these programs I discovered two areas where the Compaq is incompatible. The first and the least surprising is the display driver. Certain fast-moving graphical games such as Decathlon from Activision cause the screen to lock up; the program continues to run but the only way to clear the screen is to re-boot the system. The second and more peculiar problem occurs with a public-domain program called Slowdown. This slows the processor with NOPs (no operation, null instruction) so that timing-critical programs can run at an acceptable speed.

For some inexplicable reason, some programs that ran fine without Slowdown totally failed when Slowdown was activated. Compaq initially blamed this on Slowdown itself, but after explaining it worked fine on other machines, conceded that it might have something to do with the timing of the disk controller.

When you purchase MS-DOS 3.2 you will also be supplied with Microsoft Basic version 3. This is not the place for a review of Basic 3's features, but it does seem to represent a marked improvement over GWBasic which is supplied with most other IBM compatibles.

When a file is accessed using the 'Open' command, it can now be 'Shared' — allowing other processes to read and write to the file; and 'Lock Write' stops another process writing to the file. Basic 3 also has a 'Lock' command which allows record-locking as opposed to the file-locking provided by the 'Open' statement. This in theory should allow you to produce true multi-user network applications in Basic.

Benchmarks

Intmath	1.1secs
Realmath	1.3secs
Triglog	5.2secs
Textscrn	27.3secs
Grafscrn	6.1secs
Store	2.7secs

For a full explanation of the PCW Benchmarks, see the December 1986 issue, page 164

Documentation

The review machine was supplied with one *Operations Guide* manual, although you should also receive an MS-DOS manual and Basic manual when you purchase the operating system. The *Operations Guide* was spiral-bound and produced to a very high standard. For those who have already used a PC compatible, it covers most of the things you would want to know about the Portable III. Totally naive users, however, would find it very heavy going: for example, although disk formatting is covered, no explanation is given as to why you should want to do this.

Price

The model 1 costs £3250, the Model 20 £3950 and the Model 40 £4395. At the time of writing, the only peripheral that I could get a definite price for was the modem, which costs £435.

Conclusion

For users of the existing Compaq Portable computers, the Portable III is a very desirable upgrade. The machine is lighter, smaller and much faster than its older sibling, the Portable II. However, the Portable III remains very much a luggable and the traditional benefits of luggables — expandability, a decent screen and hard disk — have been somewhat eroded by recent developments by lapheld-computer manufacturers.

Probably the most obvious lapheld rival to the Compaq Portable is the Toshiba 3100/20. This offers a very similar specification: a 20Mbyte hard disk, 640k of RAM and a gas-plasma screen in a casing that will (just) fit in an average briefcase. One cannot resist suggesting that the Portable III is an attempt by Compaq to regain some of the sales it has lost to this popular Toshiba model.

All in all there is little to differentiate between the Toshiba and the Compaq. The Toshiba is considerably smaller and more stylish, but Compaq has the greater reputation and the more powerful machine. My personal preference is for the Toshiba, but there's very little in it. END

Technical specifications

Processor:	Intel 80286 running at 12MHz, switchable to 8MHz
ROM:	16k
RAM:	640k expandable to 6.6Mbytes internally
Mass storage:	One 20Mbyte hard disk, one 1.2Mbyte/360k floppy
Keyboard:	84-key, full-stroke IBM PC/AT-like layout
Screen:	25-lines × 80-column text, 640 × 400 pixel graphics, gas-plasma
Size:	9.8ins × 7.8ins × 16ins
Weight:	20lbs
I/O:	RS232 9-pin serial, parallel Centronics, RGBI monitor output
Operating system:	MS-DOS version 3.2
Bundled software:	None
Peripherals:	(all optional) internal 40Mbyte hard disk; internal 360k floppy; internal 1200 baud, Hayes-compatible modem; expansion unit; internal expansion board; 512k memory modules; 2Mbyte memory modules; 80287 numeric co-processor; colour monitor; EGA card; desktop pedestal; carrying case

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IBM Personal System /2

The next generation of micros from IBM brings good news for existing and new PC users. Better graphics and a new operating system will raise the power of PC compatibility and herald new standards for add-ons. Nick Walker, Owen Linderholm and David Tebbutt took the machines for a test drive.

Six years ago IBM launched a 64k Personal Computer and, like most other computers of the time, it was designed to be programmed in Basic and used an ordinary cassette tape recorder for program storage. It stood out from the crowd thanks to its IBM logo and a 16-bit processor.

Despite the relatively primitive nature of this machine, it soon became the most significant standard in the history of microcomputing. Since then, the IBM PC has acquired more RAM, disk drives, faster processors, smaller boxes and enhanced graphics. The result is that when users want to exploit the full power of the system, it almost bursts at the seams.

Now IBM has broken free of its self-inflicted stranglehold while still maintaining compatibility with the previous standard and continuing with its open-architecture policy. Having said this, it's not going to be easy for clone makers to catch up, whereas the add-in board makers and software developers should get all the help they need.

While upping the specification of its machines, IBM has managed to hold the price down. Furthermore, the cost of an old XT is about to fall by a further 25 per cent or so. The new range of machines starts with the Model 30 at £1106, rising to over £7000 for a top-of-the-range system.

Hardware

The new range is collectively known as the Personal System/2, and consists of four machines: the Models 30, 50, 60 and 80. All four machines are important, but the Model 50 is possibly the most significant since it represents the cheapest machine which conforms to the new standard. (The Model 30 is an 8086-based machine which is far more attractive than the previous PC. It has the functions of six add-in cards on the motherboard, but can still take a further three horizontally-mounted standard cards.)

The external appearance of Models 30 and 50 is a radical departure for IBM. If we were in a cruel mood, we

might suggest that the company took a leaf out of Apricot's book, even down to the 3½in disks, which IBM is now firmly committed to. The systems are still grey/beige but are not big and ugly like the earlier IBM desktop machines. The Models 60 and 80 are also attractive-looking, even though they're solidly-built, floor-standing tower systems based on the 80286 and 80386 respectively. This review will concentrate primarily on the Model 50 since it marks the point of departure from the old standards.

External connectors are mounted on the edge of the motherboard and peep out along the back of the machine. Reading from left to right, they comprise a keyboard (mini-DIN), a mouse (ditto), a bi-directional Centronics parallel, a 25-pin RS232C and a 15-pin DIN display output. Like the Model 30, these additions to the motherboard replace the add-in cards required previously. The sixth function mounted on the motherboard is the battery-backed clock/calendar. Like its predecessor, the PC/AT, the Model 50 comes with a security lock. It also provides a facility in battery-backed RAM to prevent unauthorised access. Power is drawn by a 94-watt auto-selecting 110/240-volt supply, operated by a rather stiff red switch recessed into the front of the system unit.

The Model 50 is considerably smaller than all previous IBM desktop machines in all three dimensions. The system unit weighs in at 10.5 kilos and measures 14cms high, 36cms wide and 42cms deep. While this poses obvious questions about expansion cards, it at least sits comfortably on a standard desk. One traditional IBM feature which you might miss on the new model is noise. Even though the machine contains an internal 20Mbyte hard disk and a fan, it is practically silent in operation, even when formatting disks.

The CPU in the System 50 is an 80286 running at 10MHz. However, with this machine, IBM has introduced its Micro Channel, a fast, internal bus system which enables the true throughput to be increased. It is actually a 32-bit bus cut down to 16-bit for use on the Models 50 and 60. In addition to the normal processor interrupt lines inherited from the original PC, the Micro Channel provides a bus access priority scheme known as multi-master arbitration. Each device attached to the bus, including processor, DMA and certain expansion cards, has a manufacturer-defined arbitration level. Whenever a device wants the bus, it calls upon some logic circuitry called central arbitration. If there is a conflict, all competing devices bid for attention by putting their arbitration levels onto the bus. Central arbitration then assigns the bus to the highest bidder.

By assigning the processor one of the lowest arbitration levels, future plug-in cards such as an Intel 80486 co-processor could easily take complete control of the system. In addition, certain high-speed data transfer devices can request a burst mode and hold the bus for the entire duration of a transfer.

The Model 50 comes with 1Mbyte of RAM made of up nine 1Mbit chips including one parity chip. The RAM chips are 150-nanosecond access although the Model 80 will have 80-nanosecond access RAM. The 128k onboard ROM includes CBIOS (PC-DOS and PC-compatible BIOS) and ABIOS (for OS/2 support, more of which later). It still contains Basic and a power-on self-test code.

The custom chips make the hardware of the new IBMs particularly interesting. Apart from the processor, the rest of the machine comprises four VLSI gate arrays, the proprietary bus system, and other support chips for graphics and control.

The four chips are: VGA (video graphics array) including 256k of internal RAM; DMA — 16 channels, eight of which can be used concurrently; I/O control; and processor support. These gate arrays come from IBM France. An Inmos chip is used for video to provide a colour look-up table; this allows the machine to provide 256 colours from an overall palette of 262,144 in various resolutions. It also provides synchronisation between the display and processor operations as well as the digital-to-analogue conversion necessary for video displays.

IBM has gained something of a reputation for using old technology: with the Personal System/2, this reputation has been well and truly smashed. Surface mounting is used throughout, and the design of the PCB is elegant and sparse. As the price of the chips decreases, this board should become very cheap to manufacture. A major surprise on this board is the new expansion system — the new connectors are much smaller and denser than the old ones. They are still 8-bit with a 16-bit expansion, but have been redesigned to comply with interference regulations around the world. Three 16-bit expansion slots are provided. A range of cards has been announced to provide memory expansion, asynchronous comms and a multi-protocol adaptor.

The 3½in disks are high-density and capable of storing 1.4Mbytes of data, provided you use special high-density floppy disks. To retain compatibility with current 720k 3½in disks, a software switch allows this format to be used. The Model 50 comes with a high performance 20Mbyte hard disk as standard.

Amstrad knows how dangerous it is to adopt one graphics standard and build it into the main PCB with no option to switch it off. Unlike the Amstrad, however, this system will automatically support alternative graphics cards. To drive the four new display monitors, the Model 50 uses the VGA to produce graphics resolutions from 320 × 200 to 640 × 480 pixels. A special display adaptor can manage 1024 × 768 with 256 colours. In true IBM fashion, the monitors are available at extra cost. Users do not lose their investment in software since the graphics drivers are CGA and EGA compatible.

The machine's modular construction makes it very easy to dismantle (and reassemble!). Simply undo two thumbwheel screws and whip the lid

Reinforcing the AT/E as the standard PC keyboard, the 102-key unit includes a separate cursor and numeric pad — and twelve function keys seems to be the new gospel. The stylish mouse is a standard item

The new machines lack the bulk of previous PCs and the 3½in disk drive may now be here to stay. The mains switch — a clumsy affair — has migrated to the front while the keyboard lock is now on the back

All the standard ports run off the motherboard, freeing slots for further expansion. From left to right: keyboard, mouse, bi-directional Centronics, RS232C and video out. The centrally-mounted fan is almost noiseless

off: after that, everything unclips and slides out. Inside, a number of featureless boxes cover the main PCB. A narrow, silver block running the entire length of the right-hand side contains the 93-watt power supply. Immediately to the left is space for up to two floppy disk drives, with the hard disk sitting behind. At the back of the machine in the middle is a plug-in removable fan. All these components can be removed in seconds via an ingenious system of pull-up plastic catches.

The keyboard is a new 102-key device with a separate cursor control cluster, a dozen function keys and a separate numeric pad — you know the kind of thing.

The networks supported through the use of add-in cards are: Token Ring and PC Network, both baseband and broadband. The baseband system offers a low-cost, low-tech approach which would be suitable for schools and other low-traffic installations.

System software

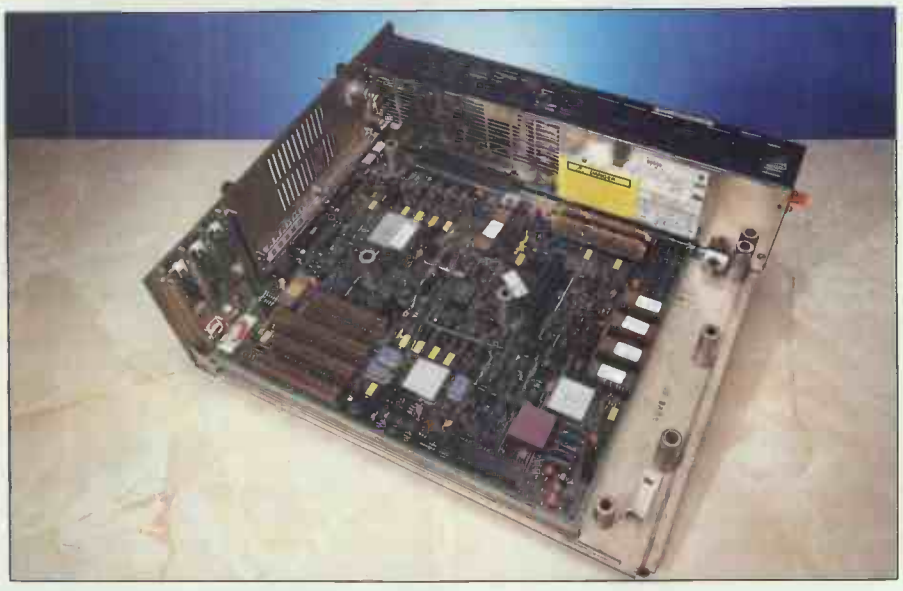
The exciting news is that the Models 50, 60 and 80 have been designed specifically to run a new generation of operating system from Microsoft. Unfortunately, while we can tell you its name and describe some of its capabilities, it looks unlikely that it will be available this year. In the meantime, the machine will be shipped with MS-DOS 3.3.

Operating System/2 (OS/2) is the new operating system and has been designed specifically for the Intel 80286 processor. As such, it should also be capable of running on the 80386 and any further processor from Intel that has an 80286 emulation mode. By running the 80286 in unprotected mode and not in 8088/8086 emulation mode, it is possible to directly address 16Mbytes of RAM as opposed to the 640k imposed by MS-DOS. In addition, the hardware multi-tasking capability of the 80286 has been utilised, which means that if one program crashes it doesn't bring down all the others running at the same time. Contrary to rumours, OS/2 will run on any compatible 80286-based machine, not just IBM's.

OS/2 will also see the demise of the A> command line. Each version of OS/2 will contain a bundled version of Windows, Microsoft's WIMP interface. For the purist, it looks as though there will be a way out of Windows, but this merely deposits you in a 'file manager' mode which sounds similar in function to Xtree.

A new version of Windows with support for both MS-DOS and OS/2 will be available *before* OS/2. Windows2, as it will be known, will have drivers for the new Personal System graphic standards, run faster under MS-DOS, and adopt overlapping windows rather than the current 'tiling' approach.

Less clear is the relationship between existing MS-DOS applications and OS/2. Straight MS-DOS applications will *not* run. Only specially written applications will be able to use OS/2's memory management and multi-tasking facilities. However, it will be possible to run one standard MS-DOS program in the bottom 1Mbyte of RAM and this can be as well or as badly behaved as it



Surface-mount technology features large inside the Model 50, making the machine cheap to manufacture and expensive though not impossible to clone. Subsystems within the box are easily installed and removed

Technical specifications: Model 50

Processor:	80286 at 10MHz
RAM:	1Mbyte as standard, expandable to 7Mbytes
ROM:	128k containing CBIOS and ABIOS (advanced BIOS) for supporting OS/2
Mass storage:	Single 3½in floppy 1.44Mbyte, 20Mbyte hard disk, optional internal 1.4Mbyte 3½in floppy, external 5¼in floppy and 200Mbyte WORM drive
Keyboard:	102-key, IBM enhanced keyboard
Monitor/display modes:	VGA (video graphics array) giving up to 64 grey scales with 640 × 480 pixels in monochrome or 640 × 480 in 256 colours
Standard interfaces:	25-pin serial RS232C, 25-pin bi-directional Centronics, IBM mouse port and keyboard port
Expansion:	16-bit internal bus, 16-bit external bus with three free 16-bit, new-style connector slots
Size:	14cms high by 36cms wide by 42cms deep
Weight:	10.5kg
Bundled software:	PC-DOS 3.3, OS/2 when available
Operating system:	PC-DOS, MS-DOS, will support OS/2
Peripherals:	Memory expansion and comms cards

In perspective

Well, the rumours can now be laid to rest. IBM hasn't gone entirely proprietary, it hasn't exactly come out with a clone-killer or an Amstrad-basher, nor has it done a Convertible on us. What it has done is announce a cohesive range of products (198 at the last count) designed not only to provide a growth path for PC users but also to forge meaningful links with IBM's other computer systems.

Very quickly then, the Model 30 is a bargain-basement evolution of the present PC/XT; the Model 50 is a new entry-level machine for those wanting to exploit the true power of the 80286; the Model 60 adds extra expansion capability, more memory and a larger hard disk in a tower-shaped box (with a handle!); and the Model 80, due goodness knows when, is an 80386 machine, once again in a tower configuration.

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Technical specifications

MODEL 30

Processor:	8086 at 8MHz with zero wait states
RAM:	640k as standard
ROM:	64k containing the CBIOS (compatibility BIOS)
Mass storage:	Model 30-002 has two 720k 3½in floppy disk drives and the Model 30-021 has one 720k floppy drive and a 3½in 20Mbyte hard disk drive. Optional external 5¼in 360k floppy and 200Mbyte WORM drive
Keyboard:	IBM enhanced keyboard, 102 keys, separate cursor and numeric pads
Monitor/display modes:	MCGA (multi-colour graphics array), giving up to 640 × 480 in mono and 320 × 200 in 256 colours
Standard interfaces:	25-pin serial RS232C and 25-pin bi-directional Centronics parallel, and IBM mouse port
Expansion:	16-bit internal bus and 8-bit expansion bus with three free standard 8-bit PC-type expansion slots
Size:	10.2cms high by 40.6cms wide by 39.7cms deep
Weight:	Floppy model 9.5kg; hard disk model 18.0kg
Bundled software:	PC-DOS 3.3
Operating system:	Existing MS-DOS/PC-DOS standard
Peripherals:	Expanded memory and comms adaptors

MODEL 60

Processor:	80286 at 10MHz
RAM:	1Mbyte, expandable to 15Mbytes
ROM:	128k of CBIOS and ABIOS
Mass storage:	1.4Mbyte 3½in floppy, Model 60-041 has one 44Mbyte hard disk drive and the Model 60-071 has one 70Mbyte hard disk. Optional extra internal disk drive of any size and external 5¼in 360k floppy and external 200Mbyte WORM drive
Keyboard:	102-key, IBM enhanced keyboard
Monitor/display modes:	VGA display modes
Standard interfaces:	25-pin serial RS232C, 25-pin bi-directional Centronics parallel, IBM mouse and keyboard ports
Expansion:	16-bit internal and expansion bus with seven free 16-bit, new-style expansion slots
Size:	59.7cms high by 16.5cms wide by 48.3cms deep
Weight:	23.5kg
Bundled software:	PC-DOS 3.3 and later OS/2
Operating system:	PC-DOS, MS-DOS and OS/2 when available
Peripherals:	Expanded memory and comms cards

MODEL 80

Processor:	80386 at 16MHz; or on Model 80-111, 80386 at 20MHz
RAM:	2Mbytes, expandable to 16Mbytes
ROM:	128k CBIOS and ABIOS
Mass storage:	1.4Mbyte 3½in floppy, 44Mbyte hard disk on Model 80-041, 70Mbyte hard disk on Model 80-071 and 115Mbyte hard disk on Model 80-111, with room for an optional internal 44Mbyte, 70Mbyte or 115Mbyte hard disk and external 5¼in 360k floppy and 200Mbyte WORM drive
Keyboard:	102-key, IBM enhanced keyboard
Monitor/display modes:	VGA display modes
Standard interfaces:	25-pin RS232C serial port, 25-pin Centronics bi-directional parallel port, IBM mouse port and keyboard port
Expansion:	Internal 32-bit bus and external 32-bit bus with three 32-bit, new-style expansion slots and four 16-bit, new-style expansion slots
Size:	59.7cms high by 16.5cms wide by 48.3cms deep
Weight:	23.6kg
Bundled software:	PC-DOS 3.3, OS/2 when available
Operating system:	PC-DOS, MS-DOS OS/2 when available and 386 operating systems when available and IBM's AIX
Peripherals:	Memory expansion and comms cards

Benchmarks

Run on Model 50 in IBM Basic

Intmath	1.448secs
Realmath	2.0375secs
Triglog	12.533secs
Textscrn	27.98secs
Grafscrn	7.93secs
Store (on 20Mbyte hard disk, no cacheing support)	4.837secs
Store (on a 1.44Mbyte floppy)	10.725secs

wishes. OS/2 will automatically protect that program and its own applications from each other.

While on the subject of memory, Microsoft is recommending a minimum 1.5Mbytes of RAM and a hard disk to get the most out of OS/2. For the Model 50, this means purchasing a RAM expansion card and using up one of the free slots.

We tried out a wide range of software on the Model 50. Everything ran perfectly with the exception of the public domain games — always the crunch test of IBM compatibility.

All in all, the new IBM machines seem very IBM compatible, with the exception of some programs which drive the video hardware directly.

Prices

The Model 30-002 (two floppy disks) sells for £1106. The Model 50 with a 20Mbyte hard disk but without a monitor costs £2658. The Model 60-071 with a 70Mbyte hard disk costs £4464; the Model 80-041 with a 44Mbyte hard disk will cost £4916; while the Model 80-111 will cost £7056 with a 115Mbyte hard disk. All these prices are exclusive of VAT and represent just a small selection from the range.

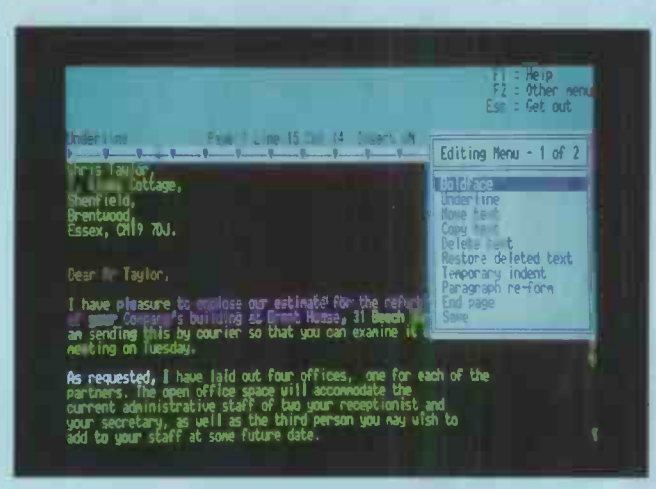
Conclusion

IBM users, dealers and — possibly more importantly — clone makers can all breathe a sigh of relief. The new machines are not an attempt by the company to isolate itself from its own industry standard. Instead, they are a realistic move into the future.

The new machines are extremely well-built with a high degree of internal integration and much improved styling. Inevitably, IBM's move is evolutionary rather than revolutionary. Nevertheless, it is the first step towards the new operating systems which will make full use of the power of the 80286.

With their much-enhanced graphics and better price/performance than their predecessors, this new range of personal computers from IBM is likely to be a huge success. Considering the machines came from IBM, we were impressed. END

PC1512 Complete Business Software



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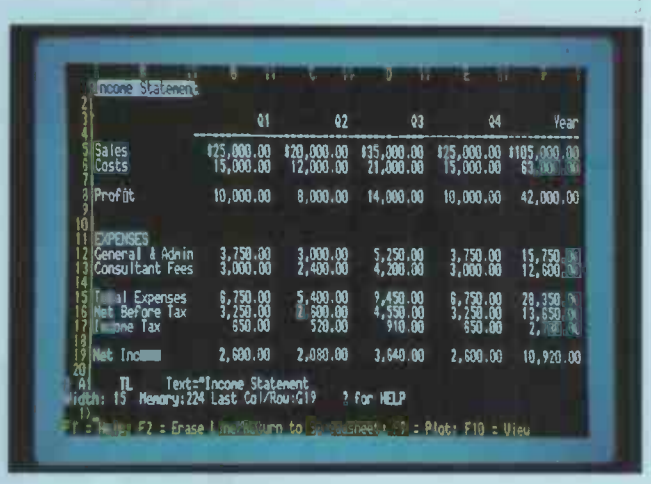

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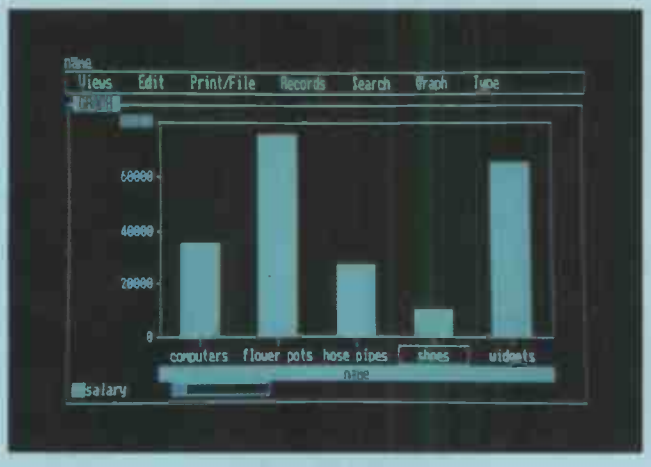

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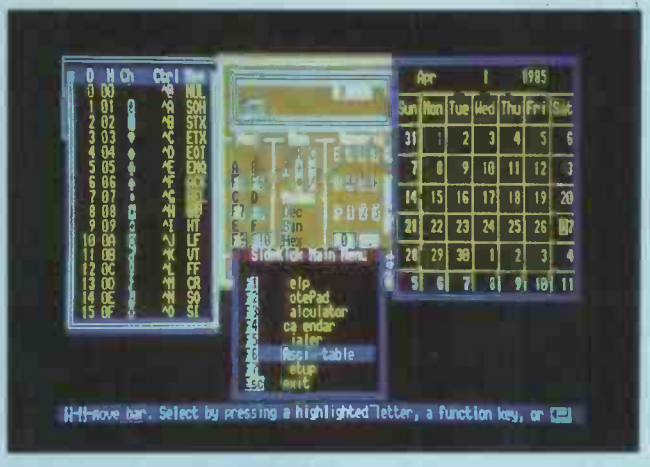

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A modem that weighs less than eight ounces, is compatible with but improves on the Hayes standard and comes with sophisticated software sounds useful. Derek Cohen was impressed.

Anyone away from home or the office with a portable computer, whether 'luggable' or 'laptop', will need to exchange files over the telephone with another computer at some time. And more than likely, they will find themselves with computer and telephone line but no modem.

Similarly, those whose desks are already groaning under the bulk of disk drives, monitors and other peripherals will not welcome yet another bulky peripheral.

The need for a small, battery-operated modem is not new, but the technology to make it possible is. Single-chip modems and surface-mount technology have combined to make it possible to fit a full-specification, Hayes-compatible auto-dial auto-answer modem into a small box. Migent's Pocket Modem weighs under 8 ounces (227g), fits into a shirt pocket, operates at 300 or 1200 baud full duplex, and runs off one small 9-volt battery.

Hardware

The heart of the Pocket Modem is a Fairchild 212AT single-chip, 1200-baud full duplex modem. This works to US comms standards and the UK model will be based around another chip, as yet unspecified.

At one end of the box is a standard 25-pin D-shaped serial connector. On many computers the modem will plug directly into the serial port. On others, where the case's moulding prevents proper connection, or the serial port is configured differently — such as the 9-pin ports on most AT-compatibles — an extension cable may be needed. Migent thoughtfully includes two cables in the package.

On top of the box is a recess for a small battery. This has been cunningly shaped so that it is impossible to insert the battery the wrong way round without obviously damaging the case.

The modem draws power from the battery as long as it is connected to the serial port of a powered-up computer. To save battery power, the modem needs to be disconnected from the serial port when it is not in use and the computer is switched on.

At the other edge of the modem are the telephone connection points and a socket for an external mains-powered power supply, which is also included in the standard price.

Installation

Installing the modem is very simple. You stick one end of the modem into your serial port or extension cable, plug the phone line into the other end, make sure the battery is in place, and aside from possibly adjusting the modem's parameters, you're in business.

On many other Hayes-like modems, configuration entails altering a number of DIP switches on the box. The Migent Pocket Modem does not have any DIP switches. Migent has followed the example of some other manufacturers by using non-volatile memory registers to store the con-

figurations. Deciding which register to set when your software asks you to 'set switch two to the ON position' would be a daunting task without the Setup program that Migent provides.

On the screen are all the parameters needed to make the modem work with your particular software. These parameters are stored in a number of registers referred to by number. The standard Hayes set — originally defined by US modem manufacturer Hayes and now followed by most manufacturers — provides for 17 registers referred to as S0 through to S16.

On the screen are presented the numerous parameters which can be set and as the screen arrow is moved around, using the cursor keys, a window in the centre shows which register that parameter relates to, the default values and the permissible range of values. For example, pointing at the line which says 'Carrier detect time' produces a prompt line:

(S9) UNITS=0.1 seconds; RANGE 1 to 255; Standard=0.6

At the bottom left of the screen is a graphic representation of the 10 DIP switches found on Hayes and other modems. Pointing at DIP switch 5 produces the message:

ON=Allow autoanswer;
OFF=Prevent autoanswer

Pressing the grey plus key puts the switch in the ON position, and the graphic switch 'flips' up. Pressing the grey minus key flips it down and the number of rings on which to answer, shown at the top of the screen as being stored in register S0, automatically changes to zero.

The bottom right of the set-up screen shows the settings for five bit-mapped registers, numbers S13, S14, S15 and the non-standard S19 and S20. The significance of each bit is explained as two arrows traverse the matrix of bits.

I found using the Setup program an education in itself, telling me more about how a modem is programmed than any other manual I have seen. The icing on an already very exciting cake is the fact that the Setup program allows for modem settings to be loaded from and saved to disk. This means it is possible to store commonly used modem configurations in files. Once loaded in or set on the screen, pressing a function key writes the settings to the modem.

Compatibility

Migent claims that the Pocket Modem is Hayes-compatible and that, as well as providing all the facilities of a standard Hayes 1200-baud Smartmodem, it also includes the responses to such events as an engaged phone number that Hayes added later with its 2400-baud modem. The facility to store the modem's configuration, extra responses and a phone number in non-volatile memory is also extra to the standard Hayes configuration.

During my use of the modem, it worked perfectly with Hayes-configured software such as Procomm and ChitChat.

However, Migent has made use of some extra registers which other manufacturers handle differently.

Migent uses bit-mapped registers S19 and S20 to determine how the modem responds to the presence or lack of signals on some of the serial port pins. My Dowty Quattro modem also does this, but with registers S21 and S22, and uses the individual bits differently.

Should you be using the Pocket Modem with any software that sets these, it would be better to check exactly which registers it addresses and best to use Migent's own Setup software for the purpose.

The modem can be installed by using the usual Hayes-originated AT command set if it is used with a non PC-compatible computer.

In use

Migent claims that a long-life alkaline battery should run the modem for 10 hours. I used the modem extensively in the US with an Epson PX-8, and accessed a number of bulletin boards and on-line services such as The Source. The modem behaved impeccably and, in fact, the computer's battery ran out before the modem's. The Pocket Modem can be configured to send a beep through the computer's speaker if its battery is getting low.

Software

As well as the Setup program, Migent includes a sophisticated comms program called BitCom from Bit Software. This software will work with any modem and provides a number of notable features.

Up to 32,000 services can be stored on disk, all within the same directory. Each one can have its own set of pre-programmed function keys as well as the usual parameters and terminal emulation. Thus, for Telecom Gold, F4 could start file transfer whereas on The Source, the process could be initiated with the PageDown key.

Terminal emulations are stored in text files and you can edit them or create new ones with a word processor. Provided are two VT100 emulations and one for IBM 3101. The manual explains in detail the format of an emulation file, and it should not be too difficult for someone to write a viewdata emulation as there are commands for cursor movement and even colour changes for individual characters.

BitCom recognises a procedural language, and the user can create Script and Action files using an ordinary word processor. These files can control dialling, uploading and downloading files, terminal emulation and screen characteristics. The difference between the two file types is that Script files are acted upon before the modem has dialled a number, and so can be invoked from the DOS command line; while Action files are run once a connection has been made, perhaps with the software and modem in auto-answer mode.

BitCom supports ASCII and all the current variations of Xmodem error-corrected file transfer. The manual says that Kermit is on its way, but as I try to avoid using anything else these days — having been spoiled by Procomm's excellent speedy Sliding Windows Kermit protocol — I missed it sorely.

Documentation

Migent's Pocket Modem has two manuals. The 44-page *User's Guide* starts by explaining the installation of the modem from scratch, and is designed to show novices how to get up and running. Later chapters move into the area of AT commands and appendices explain the function of the modem's internal registers.

The *Software Guide* is an 82-page guide to using BitCom. It is extremely thorough, explaining the purpose of every menu option and database field in the directory. At the back is a listing of the commands available for Script and Action files, as well as instructions on how to write your own terminal emulation files.

The absence of an index in either manual is unforgiveable.

Price and availability

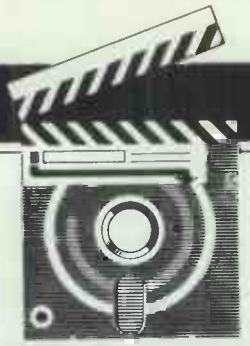
The modem package I reviewed was designed for the US market where it retails for $259 (£164). This price includes the modem, set-up and communications software, two serial cables (one 9–25 pin, one 25–25 pin), one telephone cable, and a power supply for connecting the modem to the mains.

At that price it is unbeatable value. When the modem has gained BABT approval, the same package will be on sale in the UK at what Migent calls 'a competitive price which represents comparable value for money relative to other products on the market'.

What this means is unclear. In the UK modems are on average £120–£150 more expensive than their US counterparts. Much of this extra cost is caused by the expensive approvals procedure.

However, with UK 1200-baud full-duplex modems costing nearly £400 without cables or software, Migent does not have to be that aggressive with its pricing to give UK users a good bargain.

Migent is on (01) 409 1343. END



SCREENTEST

Turbo Basic

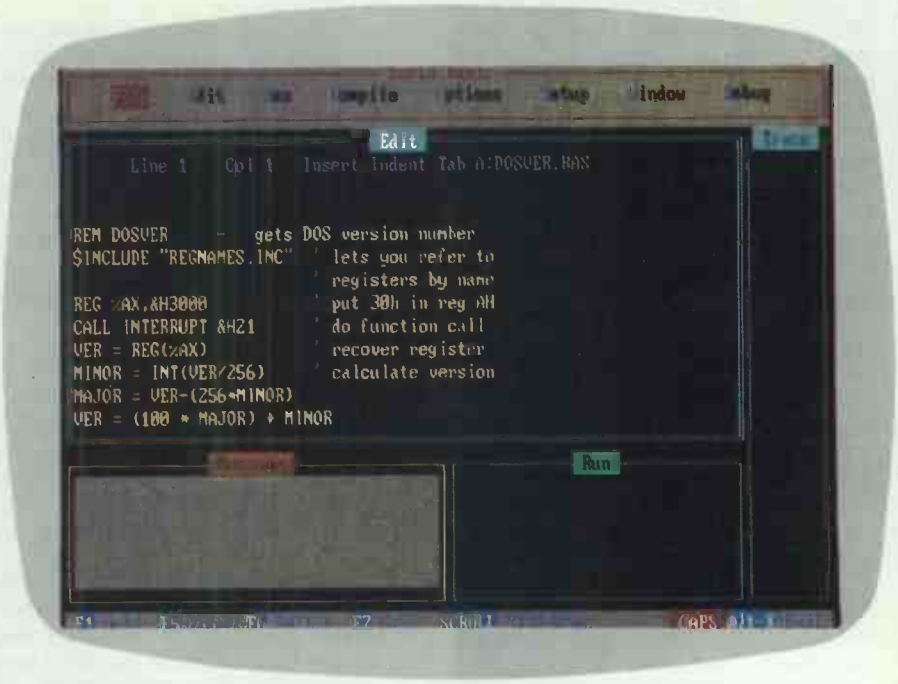
Professional programmers dismiss Basic as too slow and clumsy, but its shortcomings have been overcome by a new version from Borland. Turbo Basic should soon be on the best-seller list, explains Robert Schifreen.

Only quiche eaters program in Basic. Admit to any programmers' meeting that you actually use GOTOs and you'll be laughed out of the room. Basic, you'll be informed as they push you out the door, doesn't allow you to write structured programs. It's usually an interpreted language, so your programs are slow, and they can't be given away or sold without revealing the source code. There's no recursion, or support for command line arguments. You don't get a SELECT/CASE statement, which all decent languages have, or an easy way to call the low-level operating system routines that give features no high-level language supports.

If all this were true (which admittedly it is on most machines) then the case against Basic would be proven. But Borland's new Turbo Basic cures all these ills and more.

The package is certain to be a best-seller. It will sell to people who have come to realise that Borland knows how to write cheap, easy-to-use languages. It will sell to users who know Basic inside out from previous micros and, despite hearing wonderful things about Turbo Pascal, have never wanted to learn a new language from scratch. It will sell to PC clone users, who want to write programs in their interpreted Microsoft GW-Basic. It will sell to people who want to write Basic programs that run up to 20 times faster than under GW-Basic. It will sell to Amstrad PC owners whose bundled Basic works only under Gem and is, therefore, useless. And it will sell to anyone else who wants a damn good Basic programming development system at a damn good price.

Although this is a review of Turbo Basic, it's hard to avoid mention of its main competitor — QuickBasic from Microsoft. At the end, therefore, I have made some comparisons between the two and suggested ways of deciding which one to buy.



Turbo Basic's screen layout will be familiar if you've used any other Borland language. The size and location of all windows can be changed. Compiled. EXE programs run in the full screen — no windows are used

Turbo Basic is a self-contained environment for producing compiled, Basic programs on an IBM PC or compatible. It is almost totally compatible with Microsoft's GW-Basic and Basica, as found on the real IBM PC and available (sometimes as an extra) with every clone. Because Turbo Basic was written from scratch, it can handle things that are impossible for any version of Microsoft Basic — recursion for instance, and a straightforward way of making MS-DOS and BIOS calls.

There are a number of totally new commands and functions, which I'll go through in detail later. A couple of commands behave differently to true Microsoft Basic, because they have been made easier by Borland.

In case you're wondering, Turbo Basic's user interface is just like those of Turbo Pascal and Turbo Prolog.

Installation

Turbo Basic comes on a single 360k disk accompanied by a 450-page *Owner's Handbook*. The entire Turbo Basic environment, including editor, compiler and libraries is in one .EXE file of 190k so it can be easily put onto any work disk, and won't need its own directory on a hard disk. It is not copy-protected.

The other files on the disk are examples and are not required to use the system. The Microcalc spreadsheet program is included, as on Borland's Turbo Pascal disks, converted to Basic, as is a window-based text editor called Nanostar. There are graphics, animation and sound examples, and one that shows how to make MS-DOS calls.

The manual is thorough, though it doesn't pretend to teach you Basic programming. There is at least a page on every command and, where appropriate, notes on how that command differs from standard Microsoft Basic.

The odd bit of humour's in there, too. When boasting that Turbo Basic programs can be up to 1Mbyte long, it says 'Hell hath no fury like an interpretive Basic programmer trying to get 120k of program into 60k of memory.' It also calls Microsoft's 64k code limit stingy. It is evident that the author hasn't used Turbo Pascal recently.

Starting up

Once the system disk is copied and the original stored safely away, you start by typing TB at the MS-DOS prompt. Those of us who aren't graduates of the Peter Norton school of file naming can rename it to TURBOBAS.EXE instead.

I don't like reading manuals if I can possibly avoid them so I experimented. Within five minutes, I had written a one-line Basic program, tested it and compiled it to an executable disk file.

Creating a program

When you first start up Turbo Basic, you are placed at the main menu. Along the top line of the screen are eight menu headings which you can select with the cursor or by pressing the first letter. Below this are four windows headed 'Edit', 'Message', 'Run', 'Trace'. There is no mouse support. Some of the menu headings lead to further menus, which I'll cover in detail later. For now, though, you just select Edit to go into the edit window.

Having written your program, you return to the main menu. Press R to run, and some numbers flick by in the message window as the program is compiled.

Once the program is compiled, it starts running in the Run window.

```
REM DOSVER      -   gets DOS version number
$INCLUDE "REGNAMES.INC"   ' lets you refer to
                          ' registers by name
REG %AX,&H3000            ' put 30h in reg AH
CALL INTERRUPT &H21       ' do function call
VER = REG(%AX)            ' recover register
MINOR = INT(VER/256)      ' calculate version
MAJOR = VER-(256*MINOR)
VER = (100 * MAJOR) + MINOR
PRINT "MS-DOS IS VERSION";VER/100
```

Turbo Basic's CALL INTERRUPT command makes it easy to call MS-DOS and BIOS routines. This example calls MS-DOS function 48, which returns the version of MS-DOS being used

```
REM MTIMER.BAS - Example Turbo Basic program
REM            - to show use of microtimer.
REM
MTIMER          'start the microsecond timer
PRINT "A"       'do something
Z = MTIMER      'and read the microtimer
PRINT "PRINTING THAT LETTER TOOK";z;
PRINT "MILLIONTHS OF A SECOND."
PRINT
MTIMER          'start the timer again
PRINT CHR$(65)
Z = MTIMER
PRINT "PRINTING CHR$(65) TOOK";z;
PRINT "MILLIONTHS OF A SECOND."
```

Turbo Basic's microtimer is designed for measuring very small periods in increments of a millionth of a second. This example times how long a single command takes to execute

This window is rather small, but pressing Alt-F5 will zoom it while the program is running. At this point, it is the compiled version of your Basic program that is running. The original Basic commands that you wrote, along with the Turbo Basic programming system, are still in memory so, when your program stops running, you return to the main menu and can continue editing the program immediately — no disk access is required.

If you're used to GW-Basic, you'll keep typing RUN while in the editor, and wonder why nothing happens. It's a shame that the editor doesn't trap this specific word being typed at the start of a line. Because you can't type any immediate-mode commands in the editor, you can't do things like finding the ASCII code for characters you are about to plug into your source code. If this is a problem, SideKick's ASCII table will work quite happily with TB's editor.

Assuming everything works, your program will finish and you are automatically placed back in the editor at the line you left off, to carry on writing your program.

If your program doesn't work, the execution or the compilation stops and you are placed back in the editor with the cursor on the line that caused the error and an error message. You correct the error, recompile and rerun, all without leaving the Turbo Basic environment. When you are happy that the program works, one menu option gives it a name and another changes the 'Compile to . . .' setting from 'memory' to '.EXE'. The compiled program gets copied from memory to an executable MS-DOS command file.

Exiting Turbo Basic is done by typing Alt-X from the main menu, so Procomm users will feel at home. If you haven't saved the current version of the Basic source program, you are prompted to do so before exiting.

The menu options

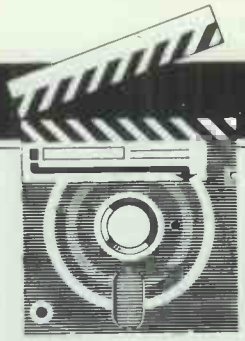
You set options and access Turbo Basic's features through menus which begin at the main title screen.

Looking at each option within each menu is a good way of listing the features available and showing the control the programmer has over the eventual compilation of the program.

The Load option loads a basic source language program into the editor, ready to amend or compile. The file can be one created with the Turbo Basic editor, or with any word processor that also saves plain ASCII files without control codes or high bits set. If you can't remember the name of the file you want to load, pressing RETURN gives a directory listing.

The New option clears the editor's workspace ready for you to start typing another program into the editor.

If the current Basic program has a



SCREENTEST

name, the Save option will save the current version to disk under the correct name. If you don't specify a name, the file will be called NONAME.BAS and will compile to NONAME.EXE on disk.

A Write To option changes the name of the current file. All files are normally given an extension of .BAS when they're saved, so it's not a good idea to give your own extensions otherwise TESTPROG.V1 and TESTPROG.V2 will be given the same name and one version will be overwritten.

The .EXE version of a compiled program can be up to 1Mbyte long if you use the $SEGMENT metastatement — see later. Source files can't be any bigger than 64k, though. You get round this by breaking large source files into chunks and using the $INCLUDE statement to merge all the modules together at compile time.

The main module, that doesn't include any code but just the $INCLUDE commands, is called the Main file and the Main File option tells Turbo Basic which file this is.

A Directory option lists the files in the current disk directory, while Change Directory is self explanatory.

OS Shell shells you to MS-DOS by running a copy of COMMAND.COM, which must be on the current disk. You can execute DOS commands from here, then type EXIT at the prompt to return to Turbo Basic in exactly the state you left it.

Customising

Turbo Basic works with an 8087 maths coprocessor. This chip speeds up number crunching, and is an optional extra on just about every PC. If you use the Options menu to specify that an 8087 is required, the compiled program will contain the instructions to drive it. Such a chip will typically speed up an empty FOR/NEXT loop tenfold. You don't have to have an 8087 in your machine to compile the program, but you *will* need one to run it. If you intend to give away or sell compiled programs then it's safer not to use the 8087 option or the eventual user will get a 'Sorry — can't run without an 8087' message.

When you write machine code programs in real machine code, they don't normally respond to the user pressing Ctrl-Break. If the program gets into a loop — tough. So it is with compiled Turbo Basic programs. To get round this, Turbo Basic will continually monitor the keyboard while running your compiled program and, if Ctrl-Break is spotted, execution is stopped. All this monitor-though, so a menu option lets you turn the checking off if you are sure that your program is safe. If it's not, you'll have to reboot.

There's a serious limitation to the way that this Ctrl-Break checking works when Keyboard Break is turned on. The extra checking only happens during input/output operations, like displaying text on the screen. So you can break out of an INPUT statement quite happily but something like 10 GOTO 10 will be disastrous. This needs fixing, though Borland doesn't have any plans to do so. Make sure you save the source code to disk before running it — that's not the best solution but it works. Graphics, by the way, is not considered as I/O.

Bounds is another error-checking option which, though useful, shouldn't be turned on in the final version of your program as it makes your code slower and larger. This goes for the in-memory compilation and the .EXE file version too. Bounds checking keeps an eye on your use of arrays and makes sure the program doesn't try to access elements that don't exist. Without bounds checking, anything can happen if you try to access element 20 of a 15 element array.

Overflow is yet another check, with similar reasons for and against its use. This one makes sure that numbers don't get too big or too small.

Stack Test keeps an eye on the size of the stack — the temporary workspace that the compiled program uses when it runs. When you develop a program, turn this test on and, if you find that the stack is too small just increase it with a $STACK command.

The Parameter Line option is really neat. A compiled program can access the command line arguments that started it by looking at variable COMMAND$. So, if you had a compiled .EXE file called PROG and you typed PROG FRED at the MS-DOS prompt, COMMAND$ would be equal to FRED.

Now this facility is all well and good in .EXE programs, but you can't normally test it when compiling to memory. This menu option lets you plug values into COMMAND$ before the program runs, so you can make sure that your program handles them properly.

A Metastatements option lets you set the stack size, and the size of the RS232 and music buffers. The music buffer will hold notes so that you can start a tune playing with the PLAY command and then continue processing while the band plays on.

Set-up

The Set-up menu allows full customisation of the colours used by Turbo Basic. Each part of each window can be a different colour. Directories can be specified, too, to tell the system where to find $INCLUDE files, where to put .EXE files and where to find the parameter file that holds all this information.

An auto-save function saves the source file before executing it, and a back-up option makes back-ups of source files when updating them on disk.

Use of windows

When you are developing a program in Turbo Basic, windows are used extensively by the system. There is an Edit window, in which the editor runs; a Trace window for use in debugging; a Message window that tells you what Turbo Basic is doing, and a Run window in which your program runs.

The Window menu allows you to control the arrangement of windows on the screen. You can opt for tiled windows, in which all the windows fill exactly a quarter of the screen, or you can stack them behind each other like a pile of papers, with only the title line of windows visible behind the front one. You can also open, close or go to any window directly with this option.

When you're developing a program, each window can be zoomed just by pressing F5. So, if you enter the editor and press F5 you get a full-screen editor that looks and works almost exactly like WordStar. There are a couple of minor differences, like being able to use function keys instead of Ctrl-K commands, but basically it's a WordStar-compatible editor that is, I'm told, identical to Turbo Pascal's (and will also be the same in Turbo C).

If you indent a line (with spaces or whatever), then pressing RETURN at the end takes you back to the same indent level. Useful if you indent loop structures for clarity.

All the Ctrl key combinations used in the editor are configurable, so you can make it behave like your favourite WP if you want.

Compiled programs that are run as .EXE files from MS-DOS don't use windowing — they take up the full screen.

Borland's changes

Turbo Basic is really a superset of Microsoft GW-Basic, so I'll concentrate only on additions and deletions from the standard Microsoft details. Anything I don't mention behaves like Basica.

Line numbers

Turbo Basic doesn't require line numbers. If you feel lost without them, you can happily put them in and Turbo will happily ignore them. They may come in useful as the destination of a GOTO or GOSUB command, in which case you can put a number on the line in question and nowhere else.

Better than line numbers, though, are labels. The GOTO command in this example is much easier to understand than a command like GOTO 10.

```
Top:
For X = 1 to 10
Print "Testing . . ."
Next
Goto Top
```

Metastatements

Metastatements are directives that instruct the compiler but don't actually form part of the program. They are in the program's source code, though, and identified by starting with a dollar sign.

There are 16 metastatements in all. Some of the most useful ones are: $IF/ELSE/ENDIF and $SEGMENT.

Turbo Basic supports conditional compilation. This means you can put some lines of source code in your program and say to the compiler 'if so-and-so variable is set, compile the following statements into the program, otherwise don't'. This allows you to have one source file that can compile into a number of versions.

The $SEGMENT metastatement splits up a compiled program into a number of 64k segments. Unlike the current Turbo Pascal, where the program you generate can be no longer than 64k, Turbo Basic lets you make programs up to 16 segments long, which is 1Mbyte — three times the capacity of a floppy disk.

Functions and procedures

Turbo Basic supports named procedures and functions. Instead of GOSUB 25116 you can have GOSUB Get_String. Defined functions can spread over more than one line, too. Normally, a DEF FN command can only be one line long, but Turbo Basic allows you to have something like:

```
DEF FNcheck_valid(a)
    if a = 4 then flag = 2
    if a = 7 then flag = 2
```

▶

Non-standard commands added to Turbo Basic

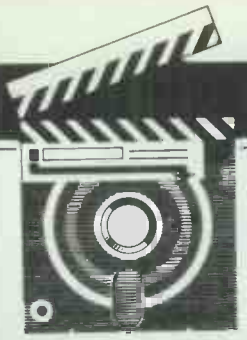
BIN$	Converts a number to binary.
CALL INTERRUPT	Calls an MS-DOS or BIOS interrupt. CALL INTERRUPT 5 prints the screen. CALL INTERRUPT &h21 makes an MS-DOS function call. The REG command allows access to registers before and after the function call.
CHAIN	Allows you to load in overlay modules, so a Basic program can be larger than available memory. The run-time library is not reloaded each time.
DECR/INCR	Decrements or increments a variable.
DELAY	Pauses for a specified number of seconds.
ENDMEM	Returns the address of the highest memory address.
ENVIRON	Allows you to read and write the MS-DOS environment variables.
EXIT	Allows you to jump neatly out of a FOR/NEXT loop before its proper completion.
EXP	EXP (n) still returns e^n. EXP10 (n) returns 10^n. EXP2 (n) returns 2^n.

IF	This has been extended so you can have:
	IF X = 4 THEN
	FOR P = 1 TO 10
	PRINT "Variable X is equal to 4"
	NEXT
	ENDIF

INKEY$	This has been extended. Returns a string of length 0,1 or 2. If 0, no key is pressed. If 1, a normal printable key is pressed. If 2, the first byte is 0 and the second is the scan code. This allows you to detect function keys and Alt sequences, though not all combinations worked, especially Ctrl-Alt sequences.
INSTAT	Tells you if there is a key waiting in the keyboard buffer, without actually having to read the key.
LCASE/UCASE	Converts a string to upper or lower case.
LOG	Will calculate logarithms to base e, 2 or 10.
MTIMER	A microtimer, only accurate for timing periods of less than 54 milliseconds. Useful for checking exactly how long a single instruction takes to execute.
OPEN . . . BINARY	A more flexible file handling option that lets you change bytes in the middle of a file without having to copy it character-by-character.
PEN	Allows you to read the position of a light pen.
REG	Lets you put values in a register before making an MS-DOS call, and read back the value from a register afterwards.
SELECT CASE	A better way of handling multiple IF . . . GOTO commands. For example: SELECT CASE X CASE < 20 PRINT "Not big enough." CASE 21,27,29 PRINT "Sorry, that number not allowed." CASE > 100 PRINT "Nope, too big." CASE ELSE PRINT "That'll do nicely." END SELECT
SHELL	Gives the user access to MS-DOS. SHELL "DIR" prints a directory on the screen. SHELL on its own puts the user in MS-DOS where he can execute commands, then return to the BASIC program by typing EXIT at the prompt.
STRIG	Lets you read the position and buttons of a joystick.

Note: The following Microsoft commands are missing from Turbo Basic:

AUTO EDIT MERGE RENUM CONT LIST MOTOR SAVE DELETE LOAD NEW USR



SCREENTEST

```
    if a > 12 then flag = flag +
    oldnum
END DEF
```

Recursion is supported, so a procedure is allowed to call itself. When you call a procedure, Basic normally stores its current position in a work area called the stack, so that it knows where to return to when the procedure ends. If a procedure keeps calling itself and doesn't return to the place it was called from, the data from the stack is never recovered and will keep filling up, resulting eventually in an out-of-memory error. Turbo Basic gets round this problem by clearing the stack each time you re-enter a procedure.

Interrupts and Inline

It's uncommon for Basics (indeed any other languages) to let you make calls to the MS-DOS operating system or the ROM BIOS. Turbo Basic has a CALL INTERRUPT command that allows you to make a call to MS-DOS easily. You can do this from interpreted Basic and through other compilers, but not easily.

CALL INTERRUPT 5, for example, will print the screen. For more complex DOS and BIOS interrupts, you have to set the registers in the machine. The REG command gives you access to these registers so you can set up the required values before making the call, then read the registers to see what values were returned.

The $INLINE directive lets you specify explicit bytes of machine code in a program. The machine code instruction Int 21h is represented in hex by the bytes CD and 21. To put the command in a program you can just type $INLINE &hCD,&h21.

If you have large chunks of code to put in INLINE commands, you don't want to have to calculate the hex bytes by hand. Instead you can generate them with an assembler and then include the results as a COM file, which is loaded once during the compilation process.

Making comparisons

Turbo's only competitor is Microsoft's QuickBasic, a very similar product that also offers a window-based development environment for Basic programming on the PC.

The price difference between the two is not really significant, so some other factors should be considered.

● Support and the future

Borland has built-in features that are not part of standard Microsoft Basic. (It's written in Turbo C, which should be launched soon.) While retaining almost total Microsoft compatibility (most GW-Basic programs can be loaded straight in, as long as they are saved in ASCII format) Borland was able to include 8087 support, recursion and some very useful commands, as well as easy access to MS-DOS and BIOS calls.

● Speed and size

To support an 8087 chip, you have to store numbers according to the official IEEE specification, and that's exactly what Borland does. The disadvantage of this is that it takes a lot of time and memory to do this (twice as much as normal). This means that Turbo Basic is not the ideal language for writing number-crunching routines unless you have an 8087 chip, in which case everything whizzes along.

There is a potential problem with *PCW*'s grafscrn Benchmark. Because the FOR/NEXT loops use floating point variables, the machine is spending more time on the maths than on the plotting. The moral is to force Basic to use the lowest precision maths possible. If you want a FOR/NEXT loop to go from 1 to 200, using integer variables (FOR X% = 1 to 200) can double the speed.

The timings in the Benchmarks box table below use the non-integer version grafscrn as printed in the December 1986 issue of *PCW*.

● OBJ files

Turbo Basic doesn't produce .OBJ files, whereas QuickBasic does. The OBJect files have to be passed through a LINK program, which takes extra time. The advantage of OBJ files is that programs produced by different languages can be linked together into one program. The INLINE command in Turbo allows the inclusion of machine code routines and, although much simpler than QuickBasic's method, it's not as versatile. QuickBasic is supplied with a copy of LINK, which should please Amstrad owners.

● Debugging

Debugging a program takes a long time, so you'll become pretty intimate with a compiler's facilities.

If QuickBasic detects an error while trying to compile your program, it will remember the details and then carry on compiling. Up to 25 errors can be stored, so you can go and correct them one by one. If Turbo encounters a compile-time error, compilation stops immediately, you correct the error and compilation starts again from the top.

Both packages have error messages in English — no need to get out the manual to look up what numbers mean.

Both have trace modes that let you step line-by-line through a program's execution to find out where errors are occurring.

Conclusion

Turbo Basic is a very usable product. It is quite possible that in a few months, programmers and MS-DOS enthusiasts will think of Microsoft Basic in the way that they now think of Microsoft Pascal. Basic is dead. Long live Basic.

Turbo Basic costs £69.95 plus VAT. QuickBasic is £75 plus VAT.

Turbo Basic requires MS-DOS or PC-DOS version 2.0 or above, both to compile a program and to run it. 640k of RAM is recommended if you want to write reasonably large programs and compile them to memory.

Toolkit routines are promised but no details were available at the time of writing.

Borland is on (01) 258 3797. END

Benchmarks

All times are in seconds. No 8087 was used. Tests were done on an Arc 4.77MHz PC-compatible with a Microscience hard disk and EGA. Keyboard Break detection was on. Compilation was directly to memory.

The Benchmarks, which spend all their time doing maths routines, are slower in Turbo Basic than in QuickBasic. The accuracy, however, is greater.

	Turbo Basic v0.73a	QuickBasic v2.0	GW-Basic interpreter
Intmath	2.5	2.3	7.1
Realmath	3.8	2.1	7.0
Triglog	27.6	14.7	53.9
Textscrn	38.2	49.2	100.1
Grafscrn	33.1	19.2	36.7
Store	4.8	9.8	14.3

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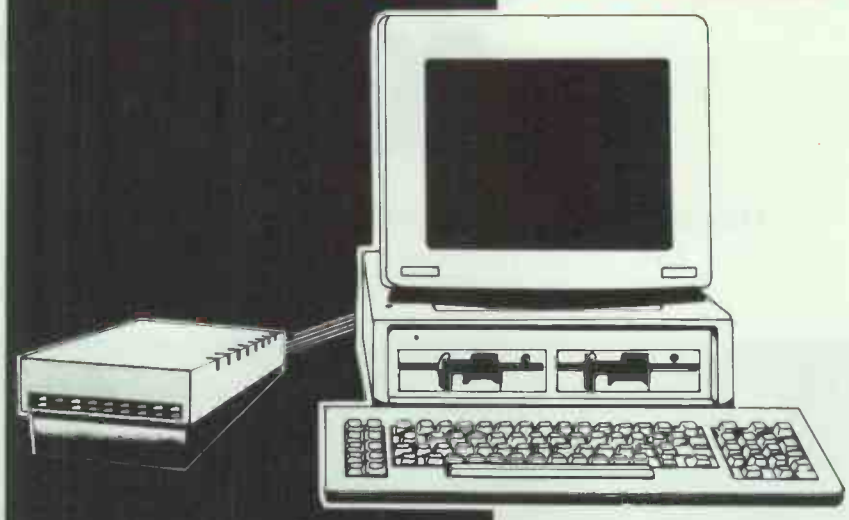

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Microtext teletext adaptor

The Microtext teletext adaptor enables Commodore 64 and Amstrad CPC users to access information from Ceefax and Oracle. Tony Hetherington describes the process.

Photography by Dennis Bunn

Considering the Commodore 64 was never designed to display teletext pages, the quality of the display is excellent. Page 100, shown here for Ceefax, is the quick index page for Oracle too

A micro magazine, user club listings and a computer problem column can be found in pages 700-750 on BBC 2. Unfortunately, all downloadable software is for the BBC Micro

When the BBC and ITV teletext services were launched thirteen years ago, users were paying a premium of £200 to buy the special sets capable of accessing this 'free' database service. Electronics magazines were packed with projects that slightly reduced the price but still left a significant difference between the cost of ordinary and specially adapted sets.

Now Microtext has produced an add-on for Amstrad CPC and Commodore 64 owners which plugs into the back of the micro and displays teletext for a fraction of the cost.

The technical solution that so dramatically reduces the cost to a third of the original price is to use the TV modulator contained within a domestic video recorder and the display capabilities of the home computer. This combination replaces the costly hardware found inside the usual teletext adaptor.

According to Microtext, this hardware configuration can be used throughout the world since the appropriate national standard video recorders will resolve the problems caused by different TV standards.

Setting up

For this review I used a Commodore 64C. The adaptor is housed in a neat black plastic box that comes with a two-metre lead and a disk or cassette containing the control software. A brief but informative manual is also supplied.

The adaptor fits neatly into the 64's user port/cartridge slot at the rear of the machine and is connected by the lead to the video-out socket of the video recorder. After that it's a simple matter to load up the software, and within a minute a teletext frame appears on your computer monitor or television.

I was quite amazed that it was that simple and actually worked. Instead of carrying the 64C, disk drive and monitor down to the video, I had brought the video to the computer and had it precariously linked to the indoor aerial of a small portable TV.

Anyone who has ever used teletext will appreciate the extraordinarily clear picture produced on the computer screen — there's a distinct lack of the jumbled characters common on adapted teletext TVs and usually caused by bad reception.

Because it is probably impractical for most households to have the family video recorder and computer within two metres of each other, longer leads are available from Microtext at 50p per metre up to a maximum of 25 metres.

The adaptor uses the little-used video-out socket that can be used when the video is idle or recording. The only time you can't use it is when you are playing back a video, as the video-out socket will carry the recorded pictures rather than the aerial signal. But when your video is on 'play', the chances are you'll be

Continually updated information is one of the main attractions of teletext. For those owning TSB, British Gas or Telecom shares, there is a full listing of share prices, updated every 20 minutes

One of the attractions of using a computer to access teletext is that pages can be both printed and saved to disk. A good start is to make a hard copy of the full index found on page 199

watching television anyway.

Applications

The most obvious way you can put the Microtext to work is to access the hundreds of pages that form Ceefax and Oracle. The pages are organised into sections, and each channel has full and sub indexes. Typing in a three-digit number on the computer keyboard brings up a page which can be saved to tape or disk, or even printed out. A television add-on with the same download options was announced last year and cost over £700!

Using teletext for just half an hour, I discovered that there actually is a Cardinal Sin (doing his bit for the Catholics in Manilla), the latest football results, stock market share prices, TV, cinema and theatre listings, a recipe for chilled chocolate cake, bridge, chess and word puzzles, the latest world news, the weather in Tokyo and which roads were clogged up with snow. Some of these pages are updated.

In the computer section I found news, games reviews and software that can be downloaded into a BBC Micro. If this section is ever extended to cover Commodore 64s and Amstrad CPC machines, then Microtext will add the necessary software to enable software to be downloaded into those machines.

The two programs which are supplied with the adaptor consist of a machine code program that controls the interface, and a Basic program that allows you to travel through the teletext pages as well as loading, saving and printing them.

You can also dramatically increase the value of teletext by writing programs that can read, use and store parts of the teletext frames. This is done by modifying the Basic driver.

The possibilities of this are almost endless, as you can transfer any page from the adaptor to your computer's memory where you can then read it. This can be used for a variety of applications such as entering football results into a pools predictor, monitoring trends in the weather, and plotting stock market or currency prices to help you judge when to buy or sell.

Programming

Microtext's software was specially written to make it easy to access teletext screens from your own program. This is achieved by supplying the original program with easy-to-use subroutines. These routines can be called by a SYS command and are used to: initialise the adaptor and request a page (including wild-card digits); check whether the adaptor has received a page; copy the page to RAM; display the page on screen; and send a page to the printer.

When in memory, a page occupies 960 bytes from location 52224 and can be read from within a program by PEEKing the appropriate memory locations. Address 52224 corresponds to the top left character of the page and 53183 to the bottom right.

The examples in the 20-page instruction leaflet include a program that prints out a teletext screen without the graphics for daisywheel printers; one that scans through a selection of the on-air database; and one to load and print out the day's television for all four channels.

More ambitious programs could store a week's football results, update a pools forecaster, produce racing formbooks or, more seriously, compile graphs based on share or stock prices.

The facility to grab this information from teletext makes the entering of the all-important data into these programs easy, and the programs practically leave you to work out how to spend the profits.

Prices

The Microtext teletext adaptor including cassette software (disk available on request), a 20-page brief but adequate instruction book and a two-metre lead for both C64 and Amstrad CPC computers cost £69.95. Longer leads are available at 50p per metre to a maximum length of 25 metres.

For those without a video or a TV with a video-out socket, you can buy a separate tuner for £48.85 that connects to the adaptor via a DIN plug connector. This also allows you to swap teletext channels from the comfort of your keyboard. *If you don't already have one, you will require a TV licence (colour if you have a colour monitor) to use this set-up.*

Conclusion

The Microtext teletext adaptor provides a cheap way to access the four teletext databases using the TV modulator built in to a domestic video recorder and the computer's display capabilities. In addition, the adaptor enables you to save and print the pages and extract information for your own use — which you can't with domestic teletext televisions.

All of the system's facilities are presented in an easy-to-follow format and setting up the system is very easy. Facilities better than commercial teletext adaptors have now become available to home computer users at a fraction of the cost.

Microtext is on (0705) 595694. END

What is teletext?

Teletext is a free database service which is available on all four television channels during normal transmission times. The information which describes each 'page' is carried in six previously unused lines out of the 625 transmitted to form each frame of a television picture.

You can 'see' the six lines of black and white dots that are converted to form the pages of Ceefax (BBC1 and 2) and Oracle (ITV and Channel 4) by reducing the height of your television picture slightly. The dancing dots at the top are decoded by the teletext adaptor to form the graphic frames.

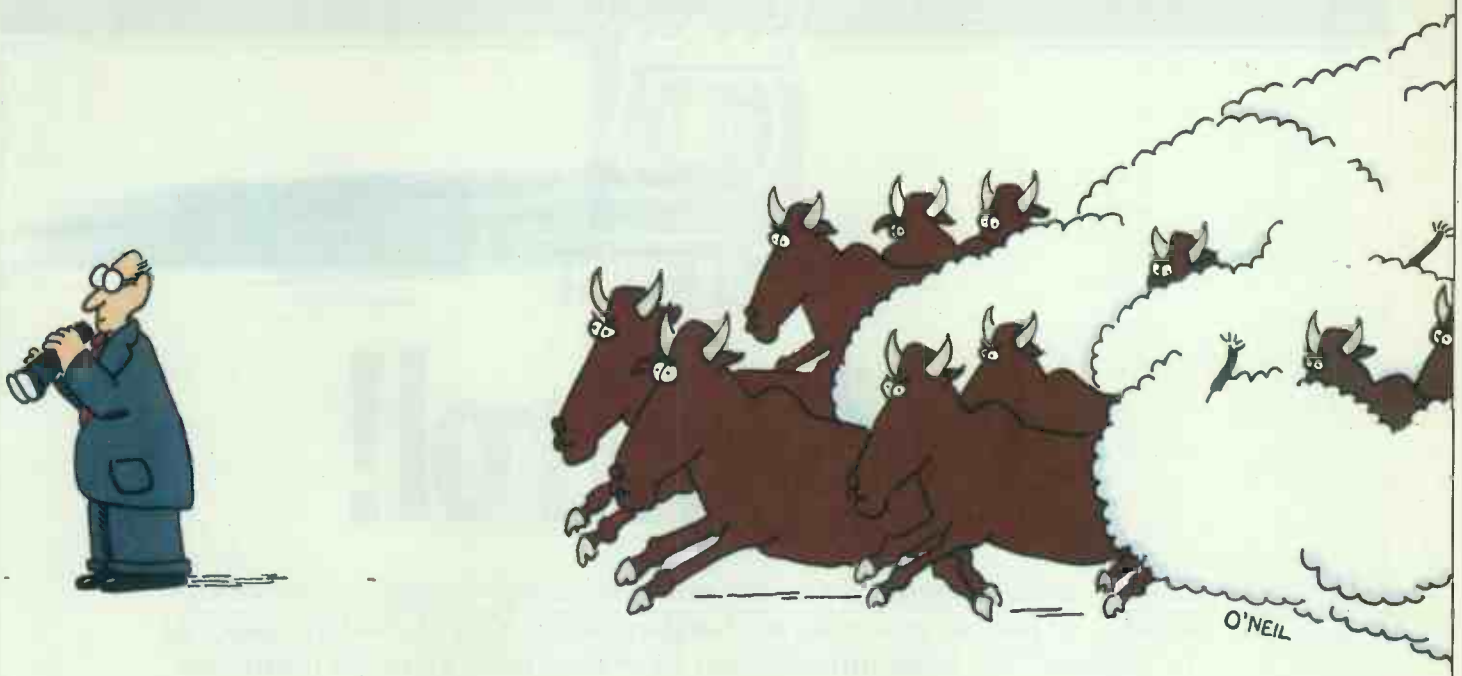
Unlike the TV signal, the teletext information is in fact a character stream which is decoded to form characters and block graphics, and to change colours and attributes such as flashing and hidden. There is much similarity between teletext characters and Prestel or BBC mode 7 graphics.

Each line on a TV picture screen can carry enough character information for one of the 24 lines of a teletext frame. This means that it takes four TV picture frames to carry one teletext frame. A teletext adaptor stores the information until it has received all 24 lines and then displays the page. This process can take as little as 1/10th of a second.

Each teletext page consists of 24 lines of 40 characters, with the top line showing the current time, date, channel and page being displayed, and a changing display which shows which page is currently being transmitted.

To access a page, you key in its three-digit number and wait for it to be transmitted. You then wait between no time at all and fifteen seconds until the page you want comes along. The display then changes to show that page.

Not all pages are transmitted with the same frequency. Popular pages such as indexes and news are transmitted every few seconds, while the more obscure information pages occur less frequently.



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SCREENTEST

In Control!

Project development can cause real headaches unless you have the benefits of proper planning and organisation. David Tebbutt looks at In Control!, an ideal introduction to critical path analysis methods.

Abtex has been selling network planning packages for donkeys' years. The company wrote a thing called Micronet for the Apple II in 1977. By the time I first saw it in 1979, it had become Pertmaster and ran under CP/M. The product has been under continuous development since then and, until very recently, came in two flavours: Pertmaster 2500 could manage — wait for it — 2500 activities; and Pertmaster 1000. These versions cost £850 and £650 respectively. Pertplotter took care of printing and plotting and cost an additional £100 when bought with Pertmaster, or a predatory £495 if bought separately.

Now the company has announced two new versions of the product: In Control!, the subject of this review; and Pertmaster Advance. Pertmaster Advance is a brand new program incorporating windows, Lotus-like menus and advanced project control facilities. This will set you back 995 smackers and, frankly, appears a much better buy than Pertmaster 2500 plus Pertplotter.

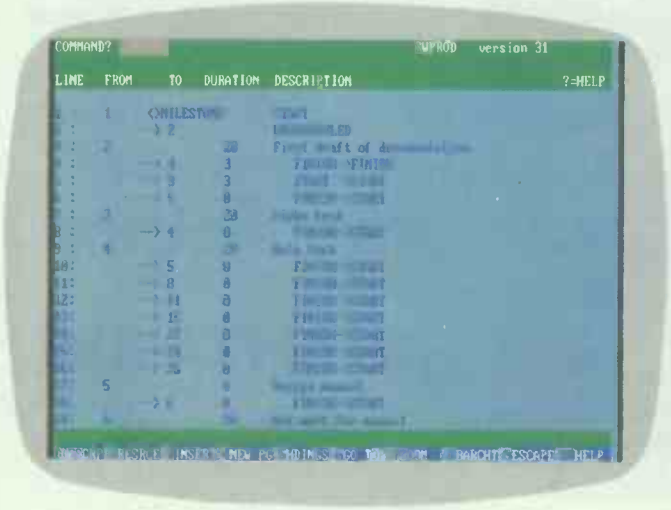
In Control! is, in fact, Pertmaster plus a bit of Pertplotter (the printing bit) and weighs in at £49.50. The limitation is that it can only handle 75 activities and 29 resources. But who cares? If you're new to project planning, this is plenty to be getting on with. Or if you're just curious about computer-based project planning, this is a cheap way to see whether you like it.

Overview

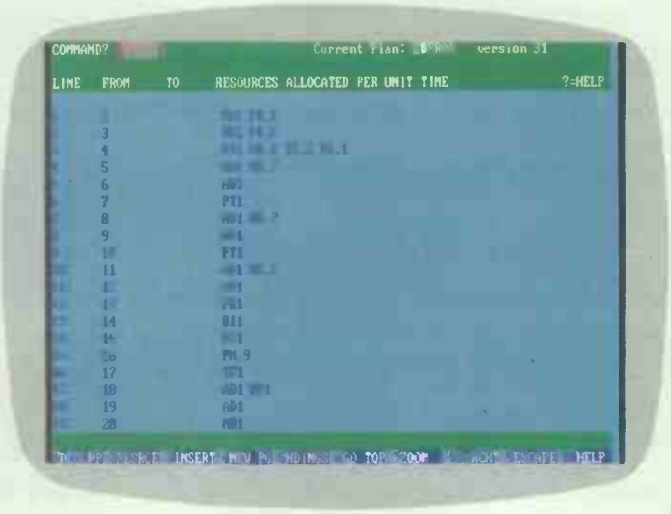
You tell In Control! about the activities in your project, their dependencies and the resources needed for each one. You also give it details of non-working days to build into its project calendar. In return you can select from a number of screen, printer and disk reports, which will enable you to decide the trade-offs necessary to make the optimum use of your resources.

The printer reports are as follows:

- The standard project report tells you the earliest and latest dates you can start and end each activity.
- The project/period barchart is effectively a plan of the entire project, showing activity durations and the critical path.
- The activities and relationships report is a listing of your entire input to the project.
- Resource reports show the usage of each resource during the project.
- The resource histogram shows resource usage or consumption in graphic form.
- Network diagrams show the activi-



This is the primary data entry and editing screen, where the duration of the tasks and their relationships in terms of starting and finishing times are entered up. Editing is usually by line number



The resources screen is a crude way of allocating tasks to time periods. A resource is labelled with a two-character identifier plus the number of units of the resource used per unit of time

ties and their relationships in diagrammatic form. You do, of course, need a graphics printer.

You can display all except the daily/weekly resource reports on-screen. The network diagram is handled in small chunks through a ZOOM command which gives a close-up of each activity with its preceding and succeeding dependencies.

Facilities are included to allow merging of network files, although this is unlikely to be a major requirement in a 75-activity system.

All In Control! files are held in fixed-sized fields and in ASCII format, which makes exchange of data with other programs a relatively simple matter. Understandably, Abtex recommends that data is exported but not imported because its own data is heavily validated before being accepted into a file. Alien data could easily cause problems because it would bypass these validation routines. The manual gives examples of transferring In Control! data to Lotus 1-2-3, SuperCalc and dBaseII.

Installation

In Control! runs on both MS-DOS and PC-DOS systems and requires a minimum of 128k RAM, two disk drives and an Epson, IBM, or compatible printer. The system used for the review was an AT-clone with a 20Mbyte hard disk, CGA and a colour screen, 640k memory and a Star NL-10 printer with an IBM personality board. Installation was a doddle — I just typed 'AT C' and In Control! was ready to run. Once inside In Control!, you are invited to tell it things like disk drives in use, printer details, and special information relating to how you want your reports presented.

Preparing for input

To try out In Control!, I decided to create a real project. Nothing too ambitious — just 47 activities, 14 resources and a timescale around five months. The project was to launch Megabrain, a new piece of software.

The first thing to do is to prepare a list of activities which make up your project, then establish the relationships between them. When you've had a first stab at this, you can start to input the details to In Control!

With the Megabrain project, I typed a list of all the project activities grouped into sub-projects like testing, manual, labels, packaging, binders, advertising, brochures and launch. The links between activities in each sub-project were easy to define. I then drew lines to show the dependencies between activities in these different sub-projects. For example, I couldn't finalise my advertisements until I knew what the product would look like. I gave each activity a number at this point, to speed input to In Control! ▶

What is critical path analysis?

All projects have a tendency to run late, cost more than intended, or produce the wrong result. Sometimes all three.

One solution has always been to indulge in more effective planning, but so many managers are so busy 'controlling' the mess they simply won't make time to learn more professional approaches. Those who have discovered the benefits of proper planning and control procedures often use a system called critical path planning, or critical path analysis.

All projects comprise activities, the things which need to be done, and resources — usually the labour and material used. A project manager's aim is to optimise the use of resources, at the same time meeting any project timescale, cost and quality constraints.

A simple tea-making example illustrates the principles. The activities might be: Fill kettle; Boil it; Put milk in cup; Put tea bag in cup; Pour boiling water into cup; Stir contents of cup; Throw out tea bag; Add sugar; Stir. You would probably put the milk and tea bag in the cup while the kettle is boiling, thus saving a little time.

Any project can be broken down into discrete activities and the relationships, or dependencies, between them identified. The kettle must boil before adding its contents to the cup. The tea must be stirred before the tea bag is thrown away.

These dependencies may be shown by a network diagram in which the 'nodes' are the activities and the lines show the relationships. Some people prefer the nodes to be numbered and the lines to show the activities. For manual network planning it doesn't make much difference, but In Control! works better using the 'activity on the node' approach. The figures in brackets are the number of seconds taken for each activity.

Fill ====	Boil ====	Pour ===	Stir ===	Remove ===	Add ===	Stir tea
kettle	kettle / / / /	boiling water	cup contents	tea bag	sugar	
(4)	(120)	(5)	(20)	(3)	(3)	(4)
Put milk -- in cup	Put tea bag in cup					
(4)	(1)					

The critical path through a network comprises all those activities which, if they took longer than planned, would delay the project's completion. In this example, it is shown as a double line and tells us that tea-making takes 159 seconds.

A project can often be speeded by applying extra resources to critical activities or by taking activities off the critical path. We could, for example, add the sugar while the kettle is boiling and remove the need for that second stir operation:

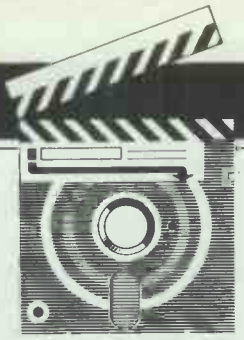
Fill ====	Boil ==========	Pour =====	Stir =====	Remove
kettle	kettle / / / /	boiling water	cup contents	tea bag
(4)	(120)	(5)	(20)	(3)
Put milk -- in cup	Put tea -- bag in cup	Add sugar		
(4)	(1)	(3)		

In a more complex project you will be planning the use of finite resources — usually equipment, materials, people and money. You will have a workforce who you want to keep more or less evenly busy. It's no good shelling out money for overtime one week if the people are idle the next.

By itemising the resources required for each activity in the network, it is possible to produce histograms of resource usage over the duration of the project. Some computer programs will 'smooth' the use of resources for you, presenting you with an optimised network. Others, like In Control!, will give you the information you need to be able to attend to the finer points of scheduling yourself.

Armed with this information you can then reallocate resources to the critical jobs to speed the project, or schedule the non-critical work to make the best use of resource availability. Similarly, you can produce cash flow projections, then move the expensive components of the project around to smooth out the costs.

One of the greatest advantages of a computerised network planning system over its manual alternative, is the ability to play 'What If' and to amend the plans in the light of project developments.



SCREENTEST

Normally, as one activity finishes, another is able to start. This type of dependency is called a Finish-to-Start link, but some links can't be described in this way. Perhaps one can start once another has begun but before it finishes. This happened a couple of times in the Megabrain project. For example, documentation took place concurrently with product testing, so the start of alpha testing was dependent on the first draft of the documentation being complete. Similarly, alpha testing couldn't be finalised until the documentation was complete. In Control! allows you to put a duration on these Start-to-Start and Finish-to-Finish links. Readers familiar with critical path methods might know such linked activities as 'ladders'.

You can designate certain activities as 'milestones' in order to get summary reports out, rather than very detailed ones. With In Control! only handling 75 activities, this feature is probably less important than in the larger versions of the product. Dummy activities, which consume neither time nor resource, can be popped in, too. These give a good way of gathering together different strands of a project to a readily identifiable point, before going on to the next activity. I didn't use any dummies in Megabrain but I could have had one called 'Everything ready for launch', for example.

Up to 10 resources may be associated with each activity and these can be of three types: conventional resources are things, like people, which can be used repeatedly; expendable resources are either consumed or produced by the project; and point resources are those which are consumed or produced only on the last day of an activity. This might involve payment to contractors, or the hire of equipment necessary to enable the transition from one activity to the next.

The only other information In Control! expects is calendar details and any fixed dates. All I knew was that I wanted Megabrain to start on 1 January and finish as early as possible. The burning issue for me was to book the launch facilities, so I had to run the model once to find out when the launch would be practicable. The calendar is simply a case of deciding which days are working days (usually Monday to Friday) and which public holidays need to be taken into account. The first thing to become clear was that the project couldn't start until 2 January.

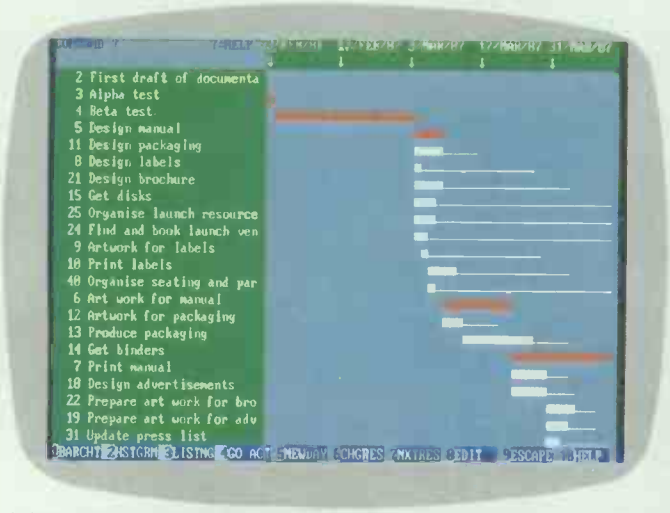
Input

Input is straightforward, albeit a little tedious. The program is written in Basic and it shows. It was also developed from a product written years ago, before IBM and others established key use standards. This means that the Delete key deletes to the left (instead of under the cursor); backspace doesn't delete; and a Return in the middle of text truncates it at the point Return is pressed. None of these things is a particular problem — you just need to ignore what have probably become your instincts. If I were paying hundreds of pounds for In Control! I would be very peeved, but at £49.50, what can I say? It's irritating but forgiveable.

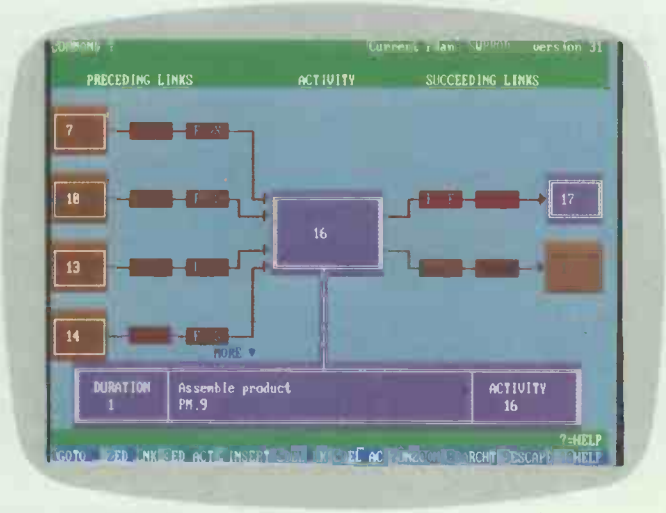
As long as you are progressing in a forward direction, data entry is fine. If you want to go back and make changes, then the normal user interface gets a bit crummy. Insertion is done by activity number: press I, Return, activity number, Return, and the defined activity (if it already exists) is shown with all its forward links. You may add to this list. Deletion is done by screen line number: type Dnn, Return, then another Return to confirm. You can amend duration, link and descriptive information by entering the appropriate screen line number, followed by Return. But if you want to amend linkage details, you have to delete the offending line and insert a new one in its place.

The ZOOM feature provides an alternative way to modify your network details. It lets you examine the network close up, in diagrammatic form. While there, you can make amendments far more easily than with normal data entry. It's probably best to do as much work as you can using the normal data entry facilities, then tidy up using ZOOM.

Resources are added by switching to another screen which simply lists the activity numbers, and you're expected to provide details of up to 10 resources against each. A written note of the details is clearly necessary. You give each resource a two-character code and a quantity used per unit of time. In the Megabrain case a unit of time was a day and I had six beta-testers working full-time, so the resource entry was BT6. Expendable and point resources have



A bar chart shows how the tasks relate to each other in time. The red bars indicate the tasks which are constraining the duration of the project. The thin white lines show how much leeway or 'float' there is on each non-critical activity



This is one node in the network showing how activity 16 relates to preceeding and succeeding activities. The box at the bottom shows which resources are used for this task and how long the task takes

to have $ and £ prefixes respectively. You create and maintain a resource abbreviation dictionary through In Control!'s housekeeping option.

When you have entered your project details, there is no way of checking their integrity except by asking for a report, either to screen or to printer. If an anomaly is encountered, you are warned that activity something-or-other is a 'dangle'; this means the network is broken at this point. You then go back into data input mode and correct the error, and any related ones you might notice. Then you go to print again only to learn there is another dangle. You go round and round this loop, one dangle at a time, until your model is clean. You could use ZOOM to find dangles, but it isn't easy.

I should point out that, despite the niggles, In Control! beats the socks off doing this work by hand.

Reporting

The reporting menu is quite nice. You select the reports you want, build them up into a print queue, and then nip of to the pub while In Control! does the work.

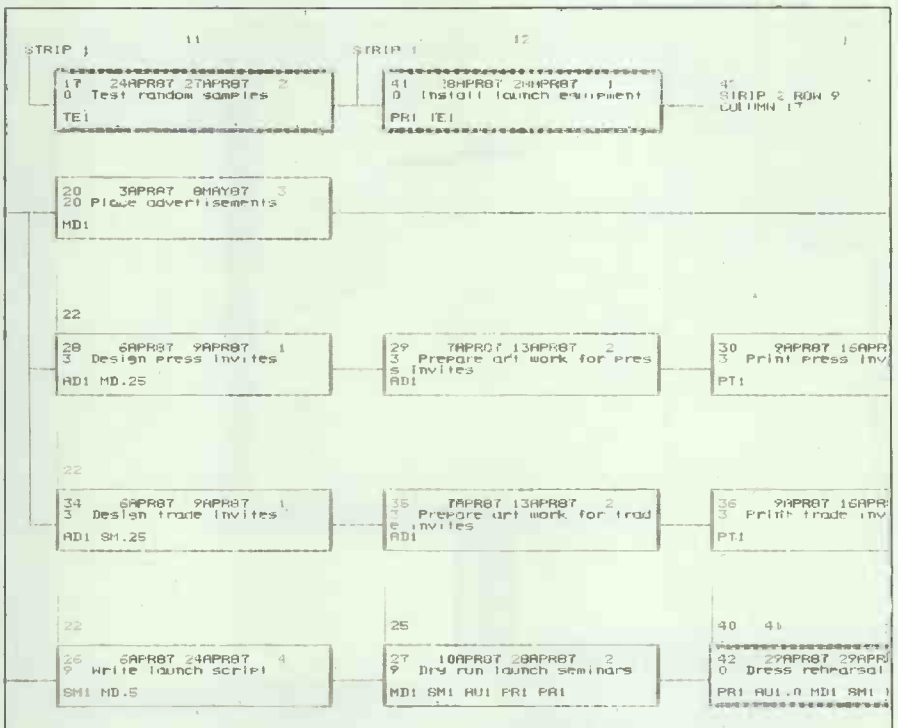
The network drawing is part of another menu so you can't include that on your 'to print' list. I tried it with a print spooler and the pair of them got in a hopeless tangle. Even without the spooler, In Control! was rather extravagant with my paper. To print a deep network, In Control! prints out a series of strips so that you can stick them together, one above the other. Whether it was a fault of In Control! or my Star printer, I don't know, but the darned thing spewed out nine blank pages after printing each strip. The full diagram of my sample project (47 activities) took over 45 minutes to produce. After that, I made do with an activity number-only version in small print which took 15 minutes and used just two sheets.

The standard listing and the project barchart can both be printed in a variety of ways. You can report in activity date sequence assuming either early or late starting. You can show critical activities first or you can make the listing alphabetical. You can select the items reported by resource, by a key phrase in the description according to whether an activity is a milestone, or by the amount of float.

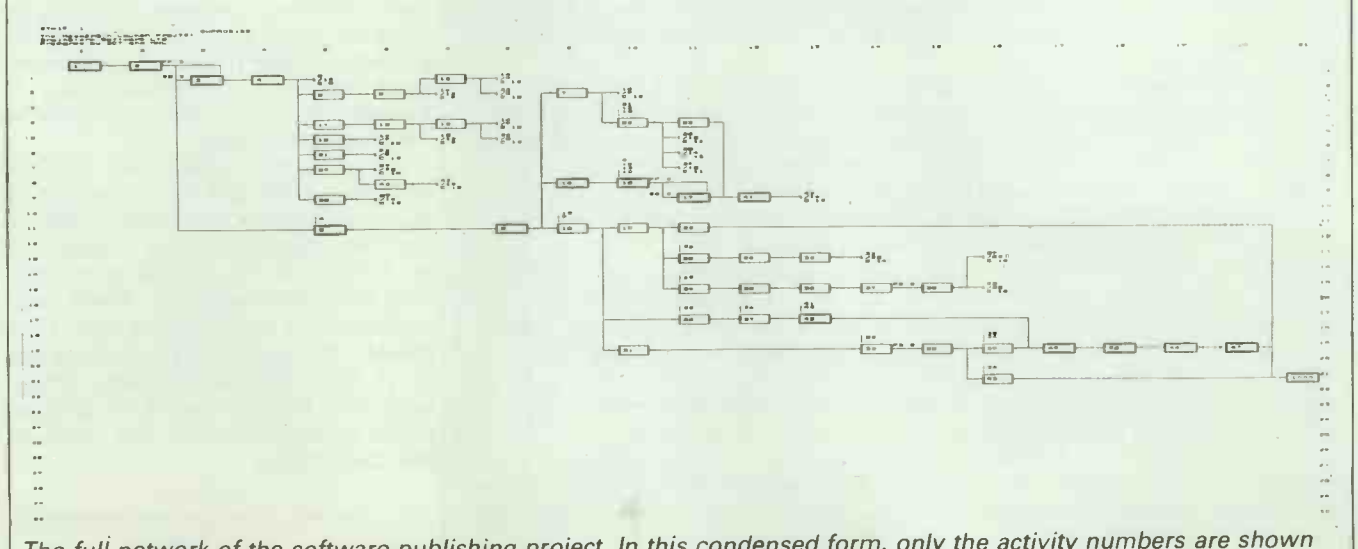
My favourite was to force only the critical activities onto the report by asking for activities with zero float. Although it isn't described in the manual, you can tweak the default printer characters: in the examples, I've used a triple line for critical activities, a double line for none-critical ones, and a single line for float. Had I set an impossible deadline, then the Megabrain project would have ended up with negative float for which I nominated a solid bar.

The network listing — the complete list of everything input — gave me printer trouble in that the last line or two went over the joins in my continuous stationery. Since some parts of In Control! handle paper OK, I must assume that such 'creep' is generated by the program.

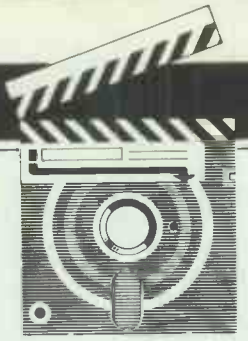
The resources report gave me hours of fun. You can have two versions — daily and weekly. Because



A section of the full network listing. Each activity is identified by its number, starting and finishing dates, and the resources it uses



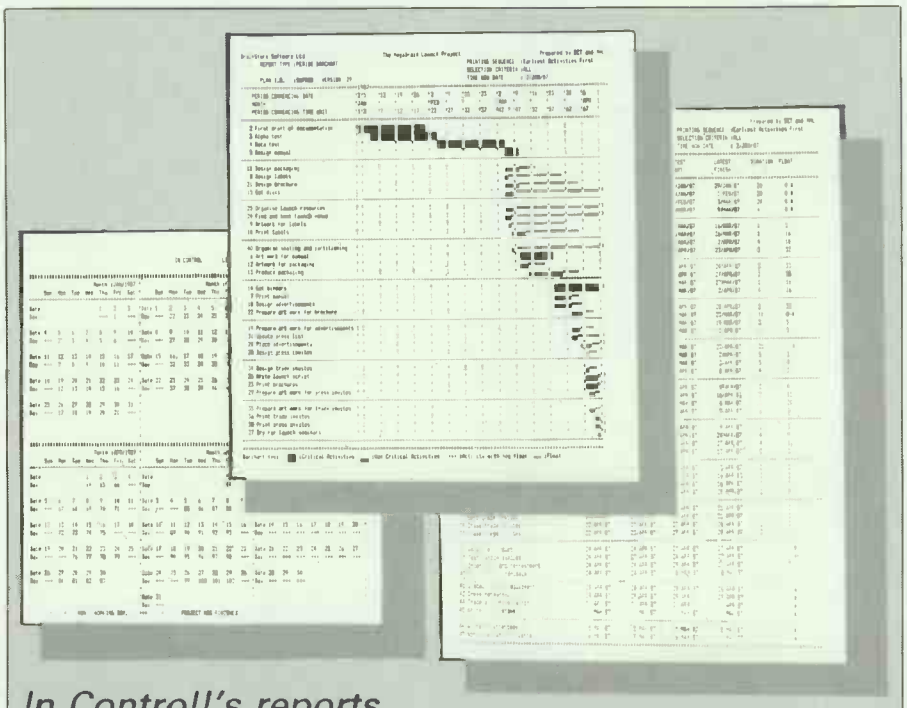
The full network of the software publishing project. In this condensed form, only the activity numbers are shown



SCREENTEST

the Megabrain project is quite light on staff, it took me a while to twig what was going on. I'd do a daily report and the usage of every resource was listed for every day. When I came to do 'daily average per week' reports, some of my resources appeared not to be used. The problem lies in rounding and scaling. In Control! works out the average daily usage for the resource but doesn't change the original mathematical precision. It really needs one more decimal place. Paul Davis, Abtex managing director, has promised to put this on the 'fix list'.

The resource histogram was pretty well an academic exercise in the Megabrain project: I could see from the resources reports where I had problems. However, in something more complex and using much higher volumes of resources, this would be truly useful. My art director ended up with the most erratic loading and, had Megabrain been a real project, would have forced me to reschedule. Incredibly, In Control! managed to mess up the paper feeding of this report too, resulting in the histogram itself being neatly separated from the date and day number information.



In Control!'s reports

The standard project report shows, for each activity, its node number, its description, the earliest date the activity can start and the earliest date it can finish. It also shows the latest dates it can start and finish without impacting the project completion date. It gives the duration of the activity and the amount of float associated with it. (All non-critical activities have more time for their completion than they actually need; this is the float figure.) As well as having zero float, all critical activities are highlighted with an asterisk.

The project/period barchart report shows the duration and timing of each activity by mapping them as horizontal bars onto a project calendar. Different characters are used to show critical activities, non-critical activities and float. This gives a very clear visual idea of the entire project. Such a chart is often referred to as a Gantt chart or a time-scaled network.

An activities and relationships report simply lists your entire input to the project: activities, relationships and resources used.

Resource reports show the usage of each resource over the entire project. A daily report gives the figure for each resource, each day. The weekly report prints the average daily usage of each resource, each week.

A resource histogram report shows the usage of consumption of a resource, or group of resources, in barchart form. This makes it easy to identify imbalances in the use of resources and to plan corrective action. Other options can report cumulative project costs or revenues.

Network diagrams are printed out sideways over several sheets of paper. You have five choices of level of detail, ranging from activity numbers only to all project information; activity number; description; resources; start and finish dates; and float and critical path.

Screen reporting

The screen reporting was nothing if not pretty. Jazzy colours made the barcharts, histograms and ZOOM illustrations look really attractive — not only attractive but useful too, not least because they save a lot of paper. Holding the arrow keys down resulted in rapid movement across the barchart but slow progress across the histogram and the network. This is because the screen was redrawn following each key 'depression'.

Documentation

Compared with many manuals I've read, this was quite good. It explained the principles of critical path planning, as well as giving operating instructions for the product. The sample project based on a forestry application was quite long-winded and should have been made much shorter for those who wanted to work through it. The supposedly helpful input documents were a masterpiece of poor design, but it would seem that these were the sole inspiration of the manual's outside author rather than Abtex itself. I only noticed one discrepancy between the manual and In Control!, and this resulted in a DIVIDE BY ZERO error and more disasters on the printer.

Conclusion

Despite the irritations, its impossible to ignore the fact that In Control! is only £50, give or take a few pence. For that money I reckon it provides an excellent introduction to Critical Path planning methods and can be used for quite realistic, albeit small, projects. Abtex provides file conversion programs to allow users to transfer their In Control! projects to Pertmaster Advance.

I'm sure that Abtex sees In Control! as a sales aid for its other products, Pertmaster Advance in particular. The problem is that it also acts as a sales aid for critical path planning programs generally. Abtex must convince the user that its own Pertmaster Advance hasn't picked up any of In Control!'s weaknesses. Otherwise, this bargain basement product could drive users into the arms of the competition.

Abtex is on (0274) 734838. END

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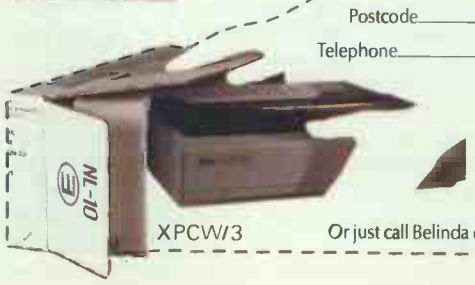

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Caught in the net

When one standalone system isn't enough, the alternative is a choice between networked PCs and a multi-user system. Peter Malcolm describes the two options and helps you decide.

There comes a time in many computer users' lives when they realise that one single PC can no longer satisfy their computing needs. Even in situations where there are a number of PCs working separately, the users may discover that they spend much of their time swapping files or moving cables around to share resources such as printers. At this time, many will be tempted to link up their PCs into a network, or start again by installing a multi-user system.

Deciding between these options is far from easy, and the distinction between networks and multi-user systems has become less clear than ever. Nonetheless, there are important distinctions in both their operation and their suitability for different tasks.

To make matters more complicated, the two are often interlinked, with hybrid systems encompassing features of both. This adds to the difficulty of specifying a suitable hardware and software solution. In this article, I'll outline the theoretical and practical differences, and go on to discuss what determines the most effective solution in a number of situations.

The bare essentials

In my last article (*PCW*, February) I discussed the technical operation of local area networks in detail. The concept of a network is perhaps best described as a roundabout. Data can enter and leave at any point, and it therefore follows that data from one station on the network can be directed to be received by any other station. Stations may be printers, disk storage, PCs or whatever. In a network system each and every station has some form of processor, and the network is simply used as a means of tranferring data between stations. Thus, each user on a network will have their own PC.

In a network system, the speed of processing and the use of local resources is quite independent. A user can only feel the effect of others on the network while transmitting or receiving data on it.

At its simplest, a multi-user machine is a single, central processor to which a number of input/output devices are connected. Each user has a terminal whose only purpose is to send information to the processor (from the keyboard) and to display information from the processor (on screen). In general, all mainframe and minicomputer systems use this concept. A multi-user machine allocates an amount of its central memory to each user and time-slices the use of the processor for a short period (typically one machine code instruction) before control of the processor before it is passed to the next user. Time slicing involves each user having complete control over the processor before it is passed to the next user. Time slicing is controlled by the operating system, and is user transparent.

Mainframe systems are able to weight time slicing according to a user's priority rights, but this technique is not used in multi-user micros. Thus, the multi-user machine consists of one central resource (however simple or complex) with a number of input/output devices (terminals, printers, and so on).

Each user is, therefore, continuously affected by other users on the system, and the speed of processing of each terminal and the availability of resources to each user depends on the processing and resource requirements of other users. In general, the speed of operation degrades in proportion to the number of users.

Consequently, a mainframe processor with hundreds of users must operate proportionately faster than a mini system with tens of users, or a micro system with only a handful of users.

Networked micro systems

In practice, micro networks fall into two categories. A high proportion of installations simply use the network to link a number of PCs to a single file server, to enable all the PCs to share the data stored on the server's hard disk. A typical situation would be where several PCs are used for a shared accounting system — data is held centrally so that the PCs can each use it.

A more complex micro network often evolves where a number of PCs used for separate tasks are linked together to share expensive resources like printers or telex links, or to send messages between users such as in an organisation with many PCs used in different departments. In this situation there may be no shared data source at all: users may have their own disk storage, and use the network only to send data to shared resources or to other users.

Multi-user micros

Multi-user machines are becoming increasingly available, particularly at the cheaper end of the market. However, a large proportion do not fall strictly within the concept I have presented.

What is common to virtually all the systems is that the user has a terminal without any local processor. Processing is done within a central unit to which every terminal, printer and any other I/O device is connected, and it is within these central units that the differences between systems become apparent.

Some systems adhere to the basic concept of a single, shared processor, such as those produced by Comart and Jarogate to name but two, and they use various processors from the 8088 to the 80386. The power required is determined by the number of users on the system and their individual processing needs. Clearly, attempting to connect more than a few users to a single 8088 processor is going to result in very slow operation, even if each user's needs are minimal. Using an 80386 processor, however, will vastly increase the possibilities — not to mention speed — if only one or two users happen to be using the system.

A significant proportion of multi-user machines are in fact multi-processor: that is, they employ more than one CPU. There are two common variations on this. The first is to

have one master processor with a number of slave processors — say, one for every four or so users. Data Dynamics' SigNet 4 and Bromcom's Hyper Micro both use this variation. It has clear advantages in that each user is only competing with a maximum of three other users, and performance can be improved by adding more slave processors so there are fewer users per processor. Reducing the number of users per processor often enables unused ports to be connected to additional printers or other serial devices.

Master and slave

The second multi-processor variation is to use one master processor and install a slave for each and every station. (This is equivalent to having only one user per slave in the previous variation.) Here, every user's processing is independent so speed never degrades (or improves). All North Star machines and the HM Systems' Minstrel 4 fall into this category.

In both multi-processor variations, the processors usually communicate with each other using an internal close-coupled network. Because of the short distances involved, and the fact that a physical bus can be used to connect the processors rather than cable, the close-coupled network is able to run faster than the normal external variety.

Will my software run?

Obviously with a network system, each user station (that is, each PC) will run any software which runs on that standard of machine. So if you use an IBM PC compatible, all software designed for that PC will run.

Unfortunately, this is virtually never the case with a multi-user micro. With one exception — North Star machines — no multi-user micro is truly IBM PC compatible. A multi-user micro cannot run any software which is machine dependent — that is, makes calls outside the operating system. A good example is Lotus 1-2-3 which, to improve speed, directly addresses the PC's memory-mapped display rather than sending characters via PC-DOS. No multi-user micros (except North Star's) use memory-mapped displays; they simply send character strings to a terminal. In fact the terminal itself does memory map the display, but there is no way of accessing this memory directly.

Thus, packages like Lotus 1-2-3, Symphony and clever word processors like Microsoft Word will not run on a multi-user micro. In addition, anything remotely connected with line graphics or windows is a non-starter. Windowing software works by saving that area of the screen area which will be over-written by a new window so that the display can be restored when the window is closed. Unless you can directly read and copy the display memory, this is virtually impossible. RAM-resident utilities like SideKick which make calls to both hardware interrupts (like the keyboard) and to the screen display (to display the SideKick window) will not work either.

Multi-user micros can generally use a variety of terminals, the more sophisticated of which have extras like built-in calculators, and user-defined keys where a string of characters can be produced from a single keystroke. These may be some compensation for the loss of RAM-resident utilities.

Software that *will* run on multi-user machines displays text and block graphics through the operating system and doesn't make machine-dependent hardware calls. Therefore, most accounting systems, including Pegasus, Omicron and Sage work fine, as do word processors like WordStar, Superwriter and NewWord. In spreadsheets you can use SuperCalc II (but not III) and MultiPlan. Most database software works without difficulty.

As multi-user micros do not have local disk drives, they can have problems with copy-protected software which uses 'key disks', and any software which controls installation on a hard disk may also prove difficult.

Remember also that with a multi-use micro, disk drives are always shared, and they may not be in the same area as all users, which could prove difficult if your application requires constant use of floppies.

Operating systems

Most multi-user systems use variants of Digital Research's Concurrent DOS, although the North Star uses PC-DOS/Netware and Altos machines use only Xenix.

Those who think that these multi-user operating systems will offer access to unlimited memory will be sorely disappointed. The most widely used version of Concurrent DOS, Version 4.1, can only address a maximum of 1Mbyte of RAM. This effectively limits the number of users per processor. Four users will get less than 256k each (after DOS has had its slice), and this is about the minimum needed for most applications these days. Jarogate reckons it can squeeze five Pegasus users into 1Mbyte; everyone else reckons on a maximum of four.

Higher amounts of RAM per user are available on systems using slave processors, in which case it is possible to approach 1 Mbyte of RAM per terminal by having only one user per slave (each slave has its own copy of Concurrent DOS), or a bit less than 512k each with two users.

A new operating system, Concurrent DOS XM (Extended Memory) can address up to 16Mbytes giving greatly improved scope. Comart reckons on having XM available by the time this article is published, and other manufacturers re expected to follow suit.

All he manufacturers using Concurrent DOS provide means of loading and running PC-DOS software within the limitations described above of screen and keyboard addressing.

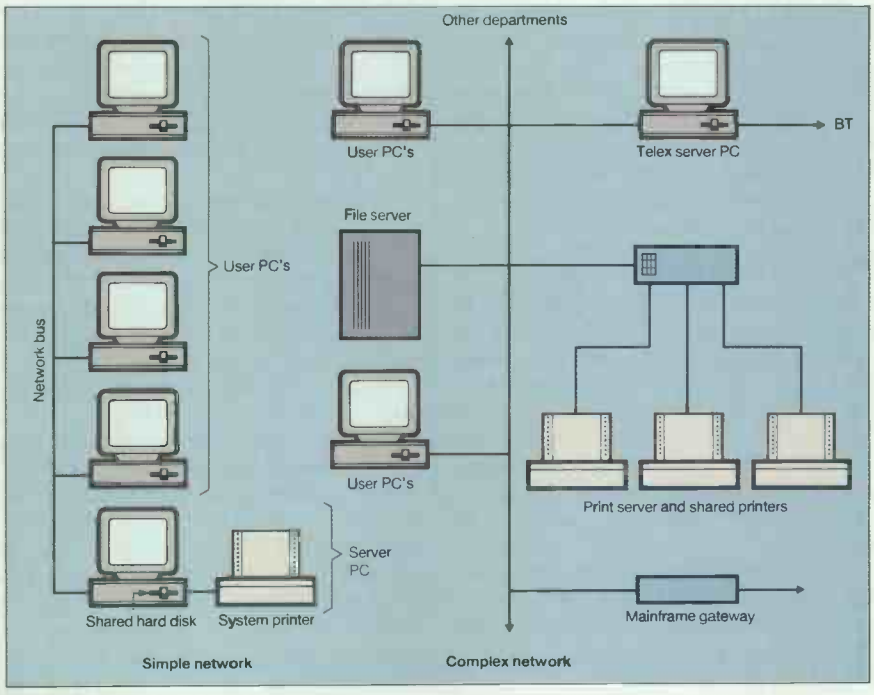

Fig 1 Simple and complex networks

Concurrent DOS also often enables you to carry out several simultaneous tasks on one workstation at a time, which sounds like good news until you realise that each task needs its own memory; making it of questionable value in practice unless each user has large amounts of memory.

Network systems employ network operating software, like Microsoft's MS-Net or Novell's Netware, which enable shared software packages to run on several stations without conflict, and to establish standards for data access. Many software houses are now making their products available for the most common network operating systems.

Multi-user micro manufacturers have adapted their systems to use this same method, producing a hybrid environment in which the software runs. Multi-processor machines using close-coupled network techniques need a network operating system by definition. The most common is Digital Research's DR-Net (simply because most systems use DR's Concurrent DOS). North Star systems use Netware or 3Com Ether Series operating software.

Hardware hybrids

It is common in a network system to employ 'servers' to give access to shared resources like printers, hard disks and other devices in addition to the local resources available to each PC. On a multi-user micro too, shared ports can usually be configured for either printers or communications devices such as modems.

Conversely, some multi-user micros allow local printers to be connected to the auxiliary port of the terminal, but otherwise all other resources are shared. Using the terminal's auxiliary port involves sending an escape sequence to redirect data, and drivers are necessary to use these local printers with standard software packages. Not all manufacturers provide these.

Multi-user micro manufacturers are increasingly providing a network option with their machines, enabling several multi-user machines to be networked together. In a multi-processor machine, this is simply extending the close-coupled network externally.

This may provide an expansion path for an otherwise fully expanded system, but I can foresee potential problems with software compatibility in such an arrangement.

Pulling the plug

With a network solution, each PC station has its own local power controls, and in general the network will continue to function with or without power applied to individual user stations.

With multi-user micros, local power controls are limited to the terminal's on/off switch. This has advantages in that turning power off does not actually affect processing: generally you can't, for example, crash the hard disk by turning off a terminal.

With a network system, however, you could make a shared network disk inconsistent by turning off your PC midway through writing. When a file is written to disk, the data areas, the file allocation table and the directory of disk files are generally all modified. If one of these areas is modified without the others, then the disk may become inconsistent and data may be lost either immediately or on some future write operation.

With a multi-user micro, switching off the central unit will kill off all users, and hence most central units have key-operated power switches. But extra safeguards are needed so that the power isn't disconnected at the wall socket.

Setting up

For ease of installation, a multi-user micro wins every time. Installation is usually a simple matter of plugging everything together and switching on. A network will certainly be more complex, requiring internal modifications to the PCs, installing and checking operating software, and possibly even the reformatting of hard disks.

But while many multi-user manufacturers advertise their systems as plug in and go — and most multi-user operators have their systems up and running fairly quickly — this may be a little optimistic. Many ignore the time it takes to install.

Shared software — that is, software which supports multiple users simultaneously, irrespective of whether the hardware is a network or a multi-user micro — is generally relatively easy to implement. Of course the packages must be designed to run under a multi-user or network environment, and they must further be compatible with the operating system or network operating software the system uses.

Given that hardware and software are compatible, multi-user software will generally run equally well on either a network or a multi-user micro.

Running existing single-user packages in a shared environment (net-

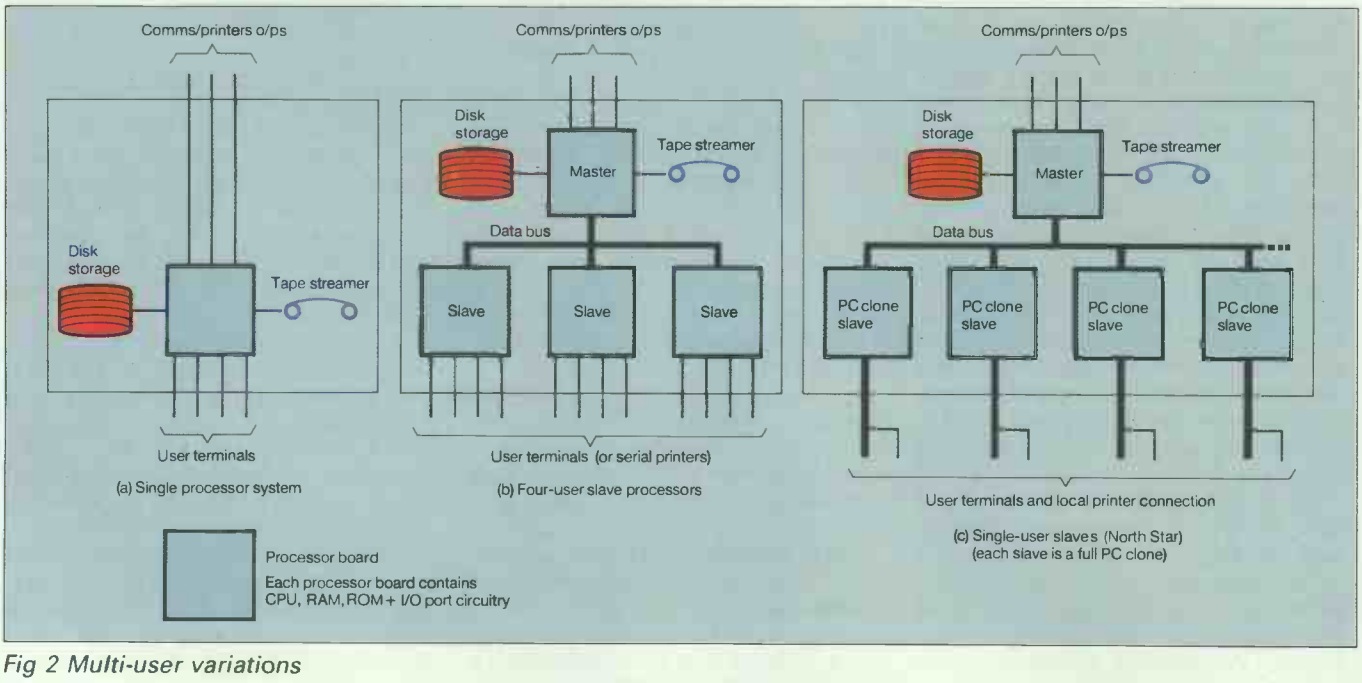

Fig 2 Multi-user variations

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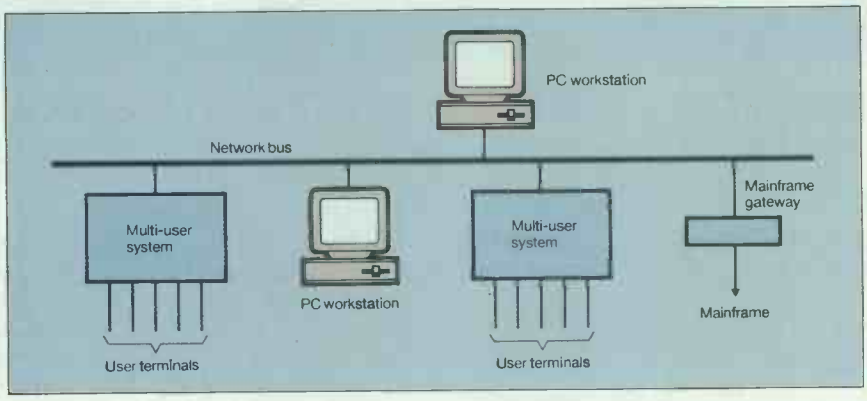

Fig 3 Networked multi-user system — other servers could be connected

work or multi-user micro) can, in fact, cause a surprising amount of difficulty.

Data security

The major problem with any shared data system is that two or more users may try to write to the same data area at the same time. The result is a mixture of two sets of data and often reduces the entire volume to garbage — even areas that were not being written to — as the directory area of the volume may be damaged, making access to any file impossible.

For example, writing a file to disk consists of three write operations; writing the data; changing the disk space allocation table; and modifying the disk directory. Should another user begin a write operation midway through storing the file, then the disk areas it sees as free may in fact be used, but the space allocation table is as yet unmodified to reflect this.

To protect against this, networking and multi-user operating systems provide for file and/or record locking. File locking ensures that only one user has write access to a file at a given time, and record locking ensures that only one user has write access to a given record at any time.

Single-user operating environments, such as MS-DOS/PC-DOS, are not true multi-user operating systems, although extensions have been added to versions of DOS from 3.1 upwards which provide some multi-user capability. Xenix and Digital Research's Concurrent DOS are genuine multi-user operating systems, and the problems of multiple writes are significantly reduced.

One solution to the problems of using single-user packages in a shared environment (network or multi-user) is to allocate each user a data volume to which only they have write access, and to place actual program files in a shared read-only volume.

However, this solution may not work if the program requires write access when loading, as some of the more complex packages such as Microsoft Word do.

This solution pre-supposes that your hardware enables you to create multiple volumes on a single physical drive. Virtually all network file servers do, but this may not be the case with multi-user micros. It is important to make the distinction between volumes — that is, virtual disks which are allocated different drive identities — and sub-directories, which share disk space allocation tables and hence are not suitable for use as separate data areas.

Choosing a system

The choice of a networked or multi-user solution depends not only on hardware requirements such as number of users and memory, but also on the applications of the system. It has to be said that a network will do virtually everything a multi-user micro will do (and much more), and it is therefore unlikely that an application could be solved by a multi-user micro but not by a network.

The only reasons for specifying a multi-user solution over a network are simplicity, reliability and cost. A network may not, however, be the most effective solution to a particular problem.

The cost considerations can be calculated quite simply, and a multi-user micro solution is generally cheaper than its equivalent in a network. The cheapest network PC station using, say, an Amstrad, is unlikely to cost less than £1000 including the network interface card and connections; whereas a terminal can cost as little as £300, needs only simple RS232 cabling and will be more robust.

However, where there are already a number of PCs installed, a multi-user solution is unlikely to be cost effective unless the user needs immediate expansion for a specific task. Even here it is likely that the best multi-user system would be one with the ability to network PCs.

Networks and multi-user systems also address different software needs. Some applications such as accounting systems need multi-user software ability, while those which are used independently such as word processing and spreadsheets work perfectly adequately on networks, even though many users may have access to them.

A given operation in an accounting package is likely to modify only a section of stored data at a time, such as a single customer's record. During word processing or spreadsheet manipulation, however, the whole model is loaded, modified and then written back later — thus the same data is not modifiable by users simultaneously.

Choosing the right solution

There are three basic reasons for choosing a network solution. Firstly, if you require capacity for more than about 20 users; secondly, if your users require anything above the most basic facilities — for example, IBM compatibility, graphics, add-on boards, and so on; and thirdly, if you require to link a number of existing PCs.

A network solution will give you great flexibility, but is therefore considerably more complex. It will almost certainly be more expensive and require more in the way of mangement once installed.

The complexities of a network solution make it often impractical to see the configuration you intend to use before you buy. Additionally, facilities available differ considerably, and it is therefore wise to take professional advice from an independent source unless you are fully familiar with the proposed solution.

If your requirements are basically simple — sharing accounts and general office procedures like word processing, for example — and you need only a limited number of users with basic facilities, then a multi-user micro provides a cost-effective and reliable solution.

You will, however, be unable to use more sophisticated software like Lotus or Microsoft Word, or any graphics or RAM-resident utilities like Sidekick.

It should be possible to see hardware and software of an established multi-user system running together before you purchase, and your dealer can probably arrange for you to visit a reference site with similar requirements to your own.

Peter Malcolm is technical developments director with consultants IQUK, and chairman of the Nestar Users' Association. END

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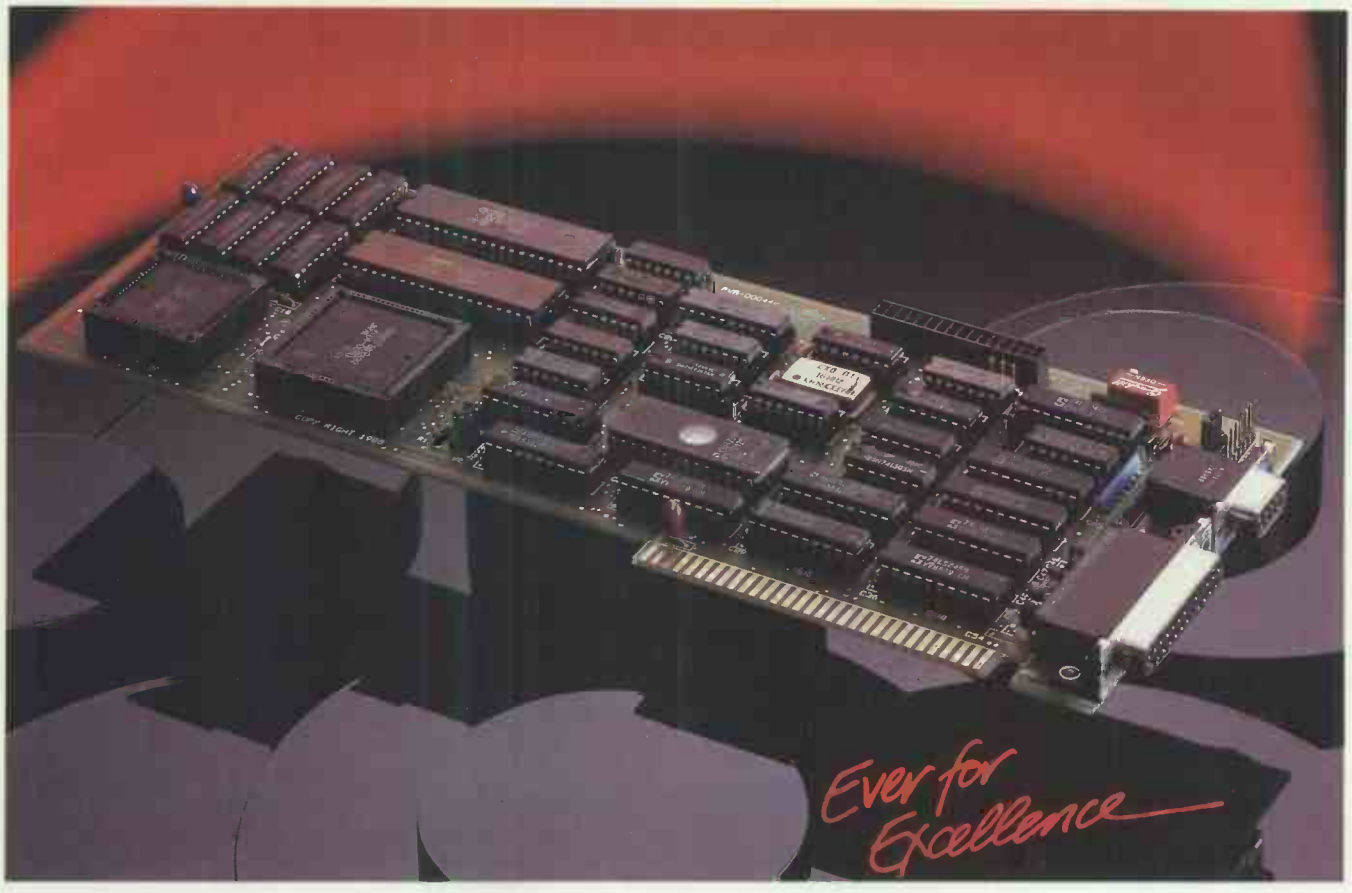

EV 654 – ENHANCER (ILLUSTRATED)

The EVEREX Enhancer is a full featured enhanced graphic display adapter with colour graphics adapter emulation.

- 640×350 graphics in 16 colours from a paletteof 64.
- A parallel printer port that can be configured as LPT1-LPT3 is included.
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- Help menus for each display mode.
- Eleven display modes for graphics and text.
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- Works in any slot.

EV 640 – THE EVEREX EDGE

It is a combination colour and monochrome video graphics adapter.

- Operates colour graphics software on the IBM monochrome display full-screen in 16 shades, without any software modifications needed.
- Runs Hercules-compatible 720×348 high resolution monochrome graphics.
- Runs LOTUS 1-2-3 and Symphony in high resolution monochrome and colour.
- Provides extended display in 132 columns by 25 or 44 rows with Lotus 1-2-3, Wordstar, and other popular programs (no more scrolling back and forth to find information).
- Displays colour software on a monochrome display in the IBM Standard 9×14 monochrome character set for superior readability.
- Parallel port is included.
- Light pen connector is included.

EV 221 EVERGRAPHICS

The Evergraphics is a Hercules compatible video adapter system. An optional Enhancement daughter-board adds enhanced graphics adapter (EGA) capability.

- Hercules 720×348 monochrome graphics with 64K screen memory.
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- 132 Column Standard
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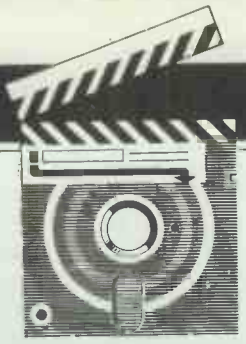


SCREENTEST

Microsoft Word 3.0

Microsoft's Word 3.0 competes well with any word-processing software on any machine, and may serve as an important catalyst in Apple's drive for office credibility. Mick O'Neil is impressed.

'They sought it with thimbles, they sought it with care;
They pursued it with forks and hope;
They threatened its life with a railway-share;
They charmed it with smiles and soap.'
(Lewis Carroll — *The Hunting of the Snark, An Agony in Eight Fits.* London: Macmillan, 1876)

The search for a complete Macintosh word-processing program has proven every bit as elusive as Lewis Carroll's *Snark*. Programs like Laser Author, Word Handler and Write Now for the Macintosh each have a unique approach to word processing and will, no doubt, compete head-on for the lower end of the Mac word-processing market, but are lacking features that are now commonplace in many MS-DOS word processors. With its introduction of Word 3.0, priced at £425, Microsoft has expanded the definition of Macintosh word processing to include page make-up facilities and outline processing, and offers a program with features unrivalled on any machine.

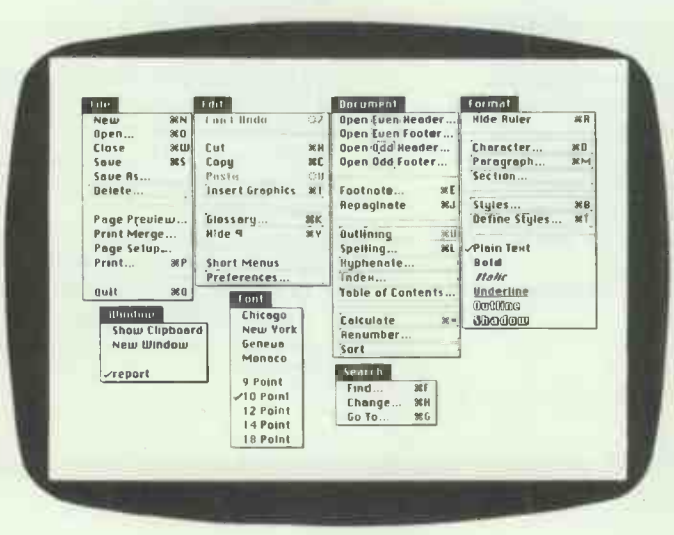
Improved features

● **Menus**

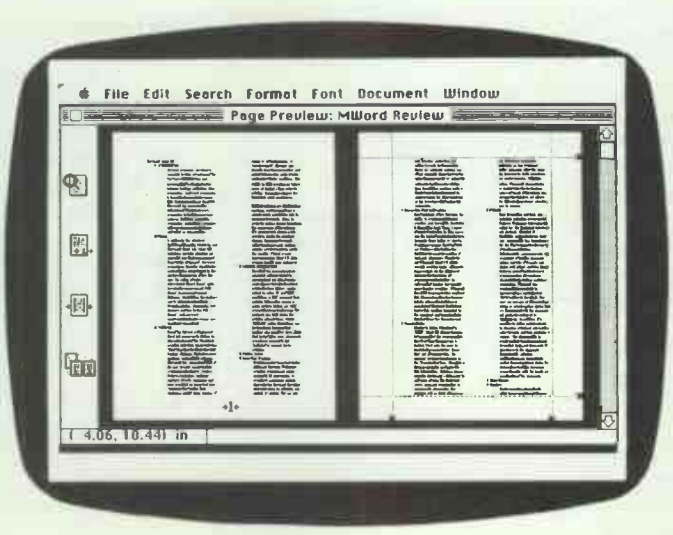
In addition to the standard facilities offered by MacWrite and Microsoft Word 1.0, Word 3.0 includes a variety of unique and powerful new features, many of them 'state of the art' for word processors. In order to minimise any confusion experienced by the novice, the program offers the user the option of using abbreviated 'short menus' while learning the program and 'full menus' to access advanced features. In addition, Word allows you to add customised fonts, formats, styles, documents and glossary entries to the full menus, and, as work requirements change, menus can be adjusted accordingly. For repetitive tasks, a customised work menu can be created and added to the menu bar.

● **WYSIWYG**

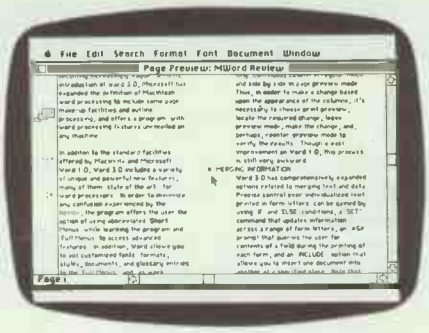
One of the fairest criticisms of Word 1.0 concerns its failure to take advantage of the Macintosh graphics interface to provide true 'What-You-See-Is-What-You-Get' headers, footers, footnotes, page numbers and multiple columns. Microsoft has gone 95 per cent of the way toward resolving this problem by displaying headers, footers, footnotes and page numbers directly onscreen, and has provided an important new 'page preview' option that displays a scaled-down version of a page or of facing pages. In 'Preview' mode, the user can directly insert a page number and can adjust margins, page breaks, and header/footer positions. The ability to preview fully up to two pages of text at a time prior to printing is a major advance for Macintosh word processors.



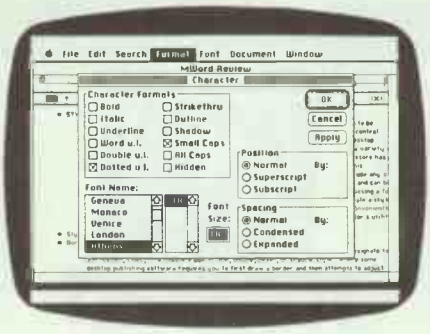
The Microsoft Word menus reveal new and powerful tools. Selecting 'Short Menus' simplifies the program by hiding the highlighted options



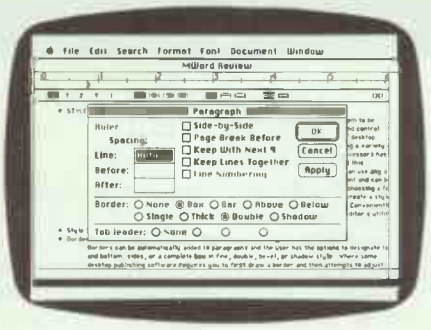
Page Preview allows the viewing of two pages at a time. Note that the margin markers on the right-hand page allow for WYSIWYG formatting



The Magnifying Glass icon allows the user to view multiple columns at actual size



Formatting options include double underlining, dotted underlining and strike-through



Paragraph formatting can include some interesting border options as well as automatic numbering

Multiple columns are displayed as one long, continuous column in 'regular' mode, and side by side in 'page preview' mode. Thus, in order to make a change based upon the appearance of the columns, it's necessary to choose 'print preview', locate the required change, leave preview mode, make the change and, perhaps, re-enter preview mode to verify the results. Although a vast improvement on Word 1.0, this process is still very awkward.

● **Merging information**

Word 3.0 has comprehensively expanded options related to merging text and data. Precise control over individualised text printed in form letters can be gained by using IF and ELSE conditions; a 'SET' command that updates information across a range of form letters; an 'ASK' prompt that queries the user for contents of a field during the printing of each form; and an 'Include' option that allows you to insert one document into another at a specified place. Note that in the latter case, documents are stored separately but 'included' or merged during printing.

● **Keyboard menus and commands**

One of the problems in designing a Macintosh word processor is catering to the large group of touch typists, who view the prospect of manipulating a mouse 'mid-text' with considerable scepticism, while offering the formatting and font control that seems integral to the Macintosh interface. Microsoft has addressed this dilemma by providing the user with the alternative of using a keystroke combination for virtually every menu command, and access to the pull-down menus via the keyboard.

● **Importing graphics**

Graphics can be imported via the clipboard from any Macintosh graphics program and can be resized to fit your needs. A graphic is considered a single character by Word and, like other characters, can be selected, cut, copied or pasted. You can add bold, shadow, underline and outline formats to the graphic frame for emphasis, and you can offset a graphic from the baseline using the superscript or subscript options in the character dialogue box. In addition, you can paste a blank frame into a document to reserve space for later paste-up or for drawing with Postscript commands.

● **Copying formats**

Character and paragraph formats can be copied with a simple keystroke combination. The user simply highlights the source paragraph or text, types Command-Option V, highlights the paragraph or text to be reformatted, and then presses Enter to pass on the formatting.

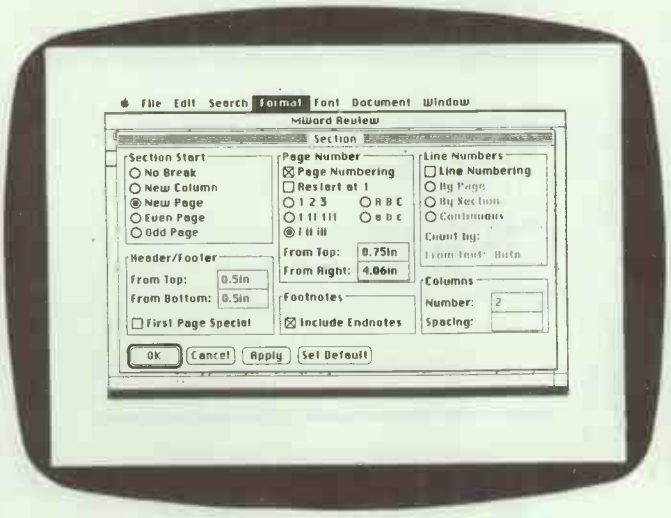
● **Find and Replace**

The Find and Replace commands have been enhanced to allow for searching with wildcards, searching for special formats (Command-Option-R), searching for special characters like tabs or end-of-paragraph marks, and the replacement of text by the contents of the clipboard. Usefully, the latter allows for substitution of formatted text: for example, it is a simple process to replace Word 3.0 everywhere in this review with **Word 3.0**!

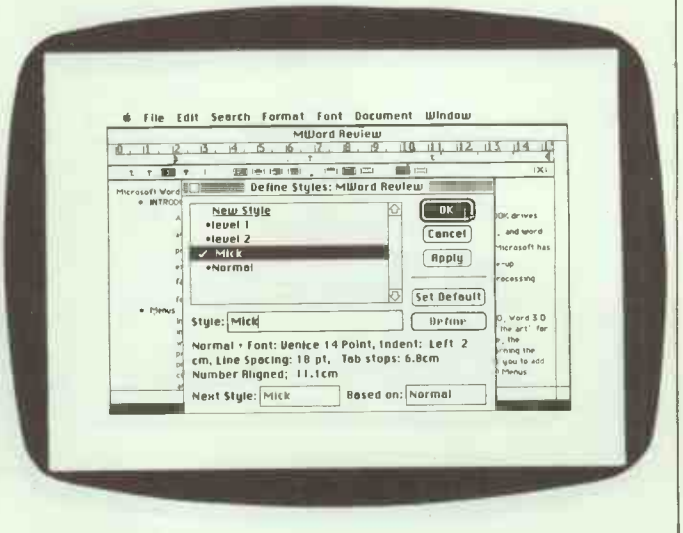
● **Glossary**

The glossary is used to store frequently used pieces of text or graphics for easy insertion into a document, and Word 3.0's Glossary feature includes the ability to save 'boiler plate' text with formatting. Thus, an inside address or a heading inserted into a document via the glossary will automatically be tabbed or centred, and in the correct style.

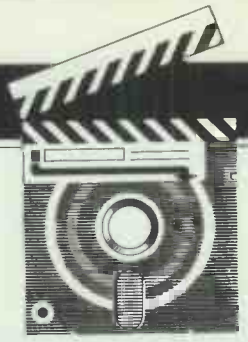
The program comes with a standard glossary that contains time and date entries, and the user can add entries to this or create an entirely new glossary.



Section formatting includes number of columns, distance between columns, line numbering, and endnotes options



The Style Editor allows the user to define styles in terms of fonts, and so on. Editing a style effects a change everywhere the style is used



SCREENTEST

New features

● **Spelling checker**
The program includes a menu-driven 80,000-word spelling checker and includes an optional UK dictionary. User dictionaries can be created to include names, acronyms, technical terms, and so on, and can be associated with a particular document or can be used generally. In the case of a misspelling, the program can suggest replacements which can then be universally substituted.

The spelling algorithm within the program seems particularly smart as suggestions include phonetic substitutes as well as similar spellings, and where a capitalised word is misspelled, capitalised suggestions are made.

● **Styles**
Text formatting and font, size and style selection are powerful features that seem to be uniquely suited for the Macintosh interface. In fact, this kind of flexibility and control over text was responsible to a large degree for the Mac's impact in the world of desktop publishing.

Unfortunately, as anyone who has processed a lengthy document using a variety of formats and styles will attest, applying these features using Macintosh word processors has always been disappointingly tedious and time consuming. Microsoft has resolved this dilemma by incorporating a sophisticated 'Style' editor in Word 3.0. The user can use any of 33 predefined styles, or create unique styles that are then saved with the document and can be transferred to 'stationery'.

● **Outlining**
Word 3.0 includes a built-in outline processor similar in concept to ThinkTank or MORE from Living VideoText. Although the advantage of using this facility while already in a word processor might seem quite compelling, Word's implementation is non-instinctive at best. An attempt is made to remain consistent with the Mac interface through use of an icon bar with arrows for rearranging headlines and text, but the logic seems cumbersome. Perhaps I was spoiled by the rest of Word 3.0 — I really expected MORE! It's as if some of the MS-DOS boys were turned loose on this section and told to use icons. Alas, it just doesn't come off.

● **Index & table of contents**
Word 3.0 can create a multi-level table of contents either directly from an outline or by individually marking those items to be included in the table with a hidden text code. The table is created at the beginning of the document complete with page numbers and filled tabs, and may be reformatted by the user like standard text. Similarly, an index can be created by individually marking index items with another hidden code, and Word's flexible 'Search and Replace' function makes this otherwise cumbersome task fairly simple.

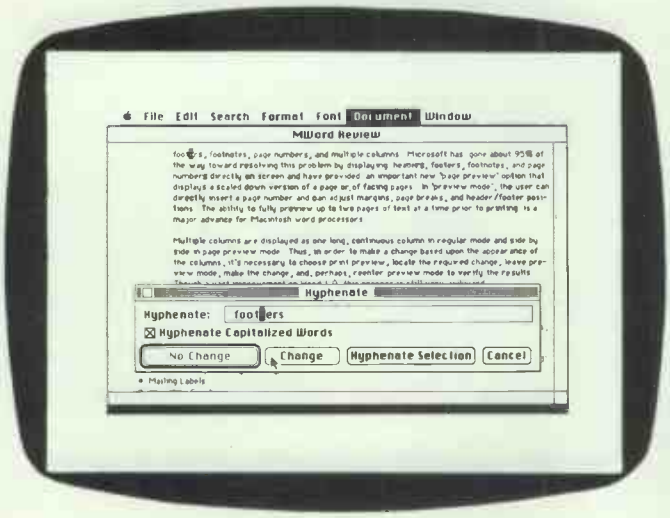
● **Hide/Show command**
By choosing 'Show ¶' from the 'edit' menu, the user can display all paragraph marks, tabs, optional hyphens, non-breaking spaces, page numbers, and so on, and these characters can be copied, moved, deleted and 'searched for' in the same manner as normal characters. This feature adds considerably to control over document set-up and design.

● **Hyphenation**
Selections can be hyphenated line by line with optional user intervention or can be completed automatically. A special hyphenation dictionary is included on the utilities disk, and in testing several documents, this process seemed to behave flawlessly. Although I'm not an expert, words appeared to be hyphenated fairly logically despite the fact that the English language and logic appear sometimes to be mutually exclusive.

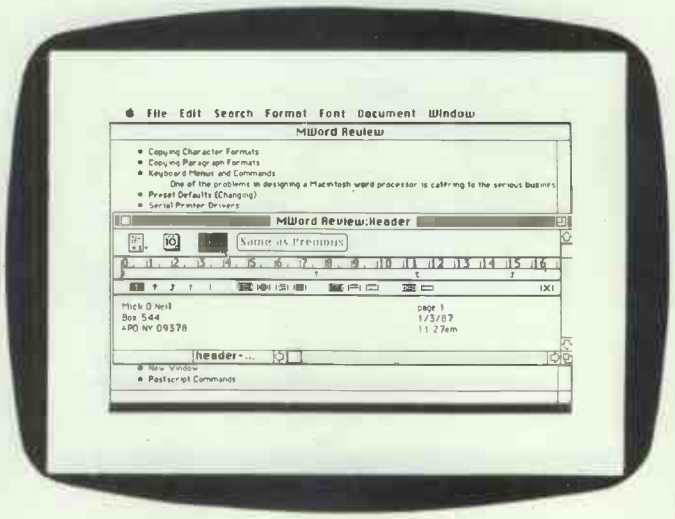
● **Borders**
Borders can be automatically added to paragraphs and the user has the options to designate top and bottom, sides, or a complete box in fine, double, bevel or shadow style. Where some desktop publishing software requires you to draw a border first and then attempts to adjust text to fit within the limits defined by your drawing, Word's approach is more text orientated. The user adjusts the margins, indents and formatting to get the text right, and then automatically sizes the border to fit the paragraph.

● **Hidden text**
A special character format called 'Hidden Text' can be used to designate text not intended for final printing. Hidden text must be used to designate codes for entries in tables of contents and indexes, to embed PostScript commands in a Word document, or to insert characters for QuickSwitch. Hidden text is also useful for editing notes or comments during document creation or review.

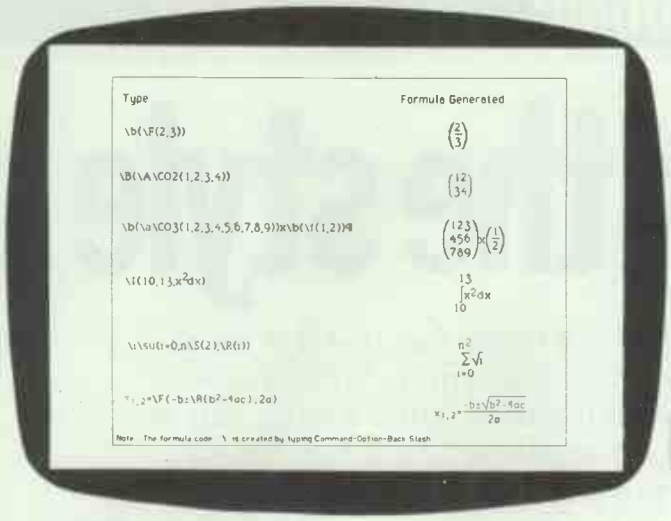
● **QuickSwitch**
QuickSwitch is a unique feature that allows the user to alter a graphic in



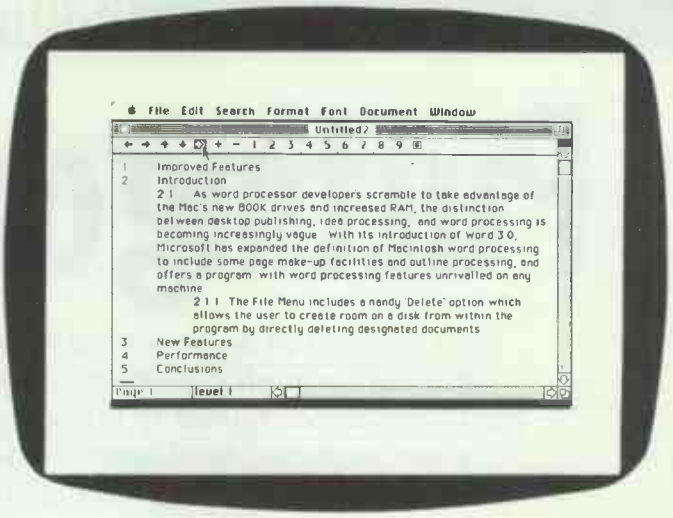
Hyphenation can be accomplished step by step or automatically. Word's hyphenation dictionary seems to do a good job breaking words logically



The header window includes its own ruler and page number, clock and calendar icons similar to MacWrite



Word's formula generator has codes which draw radicals, integrals, summations and boxes. When 'Hide ¶' is chosen, the formula is displayed



The outlining functions are carried out through the use of a special icon bar. The best that can be said about this process is that it's non-instinctual

MacPaint or MacDraw, with changes immediately effected in corresponding graphics contained in a Word document. Similarly, changes can be made in Excel worksheets or graphs, saving the business user a great deal of time. A monthly balance statement, for example, could be updated and printed in a fraction of the time it would take to create a new graph, delete the old, paste in the new, and check the formatting.

● **Converting text to graphics**

The Macintosh offers the user the ability to create sophisticated graphics, and incredible flexibility in formatting text. Thus, a cause of great frustration to Mac users was the task of combining the two to create fancy tables or charts. Graphics programs like MacPaint and MacDraw don't offer the facilities for easy formatting of text; and, of course, MacWrite and Microsoft Word 1.0 don't provide graphics tools. Attempts to move data via the clipboard between the two types of programs resulted either in unformatted text or horizontal space-hogging graphics. Microsoft Word 3.0 has completely resolved this dilemma by allowing the user to take a formatted clipboard snapshot of blocks of highlighted text, which can then be pasted in the scrapbook and imported into Paint or Draw for 'dressing-up'.

● **Delete**

The 'file' menu includes a handy 'Delete' option which allows the user to create room on a disk from within the program by directly deleting designated documents.

● **Linked documents**

Word easily handles documents up to 250 pages long. To create longer documents, it's possible to link documents together. Word treats a series of linked documents as one, and automatically generates tables of contents and indexes for the whole document. The user can print the whole series by directing Word to print the first document.

● **Formulas**

Formulas can be created within Word by using the formula code along with some built-in formula generators. Square roots, integrals, summations, fractions, boxes and formula-sized parentheses and brackets can be generated and can be displayed on-screen.

Other features

Just some of the other features of Word 3.0 include the capability to print mailing labels three across; a convenient calculation function that computes sums, differences, products, quotients, and percentages of highlighted values; line numbering and/or paragraph numbering; sorting; a number of printer defaults that will drive most popular serial printers; and Postscript commands for use with the LaserWriter.

Performance

Generally, Word's performance is fast and surprisingly bug-free for the first release of a program of this complexity. The overall design is a work of genius, with vast word-processing power easily accessible from the pull-down menus and the keyboard. Although there were a few minor quirks applying styles from the keyboard and producing the correct formula symbols from the formula generator, when I changed over to the system provided by Microsoft, these disappeared. Strangely, both system files were version 3.2.

Documentation & support

The documentation included a well-indexed reference manual, a tutorial and a quick-reference guide, and was generally very well done. Certainly, the sections explaining outlining and formula construction could be redone to include more examples. Still, Microsoft has set a tough standard with Excel, Works and Word 3.0 documentation.

The program is unprotected and so can be easily installed on a hard disk. A second disk is provided with sample files, printer drivers, a UK dictionary, Switcher 5.1 and a set of switcher files. As usual, Microsoft has released a classy package.

Conclusion

"'There is a Thingumbob shouting!'
the Bellman said.
'He is shouting like mad, only hark!
He is waving his hands, he is
wagging his head,
He has certainly found a Snark!'"
(Lewis Carroll — *The Hunting of the Snark, An Agony in Eight fits.* London: Macmillan, 1876)

It's really quite difficult to place this program in any kind of perspective as it's the first word-processing software to employ the full facilities of the Mac Plus. It's also *by far* the most powerful feature-laden word processor on any machine. If a single program like VisiCalc was responsible for the emergence of the Apple II and the general acceptance of small-business computing, Microsoft's Word 3.0 may be the irresistible force that finally establishes the dominance of the WIMPs interface and brings the raw power of the 32-bit computers to the rest of us. After all, only a very few people in a business or in the home actually use a spreadsheet, while almost everyone has occasion to use a word processor!

For anyone who writes, though, Word 3.0 is reason enough to purchase a Macintosh. END

Putting on the style

The concept of style is hard to define but many feel that it is more than a thorough grounding in grammar and syntax. Style analyst packages are designed to improve even the poor writer's work, but do such packages fulfil their literary expectations? Jonathon Green presents his controversial view.

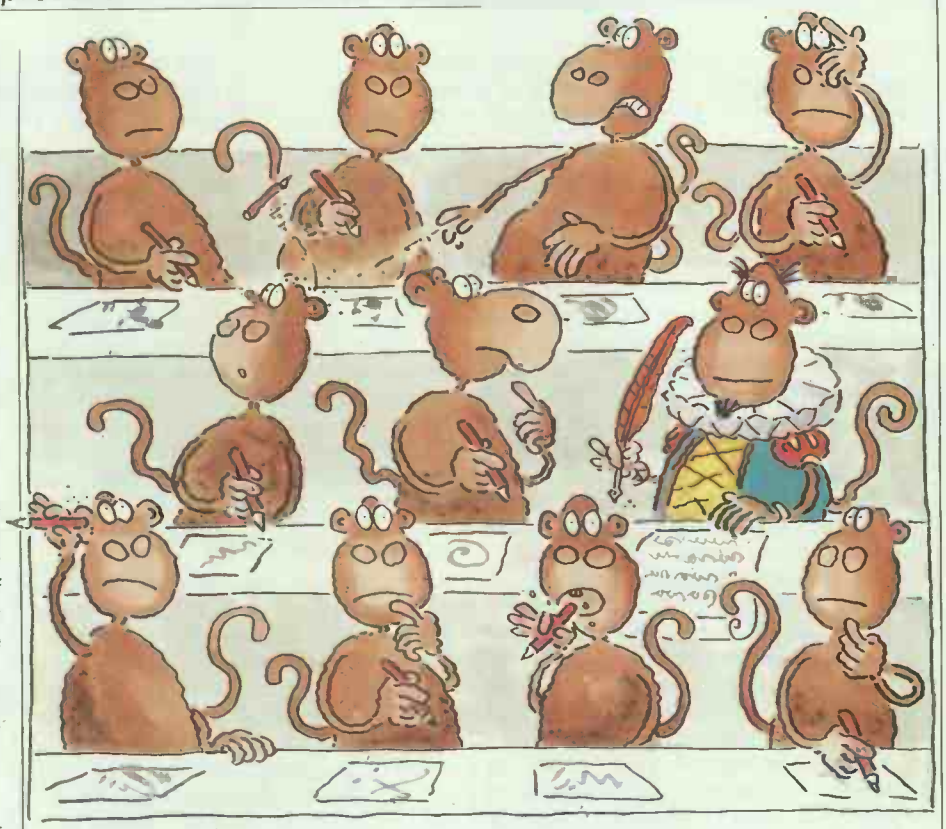


Illustration by Ian Dicks

Everyone, says the old myth, has a novel in them somewhere; this is patently untrue. There is more to writing than waving a pen or slapping keys, and the myth has yet to extend to company reports, office memos, share prospectuses and printer manuals.

It's unfortunate that, while a variety of circumstances conspire to stifle the creative fantasies of potentially great novelists, the task of writing these printer manuals, share prospectuses, and so on, is delegated round the office with hardly any thought on the part of delegator or delegatee.

It often seems that, while those hypothetical typewriting monkeys have finally abandoned their attempts to reproduce the works of Shakespeare, it is evident that they have been harnessed by the software and hardware manufacturers.

State of the art word-processing equipment does not an author make. Can anything be done to help?

What is style?

Style is essentially an abstract concept. For it to be subjected to a computer-based analysis there must be some concrete interface between the idea of style and a means of analysing it. Fifth-generation machines and their software may offer something more sophisticated but contemporary programs are subject to certain limitations. Thus the basis of all style analysts are two 'style indices': the 'Yardstick Index' designed by Rudolf Flesch and the better-known 'FOG Index' created by Robert Gunning. They both depend upon the counting of sentences and of syllables to produce a formula for the *readability* of a piece.

A further refinement has been developed by American lexicographer Hugh Rawson who offers in his *Dictionary of Euphemisms* (1981), the 'FOP (FOG or Pomposity) Index', which is a means of assessing the self-deluding circumlocution of a euphemism.

The FOG Index

The FOG Index is explained in detail in Gunning's book *The Technique of Clear Writing* (McGraw Hill, NY, 1968). Stripped to the essentials that provide the mechanisms of these analysts, it works thus:

1 Take a piece of writing (or if it is a long one, take several random chunks of around 100 words each) and count both the component sentences and the total number of words. If a complex sentence is divided by semicolons, thus denoting a number of discrete and complete thoughts, these should be counted as individual sentences. Divide the total word count by the number of sentences to obtain the average sentence length.

2 Count the number of words of three syllables or more per hundred words. Don't bother with proper names, words that are combinations of shorter, simple words — for example: 'manpower' or 'book-keeper', or verb forms that gained their extra syllable by including such common suffixes as '-ed' or '-es'. This total will provide one with the percentage of hard words in the piece.

3 Obtain the FOG Index by adding the totals together and multiplying by 0.4. The resulting figure is expressed in the form of the reading levels expected from the grades or classes of American schools. These begin at age five with first grade and continue thereafter. For UK purposes, simply add five to the figure produced to obtain an approximate UK reading age.

Origins

When personal computer word-processing began developing, the first programs set out primarily to

offer speed of editing and a gradually improving sophistication of visual appeal, with headers, footers, page-numbering, WYSIWYG text displays and the like. As far as the content of the text went, there was certainly speed, although that was still cumbersome at the beginning, but little else. You wrote your piece and its consumer ploughed on through.

The computer acted as a tool that made the writer's job slightly easier and faster, by allowing mistakes to be corrected instantly and so improve the work's presentation. No software was available that allowed the computer to use its 'intelligence' to examine what was being written and to suggest to the author ways of improving the writing, grammar or spelling.

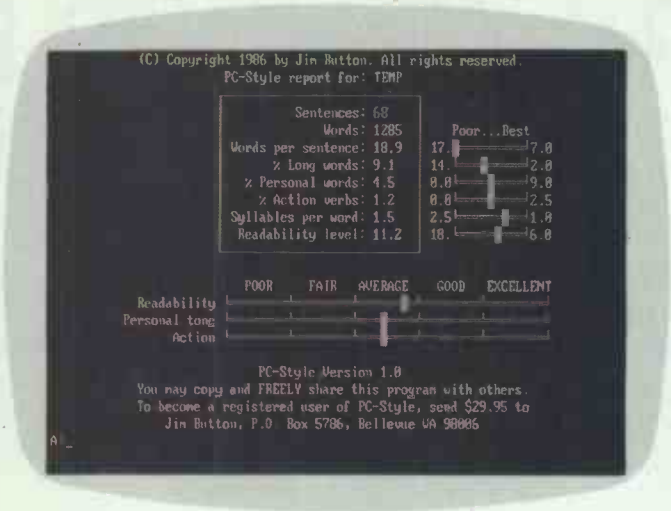
The first attempts to improve on this situation, and to smarten up the efforts of those who understandably were not always natural writers, was to make a spelling-checker available with word-processing software.

Early examples like SpellStar simply consisted of a long list of words (around 40,000, which is over twice the size of most people's vocabulary) held on disk. A special program would then scan a document word by word, making sure that every word in the document also appeared in the on-disk dictionary. Any words that did not appear were considered to be spelling or typing errors on the part of the document's creator. These were highlighted in some way so that, once the spelling-checker had finished its work, the user could re-edit the document and fix the offending words by looking them up in a real paper dictionary.

This facility seems primitive by today's standards. The dictionaries were usually American and, for anyone with a reasonable vocabulary, fairly limited. This was especially true for scientists, medical and financial people, and others whose profession used many jargon words which were considered 'errors' by the software. It was possible to update the disk dictionary so that suspect words would not be highlighted a second time, but the process was slow. Despite all this, early spelling-checkers were received enthusiastically at the time by non-spellers and non-typists alike.

Software continues to improve and so naturally do the spelling-checkers, although there's still plenty to be said for the *Concise Oxford Dictionary*. Most allow the user to augment the basic vocabulary, but amateur lexicography is time-consuming and presumably not of immediate interest.

Modern spelling-checkers contain not only much larger dictionaries (up to 150,000 words) but also have facilities for guessing the correct spelling of words that do not appear in the computerised word list. Two common typing mistakes, for example, are to omit a letter or to transpose two letters. Armed with these facts, a modern spelling-checker like CorrectStar or the one included with Word Perfect can come across the word 'paralel' in a document, and, instead of just saying 'WORD NOT RECOGNISED — RETYPE', suggest to the user that perhaps 'parallel' is the right word.



PC-Style analyses an ASCII text file and presents its results as a single screen of scales and figures. Although it is less thorough than Grammatik or RightWriter, it is by far the fastest at doing the job. A customisation program is provided which lets you change the upper and lower limits of the scales.

Introducing intelligent style checkers

Moves to improve the situation, and to give a greater 'veneer' of literacy to those whose talents lie in other directions but whose responsibilities force them to use the keyboard, have been increasing of late. A variety of programs that can be loosely grouped as 'style analysts' have been appearing. Exactly what these programs attempt to do, I'll explain shortly.

In 1982, IBM's Thomas J Watson Research Center began developing Epistle: *'a tool that can be used by editors to perform routine but essential tasks that ordinarily require a great deal of time.'* This 'text-critiquing system' could detect fourteen common grammatical errors. For example, it kept details of the conjugation of many verbs, so if you were to type 'The men is going to work' the error would be picked up. The program was designed for mainframes and did not enter the PC market-place.

There exist today a number of 'analysts' for work produced on a PC. I don't know of any UK companies who have launched such products, but I have come across three reasonably-priced offerings which, although American, are still quite suitable for use in the UK and can be imported either by dealers or by anyone with a phone and a credit card. The programs in question are RightWriter, Grammatik and PC-Style. Each runs on a standard IBM or clone with MS-DOS version 2.0 or later, and 256k of memory.

The essence of all three programs is that they will improve your writing. The blurbs rub this in with a variety of adjectival buzzwords, but in the end what they offer is a means of cutting down on basic grammatical errors, beefing up one's weaknesses and cutting down on stylistic excess or obscurity. A small dictionary is usually included.

Such a dictionary is not designed as a spelling-checker, and the manual warns you not to fill it with common words. It's supposed to be a jargon list that can be used by the program to build up an index of how jargon-ridden your text is. RightWriter comes with a number of jargon dictionaries, and you can adapt these yourself or write others from scratch if you have the RightWords utility program — an optional extra.

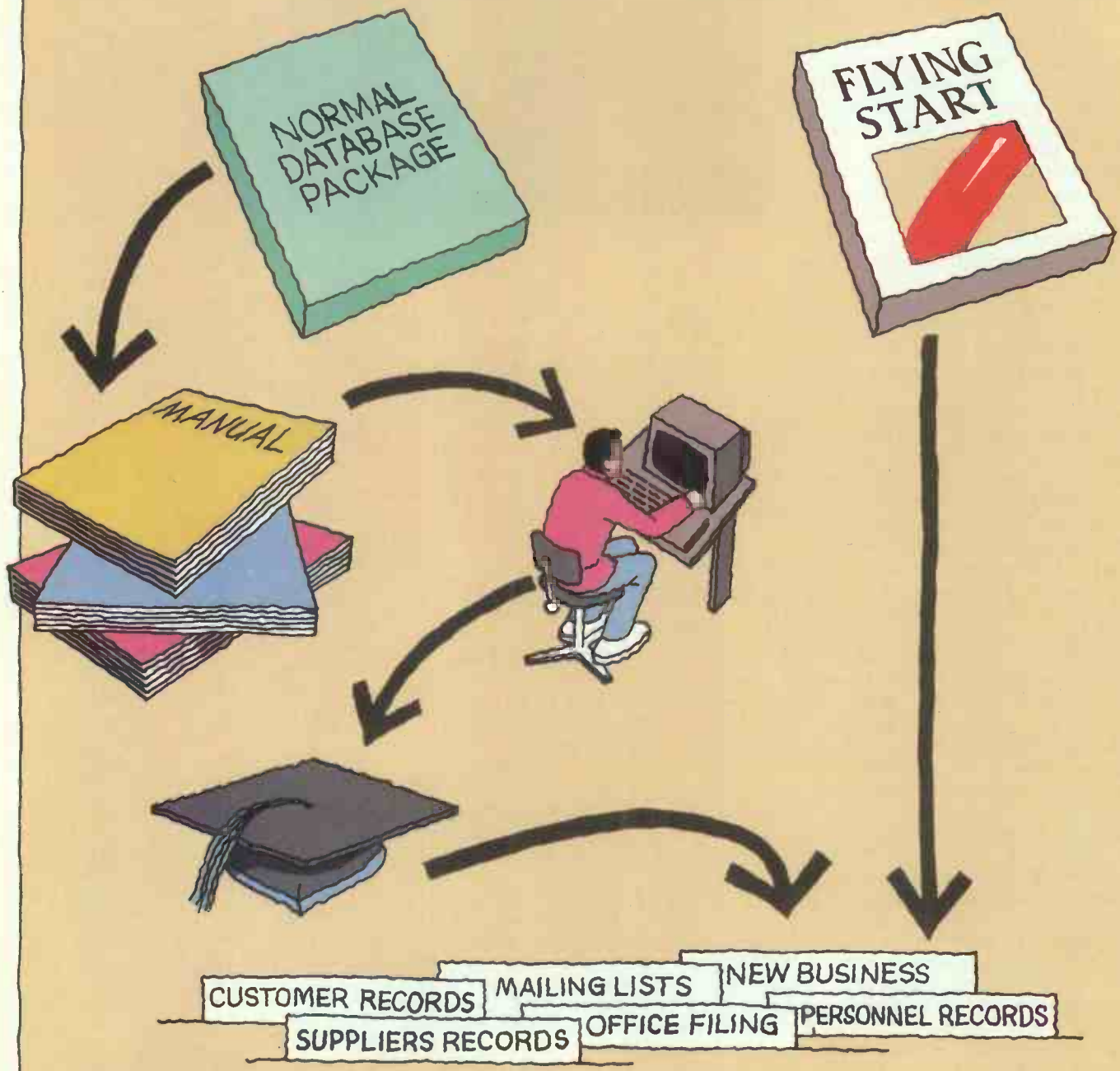
Style-checkers are not designed to create best-sellers, nor do they guarantee writing perfection but, without exception, they promise clearer, punchier prose.

How far can PC programs go?

The sophistication of style-checking programs on a PC is on a par with expert systems. Expert systems programs which form conclusions based on rules that you have typed in are really only found on mainframes. Such systems can not only manipulate the rules to form conclusions, but can often invent totally new rules using a form of artificial intelligence. Trying to do this sort of work on even the latest-model PC would take too much time to be practical. So, although you can buy expert system programs for personal computers, they are not in the same league as their big brothers and, in reality, are simply front-end query languages for databases.

Style-checkers on PCs can be said to be little more than massive look-up tables. For example, the program

WORK AT YOUR BUSINESS, NOT AT YOUR COMPUTER.



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might contain a list of 500 cliches and, if one is spotted in the text being checked, the user is alerted. There's nothing clever in the way this is done. Indeed, if your word processor has a macro facility you could program the whole operation onto one key and do the job just as well, though probably not as fast.

The three PC packages I have been looking at perform two basic tasks when style-checking a piece of work. Actually, PC-Style performs only one of them, but otherwise works in the same way. First, the programs count the number of words, full stops and other special characters in the text and present you with some straight numbers and percentages.

The sort of information you get would be the number of words in the document, the number of sentences, number of paragraphs, average number of words per sentence and, based on something like the FOG index, a guide to the readability of the piece. The programs often contain a jargon dictionary and, by checking which words in the text also appear in the dictionary, you get a guide as to how jargonised the text is.

If you compare the number of uses of words like 'its' and 'their' to words like 'your' and 'yours', you can also produce a rough guide to the personal tone of the text.

This non-intelligent phase of the style-checking process is all that PC-Style does. It just runs through the text file, prints a table containing the type of figures mentioned above, and returns you to DOS.

The best feature of PC-Style is its speed. If you've just finished the first draft of an article, there's no harm in running it through PC-Style to check the reading age and average sentence length. Reading ages should generally come out around 14 years, while an average sentence length of 18 to 20 words is about right. Journalists on *The Sun* are taught that no sentence must ever be more than nine words, though this is probably more for the readers' benefit.

RightWriter also gives a summary of the document after making its comments. This is more detailed than PC-Style's, because of all the extra information that RightWriter gathers while adding the comments. This will contain messages like: 'Most sentences contain multiple clauses. Try to use more simple sentences.' or 'Most sentences start with nouns. Try varying sentence starts.'

The second task that style-checkers perform is to 'examine' the text and suggest ways in which it can be improved. It's important to realise that no program will actually take your text file and automatically correct it according to its own rules. All that the software does is to make suggestions as to how you can tidy up your own work. RightWriter, for example, makes a copy of your text file, into which comments from a repertoire of 32 are inserted at appropriate places. The comments are identified by special characters, such as

<<*LONG SENTENCE: 44 WORDS*>>

so that, once you have taken note, a search and replace session will remove the comments from the file. If you prefer, RightWriter will take out the comments for you.

In use

To put the software to the test, I gave each program a chance to look at some text. The piece in question was the first 1300 words of the PC-Write review which appeared in the February issue of *PCW*.

```
A very strange phenomenon occurs when you show someone a new word processing
program.  Within 5 seconds, they've usually made up their mind whether to
love it for ever or to openly despise it for the rest of their days.
                                  <<* 17. LONG SENTENCE:  26 WORDS *>>^

It's hard to explain what makes the ideal word processor - ask a hundred
people and you'll get two hundred different answers.  Perhaps the opinion
that will occur most is "it has to feel right".  All that a software company
                  <<* 14. INVERTED PUNCTUATION *>>^
can do, therefore, is to keep churning out new packages and hope that they
"feel right" to enough people.
                                ^<<* 22. SPLIT INFINITIVE *>>
                      <<* 17. LONG SENTENCE:  24 WORDS *>>
                                ^<<* 31. COMPLEX SENTENCE *>>

For me, PC-Write doesn't "feel right".  As soon as I loaded it for the first
     <<* 14. INVERTED PUNCTUATION *>>^
time (5 days ago), I felt it lacked that certain something.  After around 40
hours of using it (the loneliness of the long distance software reviewer) I
still feel the same way although, to some extent, my reasons have changed. My
                                  <<* 17. LONG SENTENCE:  29 WORDS *>>^
original thoughts, especially that it doesn't feel like a professionally
written program, remain.

There's no doubting that PC-Write is a pretty complex piece of business
software.  It is designed to be a word processor and it does its job fairly
                               ^<<* 21. PASSIVE VOICE: is designed  *>>
well.  However, it's not something that I would use regularly and, once I've
finished writing this review, I shall get my copy of Word Perfect out of the
cupboard and delete PC-Write from my hard disk.
             <<* 17. LONG SENTENCE:  36 WORDS *>>^
                      <<* 31. COMPLEX SENTENCE *>>^

Despite the fact that I, personally, don't like PC-Write, I accept that a lot
   <<* 2. WORDY. REPLACE Despite the fact that  BY although  *>>
of people think it's wonderful, the editor of PCW among them.  I also
                            <<* 17. LONG SENTENCE:  26 WORDS *>>^
                                  <<* 31. COMPLEX SENTENCE *>>^
realise that many people who buy the latest version from Sageaoft will think
it's the best thing in word processing since the early days when you had to
write your text by poking holes in reels of paper tape with a blunt pencil.
                                  <<* 17. LONG SENTENCE:  45 WORDS *>>^
The remainder of this review, then, will attempt to be a fair, independent
assessment of what makes PC-Write a good or bad product.
                            <<* 17. LONG SENTENCE:  24 WORDS *>>^
                                  <<* 31. COMPLEX SENTENCE *>>^


The History
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PC-Write began life in the USA, as a user supported program.  That means that
anyone could copy it, give copies to their friends, put it on bulletin boards
and do whatever they liked with it.  If you were given a copy and you didn't
                      <<* 17. LONG SENTENCE:  24 WORDS *>>
                                  ^<<* 31. COMPLEX SENTENCE *>>
```

The verdict according to RightWriter

```
A very
--------> very
* At sentence 1 - 'V' - Vague adverb
* Press: RETURN to continue
*   or   Q first to quit checking

strange phenomenon occurs when you show someone a new word processing
program.  Within 5 seconds, they've usually made up their mind whether to
love it for ever or to openly despise it for the rest of their days.

It's hard to explain what makes the ideal word processor - ask a hundred
people and you'll get two hundred different answers.  Perhaps the opinion
that will occur most is "it has to feel right".
--------> .
* At sentence 4 - 'P' - Punctuation error
* Suggestion: .,?, or ! before "
* Press: RETURN to continue
*   or   Q first to quit checking

 All that a software company
can do, therefore, is to keep churning out new packages and hope that they
"feel right" to enough people.

For me, PC-Write doesn't "feel right".
--------> .
* At sentence 6 - 'P' - Punctuation error
* Suggestion: .,?, or ! before "
* Press: RETURN to continue
*   or   Q first to quit checking

 As soon as
--------> as soon as
* At sentence 7 - 'W' - Wordy phrase
* Suggestion: when
* Press: RETURN to continue
*   or   Q first to quit checking

I loaded it for the first
time (5 days ago), I felt it lacked that certain something.  After around 40
hours of using it (the loneliness of the long distance software reviewer) I
still feel the same way although, to some extent, my reasons have changed. My
original thoughts, especially that it doesn't feel like a professionally
written program, remain.

There's no doubting that PC-Write is a pretty complex piece of business
software.  It is designed to be a word processor and it does its job fairly

--------> fairly
* At sentence 11 - 'V' - Vague adverb
* Press: RETURN to continue
*   or   Q first to quit checking

well.  However, it's not something that I would use regularly and, once I've
finished writing this review, I shall get my copy of Word Perfect out of the
cupboard and delete PC-Write from my hard disk.
```

What Grammatik made of PCW*'s text*

PC-Style scanned the text in just a few seconds and displayed the results on screen and printer. RightWriter took a couple of minutes to produce a commented version of the file, while Grammatik insisted on displaying everything on the screen and asked me to press RETURN after each error it found, before proceeding to the next. This made the checking process take much longer than with the other programs.

With results to hand, the first thing that struck me was the way the programs counted the number of words in the text. According to PC-Style, my file contained 1280 words. RightWriter and Grammatik put the figure at 1295 and 1325 respectively.

The full results of PC-Style's report is in the screendump. The number of words per sentence came out at just under 19, which is passable. Readability was given as 11.1 years.

RightWriter gives a similar table of figures, though it also includes a count of the number of unique words. This tells you how many different words the text contains. Unless both figures are equal, you have used some words more than once, as would be expected. The number of unique words came out at 484, which is roughly a third of the document's size. Grammatik and RightWriter each had startlingly different things to say about the text, as you can see from the screendumps.

The second sentence is picked up by RightWriter as being too long, at 26 words. Whether you agree is neither here nor there — RightWriter comes preconfigured with the definition of a long sentence fixed at 22 words and you can't change that. Grammatik lets it pass.

In the next paragraph, both Grammatik and RightWriter picked up the punctuation error, where the full stop is after the quotation marks but should really be before.

Of the two programs, RightWriter seemed to be the more thorough. It certainly picked up more errors, though most of these were because of 'long' sentences.

RightWriter picked up 'not impossible', suggesting that it was a double negative and should be rephrased. It also detected a split infinitive. Grammatik seemed to lack intelligence — it just scanned for words like 'very' and 'fairly' and flagged them as being vague.

Only RightWriter counted commas and flagged as unsatisfactory sentences that contained a lot of subordinate clauses.

With regard to summaries, RightWriter gave a readability index of 14 years. PC-Style said 11.1 but Grammatik didn't offer a figure. Rightwriter also said:

STRENGTH INDEX: 0.47
The writing can be made more direct by using:
— the active voice
— shorter sentences
DESCRIPTIVE INDEX: 0.65
The use of adjectives and adverbs is within the normal range.
JARGON INDEX: 0.00
SENTENCE STRUCTURE RECOMMENDATIONS:
1. Most sentences contain multiple clauses. Try to use more simple sentences.

The complete Grammatik summary, printed after the line-by-line post mortem, consisted of the following short, ungrammatical and badly laid-out information:

sent: 71; # words: 1325
avg sent len: 18.8; avg word len: 4.3
questions: 0; # imperatives: 0
short sent (<14 wds): 22; long sent (>30 wds): 5 longest 46 wds at sent # 14; shortest 6 wds at # 22 to be's: 49; prepositions: 165

Conclusion

There is no shortage of style analysts available for those who fancy improving their style. And the question must follow: who is really going to use them, and are any of them worth the money. PC-Style is free, although registration will cost $29.95 (approx £20), but Grammatik at £125 and RightWriter at $99 (approx £67), are not cheap.

As this explanation will have made clear, the 'style' that is being analysed is inevitably grammatical and not truly literary. I have amused myself by running a variety of authors through the three programs, but 'nuance' is lost on these FOG-based assessors. Dickens should cut out his lengthy sentences, Orwell can be 'weak', and James Joyce was universally disliked. PG Wodehouse, however, scores every time. Still, the purpose of the programs is not to create masterpieces, merely readable copy. And do they?

At the risk of being Mr Smart-Aleck, I don't think I'll use them. What I do for a living is compile dictionaries of jargon and slang, and write various books, the current ones coming in at around 350,000 words apiece. I've run small examples of my material through all three programs and while they picked out the odd duplicated word, and so on (for which I'm duly grateful), I can't be doing with this endless whingeing on about the passive voice, or the assumption that 22 words makes a sentence long, and a couple of subordinate clauses makes it complex.

The programs remain too simplistic and too dictatorial to be genuinely useful. They may well help those who really find writing a nightmare, yet have to do it, but for many more people, something else is needed.

What that something appears to be is customisation. If one is willing to spend the time to work out the sort of vocabularies one uses most, to amass a list of common personal errors and to put the lot on an accessible file, then these programs can be made much slicker and more pertinent. For instance, if one could put Eric Partridge's *Dictionary of Cliches* on file and then read it into Grammatik or RightWriter you would really be dealing with style and not just grammar. But both programs only accept single words and, more vitally, generating what would in effect be personalised literary expert systems requires dedication and time. It also requires a degree of literary sophistication, and the premise of these programs is that they only exist because that's just the sort of thing the potential user lacks.

Thus, with genuine regret, thumbs down to style analysis from this hack. An idea whose time has certainly come, but not yet one that's really good enough.

Readers will no doubt have their own opinion on this subject and PCW *would be interested to hear them.* END

Details

PC-Style is shareware. This means that you can copy it from a friend quite freely. If you don't like it, just erase the disk. If you intend to use it, you are asked to send a contribution of $29.95 to the author, whose address is on the program. Documentation is included on the disk and must be printed out. The complete system fills a 360k disk and occupies around 80 files. If you intend to download it from a bulletin board, make sure that you get the archived version. This is a single file containing the whole system in compressed form. You'll also need to download a program called ARC to unpack everything.

RightWriter costs $99 and comes from Decisionware Inc at 2033 Wood Street, Suite 218, Sarasota, Florida 33577, USA. Tel: (813) 952 9211. You may also want RightWords, which contains a set of jargon dictionaries and some programs for creating your own.

Grammatik is distributed in the UK by Raven Computers at 28-32 Cheapside, Bradford, West Yorks. Tel: Bradford (0274) 309386. It costs £125 plus VAT.

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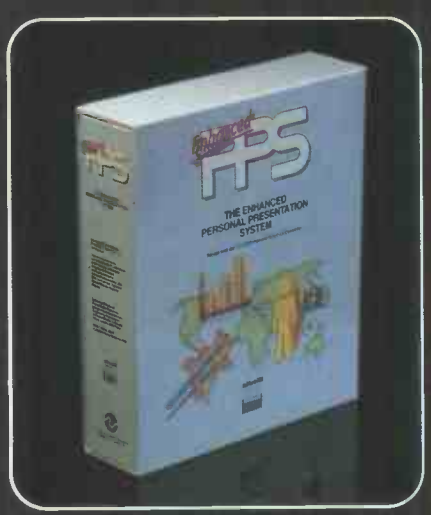

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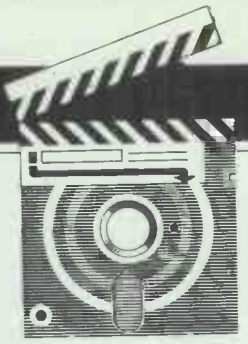


SCREENTEST

Silk

Lotus 1-2-3's domination of the spreadsheet market has never been seriously threatened, but Daybreak Technologies' Silk provides the same — and more — facilities. Mike Liardet checks out the comparisons.

When, nearly four years ago, Lotus' 1-2-3 integrated spreadsheet system was launched (reviewed by me in *PCW*, Nov 1983), it was widely regarded as the most impressive PC software product that had ever been seen. But four years is a long time in the PC software world, and more than long enough to reduce the extraordinary to the commonplace. In spite of this, to this very day, Lotus has maintained a 1-2-3 stranglehold on the spreadsheet market, and has preserved its high prices while only marginally improving the product.

Not surprisingly, a number of companies have recently been looking enviously at Lotus' dominant position, judging that with falling software prices and much bigger markets they can easily produce a substitute product at a fraction of the price. This has led to a number of 1-2-3 clones, two of which (VP Planner and The Twin) have recently been the subject of some controversy because Lotus believes they are cloning too close for comfort and is seeking to remedy this in the courts. All this controversy has overshadowed the fact that The Twin and VP Planner are not the only substitutes for 1-2-3, and in this article I'll look at another one — Silk.

Silk is the product of Daybreak Technologies, a hitherto unknown US company. It is supposedly the result of '40 person-years' of development effort, which is about four times the original 1-2-3 development effort, if the figure is to be believed. Not only can Silk both read and write 1-2-3 work files, but it can perform many of the usual 1-2-3 tasks, and it even operates in much the same way, with a very similar command structure.

Silk also has a handful of extra facilities, not available in 1-2-3, and for the few users who really need them, these may be reason enough to overcome their prejudice against a new product from an unknown company. But the main attraction for most users must be that Silk is about a third of the price of 1-2-3, at $149 in the US. Also, it does not have the inconvenience of Lotus' copy-protection schemes.

Assuming it really lives up to its claims, it is likely that Silk will be of interest to two categories of user: the corporate user currently locked into 1-2-3, but who would prefer to avoid Lotus' prices; and the new breed of budget PC (for example, Amstrad) owners who need a powerful spreadsheet system but simply cannot afford almost to double their overall expenditure to buy one. Clearly, corporate users in particular will be very concerned about close compatibility with 1-2-3, expecting that both staff and their models can be transferred to the new system with barely a hiccup.

In this review I'll take a close look at Silk and evaluate just how compatible it is with 1-2-3 (Release 2). I'll also be comparing Silk's performance to that of its more expensive rival. Daybreak Technologies claims that Silk is three times faster than 'the most popular spreadsheet', and I'll be checking the validity of this statement.

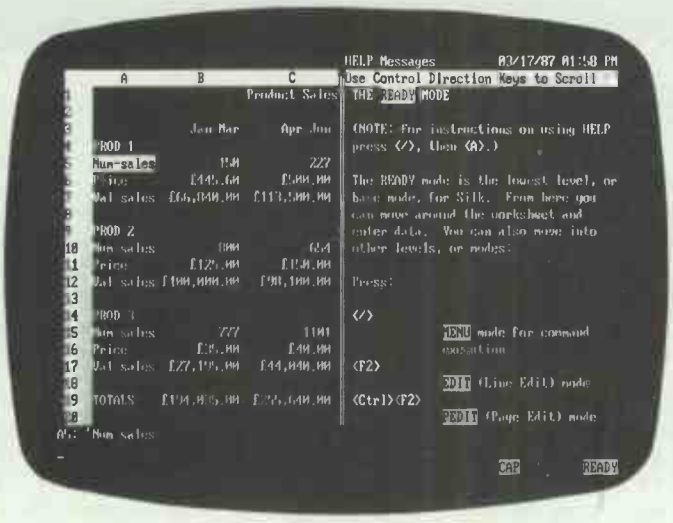
Overview

Silk is first and foremost a spreadsheet system, and this places it as one of a vast range of PC software products which are designed to be applied mainly to financial planning and mathematical modelling problems. Like all spreadsheets, Silk can generally be of value in any situation where repetitive calculations and recalculations are being made, with budgeting being the most obvious use for it.

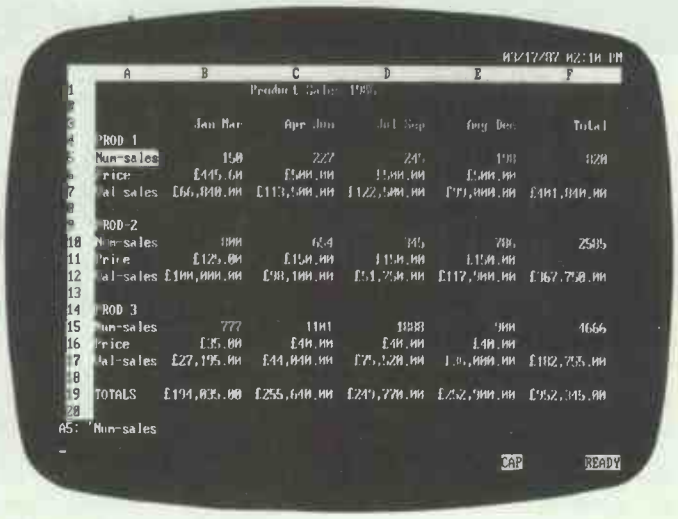
Like 1-2-3, Silk is more than just a simple spreadsheet system. Alongside some very sophisticated spreadsheet facilities, it also offers extensive business graphics options and a macro facility which enables it, in effect, to be driven by a program embedded in the spreadsheet itself. These spreadsheet, graphics and macro facilities it has in common with 1-2-3, but of course, 1-2-3 also has extensive database facilities. Although not all spreadsheet users actually need a database facility, this is a major omission in Silk, which does not offer anything to match in this department.

Although it is obviously aimed at existing 1-2-3 users, Daybreak Technologies has not faithfully followed every last nuance of 1-2-3 in the design of Silk (possibly to protect itself from legal action by Lotus). For example, the menu command structure is slightly different; also, some of 1-2-3's more complicated menu interactions are handled rather better in Silk by 'form' displays.

Silk also contains a few innovations and enhancements over 1-2-3: a goal-seeking option, key-stroke logging, advanced interactive online help. In the manual, these and other facilities are referred to as 'advanced features', but they are given rather more prominence than they deserve. It should not be concluded that none of them exists in 1-2-3. For example, circular reference detection is mentioned, and this is available in 1-2-3. Naturally, Silk's advanced features,



The help only covers half the screen, so you can see your worksheet at the same time as the help information



Silk's layout is pretty standard, with a command line at the bottom, and cells identified by column letter and row number

unique or not, do have their uses and I'll cover them later, but they are not hugely significant and most users will be more concerned with other aspects of the product.

Getting started

Silk is supplied as a manual and four disks, the disks containing the Silk software itself, some utilities, a tutorial, and an extensive file of 'help' text. The software can run on the IBM PC, XT and AT, and 'all 100 per cent compatibles'. Although Silk can be used on smaller systems, to get the best out of it a hard disk is required and at least 640k of memory. 'Power users' will also undoubtedly require extra expansion memory (they can use up to 8Mbytes) and a numeric co-processor. The review system was not the final release, but a very late 'beta test' version with a draft of the manual.

Assuming a hard disk is available, the software can simply be installed by creating a 'Silk' sub-directory and copying all four floppy disks into the sub-directory. The complete system, with all support files, requires about 1Mbyte of disk space. The system can also be run from a twin-floppy system, but this may involve occasional disk swapping. Unlike 1-2-3 there are no problems with copy-protection schemes, although the software is, of course, only licensed for a single user and should only be used on a single PC.

There are a number of programs supplied with the system, and these can each be run directly from the DOS command prompt or via a special 'Access' program. The most important options from Access allow the Silk system to be run in various ways, but there are also options to 'install' the system, print graphics, translate files to or from Lotus and other formats, and run a tutorial.

Before any of the other options are tried, 'install' must first be used; this is needed to specify what type of display card is in use in the PC, and which printer is attached. This is all completely straightforward, although the range of printers is rather small. And clearly, if the PC does not have a graphics display card, it will not then be possible to use Silk's graphics facilities.

For newcomers to Silk there are some tutorial exercises in the manual, but perhaps the easiest way to learn the system is with the interactive tutorials, available as an option on the Access menu. These tutorials are actually ordinary spreadsheet models, mainly comprising text but run under the control of Silk's macro facility. The new user need not be aware of this (although an experienced user could easily tailor them for in-house teaching requirements). The new user simply sees a sequence of screens full of information, explaining the various aspects of Silk, starting with the most basic introduction to spreadsheeting. Each screen has full instructions on what to do, and gradually the new user is taken through most of Silk's facilities.

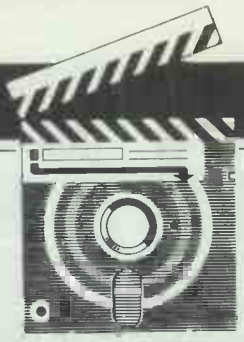
When the user has worked through some tutorials he is in a position to start using the system, but to begin with at least he may prefer to work with a Help display permanently on show. The Help display is always available at a single key-press, and remains in place until explicitly removed. It occupies about half the screen and elaborates on what options are available at any given moment, and contains other useful information, too. The information is changed each time a user action is made, to reflect the new alternatives available. This is known as context-sensitive help.

Silk comes with a file of over 200k containing nothing but Help information, so it is quite an extensive facility. Unfortunately the amount of help information on a given topic generally exceeds the space available for display, and so it is frequently necessary to spend time scrolling through the text until the required information is found. Perhaps a keyword search would be more convenient in these circumstances.

Spreadsheeting

Silk has only a few surprises in its general organisation and facilities in its worksheet, with most of its specification being very similar to 1-2-3. Silk's worksheet, which is used to hold the data and formulas for the model being worked upon, is 256 columns wide by 2048 rows long. With Silk's sophisticated storage management procedures, these generous dimensions could, for example, allow the user to create several small models scattered right across a single worksheet. But it must be remembered that although there are approximately half a million cells in all, a standard 640k PC could only permit a small percentage of them to be filled. It is only with several megabytes of expansion memory that a significant proportion of this enormous area can be fully utilised.

As in 1-2-3, the columns in the worksheet are identified by letters and the rows are numbered, so each cell can be uniquely identified by a letter+number combination: A1 for the top left-hand cell and IV2048 for the bottom right-hand one. Of course, it isn't possible to see the entire area all at once onscreen. To get round this, Silk uses the standard spreadsheet windowing technique to display onscreen a small portion of the overall area: just 6 columns by 20 rows. Silk provides all the usual keystrokes for moving this window around the worksheet and allowing the user to enter, change or view the



SCREENTEST

contents of cells. As on all spreadsheets the cell contents can be either numbers, text or formulas.

When entering a formula into Silk it is possible to create a 'circular reference'. This happens when a formula — directly, or indirectly — references the cell within which it is contained. As this almost always represents an error in the model, Silk can detect that this has happened and help the user track down the offender.

In general Silk parallels all 1-2-3's formula facilities, including its ability to control recalculation in various ways and its conventions for 'relative cell references'. The only major difference between Silk and 1-2-3 in respect of formulas and calculation, is that Silk has no database functions and does not precede its function names with "@" (1-2-3 uses "@cos(..), Silk uses "cos(...)"). Everything else is as in 1-2-3.

It is also possible to enter a macro command into a cell and then have Silk execute it rather like a program. Using this complex facility could be the subject of a whole article itself, but in brief, macros allow the user to specify commonly used procedures once and for all and then re-use them over and over again, invoking them with just a couple of keystrokes. Macros can also be useful in setting up tailored applications. And Silk has the full range of macro facilities, as in 1-2-3.

For some reason Silk does not have 1-2-3's ability to display different parts of the worksheet in two halves of the screen — the 'split screen' facility. This is possibly lacking in Silk because of the additional display complications caused by its extra Help and forms displays.

Silk also has all 1-2-3's worksheet editing commands, for deleting, inserting, copying and moving cell contents from one place to another. These all work in a practically identical fashion to 1-2-3. Undoubtedly, an experienced 1-2-3 user could sit down with Silk for the first time, without a manual, and within only a few minutes could tie all the facilities and functions together to create the sort of model shown in the screenshot.

Performance tests

In order to assess the relative performances of 1-2-3 and Silk when running a fairly typical application, a simple Benchmark test was used. The objectives of the test were to determine: (a) the size of model each could handle (on a 640k PC); and (b) their respective calculation speeds. Both factors are very important aspects of a spreadsheet's performance.

The test simulated a typical '12 months plus totals' financial calculation. It involved first of all setting up the top row of the worksheet with the numbers 1 to 12 across the first 12 columns. This was done by setting the A1 cell to one, the B1 cell to the formula A1 + 1, the C1 cells to B1 + 1, and so on. Next, the first column of the second row was given the formula:

A1 + (13 * A1) / A1 − 1

This formula is an inefficient way of evaluating A1 + 12, but it involves the primary arithmetic operations once each. It was copied across the row, resulting in the numbers 13 to 24 being displayed. In the thirteenth column of this second row, the formula 'sum(A2. .L2)' was entered. This sums all the numbers in that row. This second row was then copied down to the 200th row and recalculation timings were made, for when the top left cell was changed from 1 to 1.5. This single change forces a complete recalculation through every cell, resulting in a lengthy and significant amount of computation. Following this the rows were copied further and further down until memory was exhausted, and the number of rows thus reached was used to measure the capacity of the system.

The results of the performance tests are summarised in the table. With recalculations, there was no significant difference between the two systems — a good result for Silk, as 1-2-3 is noted for extremely good calculation speeds. But, of course, there is no evidence from these tests that Silk is three times faster than 1-2-3, as Daybreak Technologies is claiming!

The capacity test was less good for Silk, with about half the capacity of 1-2-3 on a 640k PC. This is largely because the Silk software itself is larger than 1-2-3, leaving only 255k for workspace, after it is loaded, whereas 1-2-3 allows 439k. Probably the capacity differences would seem less significant if comparisons were made with a megabyte or two of expanded memory available in the PC.

Business graphics

Silk can plot data from the worksheet in a variety of graph styles, including pie charts, line graphs and bar charts. It can use colour.

The end-result from Silk's graphics facilities is much the same as in 1-2-3, but the interaction to produce the graphs is slightly different. 1-2-3's graphics are driven entirely by menus, but Silk uses 'forms' for the user to specify the graph to be plotted (see screenshot).

Silk's forms, which are used in a few other areas of the system as well, are presented in a window on one side of the display. The user can freely move the action-point cursor up and down all the entries, and make changes as necessary. The form behaves in many respects like a very restricted worksheet. For entries which require coordinates from the worksheet, the user can temporarily escape from the form to find the place required. Any number of forms can be retained to specify different types of 'plot' that may be required, and they can, of course, all be saved permanently on disk along with the model in the worksheet. In general, I found the forms slightly easier to use than 1-2-3's methods, so this must count as a minor plus for Silk.

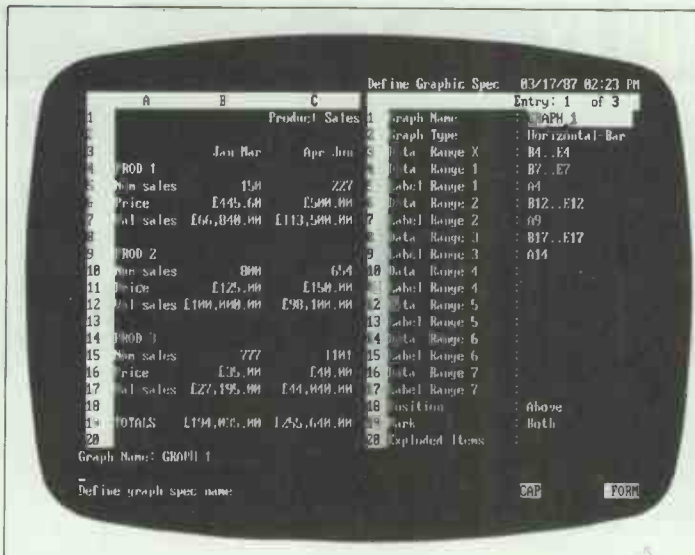
In the graphics forms it is possible to specify which style of graph is to be drawn, what information from the worksheet is to be plotted, annotation for the axes, titles and scaling, and so on.

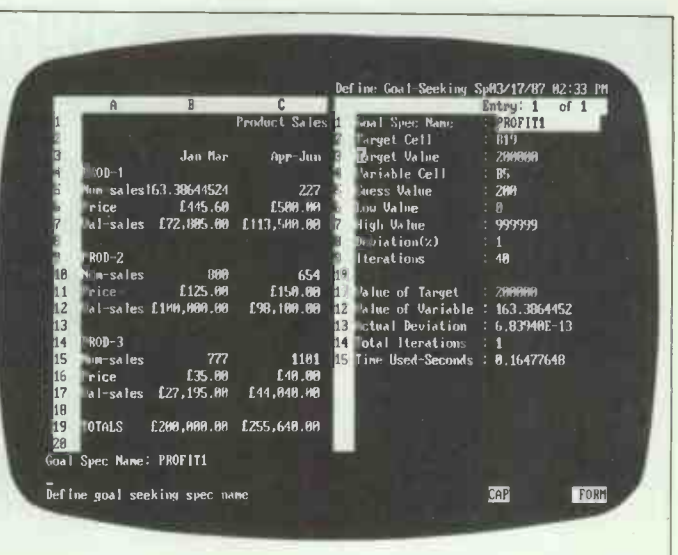
Extra facilities

As I have already mentioned, the Silk manual gives some prominence to a miscellany of 'advanced features'. Although none of them is likely to make Lotus tremble in its boots, they may be of interest in some specialised circumstances. Some of them I have already covered elsewhere, so I'll now briefly go over the remaining ones:

● **Keystroke logging** One of the more unusual features in Silk is that when it is first started up, it can be made to run with 'keystroke logging' enabled. With keystroke logging, every keystroke made during a session is recorded in a 'log' disk file, and the complete session can subsequently be rerun from the 'log' file. Logging will not operate from a floppy disk, but on a hard-disk system there are no discernible delays while the keystrokes are being logged.

A common problem in spreadsheeting is that it is very easy, using the very powerful worksheet editing commands, to overwrite or delete some part of the model accidentally. Without keystroke logging the only recovery from this situation is to either abandon the session without saving the model and then re-do all the changes that were made, or else attempt to reconstruct the damaged parts of the model. Neither option is





To produce a graph you first fill in a form which can be saved to disk for later use. Pie, bar and line charts are available

One of Silk's added extras is its ability to goal-seek. A form is used to specify which cells can change and the value of the target cell

viewed with much relish by most users. But with Silk's logging facilities it is possible to abandon the session and then effortlessly replay it from the log file, of course stopping the replay just before the fatal command is issued.

Not only can the logging facility be useful for recovering from errors, but it is an excellent means for creating demonstration systems or tutorials, and some users may even use it for auditing. Why didn't someone think of it before?

● **Goal seeking** Most worksheets are built up of cells containing formulas referencing other cells with formulas, and so on, eventually culminating with formulas referencing cells containing raw input data. Typically the bottom line of the worksheet is the most important one, containing formulas which may indirectly refer to just about every previous row in the model. For example, a TOTALS row could contain formulas that reference the three value-of-sales rows above it, with these in turn each referencing the two rows immediately above them. These number of sales and price rows all contain raw input data.

It is not unusual for the bottom line of a model to be subject to targets, and it can be problematical trying to 'cook' the raw input data higher up the model so that the targets are met. This is where Silk's goal-seeking facility can be of use.

Suppose that the Jan–Mar sales target in a spreadsheet is £200,000. Clearly, if the number of sales of Product 1 were adjusted, then this target could be met. Instead of adopting a trial and error approach to find this value, the goal-seeking option can be selected. A 'form' is used to specify that £200,000 is required in cell B19 and that cell B5, containing Product 1, can be adjusted to achieve this. The goal-seeking algorithm used by Silk also requires some help before it can solve this problem. It needs to be given a first guess for the variable cell, and it also requires a few limits to be specified so that its computations can stop in reasonable time, should it be unable to find a solution.

When the goal-seeking is successfully completed, the worksheet is updated with an appropriate new value in the raw input data cell and the required target value in the formula cell. When the new value is in place, the target value could also be arrived at by recalculating the worksheet in the normal way. Notice that Silk does not generate an integer result; and it can only vary one cell to meet the target — in the example here, it would have perhaps been advantageous if the sales of all three products could have been adjusted, and not just one.

Clearly Silk's goal-seeking facility has its uses but it is subject to some limitations, and anyone needing really powerful goal-seeking might be advised to try some alternative (non-spreadsheet) modelling systems.

● **Time series** On time-based models, it can sometimes be tedious to continually copy formulas across each time period, and it can also be difficult to maintain these models when new periods are added. For example, a model could be built in the conventional way with formulas copied across the columns, and the total column using the 'sum' function to calculate the row totals. But the model could have been built with the time-series facilities, and the copying and summing would all have been automatic. When the time information has been specified, the only action needed by the user is to specify the relationships between the rows.

When using time-series facilities the end result is the same as with conventional spreadsheeting, but especially when more complex time periods are needed, it can be a lot more convenient. For example, by using time-series facilities, models can easily be set up with monthly columns, quarterly totals and an annual total. The formulas are automatically set up to do all this once the user gives the basic row calculations. A typical row calculation might be that:

Profit = Value of Sales − Costs

All the formulas in the profit row would then be generated from this one 'English' formula. Of course, this facility is closely related to the classical financial modeller type of packages, where the 'logic' of a model is specified in a very similar way. With most financial modellers, however, the interactive worksheet is missing and they are generally a lot harder to use than spreadsheets.

Benchmarks

	Silk	1-2-3
Capacity:	370 rows	660 rows
Calculation time	15 secs	14 secs

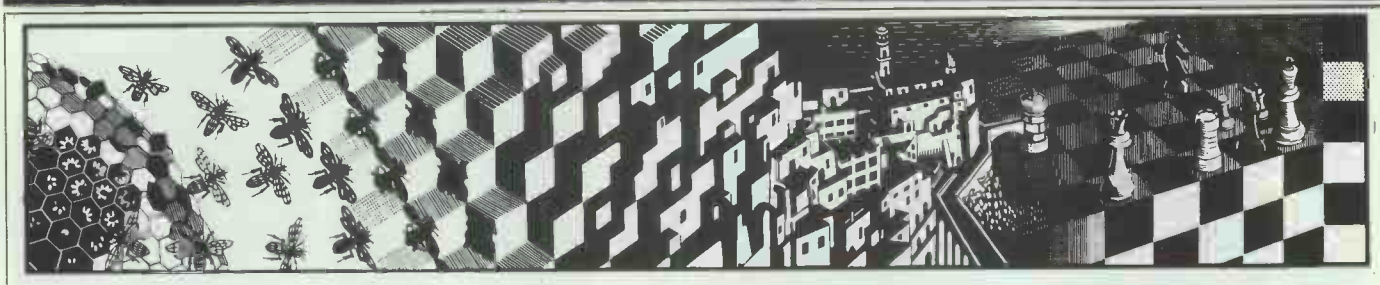
The tests were run on a 640k Zenith 150, with a NEC V-20 at 4.77MHz and a numeric co-processor.

The details of the tests are given in the text.

Conclusion

For anyone interested in a 1-2-3-like system at a third of the price, but lacking a database facility, Silk must be a serious option to consider. It does require more memory than 1-2-3, and this is likely to push the user into purchasing memory expansion boards rather earlier. But much of the system will seem very familiar to a 1-2-3 user, and for many it could be a more than satisfactory substitute for the 'real thing'.

For more information, contact: Daybreak Technologies Inc, 2271 205th Street, Torrance, CA 90501, USA. Tel: 213/212-3030. END



There's no rest for the wicked — if Stephen Applebaum isn't preparing meals for impatient diners and clearing Chicago's streets of nasty gangsters, he's trying for a hole-in-one on the golf course. Here he plays the best of this month's games.

Dealing in cuisine

Title: The B.I.G. Deal
Computer: Commodore 64/128
Supplier: Ariolasoft
Format: Cassette
Price: £9.99

The last time we saw Floyd the Droid, he was employed in extracting unwanted fauna and flora from the world's sewers. He proved to be such a success that his bosses brought him to the surface, gave him a polish and an upgrade, and put him to work in the kitchen of a large burger bar. And thus was born Floyd II, star of The B.I.G Deal.

The restaurant in which Floyd has been employed is owned by the B.I.G. (Best In Gastronomy) Corporation which, unfortunately for Floyd, does not agree entirely with the idea of automation. However, it has given the go-ahead for Floyd to be put on a week's trial. If, by the end of the week, Floyd has proved himself more efficient than a human worker, B.I.G. will hire him in another of its restaurants. If he has not, it's goodbye kitchen and hello sewer.

But it is not only Floyd's happiness that is at stake. His success will also win his inventors a contract, worth millions of dollars, to supply B.I.G. with 32,200 similar robot kitchens.

B.I.G. restaurants are open between the hours of 9am and 9pm. Most of the people who frequent them are patient and polite, though there are those who become agitated if the service is slow and start throwing chairs around in disgust. Such people can do nothing but tarnish Floyd's reputation.

Your part in The B.I.G. Deal is to operate Floyd; the object being to prepare and serve the customers' orders in the shortest amount of time possible. If, at the end of the day, you have succeeded in satisfying the restaurateur, Floyd will be promoted to a busier restaurant.

The B.I.G. Deal ends when Floyd has worked his way through a chain of increasingly more busy restaurants to earn himself the accolade of Master Chef.

During play, the display divides into two. In the top half of the screen are several small windows which show how many hotplates are in use at any one time; how many customers are in the main dining area; the contents of Floyd's memory (more of which later); and the customers' orders. The bottom window is where all the action takes place, and shows Floyd going about his duties.

Included in the program is a list of the ingredients that go into each meal on the restaurant's menu. Some of the ingredients quite often need to be prepared in a special way before they can be used. Therefore, it is not uncommon for Floyd to have to rush around chopping, boiling and frying certain foodstuffs, actions which eat up lots of valuable time.

Floyd's job is made none the easier by all the recipe ingredients being stored away in different cupboards and containers. He does have one advantage, though, and that is an internal refrigerator that can store four items of food at any one time.

When an order appears at the top of the screen, Floyd must first grab a B.I.G. box (one of those polystyrene containers that usually taste better than the food) from a small receptacle situated at the left-hand end of the kitchen. Then, if you can't remember the ingredients for the order, you must consult the aforementioned recipe list. Having decided on the recipe and collected the ingredients from the various storage sites, you can start to prepare the meal.

If the meal is a hot one, the ingredients to be cooked must be placed on one of four available hotplates. While the food is cooking, Floyd can go about preparing the other ingredients. When everything is ready, you must make Floyd collect all the various bits of food and place them in the B.I.G. box.

When the meal is complete, Floyd presents it to a scanner-like piece of equipment which checks it to see if the ingredients are correct. If they are not, the patron whose order it is becomes agitated, and it isn't long before the chairs start flying. However, if it's correct, the food can be put on a conveyer belt and taken to the customer.

The B.I.G. Deal is a fun game with some nice graphical touches. But what really makes it different from

other games of its kind — and there are some similar ones available — is the facility to program Floyd, much the same way as the game's precursor, Floyd the Droid.

Were all the meals prepared by guiding Floyd around the kitchen using the joystick, there would be no way that he could meet all the orders given to him during a day. A much faster way of preparing a meal is to train Floyd to do it independently, and this you can do in a special 'Training' mode.

Contained in a main menu which appears in the window where the recipes are displayed, is an option called 'Procedures'. Selecting Procedures allows you to either *teach* Floyd three procedures or *perform* three procedures.

To teach Floyd a routine, you select a function called 'Record' and lead Floyd through the actions you want him to perform. Each of the three procedures available has a time limit on it. Procedure 1 is the shortest, and is meant for simple orders; Procedure 3, on the other hand, is designed for complex orders and so has a rather longer time limit.

When you record a procedure, you must make sure that you don't make any mistakes; the reason being that Floyd will read them as part of the program and so make the same mistakes himself. Procedures designed in training mode can be saved onto tape for another day. But as you progress to busier establishments, you will probably find that you need to write new, faster ones.

The B.I.G. Deal is an excellent game that I am sure will appeal to children and adults alike. I wonder, though, how long it will take before someone writes a game in which you have to get a human a job?

Cleaning the streets

Title: The King of Chicago
Computer: Apple Macintosh
Supplier: Mindscape
Format: Disk
Price: Not available

In the March issue of *PCW* I reviewed SDI, the second program in Mindscape's Cinemaware range, and almost wrote off the company, the game was so bad. I am now glad I did not go the whole hog in my criticism as Mindscape has bounced back with The King of Chicago, an unusual gangster game for the Macintosh which bears all the hallmarks of the company's past triumphs.

This latest Cinemaware extravaganza takes place in Chicago. The year is 1931, and Al 'Scarface' Capone is in the slammer. Prohibition is on but there is still whisky to be had, if you know where to get it. All over town, the speakeasies are doing a roaring trade. The Windy City is blowing at gale force.

In the years between 1931 and 1934, Chicago proved to be such a hot-house of murder and corruption that the city was considered unsuitable for a place in Murder Inc, a national syndicate formed to keep violence out of the hands of individual gangs.

Your aim in The King of Chicago is to gain control of the city by wiping out gang warfare altogether. The fruits of your labour is a well-earned place in Murder Inc.

In the game you take the role of Pinky Callahan, a member of the gang controlling Chicago's Northside. With Capone safely out of the way, Callahan figures that under his guidance, the Northside could take control of the entire city. First, however, he must 'retire' his gang's current boss and convince the rest of its members that he is the man for the job.

The King of Chicago is a strange and at times uneasy mix of arcade action and mind-bending strategy. All thirteen of its characters have individual personalities which alter each time you play the game. Since you are the main protagonist who must continually make decisions, the quirks in their personalities show themselves in the form of reactions to your actions.

Personalities, situations and events constantly change from game to game. I am not sure how true Mindscape's claim is that there are over 1,000,000,000 combinations, but I did not experience two identical games. In fact, every time I won The King of Chicago, I did so by different means.

Like Mac Golf, reviewed alongside, The King of Chicago takes full advantage of the Macintosh's special features. You never have recourse to use the keyboard, as everything is controlled with the mouse.

The program's graphics are some of the best I have yet seen on the Macintosh. Every character is a grotesque caricature, similar to Max Headroom. Their faces are always shown in close-up, giving you a chance to witness the work that has gone into both drawing and animating them.

When a character speaks, he or she does so by means of speech bubbles. Although they don't make any sound, you can get a good idea of each character's feelings by their ever-changing facial expressions. This is best seen in the case of Lola, Callahan's moll. She winks, pouts, frowns and smiles, using a repertoire of animation techniques, the likes of which I have not seen before.

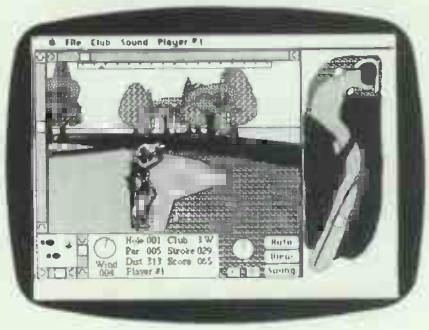
Pinky, your character, not only talks but thinks, too, which is how the program tells you that it is ready for you to make a decision. Therefore, there are points in the game when three 'think' bubbles appear next to Pinky's head. All you have to do is choose the appropriate thought for the moment by clicking on it with the mouse.

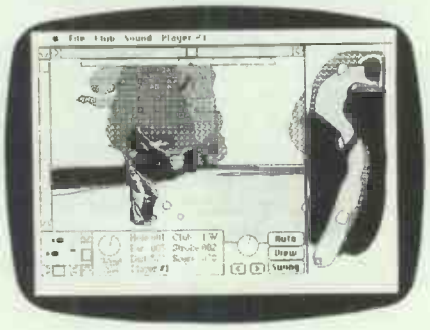
So much for the strategy — sometimes you have to do some killing, which is where the arcade sequence comes in. When someone is to be shot, the screen displays your target and a hand gripping a gun. The idea is to move the hand and shoot before your opponent shoots you.

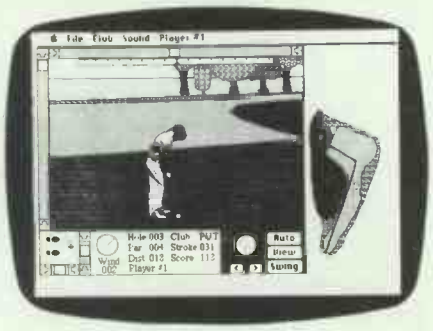
Humour is one of the key features of any Cinemaware game and The King of Chicago is no exception. This time, it emerges out of the characters' quips. Pinky, especially, is a master of the one-liner; few of these, though, are clean enough to mention here.

As well as humour, the game's programmers have also added pastiches of scenes from some of the great Hollywood gangster movies.

The King of Chicago is a brilliantly devised game that far outstrips others of its genre. It's good to see Mindscape back where it should be — on top.







Swinging pastimes

Title: Mac Golf
Computer: Macintosh
Supplier: MacSerious
Format: Disk
Price: £49.95

Although I don't like golf, I must confess a soft spot for Mac Golf; a game which has awakened in me a degree of respect for the skill of professional golfers. Even an exercise as trivial as hitting a ball into a hole requires uncommon adroitness.

Mac Golf is similar in many respects to Golf Construction Set and Leaderboard Golf. It is, however, far easier to master than either of these, if only because of the Macintosh's friendly front-end and mouse. These features make the Mac an ideal, albeit expensive, machine for this kind of game.

During part of Mac Golf's loading routine, the crisp, digitised cry of 'Fore!' issues from the Macintosh's speaker. The Macintosh's ability to reproduce sounds of the utmost fidelity has already been demonstrated in the likes of Uninvited (review, *PCW*, December 1986), but I am still taken aback by the quality of sound produced by a machine designed primarily for serious applications. However, I am sure there are lots of people who take their games-playing seriously, so I suppose 'serious application' is a relative term.

A round of Mac Golf can be played by a maximum of four persons, each of whom can contest the game at one of three skill levels. The ability to handicap players means novices can compete on almost even terms with seasoned golfers.

Two courses, Augustina National and Shinook Hills, are included on the Mac Golf disk. Before a round, players choose which one they want to play on. Both courses contain eighteen holes, as is the norm, but players need not compete over all of them: they can elect to use just the front nine holes or the back nine holes.

In play, Mac Golf's display differs very little from those of Golf Construction Set and Leaderboard Golf. The major part of the display features a box containing a 3D golfer's-eye view along the fairway, beside which is an aerial shot of the current hole which indicates the land forms between the tee and the green.

Since the Macintosh has a monochrome display, the programmers of Mac Golf have been forced to use different kinds of shading to represent hazards like water and bunkers. Far from being a drawback, this is an advantage in the sense that the designers have paid rather more attention to detail than if they had had colour at their disposal.

Had colour been available, I am sure the programmers would not have bothered to give the golfer a detailed face and creases in his trousers. They could have avoided all that with a dab of colour here and there.

Playing Mac Golf is very easy, since everything is done via the Macintosh's mouse. The only difficult part is setting up the shot so that the golfer hits the ball in the right direction and with the right amount of pace.

The strength with which the golfer strikes the ball can be altered using a vertical slide control down the left-hand side of the box containing the three-dimensional view. Using the mouse a small white block can be slid up and down, depending on whether the player wants to increase or decrease the strength of the swing. This control has a direct effect on the horizontal distance the ball travels.

At the bottom of the display is a smaller box equipped with both a horizontal and a vertical slide control. The former puts either left or right spin on the ball, while the latter adds loft, giving the ball height.

One of the most important controls is a small circle containing a line drawn half-way across its diameter. The point where the line cuts the circle's circumference represents the direction in which the golfer is facing. This can be changed by clicking on one of two arrows, pointing left and right, below the circle.

Rotating the arrow does not have an immediate effect on the three-dimensional display. To move the golfer, a box containing the word 'VIEW' must be clicked on. When this has been done, the computer clears the screen to redraw the new view. Redrawing is a long-winded process which, because it has to be done after every shot, slows the game down to a pace almost as slow as real-life golf.

Located along the top of the display are a couple of important pull-down menus. The first one, 'File', contains commands for saving the current game and loading a new one. 'Club', the second menu, is the player's golf bag; in it are contained three woods, eight irons, a pitching wedge, a sand wedge and a putter. After teeing off on a hole, it is usually necessary to access the Club menu after every shot.

To galvanise the golfer, the player has to click on a box labelled 'SWING'. When activated, the animated golfer goes through a smooth — and very realistic — golfing action. Having been struck, the ball soars off into the distance. Although the 3D view gives little away as to the ball's new position on landing, more information can be gleaned from the aerial view which tracks its flight path from start to finish.

The digitised shout I mentioned earlier is not the only sound effect in Mac Golf — far from it. Some of the other sounds to titilate the tympanic membrane are the sounds of the ball landing in a river or rolling into a hole. There is even a fickle crowd which jeers or cheers, depending on how well a player does on the green.

Overall Mac Golf is a surprisingly good game, considering its subject matter. It is far better than either Golf Construction Set or Leaderboard Golf. However, I am still not convinced of its lasting appeal, not even for golf lovers — who, no doubt, would rather be out playing the real thing. But, if you like watching golf and would take it up were it not for the walking and having to tote a heavy bag around several miles of countryside, then Mac Golf is probably the next best thing. END

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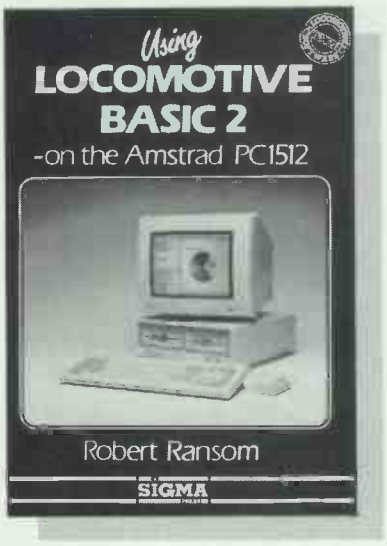
This month our book reviewers tackle introductory guides to programming languages and mastering chips.

Using Locomotive Basic 2 — on the Amstrad PC1512



Author: Robert Ransom
Publisher: Sigma Press
Price: £11.95

'Knowledge of simple BASIC programming will be useful knowledge for the intending reader of this book.' An essential prerequisite I would have thought as I honestly believe that a novice Basic user would otherwise be confused by this book. The author has a clear, explanatory style, but he does take it for granted that the user has a good working knowledge of Basic and the comparisons between Basic and Basic2 invariably crop up: *'The real power of Basic2 over earlier Basics is the use of the GEM visual interface'; 'the main differences are the provision of the mouse and the multiple screen windows';* and *'one fundamental difference . . . there are no line numbers . . . the second difference is the use of lower and upper case text'*, and so on. But if you are already familiar with Basic, then this is a very neat and handy little book to have.

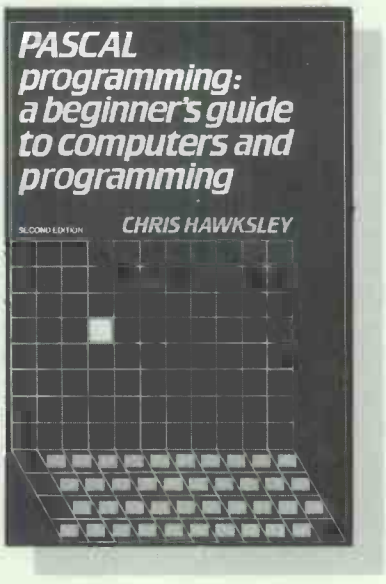
To get the most benefit from *Using Locomotive Basic*, you would need to be sitting in front of your Amstrad PC1512 (or IBM compatible) with one hand on your invaluable mouse and the other on this book; otherwise, it's very hard to visualise the effects of 'double-clicking' and 'F10-ing'.

The first section covers an excellent introduction on how to get Basic2 up and running, finding your way round the GEM desktop, how to use the windows and a general chat about the Basic2 environment. The next section moves on to more detailed work: functions, program input, using the mouse, how to translate from other Basic dialects, using alert boxes, and so on. The graphics chapter is stimulating, with plenty of examples, figures and, of course, graphs, while the final section provides appendices on Basic2 commands, functions, character codes, error codes and messages, and screen and key maps.

Using Locomotive Basic2 is a tidy, concise book: just make sure you brush up on your Basic first.

Lorna Kyle

Pascal programming: a beginner's guide to computers and programming



Author: Chris Hawksley
Publisher: Cambridge University Press
Price: £5.95

I would have thought it rare for any beginner's programming manual to expect that you could actually sit down and read the opening chapters and then feel encouraged to read on. *Pascal programming: a beginner's guide to computers and programming* is the exception. Chris Hawksley walks us through a bright and colourful garden before leading us up to the door of the Pascal house. His introduction on the foundations of programming, algorithms, symbolism, problem-solving, languages and operating systems is really very enjoyable and straightforward. He assumes that his reader has no previous knowledge of computing and was not necessarily born with a BSc or MSc in Mathematics tucked under their belt.

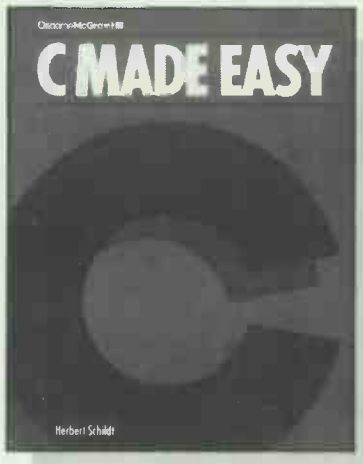
However, it is not until Chapter 5 that the author begins to discuss the Pascal language: *'Pascal embodies many of the features that are widely acclaimed today as being vital to good programming practice.'* Syntax diagrams are introduced which, although initially a strange concept to grasp, are intended to remove ambiguity in program construction and are worth persevering with. The author moves through identifiers, declarations, statements, expressions, standard functions, reading in, writing out, control structures, repetition, loops, procedures, variables and parameters, all with an ease of flow.

Exercises are provided at the end of every chapter with answers given in an appendix, and examples are plentiful throughout the text. Structured programming, arrays, text processing, analysing data, advanced functions and presenting results are all covered in Part 2.

This second edition has been revised in order to conform to the definition of standard Pascal specified in the international standard ISO 7185. All in all, *Pascal programming* is a well-written and instructive book, and an ideal and inexpensive introduction to computers and languages in general.

Lorna Kyle

C Made Easy



Author: Herbert Schildt
Publisher: Osborne McGraw-Hill
Price: £18.95

It's always a good idea to have a new concept explained in terms of a familiar and well-used one: that is, files represented as filing cabinets, records as sheets of paper in the filing cabinet drawers, and so on. This also goes for learning a new programming language, in this case C; compare it with a more familiar one, in this case Basic. That is, of course, if Basic is an old friend; if it isn't, then the comparison to it might be more of an obstacle than encouragement. There again, C probably wouldn't be the first choice for a novice programmer: *'C is a middle-level language because it combines elements of a high-level language with the functionalism of assembler.'*

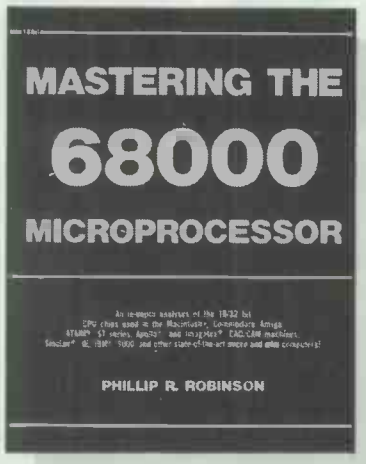
I'm currently learning C for a project that I'm working on and I did genuinely find this book very helpful. Lots of examples are given and the author, Herbert Schildt, has a very informal and practical approach throughout: *'When you write programs, remember that someone has to use them (this includes you).'*

There are 11 chapters in all, beginning with a general overview of C and moving through variables and expressions, program control statements, 'building-block' functions, pointers and arrays, and finishing with common programming errors and appendices on statement and library function summaries. Chapter 10 is entirely devoted to 'Writing a C program'. Ideas, functions and structures mentioned in earlier general chapters are expanded upon later on, and chapters 7 and 8 on 'Pointers' and 'Arrays' respectively are worth studying until you have grasped them, as these are very important concepts in the C language: there are no parallel comparisons to Basic here as the languages are dissimilar at this stage.

Useful exercises — with answers — are given at the end of every chapter — although the less honest individuals among us might have been prevented from cheating had the answers been placed at the back of the book.

Lorna Kyle

Mastering the 68000 microprocessor



Author: Phillip R Robinson
Publisher: TAB Books
Price: £12.95

Mastering the 68000, despite its title, is really a general introduction to microprocessors and assembly-level programming. Phillip Robinson believes that the 8-bit processors, such as the 6502 and Z80 as used in early micros, were created with little thought for the programmer. By comparison, the 68000 was designed as a programmers' processor.

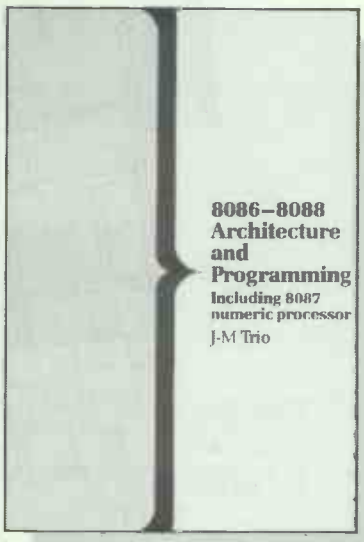
The book assumes two things: that you have a working knowledge of Basic; and that you have access to one of the following 68000-based machines: the Atari ST, the Apple Macintosh, the Commodore Amiga, the Sinclair QL or the IBM 9000. Building on your experience as a Basic programmer, Robinson very gently takes you through the fundamentals of machine-language programming. The emphasis is very much on the software aspects of the 68000, although some time is devoted to 68000 derivative and support chips.

Through special boldface references supported by extensive appendices, the book indicates any material that might depend on the reader's machine, operating system or assembler.

This is much more than an excellent introduction to programming the 68000; it is also a primer on how to write an assembly-language textbook.

Graham Wood

8086-8088 Architecture and Programming



Author: JM Trio
Publisher: Macmillan
Price: £9.50

This book has a twofold aim: first, the author sets out to describe the operation of the 16-bit Intel 8086/8088 microprocessors and their associated devices: second, and to my mind more important, to describe how these microprocessors are programmed in assembly language.

By sticking strictly to the generic instruction set of the processor and making no reference to any specific machine, the book falls into the same trap as many assembly-level tutorials. The extensive example programs throughout are all extremely dull because the author couldn't make any assumptions about the machine being used. Surely with the dominance of the IBM PC and its clones, it would have made more sense to use that machine to give the program examples a bit of meaning.

In the preface Trio states: *'What software designer has not had to concern himself with the programming of a peripheral circuit controlling a dialogue protocol between his machine and its environment, or with a circuit controlling his system interrupts?'*. I used to consider myself quite a knowledgeable software designer, but I'm obviously not in Trio's league.

To be fair, the hardware aspects of the 8086/8088 are covered comprehensively and it might make a good substitute for the official Intel technical reference material. But as an introductory book for an 8086 assembly-level programmer however, I'd be impressed if you got past page ten.

Graham Wood

A new tune on an old fiddle

The conventional word processor has hidden talents, as Mike Harrison discovered when he found he could create flowcharts using the WP's inherent macro and typeover features. Here he draws his conclusions.

Personal computers are becoming the universal tool of business but, until recently, word processor and spreadsheet programs have accounted for the largest part of the national investment in software. Now these general programs face increasing competition from software with other talents. Communications, simulation and graphics packages jostle with more specialised software that can tackle anything from projections to planning or from graphics to games. The trouble is that you can easily spend a fortune on software and a lifetime in training if you rush out to buy a program every time you hit a new problem. And you can find yourself picking a specialist package before you have had time to evaluate either it or your needs.

The great virtue of general programs is that they provide very cost-effective tools — if you take the trouble to learn what they can do and are able to apply a bit of ingenuity to their use. The versatility of spreadsheets is well-known, but word processors have hidden talents, too.

Creating flowcharts

My work as a producer of interactive video demands lots of flowcharts. Interactive video gives a computer a new peripheral — a video disc player. The disc player provides picture and sound sequences in response to inputs from the user and decisions by the computer. When you're writing a program for this combination, flowcharts form a vital part of the script. They deal with the organisation of ideas and with the control processes. All the elements of branching that are food and drink to a mainstream software programmer are there, as are the familiar flowchart symbols.

Interactive video handles complex

What are macros?

Macros show personal computing at its best; handing you the ability to tuck away bits of success for re-use as many times as they're needed. And you don't have to be a dedicated hacker or enjoy typing long pieces of code to be a macro user — they're accessible to anyone who will take the trouble to open the manual for their word processor.

The macro function makes use of an area of the computer memory which is allocated to hold pre-determined keystrokes. In most respectable packages, the contents of this volatile memory can also be held in permanent storage — on hard or floppy disk — so that the toil of putting the strings of characters into the macro is a once-only task.

You get a macro into the machine by 'recording' a sequence of keystrokes. You get it back by putting the cursor where you want the sequence to begin and entering a shorthand command — something like "{ALT-Y}", perhaps, for:

"Yours sincerely,{return}Algernon Higginbotham,{return}Managing Director".

In this case, the command {ALT-Y} sends the machine to look in the appropriate memory section where it finds the pre-recorded sign-off message and dumps it at the cursor position. Each package has its own command structure for recording and recalling macros, but the principle is always the same.

One very important feature which is available in the best programs is the ability to call one macro from another. The great advantage is that you can then build from relatively simple building blocks. You might, for example, use a macro to add a standard sign-off paragraph to contractual letters — perhaps:

'While we have made every effort to ensure that the information provided is correct, we hope you will understand that we reserve the right to make amendments at any time up to the signature of contract. {return}{ALT-Y}'

The effect of calling this macro would be to lay down the contract paragraph, followed by the usual 'Yours sincerely, etc' provided by {ALT-Y}

Macros don't have to be purely textual. Most packages allow them to contain all kinds of commands — usually anything that can be entered from the keyboard. This is what makes drawing with macros so convenient. To draw a symbol you have to use the cursor position commands to place characters in the appropriate pattern. The macro saves repeating this horrid job, which involves much awkward fiddling to get the things to look right. The best method is to sketch on the screen first, before making the macro, by overtyping symbols on a page full of spaces until you get the appearance you want. You can use this sketch as a template over which you re-type while recording the macro.

This is a particular instance where calling macros from within each other is helpful. Macros for vertical lines and horizontal lines can be combined to make boxes, boxes combined to make charts, and so on.

ideas for demanding clients. It draws together a team with a wide range of professional talents. With so much intellectual fire-power brought to bear on the programs, flowcharts go through many stages of revision. If we're not to spend all of our time re-working them and none making the video itself, I need to mechanise the process of drawing. Admittedly there are dedicated programs which can do this but they take time to learn, so I set out to see if the job could be done effectively on a word processor. I was, in any case, unwilling to buy drawing software until we had some practical experience on which to base our choice. As it turned out, our 'drawing processor' took only a couple of hours to develop and is easy to use, providing tidy drawings which are easy to modify.

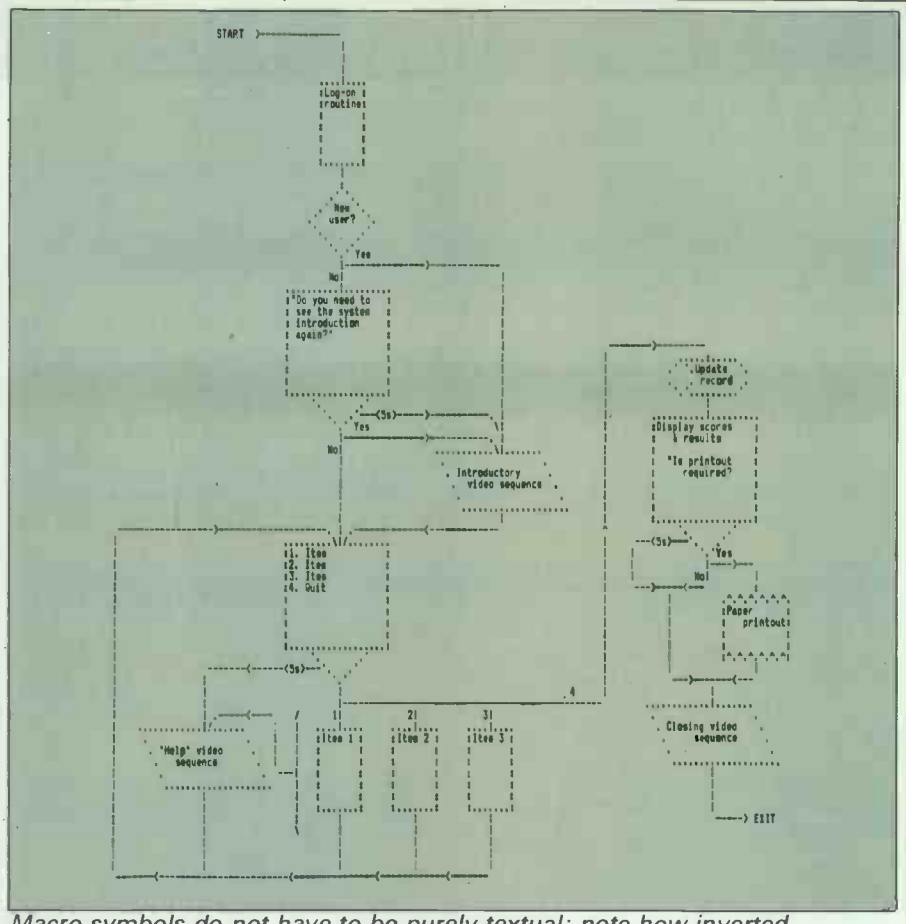
My office uses two word processor programs: Word Perfect and the multi-purpose package, Framework II. Each provides two features which, together, represent a minimum requirement for flowchart work — 'macros' and a 'typeover' feature. An advantage of these word processors is that they print more or less what they show onscreen. There is no reason why any word processor should not perform successfully with flowcharts if it has these fundamental attributes.

To avoid the need for graphics programming, the text character set which is routinely available on our printers (ASCII characters 32 to 126) forms the basis of the symbols. Along with an alphabet, this set includes punctuation marks and some particularly useful non-alphabetical characters. Patterns made from the characters, : . ' ' < > ^ \ /, form the flowchart symbols but you could construct them entirely from letters of the alphabet if you had to.

Drawing

It turned out that we already knew the basic word processor trick that would make drawings easy. Like most offices we commonly fill forms — schedules, contracts, and so on — by typing over a prepared layout. The answer to the drawing problem is to work entirely in the optional typeover mode — that is, with the word processor set not to insert characters between others in the text, but to overwrite them at the position of the cursor.

The flowchart starts as a clean sheet filled entirely with lines of spaces, with each line terminated by a hard return. The size and number of lines on this sheet is set to occupy the entire page provided by the word processor format. The common default layout of 66 lines of 80 spaces is a good starting point for an A4 page. But the format is totally a matter of what the printer and the word processor can be persuaded to do and it is better to set it to 88 lines of 132 spaces if appropriate control codes are available.

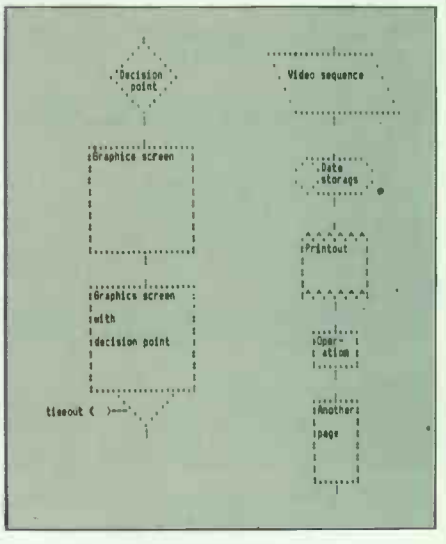


Macro symbols do not have to be purely textual: note how inverted comma symbols are used to fill diagonal lines on this flowchart

Of course, if you have access to a wide printer, the number of characters per line can be greater and the format of the drawing 'landscape' instead of 'portrait'. Constructing the clean flowchart sheet is time-consuming, so save the original and copy it each time it is needed for use.

To draw a flowchart, you manoeuvre the cursor around the screen over the field of invisible spaces and visible characters, using the normal controls. In typeover mode, any character or macro you type from the keyboard is laid down on the page in the chosen position without disrupting the existing layout.

Along with safety pins and Sellotape, macros are one of the seven great wonders of the world. They allow a single key-press to release a torrent of pre-recorded characters and commands. Their precise operation varies from package to package, but no word processor which lacks macros should be taken seriously. Each flowchart symbol is made up of a long string of characters and cursor movement commands which form the appropriate pattern. You need to have a consistent policy about the starting and finishing points for each pattern; that way you will avoid endless frustration trying to get lines and



Flowchart symbol macro

symbols to link up neatly. For that reason it's quite a good idea to preplan your macros on squared paper.

Developing macros

The set of macros you develop to provide your flowchart symbols depends entirely on your need and is limited only by ingenuity. For example, the trick of using the two inverted comma symbols (' and ') to fill diagonal lines opens up many possibilities (examples are shown in the diagrams above). Don't forget to include a simple macro for drawing vertical lines — it is very time-

Box macro listing

```
{DNARROW}    {LEFTARROW}    {LEFTARROW}    {LEFTARROW}    {LEFTARROW}
{LEFTARROW}  {LEFTARROW}    {LEFTARROW}    {LEFTARROW}    {LEFTARROW}
{LEFTARROW}  .....!.....    {DNARROW}    {LEFTARROW}    :
{DNARROW}  {LEFTARROW}    :    {DNARROW}  {LEFTARROW}  :  {DNARROW}
{LEFTARROW} :  {DNARROW}  {LEFTARROW} :  {DNARROW}  {LEFTARROW} :
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{LEFTARROW}
```

Graphics box with decision point macro

```
{CTRL-1}{CTRL-O}{LEFTARROW} {CTRL-1}{CTRL-O}. ! {CTRL-1}{CTRL-O}.
{BACKSPACE}  {DNARROW}  {LEFTARROW}  :  {DNARROW}  {LEFTARROW}  :
{DNARROW}  {LEFTARROW}  :  {DNARROW}  {LEFTARROW}  :  {DNARROW}
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{DNARROW}  {LEFTARROW}  :  {DNARROW}  {LEFTARROW}  :
{CTRL-2}{CTRL-O}{LEFTARROW}  :  {CTRL-1}{CTRL-8}.  {DNARROW}
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{RIGHTARROW} {RIGHTARROW} {RIGHTARROW}  {RIGHTARROW} {RIGHTARROW}
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>---`.  {RIGHTARROW}  {RIGHTARROW}  {RIGHTARROW}  .'  {DNARROW}
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{UPARROW}  {LEFTARROW}  {LEFTARROW}  {LEFTARROW}  {LEFTARROW}
{LEFTARROW}  {LEFTARROW}  {LEFTARROW}  {LEFTARROW}  {LEFTARROW}
{LEFTARROW}
```

consuming to have to use the cursor controls to place identical characters vertically beneath each other. Something as simple as "| — down — left" is fine.

Repeated use of this macro rules a line down the screen. Another useful one erases chunks of the drawing by overtyping them with a line of spaces — perhaps "5 spaces — down — 5 left". If you wish you can extend this eraser macro to take in the entire space of the smallest symbol; or even, if you feel it worth the work, make an 'anti-symbol' to go with each symbol which can knock it cleanly off the screen in one go. Don't be tempted to over-do the macro library, though. For speedy and confident work you need to remember them all.

Drawing quality is greatly enhanced by using the 'condensed' mode of the printer, which allows something like 132 characters instead of 80 across a standard A4 sheet. In most cases you can select this mode directly from the word processor options; or sometimes by sending control codes to the printer. In many cases a further control code will allow you to reduce the vertical spacing of the printer lines.

Caution

No-one pretends that our flowchart processor is ideal for its purpose and a note of caution is essential. Because a word processor is designed to deal with text, it can sometimes work against the interests of drawing and there are a few actions that can produce instant chaos. To avoid them it is important to understand the fundamental distinction between the two kinds of document. Text layout is not much concerned with vertical relationships on the page. The machine feels free to shuffle characters around without concern for what comes immediately underneath what — unless you are dealing with margin or column edges. There is little underlying structure to a page of text other than the order of the words.

A drawing, on the other hand, takes place on a pre-existing 'canvas' — the screenful of spaces with which you start. Preserving that structure is a first priority, so the worst thing you can do is to make a careless insertion of a return character. Returns are wholly redundant in flowchart drawing because they instantly destroy the vertical relationship of characters. If your word processor allows the re-designation of keys, it is wise to eliminate this possibility by disabling the Return key or replacing it with a 'cursor down — start of line' command.

Another common mistake is to place a large macro so near the edge of the page that the word processor thinks it must 'wrap words' at the end of the line. You can dodge this particular problem if your word processor provides 'hard spaces' (these are the kind that don't break lines during word-wrap).

In practice none of this needs to be a problem because once the flowchart macros are set up, you find that you use them in a way quite different from normal word processing — a whole new set of habits develops to take care of your work. Above all, very frequent saving to disk allows you to undo any really catastrophic consequences of error.

Conclusion

In spite of its obvious limitations, so successful has been this application of our word processors that it has passed into regular use without any real trouble. It has provided legible, clean, functional drawings which can be copied for all our team members to use and understand.

Most important, it has bought us the time to make a considered choice of a tailored drawing package which will take in all our special needs. In that way it has fulfilled perfectly one essential buyer's dictum — one which is so often defeated by the rapid comings and goings of the software market: *don't buy until you are absolutely certain what you need.*

Mike Harrison is a senior film and TV producer who specialises in what he describes as 'the tough ideas end of the market'. He spent the Sixties in education, the Seventies at the BBC and is now working with computer-controlled video programmes.

END

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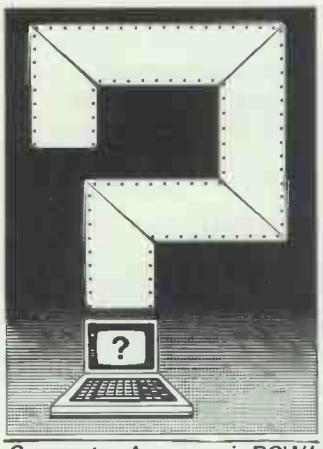


Computer Answers is PCW's help column. We offer advice about all kinds of specific hardware and software problems through the pages of the magazine. We also welcome further information in response to published queries.

File size granularity

I have had access to three machines with a hard disk, and in each case I have found a discrepancy between the total number of bytes for all the files on the disk and the total space allocated to these files. Research indicates that the difference is on a 'per file' basis, independent of the size of any particular file. It amounts to an 'overhead' of space lost per file.

On an IBM PC, with a 20Mbyte hard disk, this overhead was 6k. It was 1.5k on a 10Mbyte Sirius, and 8.2k on a 10Mbyte Olivetti. If I had 500 files on one disk (which is by no means unusual or unreasonable) this took up 15 per cent of the IBM PC's disk — a completely unreasonable loss!

I have tried dumping the files to a tape-streamer, reformatting the disk, and restoring the files individually — not an 'image' dump, and the outcome was exactly the same. I have never seen anything published about this loss. What is going on?
A Minter, Sandwich, Kent

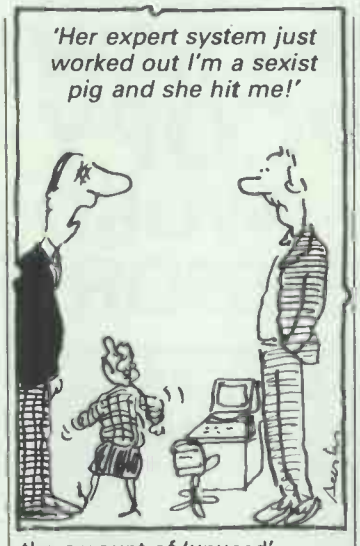
The space on most disks is not allocated character by character, but in lumps known as 'clusters' or 'granules'. The size of each cluster is encoded in the operating system — on PCs it is in the part of the operating system which deals with the nitty-gritty details of communication with a specific manufacturer's hardware. As you have found, the size of cluster often varies between one machine and another, and even between different types of drive on the same machine.

A whole number of clusters is allocated to each file. If the cluster size is 1k, a one-byte file and a 1000-byte file will occupy one cluster. A 1025-byte file will just overflow into two clusters. The smaller the cluster size used by a system, the less the overhead 'per file'. But the more clusters the operating system must keep track of, the slower it will work, under typical circumstances. This only makes sense if you understand the way files are stored on a disk.

Imagine the consequences of organising a disk as a stream of characters, with each file stored in the next available place, immediately after the previous one. This corresponds to a cluster size of one byte. Now imagine that several programs are all writing to different files on that disk. Later, the computer must be able to read the information from each file separately, without getting the data muddled up.

You could try to move entire files whenever a 'collision' might occur. This will involve very large amounts of work, during which the contents of the disk might be garbled — temporarily, unless a power-failure occurs in the meantime.

If you move files just as far as they need to go to allow data to be inserted 'in front' of them, you might end up moving almost the entire content of the disk every time a character was added to an 'old' file. But if you move files further than need be — to make a 1k or 6k 'hole', perhaps — you might have to move them back later, and you need somewhere to keep track of the amount of 'unused' space at the end of every file.



The costs and problems associated with shunting files back and forth around a disk are so terrible that no one takes this approach seriously, despite its initial appeal. It makes more sense to split the space on a disk into indivisible clusters, and allocate these as need be.

Your idea of copying all the files on a disk to tape, and then re-loading them individually, may have improved the speed of your system by ensuring that files were in contiguous clusters, rather than interleaved all over the surface of the disk. As you found, it does nothing to release the unused part of the last cluster in every file.

Clusters are clearly a good idea, or at least a practical one. But why do they tend to be so large, particularly on hard disks, and hence wasteful when small files are being used?

The average size of files on a computer system obviously depends upon the user and the application, but it is often the case that a system will contain a few very large files, but many small ones. The cluster size used by the Unix operating system was originally fixed at 512 bytes, for just this reason.

Whatever the size of each granule, the computer must reserve space outside the area used to hold file contents, so that it can tell which cluster belongs to what file, and what position it takes in the file. This information is usually held in the 'directory', along with file names, dates, and so on. In theory this can be a file like any other, but in MS-DOS it occupies a fixed area and position on the disk.

Ideally the directory would be in the middle of the disk to minimise the time taken to find it from any given point, but this gets tricky when you allow varying numbers of tracks. Microsoft puts the directory on the outside of the disk, where it can be argued data is most secure as it is spread over the longest possible arc by a constant-speed drive.

So a 1k section of the outer track on a PC floppy disk is reserved for the 'FAT', or File Allocation Table. This table keeps track of which cluster belongs to which file. It is not acceptable to have to read this table from disk every time the computer steps from one cluster to the next. Lots of time would be wasted while the head was wound back and forth between the directory and the data clusters.

Microsoft realised this. When you change the disk in a drive, the computer reads the disk's FAT into memory. This saves having to keep re-reading the allocation information from disk while a file is processed. The FAT is re-written to disk when files are closed, which is one reason you should always close output files before removing a disk from a drive.

The bigger the FAT is — hence the greater the number of clusters on a disk — the more time must be spent reading and re-writing it, after changes, and the more memory is soaked up by the FAT while a disk is in use.

As you have found, manufacturers differ as to the 'best' compromise between low granularity and efficient FAT usage. This unwelcome dilemma stems from the simplistic design and implementation of MS-DOS. About the only good thing that can be said about it is that it's more efficient than CP/M. The weaknesses of MS-DOS become especially obvious when it is asked to look after hard disks.

Monitor shakes

Fourteen months ago I purchased a new Commodore 1701 monitor. My problem is that the left and right border of the screen have a slight 'wave' which makes program lines move horizontally to the left and right as the wave moves up and down the screen. At times the wave is very noticeable but it is always there, even when turning on the power to start programming.
DV Brown, Bottesford, South Humberside

A friend of mine recently had exactly the same problem. What you are almost certainly seeing is a 'beat' between the timing pulses used to synchronise the display and the alternation of the mains electricity supply.

A TV or monitor is not too fussy about the exact frequency at which it receives frames from a computer, as long as it is near enough 50 frames a second to allow the set to 'lock on' to the timing pulse at the start of every frame. If not you get a 'rolling' picture, and have to adjust the 'vertical hold' control to bring things back into step.

The mains frequency is usually about the same as a computer's frame rate, unless you're using equipment designed for the US market. If the mains signal can 'leak across' into the input circuitry of the monitor it will interfere with the stability of the picture, causing the symptoms you describe.

The most common cause of this problem is electromagnetic interference — either a signal leaks from mains cables into nearby video cables, or, more commonly, the magnetic field from a power-supply transformer interacts with a nearby video circuit. I cured the problem with my friend's monitor by moving the computer power supply to a shelf underneath the monitor; it had previously been trapped between the monitor and the wall. Many Commodore devices use similar un-shielded external power units, so the problem may go away if you move the system around or spread out its components.

If this doesn't help, or you're pushed for space, you could try replacing the lead between the computer and the monitor — some cheap leads are so poorly screened that they work quite well as aerials!

If the wave persists, the fault is more serious. The mains alternation is meant to be filtered out from the video circuitry in the computer and the monitor, but a fault in the power supply at either end of the link could cause it to leak through. Similar instability might be caused by a more fundamental fault, although I think it unlikely.

If the problem is electrical, rather than mechanical, I would advise you to find out as much as you can and then consult a professional repair firm. You can establish whether it is the computer or the monitor which is at fault by borrowing a replacement unit and seeing if the problem persists with each half of your own system. Perform all your tests with the minimum system needed to demonstrate the fault — don't confuse yourself by involving printers and disk drives needlessly.

Batch of problems

In the July 1986 issue of *PCW*, in an article entitled 'Batch magic', John DeHaven gave a method of using environment parameters as variables in DOS commands. This procedure worked with DOS 2.1 and was very useful, but it does not seem to work with DOS 3.1. Please could you tell me what the equivalent procedure is for DOS 3.1?
B Farrar, City Treasurer, Birmingham

The equivalent procedure is an upgrade to DOS 3.2! I've been wheedling Microsoft for a while about this one, and I've contacted John DeHaven in Thailand who traded me a part-answer for another question! John acknowledged the problem, and protested that 'fetching a variable from the environment is firmly part of the MS-DOS specification.' Microsoft insists that 'it is not a documented feature' — in other words, it's something the company likes to use itself but which it doesn't want to have to support.

The changes for MS-DOS 3 were quite major, and variable-passing fell by the wayside. Microsoft observed that it 'stopped working' in MS-DOS 3.0 and 3.1, but returned for MS-DOS 3.2. Unfortunately you can't just copy the relevant file, COMMAND.COM, from 3.2 to 3.1, because MS-DOS checks the version numbers and complains unless they match. Sounds like a job for a hacker.

Doused phoenix

Like many home computer owners, I started with a ZX81. This is now lying around gathering dust. Would it be possible to use the 16k RAM pack as a printer buffer?
Hugh Weller-Lewis, Ware, Hertfordshire

Yes, it would probably be possible. But the memory in that RAM pack now sells for about a pound, in one or two chips. You'd need two RS232 channels or about 20 TTL port lines for Centronics printers, plus lots of expensive connectors, buffers and ribbon cable. You'd have to write a machine-code bootstrap ROM and buffering software.

Consult printer manuals to find the purpose and timings of interface pulses. Adrian Dicken's *Spectrum Hardware* manual, published by Melbourne House, contains lots of information that is also relevant to its simple predecessor, the ZX-81. It also documents the hardware and software of a parallel printer port.

It can be done, but by the time you've finished you won't be able to see the 16k RAM pack for other bits and pieces.

The kits on page 267 of the *Maplin Electronics* catalogue (in most newsagents) may help you to get started.

D-I-Y maths

For the past two years I have used a version of LPA Micro Prolog on my Einstein computer, and have experienced the greatest difficulty in implementing mathematical functions. The software cannot perform trigonometry, square numbers or find logarithms. It is also impossible to raise numbers to powers less than one. Could you come up with some simple algorithms to perform these functions, ideally only using addition, subtraction, multiplication and division?
Newton Emerson, Tandragee, County Armagh

You can work out the value of higher functions by repeatedly applying the normal four arithmetic operators. The normal way to apply these is in a 'convergent series' formula — a calculation made up of a sequence of similar parts. Each part works out smaller than the one before; the more you use, the more accuracy you get.

These rules are based on a mathematical principle called Taylor's approximation. They stick to the familiar four mathematical operations, but I want to introduce some 'shorthand' so that patterns can be seen quickly and clearly.

X ** Y is a quick way of saying 'X written down Y times and multiplied'. X ** 3 = X * X * X. An exclamation mark after a number means 'multiply together all the whole numbers between one and this number.' 3! = 1 * 2 * 3.

This calculation will tell you COS(X) to an accuracy of two or three digits:

```
COS(X) is roughly 1 —
X**2/2! + X**4/4!
```

To put it another way:

```
COS(X) is roughly
  1 — (X*X)/(1*2) +
  (X*X*X*X)/(1*2*3*4)
```

The pattern continues, with parts alternatively negated and added, with numbers two up from the one before. This gives you about four digits of precision:

```
(COS(X) is nearly
  1 — X**2/2! +
  X**4/4! —
  X**6/6! +
  X**8/8!
```

Incidentally, this only works for values of X in radiants, between 0 and Pi. If you plot the graph of COS you will see that it repeats itself, raising and falling across the zero line. Two steps will give you domain over all positive values of X. Negative values can be 'trapped' and converted if need be. Divide X by Pi and use the remainder in the above calculation. Then negate the result if the whole number of Pis was odd.

SIN(Y) can be worked out easily — it's just COS(Y+Pi/2). TAN(Z) is SIN(Z)/COS(Z). You can work out squares using logarithms:

```
EXP(X( is 1 + X +
  X**2/2! +
  X**3/3! +
  X**4/4! . . .
```

Consult the *School Mathematics Project Advanced Tables*, published by Cambridge University Press, for the formulae of other functions and a good supply of numbers! END

Branching out

In the final part of his series on Prolog programming, Mike Liardet implements some of the language's more advanced built-in predicates in a natural-language database.

In the previous articles in this series (*PCW*; February-April) I have covered all the major constructs of Prolog: clauses, structures, constants and lists, and so on. I have also covered a number of the simple built-in predicates (Prolog's name for 'library' facilities), such as those used for input and output, and arithmetic.

In this final article I'll introduce some further built-in predicates which can be extremely useful for advanced applications, and then use them in a system for processing natural language 'database' queries. In addition, I'll show you how Prolog programs can be speeded up by helping them to know when they can stop doing one job and move on to another.

Remember that all the example programs accompanying this article are written in Turbo Prolog and may need some modification before they will work with other versions of the language. Most notably, the declarations at the top of each example (everything up to and including the word 'clauses') should be omitted when using other Prologs.

Any readers who are unfamiliar with the Prolog terminology used here are advised to refer to the previous articles, and especially to the first one, 'Prolog power' (*PCW*, February).

Advanced built-in predicates

Prolog's advanced built-in predicates have a number of purposes. For example, they are used in 'meta-programming' (that is: writing programs which manipulate programs); controlling the execution of clauses; and modifying the syntax of the Prolog language itself.

Some Prologs (Turbo included) also have windowing, graphics, file-handling and sound predicates, and so on. Although these facilities can be extremely useful, I won't be covering them here because they are no more difficult to comprehend in Prolog than they would be in any other language.

It should be noted that Turbo Prolog has a more limited range of advanced predicates than other Prologs — in part a price that is paid for its speed of execution. Turbo Prolog offers no opportunities for modifying the syntax of the language, and has weaker meta-programming facilities. Because of these omissions I'll concentrate primarily on Turbo's 'control' facilities, which are the same as in other Prologs. These facilities are called 'cut', 'fail' and 'not'. I'll conclude this section with a brief overview of other Prologs' advanced built-in predicates which are not present in Turbo.

'. . . there is considerable scope for improving and extending the program . . .'

When the 'cut' predicate is used as a goal in a clause, it affects the flow of control as the clause is executed but is completely invisible in every other respect. The 'cut' predicate is represented by the symbol '!' in most Prologs. It takes no arguments so there is no need for any parentheses to follow it. It is usually used to make programs run more efficiently by allowing for the removal of redundant testing, and it also enables Prolog to handle logical negation.

To demonstrate the value of the 'cut' predicate, first type in the program in Fig 1. This program calculates the number of prime numbers up to and including 500. The program does not use the 'cut' predicate, and I'll

```
predicates
    num_primes_up_to(integer,integer)
    is_prime(integer)
    has_divisor(integer,integer,integer)

goal
    beep,
    num_primes_up_to(500,N),
    beep,
    write(N),nl.

clauses

num_primes_up_to(N,0):-
    N <= 1.
num_primes_up_to(N,Ans):-
    N > 1,
    is_prime(N),
    N1 = N - 1,
    num_primes_up_to(N1,Ans1),
    Ans = Ans1 + 1.
num_primes_up_to(N,Ans):-
    N > 1,
    not(is_prime(N)),
    N1 = N - 1,
    num_primes_up_to(N1,Ans).

is_prime(N):-
    not(has_divisor(N,2,_)).

/* has_divisor(N,Low,X): N has a divisor X >= Low */
has_divisor(N,Low,Low):-
    Low <= sqrt(N),
    0 = N mod Low.
has_divisor(N,Low,X):-
    Low <= sqrt(N),
    0 >< N mod Low,
    Low1 = Low + 1,
    has_divisor(N,Low1,X).
```

Fig 1 Primes program without any 'cut' predicates

show how, with just a few 'cuts' and some small changes, we can make it run considerably more efficiently.

The 'goals' statement in the program causes a beep to be sounded immediately before and after the main goal in the program is solved. This means that, when you run it, you can time on a stop-watch how long this goal takes to solve. On my fairly pedestrian PC, the main goal took about 31 seconds to be solved. On other PCs the figure could be quite different: but make a note of the time taken, whatever it is. (The answer to the problem should be 95, meaning that there are 95 prime numbers up to and including 500.)

Before showing how the performance of this program can be improved upon, I'll give a brief overview of how it works. The 'num_primes_up_to' predicate considers all the numbers from the number given in the first argument right down to 1. It tests whether or not each of these numbers is prime, and adds one to the total if it is. As, by convention, 1 and 0 are not considered to be prime, the first clause states that there are no primes 'up to' and including 1. The 'is_prime' predicate is defined by a single clause which merely reverses the result of 'has_divisor', meaning that a number is prime if it does not have a divisor. When it is invoked, the 'has_divisor' predicate has to be given a lowest possible number to start testing for divisors, and this is 2. It carries on testing with bigger and bigger numbers until it reaches the square root of the number under test; and if no divisor has been found before then, there will be no divisors at all, 'has_divisor' fails and the number is prime.

Notice that there are a number of redundant tests in the program. For example, the comparison of N and 1 is performed in each 'num_primes_up_to' clause, and the 'is_prime' test is performed twice (once within a 'not'). There are also redundancies in the 'has_divisor' clauses.

Having timed the program in Fig 1, refer to Fig 2 to modify the clauses, as shown. The goal and predicates information remains unchanged, and so has been omitted from Fig 2. One or two goals have been commented out and a new 'has_divisor' clause has been added, along with a few 'cuts'. Save the modified program under a different name so that both versions will be preserved, and then run the new program. On my PC, the modified program took 13 seconds, performing at about 2.5 times the speed of the first program.

The difference in speed is totally due to the use of 'cut', which allows all the redundant tests to be removed. (It would also be possible to improve performance with a more

Illustration by Simon Edwards

```
clauses

num_primes_up_to(N,0):-
    N <= 1,
    !.
num_primes_up_to(N,Ans):-
/*  N > 1, */
    is_prime(N),
    !,
    N1 = N - 1,
    num_primes_up_to(N1,Ans1),
    Ans = Ans1 + 1.
num_primes_up_to(N,Ans):-
/*  N > 1, */
/*  not(is_prime(N)), */
    N1 = N - 1,
    num_primes_up_to(N1,Ans).

is_prime(N):-
    not(has_divisor(N,2,_)).

/* has_divisor(N,Low,X): N has a divisor X >= Low */
has_divisor(N,Low,_):-
    Low > sqrt(N),
    !,
    fail.
has_divisor(N,Low,Low):-
/*  Low <= sqrt(N), */
    0 = N mod Low,
    !.
has_divisor(N,Low,X):-
/*  Low <= sqrt(N), */
/*  0 >< N mod Low, */
    Low1 = Low + 1,
    has_divisor(N,Low1,X).
```

Fig 2 Modifications to the Primes program, introducing the 'cut' predicate

efficient algorithm, but we are concerned with 'cut' here, not with an optimum problem solution.)

How 'cut' works

When a 'cut' is executed as a goal in a clause, it always succeeds, but it suppresses all backtracking with any of the earlier goals in that clause, and also with alternative clauses for that predicate. For example, consider the solution of three different goals:

num_primes_up_to(1,X) (1)
num_primes_up_to(2,X) (2)
num_primes_up_to(4,X) (3)

Try these goals out as command-line goals if you wish. Remember that they are each to be tried in isolation: there is, of course, no X which will solve the three together.

Goal (1) is solved by the first 'num_primes_up_to' clause, with a cut executed as the last goal in the clause. This means that, in the event of backtracking being needed, the system will look at no alternative ways of showing the previous goal, 'N <= 1' (there are none anyway), and will ignore the two following clauses. Thus, quite correctly, it will only ever use the first clause for solving goal (1).

Goal (2) is not solved by the first clause because the 'N <= 1' test fails. The 'cut' in the first clause is never reached, so the second clause is tried. This clause can assume that 'N > 1'; there is no need to test this because from the failure of the first clause, we know that N is *not* <= 1 (that is: N is > 1). How can we be sure there was a failure in the first clause? If it had succeeded, the cut would have been executed and backtracking to this second clause would have been suppressed. Therefore, it is impossible to reach the second clause if the first succeeds. In the second clause, the 'cut' follows the 'is_prime' goal. This suppresses any backtracking (alternative ways to show the number is prime) and the use of the third clause.

Goal (3) is solved by the third 'num_primes_up_to' clause. The first clause fails on the 'N <= 1' test and the second clause fails on the 'is_prime(N)' goal. Because of the two earlier 'cuts', if the third clause is used, then it must be the case that N is not <= 1 and N is not prime, so the 'N > 1' and 'not(is_prime(N))' tests are unnecessary in the third clause.

The 'has_divisor' clauses use the 'cut' in a very similar way to remove redundant tests, but in Fig 2, an extra clause precedes the two in Fig 1. This causes 'has_divisor' to fail if the second argument (Low) is greater than the square root of the first. After the test, the 'cut' suppresses back-

```
domains
    found = found_that(symbol,symbol,symbol)
    foundlist = found*
    symlist = symbol*

predicates
    person(symbol,symbol,symbol,symbol)
    offspring(symbol,symbol,symlist)
    age(symbol,symbol)
    sex(symbol,symbol)
    name(symbol,symbol)
    worth(symbol,symbol)
    ignore(symlist)
    synonyms(symbol,symlist)
    parent(symbol,symbol)
    grandparent(symbol,symbol)
    greatgrandparent(symbol,symbol)
    mother(symbol,symbol)
    father(symbol,symbol)
    son(symbol,symbol)
    daughter(symbol,symbol)
    brother(symbol,symbol)
    sister(symbol,symbol)
    grandfather(symbol,symbol)
    grandmother(symbol,symbol)
    grandson(symbol,symbol)
    granddaughter(symbol,symbol)
    cousin(symbol,symbol)
    uncle(symbol,symbol)
    aunt(symbol,symbol)
    person_enquire(symbol,symbol,symbol)
    attr_enquire(symbol,symbol,symbol)
    identify_somebody(symlist,symlist,symbol)
    identify_somebody1(symlist,symlist,symbol,symbol)
    identify_everybody(symlist,symlist,symlist)
    filter(symlist,symlist)
    member(symbol,symlist)
    empty(symlist)
    query(symlist)
    get_values(symlist,foundlist)
    no_repeats(symlist,symlist)
    lookup(symbol,symlist,foundlist)

clauses
```

Fig 3 The preamble for the natural language/database system. This is not required in other versions of Prolog

```
/* handle a query X */
query(X):-
    write(X),nl,
    filter(X,Fx),
    get_values(Fx,Answers),
    write(Answers),nl.

/* process the filtered text to get the result(s) */
get_values(Text,Answers):-
    identify_everybody(Text,[],Persons),
    no_repeats(Persons,Ps),
    lookup(name,Ps,Answers).
get_values([Attrib|Rest],Answers):-
    identify_everybody(Rest,[],Persons),
    no_repeats(Persons,Ps),
    lookup(Attrib,Ps,Answers).
get_values(Text,Answers):-
    identify_everybody(Text,[apos,Attrib],Persons),
    no_repeats(Persons,Ps),
    lookup(Attrib,Ps,Answers).
get_values(Text,Answers):-
    identify_everybody(Text,[Attrib],Persons),
    no_repeats(Persons,Ps),
    lookup(Attrib,Ps,Answers).

/* identify a person from the supplied text.
eg the aunt of the daughter of John' son 's cousin... */
identify_somebody([Person|Rest],Text_after,Person_identified):-
    person(Person,_,_,_),
    identify_somebody1(Rest,Text_after,Person,Person_identified).
identify_somebody([Reln|Rest],Text_after,Person_identified):-
    identify_somebody(Rest,Text_after,Other_person),
    person_enquire(Reln,Other_person,Person_identified).
identify_somebody([Reln|Rest],Rest,Person_identified):-
    person_enquire(Reln,_,Person_identified).

/* handle the apostrophes when identifying somebody
eg John son's cousin... */
identify_somebody1([apos, Reln|Rest],Text_after,Person_before,
      Person_identified):-
    person_enquire(Reln,Person_before,Other_person),
    identify_somebody1(Rest,Text_after,Other_Person,Person_identified).
identify_somebody1(Text,Text,Person,Person).
```

Fig 4 The language processing predicates (continued)

tracking and the 'fail' guarantees failure. The 'fail' predicate is the simplest Prolog predicate there is, since it is defined by no clauses whatsoever! Thus, in most Prologs, any unused predicate name would do instead of 'fail', but Turbo Prolog complains about undefined predicates if the word 'fail' is not used.

Turbo Prolog has a few other advanced built-in predicates. For example: 'findall', which is used in the natural-language example (see below); and some 'database' predicates which enable programs, while they are running, to dynamically create and remove 'fact' clauses.

Other Prologs have all the Turbo Prolog facilities I have mentioned above, and a great many more besides. Their 'database' predicates can create and delete general clauses, not just fact clauses. They can also convert between lists and structures. Another useful facility they provide is

'When you have done all this, you will just about have developed a genuine, practical system!'

for structures to be 'declared' as operators, which allows for more readable programs — for example, 'john is__the__father__of tom' instead of 'father__of(tom,john)'. All these facilities can be very useful in advanced applications, and it is unfortunate that Turbo Prolog lacks them. Undoubtedly, one reason for their omission is that they are extremely difficult to implement in an efficient compiled system like Turbo Prolog, and this is one of the penalties to be paid for its performance.

A natural-language database system

Prolog is an ideal programming language for implementing natural-language understanding systems and for handling intelligent databases. In this section I'll show the language at work on both these problems together.

The system described here operates on a 'database', actually consisting of a number of fact clauses about people, their ages, financial positions, and their marriages and offspring. From these basic facts in the database it can derive their family relationships — that is, who are the grandparents and uncles, and so on. It can then process English enquiries about the family members, and answer questions like:

How old are John's grandparents?
Who is the aunt of Avril?

```
/* get everybody (at least one person) query might be referring to */
identify_everybody(Text_before,Text_after,Persons):-
    findall(Person,identify_somebody(Text_before,Text_after,Person)
      ,Persons),
    not(empty(Persons)).

/* dictionary: words to ignore and synonyms */

ignore([which,please,tell,me,who,what,how,much,is,are,the,a,an,of,
        all,does,have,has,somebody]).
synonyms(age,[age,old,ages]).
synonyms(sex,[sex,sexes]).
synonyms(name,[name,names,called]).
synonyms(father,[father,fathers,dad,dads]).
synonyms(mother,[mother,mothers,mum,mums]).
synonyms(worth,[wealth,money,cash,lucre,loot]).
synonyms(grandparent,[grandparent,grandparents]).

/* filter out words to be ignored and substitute synonyms */
filter([Word|Words],Fwords):-
    ignore(Iwords),
    member(Word,Iwords),
    !,
    filter(Words,Fwords).
filter([Word|Words],[Sword|Fwords]):-
    synonyms(Sword,Syns),
    member(Word,Syns),
    !,
    filter(Words,Fwords).
filter([Word|Words],[Word|Fwords]):-
    filter(Words,Fwords).
filter([],[]).
```

```
/* specifies the name, age, sex, and assets of each person */
person(mike,"68",male,"100000").
person(susan,"66",female,"500000").
person(fred,"55",male,"10000").
person(elaine,"50",female,"20000").
person(john,"27",male,"200").
person(mary,"30",female,"30000").
person(paul,"2",male,"1000").
person(tom,"4",male,"7500").
person(tim,"44",male,"3000").
person(bessy,"44",female,"200000").
person(avril,"26",female,"8000").

/* the marriages and children */
offspring(john,mary,[paul,tom]).
offspring(fred,elaine,[john]).
offspring(mike,susan,[elaine,tim]).
offspring(bessy,tim,[avril]).

/* calculation of the various family relationships */
parent(Child,Par):-
    offspring(Par,_,Kids),
    member(Child,Kids).
parent(Child,Par):-
    offspring(_,Par,Kids),
    member(Child,Kids).
grandparent(Child,Gpar):-
    parent(Par,Gpar),
    parent(Child,Par).
greatgrandparent(Child,GGpar):-
    grandparent(Par,GGpar),
    parent(Child,Par).
mother(Child,Mum):-
    parent(Child,Mum),
    person(Mum,_,female,_).
father(Child,Dad):-
    parent(Child,Dad),
    person(Dad,_,male,_).
son(Par,Son):-
    parent(Son,Par),
    person(Son,_,male,_).
daughter(Par,Daughter):-
    parent(Daughter,Par),
    person(Daughter,_,female,_).
brother(Either,Male):-
    mother(Male,Par),
    mother(Either,Par),
    Male >< Either,
    person(Male,_,male,_).
sister(Either,Female):-
    mother(Female,Par),
    mother(Either,Par),
    Female >< Either,
    person(Female,_,female,_).
grandfather(Child,Gdad):-
    grandparent(Child,Gdad),
    person(Gdad,_,male,_).
grandmother(Child,Gmum):-
    grandparent(Child,Gmum),
    person(Gmum,_,female,_).
grandson(Gpar,Gson):-
    grandparent(Gson,Gpar),
```

Fig 5 The database and database processing predicates (continued)

As with any natural-language system there is considerable scope for improving and extending the program, and I'll make a number of suggestions as to where this can be done.

The complete program is given in Figs 3-6 (non-Turbo Prologers can omit the declarations of Fig 3). When the program has been entered, from the command goal prompt it can respond to queries, as shown in Fig 7. Notice that the queries must all be set up in comma-delimited lists and without capitalising names (otherwise they will be mistaken for variables). The "s' sequence has to be entered as 'apos' instead. The program's text manipulation facilities could be greatly improved by recourse to string manipulation facilities, and you are invited to do this.

'Turbo Prolog has a more limited range of advanced predicates than other Prologs . . . a price that is paid for in its speed of execution.'

With the aid of the comments it should not be too difficult to understand most of the individual predicate definitions, so I'll just present an overview of the system here, starting with Fig 4.

The top-level clause in the system is the 'query' clause. This takes the list of English words, prints it to the screen, then gets rid of all superfluous words and substitutes any synonyms (using 'filter'). It then uses whatever words are left to actually make the query (in the 'get_values' goal). Assuming the query can be answered, then the answers are displayed. Notice that there can be more than one answer, so the result of the query is returned as a list.

The 'get_values' clauses evaluate who is/are being referred to, and what particular attribute is of interest. In some cases the same person may be identified more than once, so 'no_repeats' is used to ensure that the list of people has no repetitions. The specified attribute is then looked up for each of the people on the list (using 'lookup'). In some cases no attribute may have been specified in the original sentence, in which case the 'name' attribute is looked up.

The 'identify_everybody' clause uses a Turbo Prolog special built-in

```
    person(Gson,_,male,_).
granddaughter(Gpar,Gdaughter):-
    grandparent(Gdaughter,Gpar),
    person(Gdaughter,_,female,_).
cousin(X,Y):-
    grandmother(X,Gpar),
    grandmother(Y,Gpar),
    mother(X,Par1),
    mother(Y,Par2),
    Par1 >< Par2.
uncle(Child,Unc):- /* blood uncle and aunt only */
    brother(Par,Unc),
    parent(Child,Par).
aunt(Child,Aunt):-
    sister(Par,Aunt),
    parent(Child,Par).

/* access of the various attributes of a person */
age(Person,Age):-
    person(Person,Age,_,_).
sex(Person,Sex):-
    person(Person,_,Sex,_).
name(Person,Person):-
    person(Person,_,_,_).
worth(Person,Worth):-
    person(Person,_,_,Worth).
```

```
/* person_enquire(Relation Person Person) effectively allows a variable
predicate call for people */
person_enquire(parent,X,Y):-parent(X,Y).
person_enquire(grandparent,X,Y):-grandparent(X,Y).
person_enquire(greatgrandparent,X,Y):-greatgrandparent(X,Y).
person_enquire(mother,X,Y):-mother(X,Y).
person_enquire(father,X,Y):-father(X,Y).
person_enquire(son,X,Y):-son(X,Y).
person_enquire(daughter,X,Y):-daughter(X,Y).
person_enquire(brother,X,Y):-brother(X,Y).
person_enquire(sister,X,Y):-sister(X,Y).
person_enquire(grandfather,X,Y):-grandfather(X,Y).
person_enquire(grandmother,X,Y):-grandmother(X,Y).
person_enquire(grandson,X,Y):-grandson(X,Y).
person_enquire(cousin,X,Y):-cousin(X,Y).
person_enquire(uncle,X,Y):-uncle(X,Y).
person_enquire(aunt,X,Y):-aunt(X,Y).
person_enquire(brother,X,Y):-brother(X,Y).

/* attr_enquire(Attribute Person Value) effectively allows a variable
predicate call for people's details */
attr_enquire(age,X,Y):-age(X,Y).
attr_enquire(sex,X,Y):-sex(X,Y).
attr_enquire(name,X,Y):-name(X,Y).
attr_enquire(worth,X,Y):-worth(X,Y).

/* test for the empty list */
empty([]).

/* list membership */
member(X,[X|_]).
member(X,[_|Y]):- member(X,Y).

/* removes repetitions from a list */
no_repeats([X|Y],NY):-
    member(X,Y),
    !,
    no_repeats(Y,NY).
no_repeats([X|Y],[X|NY]):-
    no_repeats(Y,NY).
no_repeats([],[]).

/* looks up a particular attribute for a list of people */
lookup(Attrib,[Person|Persons],[found_that(Attrib,Person,Ans)|Answers]):-
    attr_enquire(Attrib,Person,Ans),
    lookup(Attrib,Persons,Answers).
lookup(_,[],[]).
```

Fig 6 Utility predicates

```
Goal: query([how much,is,paul,apos,grandfather,worth]).
[found_that("worth","fred","10000")]

Goal: query([what,sex,is,avril,cousin]).
[found_that("sex","john:,"male")]

Goal: query([how,old,is,the,father,of,avril,apos,aunt]).
[found_that("age","mike",68)]
```

Fig 7 Query and responses to the natural-language database system

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predicate — 'findall'. 'findall' calls the 'identify_somebody' goal repeatedly in order to assemble all the possible people who fit the bill onto a list. If nobody can be identified, 'identify_everybody' fails because of the 'not-empty' test. Nobody will be identified if a relation does not exist in the family tree, or if there is some grammatical error or unknown word encountered.

The dictionary of synonyms and words to be ignored could be greatly extended to include all the pet-names and plurals for the various family relations (for example, 'aunts', 'grandpa', and so on). The first argument of the synonyms predicate is the 'internal' name of the relation — that is, the predicate used in the database.

The family 'database' in Fig 5 is largely self-explanatory. Many possible family relationships have been omitted (for example, in-laws, nieces, and so on), and the reader may care to add them.

To add a new family relationship, first create its definition along the lines of the clauses shown. Then add an extra clause to the 'person_enquire' clauses in Fig 6, and also set up any synonyms (Fig 4) that could be alternative names for the relationship when it appears in enquiries.

It is surprisingly easy to get the definitions of family relationships wrong. For example, without the 'Male >< Either' test in 'brother', the 'brother' predicate would find that someone could be a brother of himself! A good way to test a new definition is to execute a definition directly as a command line goal with only variables as arguments. This finds everyone in the family to whom that relationship could apply, and if you have drawn a family tree, it is easy to spot if the definition is missing anyone or finding too many people. Ideally, each solution it finds should be unique.

It is also very easy to set up an alternative family tree, possibly with your own relatives. Notice that the numeric values in the 'person' fact clauses are given in quotes. This means that internally they are treated as symbols and not numbers, and this simplifies the Turbo Prolog declarations — try removing the quotes if you don't believe me. Make sure that all individuals in the family are represented by different names, otherwise the results of queries may appear to be somewhat incestuous!

Both the 'enquire' utility predicates, defined in Fig 6, could be greatly abbreviated in other Prologs. All they do is convert their three arguments into a goal to be solved. The only way to do this in Turbo Prolog is with a clause for each case to be handled; in other Prologs, a single clause could handle all the cases.

Further exercises

For the enterprising reader, there are a number of major extensions that could be attempted. It would be an interesting exercise to extend the system to handle maximum and minimum-type enquiries (youngest brother, richest auntie, and so on). The information held on each person could be made more elaborate, with addresses, phone numbers and birthdays. Also, an ability to handle 'I' and 'my' would be useful (for example, my uncle, my money). And finally, if you really want to enter a minefield, try to handle the word 'and' in all its connotations. When you have done all this, you will just about have developed a genuine, practical system! END

Last month's homework

Last month's homework was to write some programs to sort lists of integers. There are numerous sorting algorithms (see, for example, nearly 400 pages in *The Art of Computer Programming: Sorting and Searching*, DE Knuth, Addison-Wesley 1973), and here I'll present the Prolog implementation of just two — Insertion Sorting and Quicksort.

The goals statement below includes provision for timing the different sort methods, but on the short lists given the execution is virtually instantaneous. Use longer lists to obtain more meaningful comparisons.

It is also interesting to experiment with the order of clauses for each predicate, and to perform optimisations with the 'cut' predicate (introduced in this article) to see how the timings are affected.

```
domains
    integerlist =integer*

predicates
    insert_sort(integerlist,integerlist)
    insert(integer,integerlist,integerlist)
    qsort(integerlist,integerlist,integerlist)
    partition(integerlist,integer,integerlist,integerlist)
    elapsed_secs(real)

goal
    time(0,0,0,0),
    insert_sort([3,7,1,12,5,3,19],Ans1),
    elapsed_secs(Insert_sort_time),
    write(Ans1),nl,write(Insert_sort_time),nl,
    time(0,0,0,0),
    qsort([3,7,1,12,5,3,19],Ans2,[]),
    elapsed_secs(Qsort_time),
    write(Ans2),nl,write(Qsort_time),nl.


clauses
    /* Insertion sorting */
    insert_sort([],[]).
    insert_sort([X],[X]).
    insert_sort([X|Xs],XXssorted):-
        insert_sort(Xs,Xssorted),
        insert(X,Xssorted,XXssorted).

    insert(X,[],[X]).
    insert(X,[Y|Ys],[X,Y|Ys]):-
        X <= Y.
    insert(X,[Y|Ys],[Y|XYs]):-
        X > Y,
        insert(X,Ys,XYs).


    /* Quicksort */
    qsort([X|Y],Z1,Z2):-
        partition(Y,X,Y1,Y2),
        qsort(Y2,Z3,Z2),
        qsort(Y1,Z1,[X|Z3]).
    qsort([],X,X).

    partition([X|Z],Y,[X|Z1],Z2):-
        X < Y,
        partition(Z,Y,Z1,Z2).
    partition([X|Z],Y,Z1,[X|Z2]):-
        X >= Y,
        partition(Z,Y,Z1,Z2).
    partition([],_,[],[]).

    elapsed_secs(X):-
        time(Hrs,Mins,Secs,Huns),
        X = (Hrs * 60 + Mins) * 60 + Secs + Huns/100.

    ----------
```

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Use 1-2-3®-like commands and menus.

After the master file is selected, R&R shows an empty screen area to "write" on. Text simply is typed and fields are inserted where wanted; 1-2-3- like commands do the rest. R&R isn't particular about the order of doing things. File relations can be set as needed, or all at once. Fields can be formatted when inserted, or later. Any part of the report can be changed at any time.

Set and edit file relations.

File relations are set one at a time through a series of commands aided by prompts. The narrative near the bottom of the screen shows the highlighted relationships in plain-English.
Up to nine relations may be set among up to ten files, through dBASE indexes. One-to-one, or "lookup", relations find a single record in the related file for each value of the linking field; for example, the company name for a specific customer number. One-to-many, or "scanning", relations find as many records in the related file as have the same value of the linking field; for example, all of the lineitems with the same order number.
Relations may be nested in up to nine levels, with a "scanning" relation and any number of "lookup" relations at each level.

Insert fields from pull-down menus.

Using the Field insert command, fields from the pull-down menu are inserted at the current cursor location. The pull-down menu graphically shows file and field relationships.

Move fields and text freely around the report.

Individual fields, segments of text, or entire lines can be highlighted and then moved elsewhere with the cursor movement keys.

Sort and independently group records.

R&R makes complete and efficient use of dBASE Indexes for file processing and record ordering. When the resulting record order is not as wanted, R&R can sort records on up to eight levels, using any fields including those calculated by R&R itself.

Create new calculated fields.

New (calculated) fields are created by typing expressions containing field names, functions, operators, and other expressions, or by selecting them from pull-down menus. More than 60 functions are available for character, date, mathematical, and special test calculations.

Get HELP whenever it's needed.

Pressing the HELP key gives an instant reference for whatever is being done. Each screen has cross-references to the pages in the User's Guide, and to other HELP screens.

Format fields and text for finished layout.

Text is shown just as it will be printed. Fields are shown by pictures that indicate field type, format, and width.
Calculated numeric fields are shown as #'s. The highlighted field is formatted as currency, and will print with leading $-sign and imbedded commas. **Bolded** items will print in **bold**, *italics*, underlined, or some **combination** of print attributes specified item-by-item or by line.

Select records using plain-English query.

Queries are built in plain-English by selecting fields, comparison operators, and logical connectors from pull-down menus. Any level of complexity can be attained with AND/OR connectors and full nesting of parentheses.

Control output with print options.

Numerous print options give complete control over such things as page margins. All settings are clearly shown on status screens.
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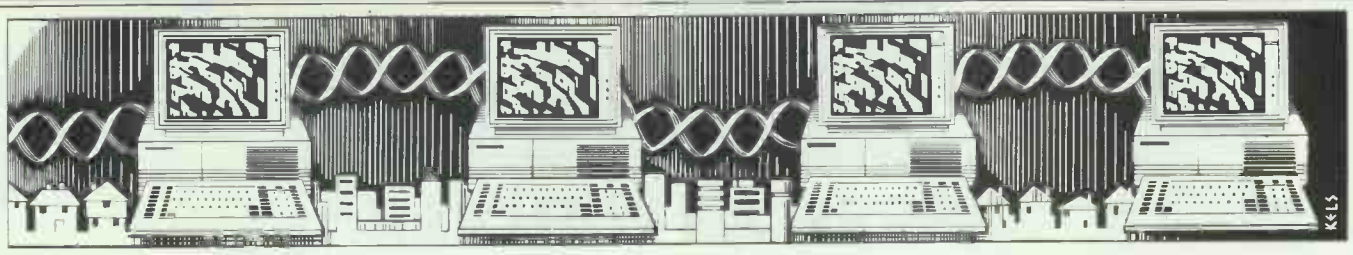


News bulletin

Peter Tootill advocates the attractions and benefits of bulletin boards and presents some straightforward advice on how to set one up.

Microcomputer-based bulletin board systems, or BBSs as they are commonly known, can fulfil a wide range of applications — not just as a message area for hobbyists and home computer users (although this is admittedly the one that most people think of). In fact, there are a number of reasons why a company might want to set up a BBS, but first a little history . . .

The first BBS was set up in 1978 by Ward Christensen (who, incidentally, devised the popular Xmodem protocols for file transfer). It was a very basic system that allowed members of the local computer club to call in and leave messages — just as if they were pinning them to the wall in the clubroom — hence the name 'bulletin board'. The idea developed and before long it really took off and there were hundreds — even thousands — of BBSs operating in the US. These were initially run by computer hobbyists and usually open to the public, but before long business and professional users began to realise that here was a tool that could be useful to them, and commercial and private systems began to appear.

The early BBSs were, as mentioned above, very simple systems. All they allowed was storing and retrieving of messages. Things soon moved on, though, and a modern BBS package will allow a wide range of quite sophisticated facilities. Most of these will recognise a user who has called before and automatically configure their output to suit the type of computer he/she is using to call.

Message facilities will include the ability to categorise public messages by topic and private 'electronic mail' — messages that can only be seen by the sender and the addressee. As well as this, there will be news and information files that can be displayed to callers. Programs can be 'down' as well as 'uploaded', with a range of error-correcting protocols (essential when using ordinary telephone lines). Question and answer files will allow such things as the online ordering of goods (perhaps those that a caller has just read about in an information area).

With such features, a bulletin board running on a microcomputer can provide a very sophisticated electronic messaging and information service for a modest cost. This could be used, for example, by a company to keep in touch with field

Bulletin board software available in the UK

BBC MICRO

FBBS

Cost: £20
Facilities: Menu editor, questionnaire editor, SIG editor, userlog editor. Xmodem file transfer, external hosted programs, 255 levels of user privilege, eight user flags, Mode 7 graphics for BBC callers
Format: Disk and ROM, printed manual
Hardware: BBC Micro, 200k disk drive. (Master version coming)
Modems: Nightingale, WS2000, LeModem, Demon
Contact: Marctel BBS. Tel: (01) 349 1540, or via Prestel Mailbox 919993304

OBBS

Cost: £25 (single-density) £30 (double-density)
Facilities: User-defined menus, Mode 7 graphics, Xmodem file transfer, 255 levels of user privilege, eight user flags, double density version has more flexible menus and easier downloading and sub-directories
Format: Disk, manual on disk
Hardware: BBC B, DFS or ADFs, one disk drive
Modems: Nightingale
Contact: R O'Donnel, 16 Springfield Close, Stanmore, Middlesex, HA7 3DE, or via Prestel Mailbox 819990028

NBBS Plus

Cost: £50
Facilities: User-defined menus, Mode 7 graphics, Viewdata graphics, scrolling terminals with colour, 255 levels of user privilege, eight user flags (one set for each of menus, messages and downloads), eight message boards, remote sysops with full-screen menu editor, hosted programs, Xmodem file transfer (inc CRC method)
Format: 2×16k EPROMs plus utilities disk. Printed manual. Min system 'ready to go'
Hardware: BBC B, Master, maybe Compact, one disk drive
Modems: Range of modem drivers provided
Contact: S Harman, Hertford BBS. Tel: (0992) 552 188 (V23) or Prestel mailbox numbers 992552188 and 277228867

sales or maintenance staff, for customer support and information or for mail-order type sales.

As well as these there are also 'hobby systems', which is what most people think of when you mention bulletin boards. Hobby systems use the features of BBS software to provide messaging and information systems that are normally open to all callers, either free or on payment of a modest subscription, and which normally include specialist sections for particular topics (usually, but not always, microcomputer-orientated) and public-domain software for downloading.

What is needed?

The equipment required to run a BBS consists basically of a microcomputer (with a serial port and disk drives), an auto-answer modem and some BBS software. A printer is useful and the more disk capacity you have the better; a hard disk is ideal — not only does it allow more space for messages, user files and information or download areas, but the increased speed of access also makes the whole system faster and more responsive to the caller. Just about any micro can be used — from Spectrums through Commodore 64s and Ataris to the IBM PC/AT. Software is available for all these and more.

In general, micros (and operating systems) that are widely available in the US are better provided for, as the whole bulletin board scene is much bigger over there and most BBS software is of US origin — the exception being the BBC Micro.

The other thing you need is a dedicated phone line. Although it is possible to run a BBS on a line used for other purposes, I would not recommend it. Set system hours or ring-back methods designed to allow people and computers to share phone lines do not, in my experience, work very well. There will always be people who call at the wrong time or in the wrong way, and the result can lead to a lot of aggravation from those who want to use the line for other purposes.

Choosing software

Choosing BBS software is not easy. It isn't the sort of program that you can see demonstrated at your local micro shop — or even at a computer show. The market is limited, and many BBS packages are public-domain or shareware; even tracking down the source of a program can be difficult.

User group libraries are one source for the public-domain systems — as well as bulletin boards using the software. Most Fido systems, for example, will be able to supply a copy of Fido, even if it isn't already online in their download areas. The commercial programs are again often available from the operators of existing systems. There are, however, relatively few commercial packages available in the UK — it is a small market, and they are likely to sell in tens rather than hundreds or thousands.

What do you look for? To some extent this is a matter of individual taste and requirements. You can get a good idea of what a particular package can do by calling one of the public access systems that use it. Many are covered in the BBS list in the 'End Zone' section of *PCW*. If you call a few systems you can get an idea of how easy they are for callers to use and understand; and by comparing differences between systems using the same software, you can get an impression of how flexible that system is. You can leave a message for the operator (called the 'Sysop') and ask how easy it is to set up and to maintain.

Alongside is listed a selection of BBS packages. The list is by no means exhaustive and I have concentrated on software that is available in this country (but even so there is more BBS software around). A viewdata (Prestel-type) system can be set up with packages such as CommunITel on a BBC Micro or even, unusually, on an IBM clone with an American package called PC-Display. CP/M systems are well supported by public-domain packages such as RBBS, CBBS and Octopus.

A couple of Amiga-based systems are now running in Ireland using a package called BBS-PC, but as far as I know it is only available from the US. Apple-based BBSs certainly still exist but I haven't found anyone to describe the software to me.

However, if you have one of these systems and want to set up a BBS, then the best course of action is to contact the relevant user group.

If you cannot find a purpose-made system for your microcomputer, then all is not lost. John Balshaw (sysop of Diggertel #1 in Bolton, tel: (0204) 43082) has written his own system — entirely in Microsoft Basic. It should be fairly straightforward to convert to run on other systems. John already has versions running under CP/M and MS-DOS.

You can contact Peter Tootill electronically on: Telecom Gold 83:VNU202, Prestel 219991119, or CompuServe 72746,3202

END

IBM PC & CLONES

Fido

Cost: User-supported. Private systems $60 contribution
Facilities: Six levels of user privilege, 99 message areas, exit to DOS for hosted programs, various file transfer protocols
Format: Disk, manual on disk
Hardware: IBM PC or compatible, 256k RAM, two disk drives
Modems: Hayes-compatible only
Contact: Any existing Fido system

OPUS

Cost: Public domain
Facilities: Fido look-alike, but adds ANSI terminal support giving colour and also IBM graphics. User-defined menus, Easier for sysop than Fido. Additional file-transfer protocols
Format: Disk, manual on disk
Hardware: IBM PC or compatible, 128k RAM, two drives
Modems: Hayes-compatible only (source code for comms driver included)
Contact: Any existing OPUS system

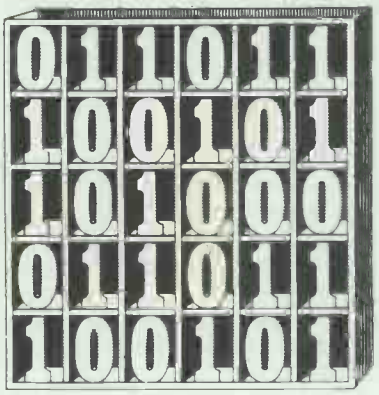
TBBS

Cost: £250
Facilities: User-defined menus, 255 levels of user privilege, 64 user flags, Xmodem (incl CRC) and Ymodem file-transfer, timed external events for easy maintenance. 52 message boards, remote sysops, hosted programs. FidoNet support. Userlog, menu file and configuration editors, questionnaires
Format: Disk, printed manual
Hardware: IBM PC or compatible, 256k RAM, two disk drives
Modems: Hayes, some dumb modems
Contact: Beta Micro Services, 7 Stockville Rd, Liverpool L18 3EJ Tel: (051) 428 2733

PC-Display/PC-Editor

Cost: £700
Facilities: Viewdata system. Supports up to ten callers with inter-user chat. Private mailboxes, viewdata & scrolling users, gateways, Xmodem file-transfer
Hardware: IBM-compatible with 256k and one disk drive (single-user)
Modems: Hayes-compatible
Contact: Hartlepool Computer Services. Tel: (0429) 869 988

SUBSET



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to SubSet, PCW, 32-34 Broadwick Street, London W1A 2HG.

Z80 Disassembler

This month's code consists of two fairly large routines, DISZ80 and OPRNDZ, and their data tables. These complete the 1094-byte disassembler from John Kerr of Glasgow. The three other routines in the program, CONVHL, XTRACT and FETCH (including ADRSP), were published in February, March and April SubSets respectively.

Apart from these five datasheets, the program does call a system-specific routine 'CHROUT' to output the ASCII character in A to screen, printer or disk file. Your operating system or machine code monitor should include such a routine, but do check first to ensure that it does not alter registers. If it does corrupt any register, then you will have to write an interface routine to save and restore registers.

The listing in Datasheet 1 is of an already assembled DISZ80; this is how you would normally see it. Each line consists of the address and code of each instruction, followed by the original source program line. Only the line numbers are absent.

Fig 1 shows hex dumps of the four data tables used by DISZ80; again, this would be the normal method of listing large amounts of assembled data. The ASCII characters associated with each byte listed in the right-hand column are of little use in deciphering the instruction decoders of GROUP2, GROUP1 and GROUP3, but useful for recognising the Z80 mnemonics in MONICS.

Datasheet 2 is an actual disassembly listing of OPRNDZ to which I have appended labels and comments from John's original source program.

Fig 2 is a 'disassembly' of the data table RGSTRS and illustrates one insurmountable problem — data is decoded as a sequence of instructions. The first three of these 'instructions' actually make sense, as do the next four. Not until B is loaded from C, (HL), H and L in turn does it become obvious that the code is not a sequence of short subroutines.

DATASHEET 1

```
;
;DISZ80          Instruction Disassembler. To disassemble and output
;                any valid Z80 machine code instruction.
;
;-----------------------------------------------------------------------
;STRUCTURAL CONCEPTS
;DATA            Disassembled line:
;                     field 1: instruction 1st byte location (5 cols).
;                     field 2: instruction bytes (12 cols).
;                     field 3: mnemonic (5 cols).
;                     field 4: operand(s) (13 cols).
;
;                Location address  : ASCII hex (4 digits).
;                Instruction bytes : ASCII hex (2 digits sequence).
;                Operand data &    : ASCII hex with appended "H" if >9,
;                  addresses       : and preceding "0" if 1st digit >9.
;                Operand offsets   : signed decimal, linked "+" or "-".
;
;PROGRAM         See line comments.
;-----------------------------------------------------------------------
;SYSTEM REQUIREMENTS
;PROCESSOR       Z80
;HARDWARE        Memory containing object program.
;                Output device or file.
;SOFTWARE        OPRNDZ: (Datasheet 2) Disassemble a valid Z80 operand.
;                ADRSP: (April, 1987) Output a 4-digit hexadecimal
;                       value, followed by a space.
;                FETCH: (April, 1987) Get source byte & output in hex,
;                       followed by a space.
;                XTRACT: (March, 1987) Copy a string from a table of
;                       keywords.
;                CHROUT: (System specific) Output ASCII character in A,
;                       preserving registers.
;-----------------------------------------------------------------------
;PROGRAM DETAILS
;INPUT           DE addresses 1st byte of instruction to disassemble.
;OUTPUT          35 character disassembled line to output device.
;STATE CHANGES   DE updated to address 1st byte of next instruction.
;                AF BC HL changed.
;I/O ERRORS      None.
;OPTIMISATION    Not given.
;INTERRUPT EFFECT May be interrupted and re-entered.
;LOCATION NEEDS  Not specific. Not relocatable. PROMable.
;                (Listing in this datasheet is assembled at 0100H.)
;PROGRAM BYTES   695: code 206 + referenced tables:-
;                     GROUP2 (27), GROUP1 (168), GROUP3 (86),
;                     MONICS (208).
;STACK BYTES     46 maximum.
;CLOCK CYCLES    Not given.
;-----------------------------------------------------------------------
                ;
                ;...Assembly listing with assembled object code.
                ;
0100: CD F2 04  DISZ80  CALL ADRSP          ;Output the source pointer.
                ;
0103: 01 00 09          LD   BC,900H        ;Create an 18-byte output
0106: 21 20 20          LD   HL,2020H       ;buffer in the stack area.
                ;
0109: E5        BUFFER  PUSH HL             ;Buffer initially contains
010A: 10 FD             DJNZ BUFFER         ;18 ASCII spaces (20H).
010C: 60                LD   H,B            ;Copy SP into HL, so the
010D: 69                LD   L,C            ;first byte of the output
010E: 39                ADD  HL,SP          ;buffer is addressed by HL.
                ;
010F: C5                PUSH BC             ;Save original IX and
0110: DD E3             EX   (SP),IX        ;initialise to zero.
0112: C5                PUSH BC             ;Initialize temp storage
0113: C5                PUSH BC             ;(workspace) to all zeros.
0114: DD 39             ADD  IX,SP          ;Point IX to workspace.
                ;
0116: E5                PUSH HL             ;Save buffer pointer; point
0117: 21 91 02          LD   HL,GROUP3      ;to "ED" instruction group.
                ;
011A: CD E7 04  TRYNDX  CALL FETCH          ;Fetch a byte of code.
                ;
011D: 41                LD   B,C            ;First check whether this
011E: FE ED             CP   0EDH           ;is an "ED" instruction.
0120: 28 0A             JR   Z,CONFLG       ;Yes; clear the index flag.
                ;
0122: 04                INC  B              ;Ready to set flag to "1"
0123: FE DD             CP   0DDH           ;if the byte is 0DDH (an
0125: 28 05             JR   Z,CONFLG       ;instruction using IX).
                ;
0127: 04                INC  B              ;Ready to set flag to "2"
0128: FE FD             CP   0FDH           ;if the byte is 0FDH (an
012A: 20 08             JR   NZ,NOTNDX      ;instruction using IY).
                ;
012C: DD 70 01  CONFLG  LD   (IX+1),B       ;Condition the index flag.
012F: 04                INC  B              ;Repeat index tests if the
0130: 10 E8             DJNZ TRYNDX         ;pre-byte was 0DDH or 0FDH.
0132: 18 2A             JR   NXBYTE         ;Otherwise continue.
                ;
0134: 4F        NOTNDX  LD   C,A            ;Save byte; check if index
0135: DD 7E 01          LD   A,(IX+1)       ;flag was set (allows any
0138: B7                OR   A              ;series of 0DDH and/or 0FDH
0139: 28 18             JR   Z,NODISP       ;bytes, as per Zilog spec).
                ;
013B: 79                LD   A,C            ;If so, check for presence
013C: FE CB             CP   0CBH           ;of any displacement.
013E: 28 0D             JR   Z,GETDIS       ;0CBH needs a displacement.
                ;
0140: E6 44             AND  44H            ;A displacement is required
0142: FE 04             CP   4              ;if opcode has bit 2 set
0144: 28 07             JR   Z,GETDIS       ;and bit 6 reset.
                ;
0146: 79                LD   A,C            ;A displacement is required
0147: E6 C0             AND  0C0H           ;if opcode has bit 6 set
0149: FE 40             CP   40H            ;and bit 7 reset.
014B: 20 06             JR   NZ,NODISP      ;
                ;
014D: CD E7 04  GETDIS  CALL FETCH          ;Get displacement if needed
0150: DD 77 02          LD   (IX+2),A       ;and save it in workspace.
                ;
0153: 21 E9 01  NODISP  LD   HL,GROUP1      ;"Main" instruction group.
0156: 79                LD   A,C            ;Recover opcode & check
0157: FE CB             CP   0CBH           ;for 0CBH ("bit" group).
0159: 20 07             JR   NZ,NEWMSK      ;No; start the search.
                ;
015B: 21 CE 01          LD   HL,GROUP2      ;Yes; point to "CB" group.
                ;
015E: CD E7 04  NXBYTE  CALL FETCH          ;Fetch the last non-data
```

```
0161: 4F                LD   C,A          ;byte and store it in C.
                ;
0162: 7E        NEWMSK  LD   A,(HL)       ;Fetch a mask from table.
0163: B7                OR   A            ;Mask value of 0 indicates
0164: 28 16             JR   Z,TABEND     ;end of table; quit search.
                ;
0166: A1                AND  C            ;Otherwise mask the opcode
0167: 23                INC  HL           ;and address the mode byte.
                ;
0168: 46        NEWMOD  LD   B,(HL)       ;Fetch the mode byte in B.
0169: 23                INC  HL           ;Point to the match byte.
016A: 04                INC  B            ;Test if the mode is 0FFH,
016B: 28 F5             JR   Z,NEWMSK     ;and if so, get a new mask.
                ;
016D: BE        TRYMAT  CP   (HL)         ;Is the masked opcode
016E: 23                INC  HL           ;equal to the match byte?
016F: 28 07             JR   Z,GETNDX     ;Stop searching if it is.
                ;
0171: CB 7E             BIT  7,(HL)       ;Index byte bit 7 is set if
0173: 23                INC  HL           ;address mode changes.
0174: 28 F7             JR   Z,TRYMAT     ;No change; try next match.
                ;
0176: 18 F0             JR   NEWMOD       ;Change; get a new mode.
                ;
0178: 7E        GETNDX  LD   A,(HL)       ;Matched; fetch mnemonic
0179: E6 7F             AND  7FH          ;index, mask bit 7, and
017B: 05                DEC  B            ;restore the mode byte.
                ;
017C: E1        TABEND  POP  HL           ;Save the source pointer
017D: D5                PUSH DE           ;below the output buffer
017E: E5                PUSH HL           ;pointer on stack.
                ;
017F: EB                EX   DE,HL        ;Point HL to start of the
0180: 21 E7 02          LD   HL,MONICS    ;mnemonics table.
0183: CD 11 05          CALL XTRACT       ;Copy mnemonic to buffer.
                ;
0186: E1                POP  HL           ;Restore output pointer
0187: 11 05 00          LD   DE,5         ;and adjust to align
018A: 19                ADD  HL,DE        ;any operands present.
018B: D1                POP  DE           ;Restore source pointer.
                ;
018C: 78                LD   A,B          ;Test high-order B to see
018D: E6 F0             AND  0F0H         ;if any "first" operand
018F: 28 13             JR   Z,SECOND     ;is present.
                ;
0191: 1F                RRA               ;Yes; move the operand
0192: 1F                RRA               ;index into the lower
0193: 1F                RRA               ;half of A.
0194: 1F                RRA               ;Then save
0195: C5                PUSH BC           ;operand byte and opcode.
                ;
0196: 47                LD   B,A          ;Operand index in B.
0197: 79                LD   A,C          ;Restore opcode to A.
0198: CD B7 03          CALL OPRND1       ;Process the operand.
                ;
019B: C1                POP  BC           ;Restore the operand byte
019C: 78                LD   A,B          ;and opcode; test
019D: E6 0F             AND  0FH          ;low-order B for any
019F: 28 0B             JR   Z,OPDONE     ;"second" operand.
                ;
01A1: 36 2C             LD   (HL),','     ;Two operands; send a
01A3: 23                INC  HL           ;comma to output buffer.
                ;
01A4: 78        SECOND  LD   A,B          ;Check for the presence
01A5: E6 0F             AND  0FH          ;of a "second" operand.
                ;
01A7: 47                LD   B,A          ;Operand index in B.
01A8: 79                LD   A,C          ;Restore opcode to A.
01A9: C4 BD 03          CALL NZ,OPRND2    ;Process any operand.
                ;
01AC: 3E 03     OPDONE  LD   A,3          ;Check how many bytes
01AE: DD 96 00          SUB  (IX)         ;have been fetched.
                ;
01B1: E1                POP  HL           ;Discard workspace.
01B2: E1                POP  HL           ;
01B3: DD E1             POP  IX           ;Restore index register.
                ;
01B5: 38 0C             JR   C,OUTEXT     ;4 or more bytes fetched.
                ;
01B7: 3C                INC  A            ;Less than four bytes
01B8: 47                LD   B,A          ;fetched; so output
01B9: 80                ADD  A,B          ;enough spaces to
01BA: 80                ADD  A,B          ;align the mnemonics.
01BB: 47                LD   B,A          ;
                ;
01BC: 3E 20     SPACES  LD   A,20H        ;Output spaces
01BE: CD 46 05          CALL CHROUT       ;to start of
01C1: 10 F9             DJNZ SPACES       ;mnemonic field.
                ;
01C3: 06 12     OUTEXT  LD   B,18         ;Set buffer byte count.
                ;
01C5: 3B        PUTOUT  DEC  SP           ;Copy stored text, byte
01C6: E1                POP  HL           ;at a time, from output
01C7: 7C                LD   A,H          ;buffer on stack to
01C8: CD 46 05          CALL CHROUT       ;the output channel.
01CB: 10 F8             DJNZ PUTOUT       ;
                ;
01CD: C9                RET               ;Instruction disassembled.
                ;
```

Fig 1

```
;
;   HEX DUMP OF DECODERS AND MNEMONICS USED BY DISZ80.
;
;...GROUP2, GROUP1 and GROUP3 are instruction decoding tables and have
;...the following structure:
;
;               [ mask { mode ( match , index ) } 0FFH ] 0.
;
;...The repeating group ( match , index ) terminates when the MSB of the
;...index byte is set. The interpretation of the "mode" byte is
;...explained in the documentation to datasheet OPRNDZ.
;
;...MONICS contains the Z80 instruction mnemonics, in roughly
;...alphabetical order; each string is terminated by setting bit 7 of
;...the last character.
;
GROUP2
;
01CE:                                                   C0 36           @6
01D0: 40 04 80 2D C0 8E FF F8-06 00 33 08 38 10 35 18   @..-@).x..3.8.5.
01E0: 3A 20 3F 28 40 30 00 38-C1                        : ?(@0.8A
;
GROUP1
;
01E9:                                       FF 00 00 24 07 32 0F          ...$.2.
01F0: 37 17 31 1F 36 27 0D 2F-0B 37 3D 3F 06 76 14 C9   7.1.6'./.7=?.v.I
0200: 30 D9 12 F3 0F FB 91 72-C6 02 CE 01 DE BC 02 D6   0Y.s.{.rF.N.^<.V
0210: 42 E6 03 EE 43 F6 25 FE-8C 04 08 93 01 10 10 18   Bf.nCv%~........
0220: 9D AF 22 A2 FA 2A A2 A7-32 A2 7A 3A A2 03 C3 1C   ./""z*"'2"z:".C.
0230: CD 85 97 D3 AA 79 DB 9B-5F E3 93 0E E9 9C 05 EB   M..S*y[._c..i..k
0240: 93 DF F9 A2 FF C0 B6 40-A2 FF F8 76 80 02 88 01   ._y".@6@".xv....
0250: 98 BC 06 90 42 A0 03 A8-43 B0 25 B8 8C FF C7 0B   .<..B .(C0%8..G.
0260: 04 16 05 8E B2 06 A2 20-C0 BD 23 C2 1C C4 85 10   ....2." @0#B.D..
0270: C7 BB FF CF D3 01 A2 0D-03 16 0B 8E FD 09 82 60   G;.OS."......}..`
0280: C1 2B C5 AC FF E7 21 20-9D FF EF E7 02 A2 7E 0A   A+E,.g! ..og."~.
0290: A2                                                "
;
GROUP3
0291:    FF 00 44 23 45 2F 4D-2E 4E 00 67 39 6F 34 70     ..D#E/M.N.g9o4p
02A0: 00 71 00 A0 21 A1 0A A2-1A A3 29 A8 1F A9 08 AA   .q. !!.".#)(.).*
02B0: 18 AB 28 B0 20 B1 09 B2-19 B3 27 B8 1E B9 07 BA   .+(0 1.2.3'8.9.:
02C0: 17 BB A6 FF C7 B8 40 9B-8B 41 AA FF CF FD 42 3C   .;&.G8@..A*.O}B<
02D0: 4A 81 AD 43 A2 DA 4B A2-FF E7 40 46 95 FF F7 C7   J.-C"ZK".g@F..wG
02E0: 47 A2 7C 57 A2 FF 00                              G"|W"..
;
MONICS
;
02E7:                                   BF-41 44 C3 41 44 C4 41 4E          ?ADCADDAN
02F0: C4 42 49 D4 43 41 4C CC-43 43 C6 43 50 44 D2 43   DBITCALLCCFCPDRC
0300: 50 C4 43 50 49 D2 43 50-C9 43 50 CC 43 D0 44 41   PDCPIRCPICPLCPDA
0310: C1 44 45 C3 44 C9 44 4A-4E DA 45 C9 45 58 D8 45   ADECDIDJNZEIEXXE
0320: D8 48 41 4C D4 49 CD 49-4E C3 49 4E 44 D2 49 4E   XHALTIMINCINDRIN
0330: C4 49 4E 49 D2 49 4E C9-49 CE 4A D0 4A D2 4C 44   DINIRINIINJPJRLD
0340: 44 D2 4C 44 C4 4C 44 49-D2 4C 44 C9 4C C4 4E 45   DRLDDLDIRLDILDNE
0350: C7 4E 4F D0 4F D2 4F 54-44 D2 4F 54 49 D2 4F 55   GNOPOROTORDTIROU
0360: 54 C4 4F 55 54 C9 4F 55-D4 50 4F D0 50 55 53 C8   TDOUTIOUTPOPPUSH
0370: 52 45 D3 52 45 54 C9 52-45 54 CE 52 45 D4 52 4C   RESRETIRETNRETRL
0380: C1 52 4C 43 C1 52 4C C3-52 4C C4 52 CC 52 52 C1   ARLCARLCRLDRLRRA
0390: 52 52 43 C1 52 52 C3 52-52 C4 52 D2 52 53 D4 53   RRCARRCRRDRRRSTS
03A0: 42 C3 53 43 C6 53 45 D4-53 4C C1 53 52 C1 53 52   BCSCFSETSLASRASR
03B0: CC 53 55 C2 58 4F D2                              LSUBXOR
;
```

DATASHEET 2

```
;
;OPRNDZ          Operand Disassembler. To disassemble and output a valid
;                Z80 machine code operand.
;OPRND1          Entry point for certain modes (see DATA).
;OPRND2          Entry point for certain modes (see DATA).
;
;STRUCTURAL CONCEPTS
;DATA            Operand: Standard Z80 assembler format.
;                         The operand mode is determined by an input
;                         index (1 - 15) and by point of entry:-
;
;                Index          OPRND1              OPRND2
;                  1            RST address         Relative address
;                  2            Condition           Immediate byte
;                  3            Bit number          Immediate word
;                  4            Interrupt mode      AF,AF'
;                  5            (SP)                DE,HL
;                  6            Register pair       8-bit source
;                  7                    A
;                  8                    (C)
;                  9                    (port number)
;                 10                    (Absolute address)
;                 11                    8-bit destination
;                 12                    I or R
;                 13                    16-bit register
;                 14                    Address in 16-bit register
;                 15                    Index register
;
;PROGRAM         See added line comments and DATA.
;
;SYSTEM REQUIREMENTS
;PROCESSOR       Z80
;HARDWARE        Memory containing the object program.
;                Memory for output buffer and workspace.
;SOFTWARE        FETCH: (April, 1987) Get source byte & output in hex,
;                                     followed by a space.
;                XTRACT: (March, 1987) Copy string from a table of keywords.
;                CONVHL: (February, 1987) Convert HL to ASCII decimal or
;                                         hexadecimal.
;
;PROGRAM DETAILS
;INPUT           A = opcode.
;                B = operand index.
;                DE addresses next instruction byte.
;                HL addresses next free byte in output buffer.
;                (IX+0) = no. of instruction bytes fetched.
;                (IX+1) = index register flag (1=IX, 2=IY, else 0).
;                (IX+2) = displacement for any indexed instruction.
;OUTPUT          Operand is in output buffer.
;                DE and HL are updated.
;STATE CHANGES   AF BC are changed.
;                IX IY (IX+0,1,2) are unchanged.
;I/O ERRORS      Operand index in B is not valldated.
;OPTIMISATION    Not given
;INTERRUPT EFFECT May be interrupted and re-entered.
;LOCATION NEEDS  Not specific. Not relocatable. PROMable.
;                (Listing in this datasheet is assembled at 03B7H.)
;PROGRAM BYTES   304: code 247 + referenced table:- RGSTRS (57).
;STACK BYTES     18 maximum.
;CLOCK CYCLES    Not given.
*...Actual disassembly listing.    Added labels and comments.
*...with sectional blank lines
*...inserted for clarity.
*
03B7 10 12      DJNZ 3CBH          OPRND1 <CONDIT> First entry point; is mode
03B9 E6 38      AND  38H           RSTADR          a restart address? If so,
03BB 18 2A      JR   3E7H                <DA>      isolate opcode bits 5-3.
*
03BD 10 1D      DJNZ 3DCH          OPRND2 <DAT8>   2nd entry point; is mode
03BF CD E7 04   CALL 4E7H          RELADR <FETCH>  PC relative? If so, fetch
03C2 4F         LD   C,A                           displacement & extend
03C3 17         RLA                                sign; put full 16-bit
```

PW-1080A or B NLQ MATRIX
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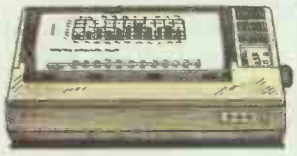
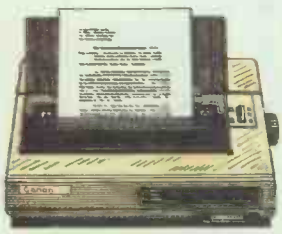
Speed: 160cps (Draft), 30cps (NLQ).
Columns: 80.
Compatibility: A = Epson. B = IBM.
Price: £349.



A55 NLQ MATRIX
This attractive NLQ printer offers low cost with high performance.
Speed: 180cps (Draft), 34cps (NLQ).
Columns: 156.
Compatibility: IBM/Epson.
Price: £499.



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A new range of fast, highly competitive printers offering superb word processing quality (WPQ) output.
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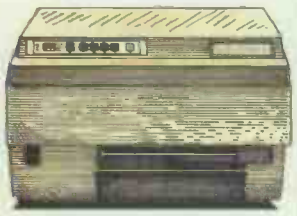
Compatibility: Epson.
Price: £499.



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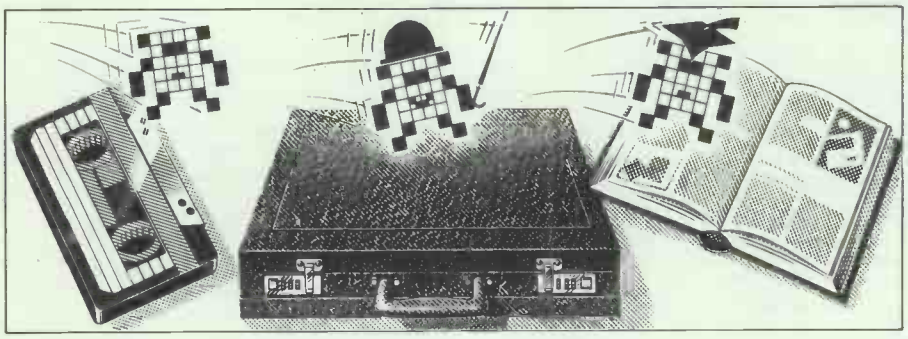
```
03C4 9F         SBC  A,A                        signed displacement into
03C5 47         LD   B,A                        BC.
03C6 EB         EX   DE,HL                      Move source pointer to HL,
03C7 E5         PUSH HL                         save it on stack, compute
03C8 09         ADD  HL,BC                      destination address & send
03C9 18 2D      JR   3F8H            <DHL>      to the output buffer.
*
03CB 1F         RRA                  CONDIT     Opcode bits 2-0 are not
03CC 1F         RRA                             needed for any of the
03CD 1F         RRA                             following modes (OPRND1).
03CE 10 13      DJNZ 3E3H            <BITNUM>   Is operand a condition?
03D0 CB 67      BIT  4,A                        If so, check whether the
03D2 20 02      JR   NZ,3D6H         <ABS>      address mode is relative
03D4 E6 03      AND  3                          or absolute. If relative,
03D6 E6 07      AND  7               ABS        adjust condition index.
03D8 C6 14      ADD  A,14H                      Index condition in table.
03DA 18 36      JR   412H            <PS1>      Copy it to output buffer.
*
03DC 10 0D      DJNZ 3EBH            DAT8       Is operand immediate byte?
*
03DE CD E7 04   CALL 4E7H            D8   <FETCH>  Fetch a byte.
03E1 18 04      JR   3E7H            <DA>       Send to output buffer.
*
03E3 10 27      DJNZ 40CH            BITNUM <INTMOD> Is operand a bit number?
03E5 E6 07      AND  7                          Yes; isolate bit index.
*
03E7 4F         LD   C,A             DA         Move 8-bit data for output
03E8 97         SUB  A                          from A into AC (so A=0)
03E9 18 09      JR   3F4H            <DAC>      and send to output buffer.
03EB 10 38      DJNZ 425H            DAT16 <EXAF>  Is operand an address?
*
03ED CD E7 04   CALL 4E7H            D16  <FETCH>  Fetch low-order byte.
03F0 4F         LD   C,A                        Save it in C.
03F1 CD E7 04   CALL 4E7H            <FETCH>    Fetch high-order byte.
*
03F4 EB         EX   DE,HL           DAC        Exchange source & output
03F5 E5         PUSH HL                         pointers. Save the source
03F6 67         LD   H,A                        pointer & copy output data
03F7 69         LD   L,C                        from AC into HL.
*
03F8 0E F8      LD   C,0F8H          DHL        Specify hex conversion.
03FA E5         PUSH HL                         Save output for checking.
03FB CD 26 05   CALL 526H            <CONVHL>   Perform ASCII conversion.
03FE E1         POP  HL                         retrieve output value.
*
03FF 01 0A 00   LD   BC,0AH                     Check whether the value
0402 B7         OR   A                          output was greater than 9.
0403 ED 42      SBC  HL,BC                      Result of test in in Cy.
*
0405 E1         POP  HL                         Restore source & output
0406 EB         EX   DE,HL                      pointers to their original
0407 D8         RET  C                          registers. Exit if output
0408 36 48      LD   (HL),48H                   value was 9 or less; else
040A 23         INC  HL                         put "H" (denoting hex)
040B C9         RET                             after the output & exit.
*
040C 10 06      DJNZ 414H            INTMOD <STKTOP> Is operand interrupt mode?
040E E6 03      AND  3                          Index the list of
0410 C6 1C      ADD  A,1CH                      interrupt modes (0,1,2).
0412 18 52      JR   466H            PS1  <PS3>    Copy to output buffer.
*
0414 0E 13      LD   C,13H           STKTOP     The constant operand (SP)
0416 05         DEC  B                          is entry number 19 in the
0417 28 4C      JR   Z,465H          <PS2>      RGSTRS table.
*
0419 10 42      DJNZ 45DH            REG16P <COMMON> Is operand register pair?
041B 1F         RRA                             Isolate the 2 bits of the
041C E6 03      AND  3                          opcode which determine the
041E FE 03      CP   3                          pair. Is it AF?
0420 20 68      JR   NZ,48AH         <RX>       No; go to double register.
0422 3D         DEC  A                          Yes; adjust pointer.
0423 18 69      JR   48EH            <RNX>      Copy out register name.
*
0425 0E 0A      LD   C,0AH           EXAF       The constant operand
0427 05         DEC  B                          AF,AF' is entry number 10
0428 28 3B      JR   Z,465H          <PS2>      in the RGSTRS table.
*
042A 0C         INC  C               EXDE       The constant operand DE,HL
042B 05         DEC  B                          is entry number 11 in
042C 28 37      JR   Z,465H          <PS2>      the RGSTRS table.
*
042E 10 2A      DJNZ 45AH            REG8S <ACCUM>  Is operand 8-bit source?
*
0430 E6 07      AND  7               R8         Get register number.
0432 FE 06      CP   6                          Is it a memory location?
0434 20 30      JR   NZ,466H         <PS3>      No; so it's B/C/D/E/H/L/A.
0436 36 28      LD   (HL),28H                   Yes; put left parenthesis
0438 23         INC  HL                         into the output buffer.
0439 CD 9E 04   CALL 49EH            <REGX>     Copy register HL/IX/IY.
043C DD 7E 02   LD   A,(IX+2)                   Retrieve offset; check if
043F B7         OR   A                          it is zero. If so, don't
0440 28 58      JR   Z,49AH          <RP>       bother to print it.
0442 36 2B      LD   (HL),2BH                   Otherwise, put a "+" sign
0444 07         RLCA                            into output buffer, but
0445 0F         RRCA                            now test the offset sign.
0446 30 04      JR   NC,44CH         <POS>      If negative, change the
0448 36 2D      LD   (HL),2DH                   sign to "-" and negate
044A ED 44      NEG                             the offset.
*
044C 23         INC  HL              POS        Update the output pointer.
044D EB         EX   DE,HL                      Exchange pointers, saving
044E E5         PUSH HL                         source pointer on stack.
044F 60         LD   H,B                        Put the absolute value
0450 6F         LD   L,A                        of the offset into HL.
0451 0E FB      LD   C,0FBH                     Specify decimal and
0453 CD 26 05   CALL 526H            <CONVHL>   perform ASCII conversion.
0456 E1         POP  HL                         Restore pointers to their
0457 EB         EX   DE,HL                      original registers.
0458 18 40      JR   49AH            <RP>       Go put right parenthesis.
*
045A 1F         RRA                  ACCUM      Opcode bits 2-0 can now
045B 1F         RRA                             be discarded by OPRND2.
045C 1F         RRA
*
045D 0E 07      LD   C,7             COMMON     OPRND1 and OPRND2 merge.
045F 05         DEC  B                          Accumulator addressing;
```

```
0460 28 03      JR   Z,465H          <PS2>      put "A" to output buffer.
*
0462 0D         DEC  C               PORTC      Constant operand "(C)" is
0463 10 03      DJNZ 468H            <IDAT8>    entry number 6 in RGSTRS.
0465 79         LD   A,C             PS2        Copy string number into A.
0466 18 3B      JR   4A3H            PS3  <PS4>    Go copy out the string.
*
0468 10 08      DJNZ 472H            IDAT8  <IDAT16> Is operand a constant port
046A 36 28      LD   (HL),28H                   number? If so, that's just
046C 23         INC  HL                         like an immediate byte but
046D CD DE 03   CALL 3DEH            <D8>       inside brackets.
0470 18 28      JR   49AH            <RP>       Close the brackets.
*
0472 10 08      DJNZ 47CH            IDAT16 <REG8>  Is operand an address for
0474 36 28      LD   (HL),28H                   data? That's just like a
0476 23         INC  HL                         CALL or JP address but
0477 CD ED 03   CALL 3EDH            <D16>      inside brackets.
047A 18 1E      JR   49AH            <RP>       Close the brackets.
*
047C 05         DEC  B               REG8       Use 8-bit source routine
047D 28 B1      JR   Z,430H          <R8>       for an 8-bit destination.
*
047F 10 04      DJNZ 485H            IPAREF <REG16>  Is operand I or R?
0481 E6 09      AND  9                          Yes; then copy the correct
0483 18 1E      JR   4A3H            <PS4>      string from RGSTRS.
*
0485 1F         RRA                  REG16      Is operand a
0486 10 0A      DJNZ 492H            <IREG16>   16-bit register?
*
0488 E6 03      AND  3               R16        Check for index register.
*
048A FE 02      CP   2               RX         if it's an index register,
048C 28 10      JR   Z,49EH          <REGX>     go use separate routine.
*
048E C6 0C      ADD  A,0CH           RNX        Not an index register;
0490 18 11      JR   4A3H            <PS4>      point to BC/DE/AF/SP.
*
0492 10 0A      DJNZ 49EH            IREG16 <REGX>  Is the operand an address
0494 36 28      LD   (HL),28H                   contained in a register?
0496 23         INC  HL                         Then just put brackets
0497 CD 88 04   CALL 488H            <R16>      round the result from R16.
*
049A 36 29      LD   (HL),29H        RP         Put right parenthesis in
049C 23         INC  HL                         output buffer, update
049D C9         RET                             pointer, then exit.
*
049E DD 7E 01   LD   A,(IX+1)        REGX       Use the index flag to
04A1 C6 10      ADD  A,10H                      select an index register.
*
04A3 EB         EX   DE,HL           PS4        Copy a string from RGSTRS.
04A4 E5         PUSH HL                         Exchange pointers; save
04A5 21 AE 04   LD   HL,4AEH         <RGSTRS>   source pointer; point HL
04A8 CD 11 05   CALL 511H            <XTRACT>   to start of table and
04AB E1         POP  HL                         copy out the string. Then
04AC EB         EX   DE,HL                      restore pointers to their
04AD C9         RET                             original registers, exit.
*
```

Fig 2

```
;
*
*   DISASSEMBLY LISTING OF DATA. The mnemonics and operands are meaningless.
*
*..."RGSTRS" - Table of constant strings used by OPRNDZ. The end of each
*...          string is marked by setting bit 7 of the last character.
*
*...Actual disassembly listing.    Added labels and comments.
*
04AE C2 C3 C4   JP   NZ,0C4C3H       RGSTRS     "B" "C" "D"   8-bit
04B1 C5         PUSH BC                          "E"           registers
04B2 C8         RET  Z                           "H"           B C D E H L
04B3 CC 28 43   CALL Z,4328H                     "L" "(C       (C) A I R
04B6 A9         XOR  C                           )"
04B7 C1         POP  BC                          "A"
04B8 C9         RET                              "I"
04B9 D2 41 46   JP   NC,4641H                    "R" "AF       exchange
04BC 2C         INC  L                           ,             special
04BD 41         LD   B,C                         A             operands
04BE 46         LD   B,(HL)                      F             AF,AF'
04BF A7         AND  A                           '"            DE,HL
04C0 44         LD   B,H                         "D
04C1 45         LD   B,L                         E
04C2 2C         INC  L                           ,
04C3 48         LD   C,B                         H
04C4 CC 42 C3   CALL Z,0C342H                    L" "BC"       16-bit
04C7 44         LD   B,H                         "D            registers
04C8 C5         PUSH BC                          E"            BC DE AF SP
04C9 41         LD   B,C                         "A            HL IX IY (SP)
04CA C6 53      ADD  A,53H                       F" "S
04CC D0         RET  NC                          P"
04CD 48         LD   C,B                         "H
04CE CC 49 D8   CALL Z,0D849H                    L" "IX"
04D1 49         LD   C,C                         "I
04D2 D9         EXX                              Y"
04D3 28 53      JR   Z,528H                      "(S
04D5 50         LD   D,B                         P
04D6 A9         XOR  C                           )"
04D7 4E         LD   C,(HL)                      "N            conditions
04DB DA DA 4E   JP   C,4EDAH                     Z" "Z" "N     NZ Z NC C
04DB C3 C3 50   JP   50C3H                       C" "C" "P     PO PE P M
04DE CF         RST  8                           O"
04DF 50         LD   D,B                         "P
04E0 C5         PUSH BC                          E"
04E1 D0         RET  NC                          "P"
04E2 CD B0 BF   CALL 0BFB0H                      "M" "0" "?"   Interrupt
04E5 B1         OR   C                           "1"           mode
04E6 B2         OR   D                           "2"           0 ? 1 2
*
;
```



- *Games*
- *Scientific/mathematic*
- *Business*
- *Toolkit/utilities*
- *Educational/Computer Aided Learning*

Making a hash of it

Owen Linderholm describes the advantages of hashing, and selects the best of this month's programs. For details on submitting your own, see the box below.

This month's programming technique, hashing, is essentially a quick method of indexing a large number of data items so that they can be found extremely quickly. The technique is useful because it is a relatively simple searching technique which is very fast, even with large amounts of data. Its problems are that space needs to be allocated in advance for storage; it is rather limited; and problems can occur with 'worst case' situations.

Hashing is particularly useful in languages like Basic where advanced data structures are not implemented. It provides a useful way of storing data in arrays in such a way that it can be retrieved easily. If you are storing information in an array and have to look through the information to find certain items, there are two standard techniques. If time isn't a problem, you can simply look through all the elements in the array one after another. Alternatively, you can sort all the elements when you insert new ones so that you can find items in the array immediately. This method involves lots of repositioning of old items to make space.

Hashing gets around this. Every data item is generated a simple code by a 'hashing algorithm'; the string is then inserted in the array at the point indicated by this code. The code needs to be generated in such a way that it produces a number that fits inside the array, and is different for each string or data item. This often turns out to be impossible, so some kind of 're-hashing' algorithm is required to produce another code if there is a clash.

Simple strings

This may all sound rather complicated, but I'll try to explain it using a simple string example. It's a good idea with hashing techniques to use data areas which are a prime number in size, because prime numbers can be used to produce well-scattered hash values. Many people have spent months of research on this problem and it isn't easy to summarise a solution. For this example I'll use a string array of 67 elements, so assume that there is an array created by DIM DTA$(67) to hold ordinary Basic strings of any length.

The hashing algorithm to be used is to add up all the ASCII values of the characters in the string and then take the modulus with 67 (hashval=asciitotal MOD67). If there is already a data item present with that hash value and re-hashing is necessary, then repeat the following formula until an empty space is found:

newhashval=(oldhashval+secondhashval) MOD 67, where
secondhashval=67−2−(asciitotal MOD 65).

This algorithm may seem long-winded and contrived, but is in fact based on research on hashing algorithms and is one of the most efficient methods that can be used.

Initially three strings, 'SmithJ', 'SmithL' and 'SmithK' are entered and are to be put into the array using hashing. Firstly, the string SmithJ is hashed. The total ASCII value is 83+109+105+116+104=517, so the hash value is 517 MOD 67 which is

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.

Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in). 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. If possible, please include printed sample output.

We will try to return submissions if they are accompanied by a stamped, addressed envelope of the appropriate size, but 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 Owen Linderholm, Program File, *PCW*, 32-34 Broadwick Street, London W1A 2HG.

55. Therefore, DTA$(55) is set to SmithJ (DTA$(55)=SmithJ). Similarly, the string SmithL is hashed and the value is 57, so DTA$(57) is set to SmithL. Finally, SmithK is hashed and inserted at DTA$(56) — easy so far, isn't it!

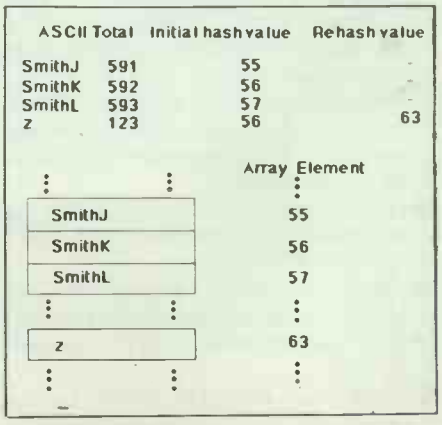
If you now want to search the data array to see if the string SmithL is there, you calculate the hash value — 57 — and look there. Sure enough, SmithL is there. But what if there is nothing there? In this case, SmithL is not among the data. What if there is another string there? You will have to keep looking by doing a re-hash. Let's try it.

We want to insert the simple string 'z' in the array. This produces a hash value of 56 (123 MOD 67), the same as SmithK, so we have to put it somewhere else. The re-hash algorithm is applied. The ASCII value of the string 'z' is 123, so the second hashvalue is 67-2-(123 MOD 65) which is 7. Now the new hashvalue is (56+7) MOD 67, which is 63, so 'z' is inserted at DTA $(63) (Fig 1).

If we now search the array for the string 'z', the first place we look is at the first hashvalue — 56. This is occupied by SmithK so we re-hash and get 63, and there is 'z'. If we had *not* inserted 'z' earlier, then this space would be empty and we could say that 'z' wasn't among the data. Alternatively, if 63 contained another string, we would have to keep re-hashing until we found 'z' or an empty space.

This may seem unnecessarily complex, but in practice it is a lot quicker than continually re-sorting the data.

There is one major drawback. What happens if the data array is almost full? Suppose that there are only 7 spaces left out of the 67 — there is a very slight chance that the routine will find an empty space, *and* it will take the rehash routine several tries to find an empty slot. This can completely ruin the speed advantage that hashing offers. The practical solution is to make sure you can allocate at least 20 per cent more space than you are going to need. Hashing isn't a good idea when memory space is important, but it is the best technique to use if there is memory to spare.



Conclusion

The Basic program example implements the above hashing and re-hashing technique for an array of strings, and provides simple insertion and searching. The actual algorithm used in hashing is extremely important, to avoid clashes and repetitions (continually looking in the same place). More information on hashing can be found in the excellent book *Algorithms* by Robert Sedgewick, published by Addison Wesley. Other good sources are Knuth's three volumes *The Art of Computer Programming*, also published by Addison Wesley; and *Data Structures and Algorithms* by Aho, Hopcroft and Ullman, published by — you guessed it — Addison Wesley.

```
      REM/MAIN CONTROL PROGRAM FOR HASHING. SETS UP STRING ARRAY
      REM/THEN CALLS INPUT CONTROL ROUTINE REPEATEDLY
      REM/VARIABLES USED:
      REM/     DTA$(..) - ARRAY TO HOLD STRING ITEMS
      REM/     C$ - COMMAND STRING
      REM/     X$ - DATA STRING TO INSERT OR LOOK FOR
      REM/     EM$ - MESSAGE STRING
      REM/     EMPTY - REACHED EMPTY SPACE IN ARRAY FLAG
      REM/     FOUND - FOUND ITEM IN ARRAY FLAG
      REM/     H1 - CURRENT HASHVALUE
      REM/     H2 - SECOND HASHVALUE FOR REHASHING
      REM/     AST - ASCII TOTAL FOR CURRENT STRING
1000 DIM DTA$(66)
      REM/SET UP ARRAY WITH 67 ELEMENTS (66+1 FOR ELT. 0)
1010 FOR X=0 TO 66:DTA$(X)=CHR$(255):NEXT X
      REM/FILL ARRAY WITH 'EMPTY' CHARACTER
1020 GOSUB 1100:GOTO 1020
      REM/REPEAT INPUT

      REM/INPUT ROUTINE - GETS COMMAND, THEN STRING AND CALLS THE
      REM/APPROPRIATE ROUTINE
1100 PRINT"Enter command - (S)earch or (I)nsert: ";
1120 INPUT C$:IF (C$<>"S") AND (C$<>"I") THEN EM$="Invalid command":
      GOSUB 2000:GOTO 1100
1130 PRINT"Enter string: ";:INPUT X$
1140 IF C$="S" THEN GOSUB 1300
1150 IF C$="I" THEN GOSUB 1200
1160 RETURN

      REM/INSERTION ROUTINE. IT CALLS THE HASHING CONTROL ROUTINE
      REM/TO CHECK ON HASHVALUES. IF THE STRING IS ALREADY IN THE
      REM/ARRAY, THEN THE FOUND FLAG WILL HAVE BEEN SET, SO THE
      REM/MESSAGE 'ITEM ALREADY THERE' WILL BE DISPLAYED. OTHERWISE
      REM/AN EMPTY SPACE WILL HAVE BEEN FOUND AND THE STRING CAN BE
      REM/INSERTED. THE ONLY OTHER POSSIBILITY IS IF THE ARRAY IS FULL
      REM/THEN THE HASHING ROUTINE WILL GO INTO AN INDEFINITE LOOP,
      REM/UNABLE TO FIND A FREE SPACE.
1200 GOSUB 1400
1210 IF FOUND=1 THEN EM$="Item already there":GOSUB 2000:RETURN
1220 IF EMPTY=1 THEN DTA$(H1)=X$
1230 RETURN

      REM/THE SEARCH ROUTINE. THIS OPERATES SIMILARLY TO THE INSERT
      REM/ROUTINE EXCEPT THAT IF AN ITEM IS FOUND, A MESSAGE IS
      REM/PRINTED OUT ALONG WITH THE HASH VALUE/POSITION IN ARRAY.
1300 GOSUB 1400
1310 IF FOUND=1 THEN EM$="Item found at position: "+STR$(H1):
      GOSUB 2000:RETURN
1320 IF EMPTY=1 THEN EM$="Item not there":GOSUB 2000
1330 RETURN

      REM/HASH CONTROL ROUTINE. THIS REPEATS THE HASHING AND REHASHING
      REM/ROUTINES UNTIL EITHER FOUND IS TRUE OR EMPTY IS TRUE. THIS
      REM/IS DONE BY FIRST CALLING THE ASCII TOTAL ROUTINE. THEN THE
      REM/INITIAL HASHING ROUTINE IS CALLED. NEXT, THE LOOKUP ROUTINE
      REM/IS CALLED TO CHECK THE ENTRY IN THE ARRAY AT THE CURRENT
      REM/HASHVALUE. IF FOUND OR EMPTY ARE SET, THEN THE ROUTINE
      REM/ENDS, OTHERWISE THE REHASH ROUTINE IS CALLED AND THIS
      REM/ROUTINE LOOPS BACK TO CALLING THE LOOKUP ROUTINE.
1400 GOSUB 1900     :REM/CALL ASCII TOTAL
1410 GOSUB 1800     :REM/CALL HASH
1420 GOSUB 1500     :REM/CALL LOOKUP
1430 IF FOUND=1 THEN RETURN       :REM/IF FOUND END
1440 IF EMPTY=1 THEN RETURN       :REM/IF EMPTY END
1450 GOSUB 1600     :REM/CALL REHASH
1460 GOTO 1420      :REM/LOOP BACK TO CALL LOOKUP
1470 RETURN

      REM/LOOKUP ROUTINE. THIS CHECKS THE CONTENTS OF THE ARRAY AT
      REM/THE CURRENT HASHVALUE POSITION
1500 FOUND=0:EMPTY=0                    :REM/INITIALISE FLAGS
1510 IF DTA$(H1)=X$ THEN FOUND=1     :REM/IF ITEM ALREADY THERE SET FOUND
1520 IF DTA$(H1)=CHR$(255) THEN EMPTY=1 :REM/IF NO ITEM THERE SET EMPTY
1530 RETURN

      REM/REHASH ROUTINE. CALLS CALCULATE SECOND HASHVALUE AND
      REM/CALCULATES THE NEW HASHVALUE
1600 GOSUB 1700                         :REM/CALL SECOND HASHVALUE
1610 H1=(H1+H2) MOD 67:RETURN

      REM/SECONDHASH ROUTINE
1700 H2=67-2-(AST MOD 65):RETURN

      REM/HASH ROUTINE
1800 H1=AST MOD 67

      REM/ASCII TOTAL ROUTINE. ADDS UP THE ASCII VALUES OF THE
      REM/CHARACTERS IN THE CURRENT STRING
1900 AST=0
1910 FOR I=1 TO LEN(X$):AST=AST+ASC(MID$(X$,I,1)):NEXT I
1920 RETURN

      REM/OUTPUT MESSAGE ROUTINE
2000 PRINT:PRINT
2010 PRINT EM$
2020 BEEP
2030 RETURN
```

PROGRAM FILE

This month's programs

My apologies for the lack of variety in Program File last month. The CMOS RAM listings took up much more room than was originally planned. We'll make extra efforts to avoid this confusion in future and try to keep Program File a broad-based section of the magazine. Your contributions are very welcome.

The Program of the Month is a superb utility by Stephen Devine. Some readers may remember that we published his simple Basic Compiler for the Amstrad CPC range in the June 1986 issue — this program is of similar quality. It is called Amstrad In-Line Assembler and is exactly that. The program consists of a lot of data statements, but from now on, submissions using machine code from CPC owners will no longer need to include them. The data is also carefully checksummed.

Other programs include a desktop program for the Spectrum which features drop-down menus and windows. The windows and menus are controlled by a group of subroutines that can be used in your own programs. There are also programs for the BBC Micro and other machines.

Program of the Month
Amstrad CPC In-Line Assembler

by Stephen Devine

This program sets up a number of RSX commands which provide you with an in-line assembler facility similar to that found on BBC machines. The program should run on any of the Amstrad CPC range of computers.

This method of assembly offers considerable advantages over more traditional approaches of generating machine code routines for use with Basic programs. These usually involve the use of a separate assembler, in Basic or machine code, to generate the routines. These are then either loaded into the Basic program each time it is run, or converted into long lists of Data statements containing strings of apparently meaningless hex values. With this in-line assembler, machine code instructions can be freely interspersed with normal Basic statements. This means that time-saving machine code routines can be easily incorporated into Basic programs, and the fact that they are written in assembler means that they are easily readable and can be altered at any time. Speed of assembly is also very fast, at up to 60 instructions per second!

After typing in the program in Listing 1, you should save it to tape or disk and then RUN it. If all is well, the program will set up the necessary machine code in high memory and then automatically save it for you. (If you have made any typing errors in the Data statements, the program will inform you of them. You can then correct the offending line(s) and RUN the program again.)

The saved code contains all you need in order to use the assembler. When you subsequently want to use the assembler, just add the following line at the start of your Basic program:

```
MEMORY 39499 : LOAD "asm.bin",
  39500 : CALL 39500
```

This will load the assembler into memory and initialise all the RSXs ready for use.

The assembler uses 8080 mnemonics throughout, but additional commands are provided to enable all Z80 instructions to be used. All the available mnemonics are listed with the program beside their Z80 equivalents. Note that M, X+n and Y+n are used throughout in place of the Z80's (HL), (IX+n) and (IY+n).

In addition, the following special commands are provided:

IORG, addr Tells the assembler where in memory to put the generated code.

IPHASE, addr Used to asemble code at one address (as specified by the IORG command) which will later be loaded and run at the address specified with IPHASE. For example, you may wish to load an RSX way up at 40000, but you can't assemble it there directly since it would overwrite the assembler itself. Therefore, you would use something like:

```
MEMORY 29999
IORG, 30000
IPHASE, 40000
```

and then save the assembled code using:

```
SAVE "filename. bin", b ,30000,
  length
```

and later re-load it with:

```
LOAD "filename. bin", 40000
```

IDEFB or **IDB** Each is followed by a list of values (up to 32) which will be placed consecutively into memory as single bytes.

IDEFW or **IDW** Each is followed by a list of values (up to 32) which will be placed consecutively into memory as 16-bit words in Z80 byte-reversed format.

IDEFS, n or **IDS, n** Used to reserve a space of n bytes in the code generated. Note that this space is simply skipped by the assembler — it is *not* initialised to zero.

IDEFM or IDM Followed by a quoted string (6128 only) or the address of a previously initialised string variable, it inserts the specified string into memory.

IDEFC OR IDC As above, except that the very last character of the string is stored with the high bit set.

ILABEL,@var or **IDEFL, @var** or **IDL, @var** Used to assign the current assembly address to the specified Basic variable. (The variable must be previously defined and should not be used in any other ILABEL command.)

IEND Used to signal the end of the assembly.

IEND,@var As above, but loads the specified variable with the address of the next free byte after the generated code. Thus, it is equivalent to writing ILABEL,@var : IEND and, as with ILABEL, the variable must be previously defined.

IDISPLAY or **IDISPLAY, 1** This command causes the message 'Assembling at &nnnn' to appear onscreen. All subsequent commands will update the displayed value as assembly progresses, which provides useful confirmation that the assembly is still proceeding and indicates where the code is being placed. If this display option is still active when an IEWND command is met, then the program will automatically display the start and end addresses of the generated code and its total size in bytes. Note that all displayed values are in hex.

IDISPLAY, 0 This command turns off the above screen display, if active. Note that the IEND command does this automatically.

The demonstration program shown in Listing 2 illustrates how to use the assembler. The important points to note are as follows:

- Only integer variables should be used throughout, hence the DEFINT a-z in Line 40.
- Space should be reserved for the machine code to be generated by setting the top of memory as shown in line 60.
- Lines 100 and 110 must be in-

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PROGRAM FILE

cluded in any program since they initialise the necessary register constants for the program to work.

- All labels used in the assembler must first be declared, as in line 120.
- The assembler statements should all be executed twice (lines 180 and 350) to make sure that all forward-referenced labels are assigned the correct address.
- All programs must have an IORG command and this must be executed before any other command.
- If an IPHASE command is used, it must immediately follow the IORG command.
- Multiple commands are allowed on a line.
- Comments may be included using the normal Basic ' or REM.
- Conditional assembly is possible using IF . . . THEN statements; or IF . . . THEN . . . ELSE statements for short pieces of code on a single line; or WHILE . . . WEND structures for more substantial amounts of code.
- Limited macro facilities are possible using Basic's GOSUB command, and repeat operations can be assembled using FOR . . . NEXT structures.

It is also possible to use the assembler from the command level without having to construct a program. For instance, try entering the following:

```
MEMORY 29999
A =7
IORG, 30000
IMVI, A,224
ICALL, &BB5A
IRET
IEND
```

Now type:

```
CALL 30000
```

and you should see a smiling face appear on the screen! However, this method of entering code is not really recommended, even for very short programs, since it is much too easy to make a mistake. It is far better to write a proper program and save it to tape or disk before assembling and running it.

If desired, the names of any of the commands can be altered simply by changing the entries in lines 3000 to 3250 in Listing 1 and then re-running the program. However, ensure that no names are removed or added and that the entries remain in exactly the same order as in the original listing. Also, each name should only contain valid RSX characters such as A to Z.

```
   10 REM Assembler Demo Program
   20 REM ======================
   30 '
   40 DEFINT a-z  : REM Use integer variables throughout.
   50 start=30000 : REM Address to assemble machine-code.
   60 MEMORY start-1 : REM Reserve space for machine-code.
   70 LOAD"asm.bin",39500 : REM LOAD assembler into high memory.
   80 CALL 39500 : REM Set up RSX commands.
   90 REM Initialize register constants.
  100 B=0 : C=1 : D=2 : E=3 : H=4 : L=5 : M=6 : A=7
  110 X=384 : Y=640 : PSW=7 : SP=6
  120 loop=0 : REM Initialize label used in assembly listing.
  130 setmode=&BC0E : scrnmode=1 : REM Define some constants.
  140 '
  150 REM Demonstration routine to display ASCII character set.
  160 REM ------------------------------------------------------
  170 '
  180 FOR pass=1 TO 2
  190   PRINT"PASS";pass
  200   IF pass=1 THEN !DISPLAY,0 ELSE !DISPLAY,1
  210 '
  220   !ORG,start
  230   !MVI,a,scrnmode                 'Set the
  240   !CALL,setmode                   'screen mode.
  250   !MVI,a,ASC(" ")                 'Initialize 1st character
  260   !MVI,b,128-ASC(" ")             'and character count.
  270 '
  280 !LABEL,@loop
  290   !CALL,&BB5A                     'Display character
  300   !INR,a                          'and move to next one.
  310   !DJNZ,loop                      'Continue until all done.
  320   !RET                            'Return to BASIC.
  330   !END
  340 '
  350 NEXT pass
  360 PRINT"Type CALL";start;"to run machine code." : PRINT
  370 END

   10 REM Amstrad in-line assembler
   20 REM  (C) 1987 Stephen Devine
   30 '
   40 DEFINT a-z
   50 start=&9A4C      'Load address for RSX (39500 decimal)
   60 MEMORY start-1   'Reserve space for RSX
   70 '
   80 PRINT : PRINT "Running..."
   90 address=start
  100 FOR dataline=1000 TO 2310 STEP 10
  110   sum=0
  120   FOR byte=1 TO 16
  130     READ a$ : num=VAL("&"+a$)
  140     POKE address,num : address=address+1
  150     sum=sum+num
  160   NEXT byte
  170   READ checksum
  180   IF sum()checksum THEN PRINT "Checksum Error in line";dataline : a
bort=-1
  190 NEXT dataline
  200 IF abort THEN PRINT "Please correct offending line(s) and re-RUN t
he program." : END
  210 '
  220 address=address-5
  230 FOR command=1 TO 161
  240   READ word$ : word$=UPPER$(word$)
  250   FOR letter=1 TO LEN(word$)-1
  260     POKE address,ASC(MID$(word$,letter))
  270     address=address+1
```

PROGRAM FILE

```
280   NEXT letter
290   POKE address,ASC(RIGHT$(word$,1))+128
300   address=address+1
310 NEXT command
320 POKE address,0 : address=address+1
330 '
340 PRINT"Machine code loaded ok."
350 CALL start
360 PRINT : PRINT "Saving RSX..."
370 SAVE "asm.bin",b,start,address-start
380 PRINT"Saved ok." : PRINT
390 END
400 '
1000 DATA 01,5A,9A,21,56,9A,CD,D1,BC,C9,00,00,00,00,87,A2,1618
1010 DATA C3,3F,9C,C3,52,9C,C3,6A,9C,C3,5C,9C,C3,5C,9C,C3,2385
1020 DATA 5C,9C,C3,B4,9C,C3,B4,9C,C3,D5,9C,C3,D5,9C,C3,FC,2885
1030 DATA 9C,C3,FC,9C,C3,13,9D,C3,13,9D,C3,37,9D,C3,37,9D,2315
1040 DATA C3,EC,9D,C3,0F,9E,C3,13,9E,C3,17,9E,C3,1B,9E,C3,2279
1050 DATA 1F,9E,C3,23,9E,C3,27,9E,C3,2B,9E,C3,2F,9E,C3,33,2011
1060 DATA 9E,C3,37,9E,C3,3B,9E,C3,3F,9E,C3,43,9E,C3,47,9E,2238
1070 DATA C3,4B,9E,C3,4F,9E,C3,53,9E,C3,57,9E,C3,5B,9E,C3,2375
1080 DATA 5F,9E,C3,63,9E,C3,67,9E,C3,6B,9E,C3,6F,9E,C3,73,2395
1090 DATA 9E,C3,77,9E,C3,7B,9E,C3,7F,9E,C3,83,9E,C3,87,9E,2558
1100 DATA C3,8B,9E,C3,8F,9E,C3,93,9E,C3,97,9E,C3,9B,9E,C3,2695
1110 DATA 9F,9E,C3,A3,9E,C3,A7,9E,C3,AB,9E,C3,AF,9E,C3,B3,2779
1120 DATA 9E,C3,B7,9E,C3,BB,9E,C3,BF,9E,C3,C3,9E,C3,C7,9E,2878
1130 DATA C3,CB,9E,C3,CF,9E,C3,D3,9E,C3,D7,9E,C3,DB,9E,C3,3015
1140 DATA DF,9E,C3,E3,9E,C3,E7,9E,C3,EB,9E,C3,EF,9E,C3,F3,3163
1150 DATA 9E,C3,F7,9E,C3,FB,9E,C3,FF,9E,C3,03,9F,C3,07,9F,2688
1160 DATA C3,0B,9F,C3,0F,9F,C3,13,9F,C3,17,9F,C3,1B,9F,C3,2060
1170 DATA 1F,9F,C3,23,9F,C3,27,9F,C3,2B,9F,C3,2F,9F,C3,33,2016
1180 DATA 9F,C3,37,9F,C3,3B,9F,C3,3F,9F,C3,43,9F,C3,47,9F,2244
1190 DATA C3,4B,9F,C3,4F,9F,C3,81,9F,C3,90,9F,C3,A5,9F,C3,2557
1200 DATA A9,9F,C3,AD,9F,C3,B1,9F,C3,DE,9F,C3,E5,9F,C3,EC,2976
1210 DATA 9F,C3,F0,9F,C3,F4,9F,C3,2A,A0,C3,40,A0,C3,44,A0,2590
1220 DATA C3,48,A0,C3,4C,A0,C3,50,A0,C3,54,A0,C3,58,A0,C3,2370
1230 DATA 5C,A0,C3,60,A0,C3,64,A0,C3,68,A0,C3,6C,A0,C3,70,2387
1240 DATA A0,C3,74,A0,C3,78,A0,C3,7C,A0,C3,80,A0,C3,84,A0,2555
1250 DATA C3,88,A0,C3,8C,A0,C3,90,A0,C3,94,A0,C3,98,A0,C3,2690
1260 DATA 9C,A0,C3,F6,A0,C3,28,A1,C3,2F,A1,C3,33,A1,C3,37,2373
1270 DATA A1,C3,3B,A1,C3,48,A1,C3,5B,A1,C3,64,A1,C3,6D,A1,2366
1280 DATA C3,7F,A1,C3,86,A1,C3,8A,A1,C3,B0,A1,C3,B4,A1,C3,2730
1290 DATA B8,A1,C3,BC,A1,C3,C0,A1,C3,C4,A1,C3,C9,A1,C3,CE,2947
1300 DATA A1,C3,D2,A1,C3,D6,A1,C3,DA,A1,C3,DE,A1,C3,E3,A1,3032
1310 DATA C3,E8,A1,DD,6E,00,DD,66,01,22,81,A2,22,85,A2,3A,1955
1320 DATA 7F,A2,B7,C4,A1,9D,DD,6E,00,DD,66,01,22,83,A2,C9,2169
1330 DATA ED,5B,83,A2,DD,6E,00,DD,66,01,73,23,72,C9,ED,5B,2069
1340 DATA 85,A2,B7,C4,60,9C,3A,7F,A2,B7,C8,AF,32,7F,A2,21,2203
1350 DATA C7,9D,CD,A8,9D,2A,81,A2,E5,CD,80,9D,21,D3,9D,CD,2544
1360 DATA A8,9D,2A,85,A2,E5,CD,80,9D,21,DD,9D,CD,A8,9D,E1,2547
1370 DATA D1,B7,ED,52,CD,80,9D,21,E7,9D,CD,A8,9D,C9,47,18,2448
1380 DATA 04,DD,23,DD,23,10,FA,C9,B7,C8,CD,AA,9C,2A,85,A2,2234
1390 DATA ED,5B,83,A2,47,DD,7E,00,77,13,23,DD,2B,DD,2B,10,1756
1400 DATA F4,22,85,A2,ED,53,83,A2,C9,B7,C8,CD,AA,9C,2A,85,2476
1410 DATA A2,ED,5B,83,A2,47,DD,7E,00,77,23,DD,7E,01,77,23,1857
1420 DATA 13,13,DD,2B,DD,2B,10,EE,22,85,A2,ED,53,83,A2,C9,1963
1430 DATA B7,C8,DD,5E,00,DD,56,01,2A,83,A2,19,22,83,A2,2A,1735
1440 DATA 85,A2,19,22,85,A2,C9,B7,C8,DD,6E,00,DD,66,01,7E,2014
1450 DATA B7,C8,23,5E,23,56,4F,06,00,2A,83,A2,09,22,83,A2,1389
1460 DATA 2A,85,A2,EB,ED,B0,ED,53,85,A2,C9,B7,C8,DD,6E,00,2515
1470 DATA DD,66,01,7E,B7,C8,23,5E,23,56,4F,06,00,2A,83,A2,1503
1480 DATA 09,22,83,A2,2A,85,A2,EB,ED,B0,ED,53,85,A2,EB,2B,2214
1490 DATA CB,FE,C9,F5,1F,1F,1F,1F,E6,0F,FE,0A,38,02,C6,07,1799
1500 DATA C6,30,CD,5A,BB,F1,E6,0F,FE,0A,38,02,C6,07,C6,30,1987
1510 DATA CD,5A,BB,C9,7C,CD,5F,9D,7D,CD,5F,9D,C9,3E,08,CD,2322
1520 DATA 5A,BB,3E,08,CD,5A,BB,3E,08,CD,5A,BB,3E,08,CD,5A,1746
1530 DATA BB,CD,80,9D,C9,2A,85,A2,CD,89,9D,C9,7E,B7,C8,CD,2629
1540 DATA 5A,BB,23,18,F7,0D,0A,41,73,73,65,6D,62,6C,69,6E,1532
1550 DATA 67,20,61,74,3A,26,20,20,20,20,00,0D,0A,0D,0A,53,701
1560 DATA 74,61,72,74,3A,26,00,0D,0A,20,20,45,6E,64,3A,26,1001
1570 DATA 00,0D,0A,20,53,69,7A,65,3A,26,00,0D,0A,0D,0A,00,608
1580 DATA 21,7F,A2,B7,28,11,DD,7E,00,DD,B6,01,20,09,36,00,1408
1590 DATA 21,E9,9D,CD,A8,9D,C9,36,01,21,B1,9D,CD,A8,9D,CD,2311
1600 DATA A1,9D,C9,CD,16,A2,3F,CD,16,A2,2F,CD,16,A2,27,CD,2040
1610 DATA 16,A2,F3,CD,16,A2,FB,CD,16,A2,03,CD,16,A2,EB,CD,2293
1620 DATA 16,A2,E3,CD,16,A2,D9,CD,16,A2,76,CD,16,A2,E9,CD,2351
1630 DATA 16,A2,F9,CD,16,A2,00,CD,16,A2,37,CD,16,A2,C9,CD,2061
1640 DATA 16,A2,17,CD,16,A2,07,CD,16,A2,1F,CD,16,A2,0F,CD,1632
1650 DATA 16,A2,C0,CD,16,A2,C8,CD,16,A2,D0,CD,16,A2,D8,CD,2372
1660 DATA 16,A2,E0,CD,16,A2,E8,CD,16,A2,F0,CD,16,A2,F8,CD,2500
1670 DATA 3D,A2,E3,CD,41,A2,E3,CD,3D,A2,E9,CD,41,A2,E9,CD,2640
1680 DATA 3D,A2,F9,CD,41,A2,F9,CD,37,A2,A1,CD,37,A2,A9,CD,2532
1690 DATA 37,A2,B1,CD,37,A2,B9,CD,37,A2,A2,CD,37,A2,AA,CD,2382
1700 DATA 37,A2,B2,CD,37,A2,BA,CD,37,A2,47,CD,37,A2,4F,CD,2202
1710 DATA 37,A2,57,CD,37,A2,5F,CD,37,A2,A0,CD,37,A2,A8,CD,2198
1720 DATA 37,A2,B0,CD,37,A2,B8,CD,37,A2,44,CD,37,A2,A3,CD,2279
1730 DATA 37,A2,AB,CD,37,A2,B3,CD,37,A2,BB,CD,37,A2,45,CD,2294
1740 DATA 37,A2,4D,CD,37,A2,6F,CD,37,A2,67,CD,EC,A1,80,CD,2287
1750 DATA EC,A1,88,CD,EC,A1,A0,CD,EC,A1,B8,CD,EC,A1,B0,CD,3064
1760 DATA EC,A1,90,CD,EC,A1,98,CD,EC,A1,A8,CD,1A,A2,C6,CD,2861
1770 DATA 1A,A2,CE,CD,1A,A2,E6,CD,1A,A2,FE,CD,1A,A2,F6,CD,2508
1780 DATA 1A,A2,D6,CD,1A,A2,DE,CD,1A,A2,EE,0E,10,18,18,0E,1740
1790 DATA 00,18,14,0E,18,18,10,0E,08,18,0C,0E,20,18,08,0E,272
1800 DATA 28,18,04,0E,38,18,00,DD,CB,01,46,28,05,CD,4D,A2,1146
1810 DATA 18,09,DD,CB,01,4E,28,13,CD,51,A2,CD,45,A2,DD,7E,1826
1820 DATA 00,D6,80,57,3E,06,81,5F,C3,62,A2,CD,45,A2,DD,7E,1959
1830 DATA 00,81,C3,55,A2,DD,7E,00,FE,08,30,03,87,87,87,C6,1834
1840 DATA C7,C3,55,A2,DD,7E,00,B7,20,04,CD,37,A2,46,3D,20,1792
1850 DATA 04,CD,37,A2,56,CD,37,A2,5E,CD,1A,A2,DB,CD,1A,A2,2033
1860 DATA D3,0E,05,18,02,0E,04,DD,CB,01,46,28,05,CD,4D,A2,1258
1870 DATA 18,09,DD,CB,01,4E,28,10,CD,51,A2,3E,30,81,57,DD,1587
1880 DATA 7E,00,D6,80,5F,C3,62,A2,DD,7E,00,87,87,87,81,C3,2094
1890 DATA 55,A2,CD,49,A2,0E,40,18,EF,CD,49,A2,0E,41,18,E8,1803
1900 DATA 0E,40,18,06,0E,80,18,02,0E,C0,DD,46,00,DD,CB,01,1198
1910 DATA 46,28,05,CD,4D,A2,18,09,DD,CB,01,4E,28,12,CD,51,1439
1920 DATA A2,CD,45,A2,DD,7E,00,D6,80,CD,55,A2,06,06,18,03,1778
1930 DATA CD,45,A2,DD,7E,02,87,87,87,81,80,C3,55,A2,0E,10,1919
1940 DATA DD,6E,00,DD,66,01,ED,5B,83,A2,B7,ED,52,2B,2B,51,1945
1950 DATA 5D,C3,62,A2,0E,18,18,E8,0E,20,18,E4,0E,28,18,E0,1442
1960 DATA 0E,30,18,DC,0E,38,18,D8,CD,21,A2,CD,CD,21,A2,C4,1817
1970 DATA CD,21,A2,CC,CD,21,A2,D4,CD,21,A2,DC,CD,21,A2,E4,2464
1980 DATA CD,21,A2,EC,CD,21,A2,F4,CD,21,A2,FC,CD,21,A2,C3,2527
1990 DATA CD,21,A2,C2,CD,21,A2,CA,CD,21,A2,D2,CD,21,A2,DA,2424
2000 DATA CD,21,A2,E2,CD,21,A2,EA,CD,21,A2,F2,CD,21,A2,FA,2552
2010 DATA 0E,40,DD,CB,03,46,28,05,CD,4D,A2,18,09,DD,CB,03,1524
2020 DATA 4E,28,13,CD,51,A2,3E,30,81,DD,86,00,57,DD,7E,02,1615
2030 DATA D6,80,5F,C3,62,A2,DD,CB,01,46,28,05,CD,4D,A2,18,1900
2040 DATA 09,DD,CB,01,4E,28,16,CD,51,A2,DD,7E,02,87,87,87,1776
2050 DATA 81,C6,06,57,DD,7E,00,D6,80,5F,C3,62,A2,DD,7E,02,2008
2060 DATA 87,87,87,81,DD,86,00,C3,55,A2,DD,CB,03,46,28,04,1872
2070 DATA 16,DD,18,08,DD,CB,03,4E,28,13,16,FD,1E,36,CD,62,1501
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PROGRAM FILE

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2080 DATA A2,DD,7E,02,D6,80,57,DD,5E,00,C3,62,A2,DD,7E,02,2059
2090 DATA 87,87,87,C6,06,57,DD,5E,00,C3,62,A2,CD,49,A2,0E,1920
2100 DATA 4A,18,5F,0E,09,18,5B,0E,0B,18,57,0E,03,18,53,0E,605
2110 DATA C1,DD,7E,00,FE,07,20,4A,CD,16,A2,F1,0E,C5,DD,7E,2035
2120 DATA 00,FE,07,20,3D,CD,16,A2,F5,CD,4D,A2,DD,CB,01,46,1927
2130 DATA 0E,09,3E,04,20,47,18,42,CD,51,A2,DD,CB,01,4E,18,1257
2140 DATA EF,DD,23,DD,23,0E,01,CD,8E,A1,DD,56,FE,DD,5E,FF,2405
2150 DATA C3,62,A2,CD,49,A2,0E,42,18,08,0E,02,18,04,0E,0A,1075
2160 DATA 18,00,DD,CB,01,46,28,05,CD,4D,A2,18,09,DD,CB,01,1466
2170 DATA 4E,28,07,CD,51,A2,DD,36,00,04,DD,7E,00,87,87,87,1604
2180 DATA 81,C3,55,A2,CD,21,A2,3A,CD,21,A2,32,CD,2E,A2,4B,1967
2190 DATA CD,2E,A2,5B,CD,21,A2,2A,CD,4D,A2,18,F7,CD,51,A2,2109
2200 DATA 18,F2,CD,2E,A2,7B,CD,2E,A2,43,CD,2E,A2,53,CD,21,2016
2210 DATA A2,22,CD,4D,A2,18,F7,CD,51,A2,18,F2,CD,2E,A2,73,2153
2220 DATA DD,CB,01,46,28,05,CD,4D,A2,18,09,DD,CB,01,4E,28,1560
2230 DATA 11,CD,51,A2,E1,3E,06,86,57,DD,7E,00,D6,80,5F,C3,1958
2240 DATA 62,A2,E1,DD,7E,00,86,C3,55,A2,E1,7E,18,3B,E1,56,2153
2250 DATA DD,5E,00,18,41,E1,7E,CD,55,A2,DD,56,00,DD,5E,01,1830
2260 DATA 18,34,E1,5E,16,ED,CD,62,A2,18,EF,16,ED,E1,5E,18,1984
2270 DATA 25,16,DD,18,F8,16,FD,18,F4,3E,CB,18,0C,3E,ED,18,1719
2280 DATA 08,3E,DD,18,04,3E,FD,18,00,2A,85,A2,77,23,22,85,1316
2290 DATA A2,2A,83,A2,18,10,2A,85,A2,72,23,73,23,22,85,A2,1502
2300 DATA 2A,83,A2,18,00,23,23,22,83,A2,3A,7F,A2,B7,C8,CD,1691
2310 DATA A1,9D,C9,00,00,00,00,00,00,00,00,4F,52,C7,50,48,1031
2320 '
3000 DATA "ORG","PHASE","END","LABEL","DEFL","DL","DEFB","DB"
3010 DATA "DEFW","DW","DEFS","DS","DEFM","DM","DEFC","DC","DISPLAY"
3020 DATA "CMC","CMA","DAA","DI","EI","XPSW","XCHG","XTHL"
3030 DATA "EXX","HLT","PCHL","SPHL","NOP","STC","RET"
3040 DATA "RAL","RLCA","RAR","RRCA"
3050 DATA "RNZ","RZ","RNC","RC","RPO","RPE","RP","RM"
3060 DATA "XTIX","XTIY","PCIX","PCIY","SPIX","SPIY"
3070 DATA "CPIC","CPDC","CPIR","CPDR","INI","IND","INIR","INDR"
3080 DATA "LDIA","LDRA","LDAI","LDAR","LDI","LDD","LDIR","LDDR"
3090 DATA "NEG","OUTI","OUTD","OTIR","OTDR","RETN","RETI"
3100 DATA "RLD","RRD"
3110 DATA "ADD","ADC","ANA","CMP","ORA","SUB","SBB","XRA"
3120 DATA "ADI","ACI","ANI","CPI","ORI","SUI","SBI","XRI"
3130 DATA "RL","RLC","RR","RRC","SLA","SRA","SRL"
3140 DATA "RST","IM","IN","OUT","DCR","INR","INBC","OTBC"
3150 DATA "BIT","RES","SET"
3160 DATA "DJNZ","JR","JRNZ","JRZ","JRNC","JRC"
3170 DATA "CALL","CNZ","CZ","CNC","CC","CPO","CPE","CP","CM"
3180 DATA "JMP","JNZ","JZ","JNC","JC","JPO","JPE","JP","JM"
3190 DATA "MOV","MVI"
3200 DATA "DADC","DAD","DCX","INX"
3210 DATA "POP","PUSH"
3220 DATA "DADX","DADY"
3230 DATA "LXI","DSBB","STAX","LDAX","LDA","STA"
3240 DATA "LBCD","LDED","LHLD","LIXD","LIYD","LSPD"
3250 DATA "SBCD","SDED","SHLD","SIXD","SIYD","SSPD"
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Z80	8080	Z80	8080
ADC A,r	ADC r	LD A,(nn)	LDA nn
ADC A,n	ACI n	LD r1,r2	MOV r1,r2
ADC HL,dd	DADC dd	LD r,n	MVI r,n
ADD A,r	ADD r	LD A,I	LDAI
ADD A,n	ADI n	LD A,R	LDAR
ADD HL,dd	DAD dd	LD I,A	LDIA
ADD IX,dd	DADX dd	LD R,A	LDRA
ADD IY,dd	DADY dd	LD SP,HL	SPHL
AND r	ANA r	LD SP,IX	SPIX
AND n	ANI n	LD SP,IY	SPIY
BIT n,r	BIT n,r	LD dd,nn	LXI dd,nn
CALL nn	CALL nn	LD BC,(nn)	LBCD nn
CALL C,nn	CC nn	LD DE,(nn)	LDED nn
CALL M,nn	CM nn	LD HL,(nn)	LHLD nn
CALL NC,nn	CNC nn	LD IX,(nn)	LIXD nn
CALL NZ,nn	CNZ nn	LD IY,(nn)	LIYD nn
CALL P,nn	CP nn	LD SP,(nn)	LSPD nn
CALL PE,nn	CPE nn	LD (nn),BC	SBCD nn
CALL PO,nn	CPO nn	LD (nn),DE	SDED nn
CALL Z,nn	CZ nn	LD (nn),HL	SHLD nn
CCF	CMC	LD (nn),IX	SIXD nn
CP r	CMP r	LD (nn),IY	SIYD nn
CP n	CPI n	LD (nn),SP	SSPD nn
CPD	CPDC	LDD	LDD
CPDR	CPDR	LDDR	LDDR
CPI	CPIC	LDI	LDI
CPIR	CPIR	LDIR	LDIR
CPL	CMA	NEG	NEG
DAA	DAA	NOP	NOP
DEC r	DCR r	OR r	ORA r
DEC dd	DCX dd	OR n	ORI n
DI	DI	OTDR	OTDR
DJNZ n	DJNZ n	OTIR	OTIR

EI	EI	OUTD	OUTD
EX (SP),HL	XTHL	OUTI	OUTI
EX (SP),IX	XTIX	OUT (C),r	OTBC r
EX (SP),IY	XTIY	OUT (n),A	OUT n
EX AF,AF'	XPSW	POP dd	POP dd
EX DE,HL	XCHG	PUSH dd	PUSH dd
EXX	EXX	RES n,r	RES n,r
HALT	HLT	RET	RET
IM 0	IM 0	RET C	RC
IM 1	IM 1	RET M	RM
IM 2	IM 2	RET NC	RNC
IN A,(n)	IN n	RET NZ	RNZ
IN r,(C)	INBC r	RET P	RP
INC r	INR r	RET PE	RPE
INC dd	INX dd	RET PO	RPO
IND	IND	RET Z	RZ
INDR	INDR	RETI	RETI
INI	INI	RETN	RETN
INIR	INIR	RL r	RL r
JP nn	JMP nn	RLA	RAL
JP (HL)	PCHL	RLC r	RLC r
JP (IX)	PCIX	RLCA	RLCA
JP (IY)	PCIY	RLD	RLD
JP C,nn	JC nn	RR r	RR r
JP M,nn	JM nn	RRA	RAR
JP NC,nn	JNC nn	RRC r	RRC r
JP NZ,nn	JNZ nn	RRCA	RRCA
JP P,nn	JP nn	RRD	RRD
JP PE,nn	JPE nn	RST n	RST n
JP PO,nn	JPO nn	SBC A,r	SBB r
JP Z,nn	JZ nn	SBC A,n	SBI n
JR n	JR n	SBC HL,dd	DSBB dd
JR C,n	JRC n	SCF	STC
JR NC,n	JRNC n	SET n,r	SET n,r
JR NZ,n	JRNZ n	SLA r	SLA r
JR Z,n	JRZ n	SRA r	SRA r
LD (BC),A	STAX B	SRL r	SRL r
LD (DE),A	STAX D	SUB r	SUB r
LD (nn),A	STA nn	SUB n	SUI n
LD A,(BC)	LDAX B	XOR r	XRA r
LD A,(DE)	LDAX D	XOR n	XRI n

Z80

r: A B C D E H L (HL) (IX+n) (IY+n)

dd: AF BC DE HL IX IY SP

8080

r: A B C D E H L M X+n Y+n

dd: PSW B D H X Y SP

Spectrum Desktop and WIMP Routines

by L Ireland

This program provides windowing and menu routines, and so on, on the humble Spectrum. Who needs a Mac, anyway?

WIMP routines

This program uses a series of short, command-like subroutines. These commands, used in Listing B, are explained below:

DWINDOW NO,X,Y,D,W,G (lines 8180 to 8215)

This command sets a window at X,Y with depth D and width W for use by command GWINDOW. NO is

PROGRAM FILE

the window number and G indicates whether or not the area beneath the window is to be stored in memory for recall.

GWINDOW NO (lines 8220 to 8265)
This command displays the window defined by DWINDOW.

WHEAD NO (lines 8270 to 8320)
This command is used by GWINDOW to head the window with the text stored by DHEAD.

TOPBAR T$ (lines 8325 to 8390)
This command displays a pull-down-menu bar at the top of the screen and places T$ within it.

BOX NO (lines 8395 to 8440)
This command, used by GWINDOW, draws a box around window NO.

PBOX NO (lines 8445 to 8480)
This command, used by PULL, draws a box around menu NO.

MOVEPOINT X,Y (lines 8485 to 8585)
This command is the basis for all actions: it simply moves an arrow cursor around the screen.

MOVETO X,Y (lines 8590 to 8630)
This command just utilises MOVEPOINT until point X,Y is reached and fire is pressed.

DESK (lines 8635 to 8655)
This command just fills the screen with a shaded pattern.

DHEAD NO, T$ (lines 8660 to 8675)
This command defines a header T$ for window NO.

DPULL NO,Y,T$ (lines 8680 to 8730)
This command defines pull-menu NO, at column Y, containing items in T$. Each item should be separated by a '*'.

PULL NO (lines 8735 to 8790)
This command pulls the menu NO down.

MOVEBAR (lines 8795 to 8880)
This command moves a bar within the last menu pulled; the row number is returned in variable D.

SETUP (lines 8885 to 9065)
This should be called at the start of all programs and defines all arrays.

ATTR (lines 9125 to 9165)
This command fills a window with blank squares.

Other useful subroutines that are used by most programs

WAIT (lines 9070 to 9120)
This command displays a 'please wait' message.

SURE (lines 9170 to 9255)
This command requires a click over YES or NO, and defines variable YES and NO appropriately.

CALCULATOR (lines 9460 to 9770)
This is a four-function calculator.

NOTEBOOK (lines 9310 to 9455)
A notebook; exit by pressing ENTER.

The line numbers for the above commands should be defined as variables, as shown at the beginning of Listing A. Be sure to include them in all programs or they might not work properly.

The keys for all actions are Q-up, A-down, O-left, P-right and M-fire/select, although these can be changed by altering the appropriate line.

Where a Graphic is included in a PRINT statement, it means that all characters within those quotes should be entered in Graphic mode (CAPS+9).

Main program

Listing A shows the actual desktop program and can be split up as follows:

Lines 5 to 170 — set up variables, arrays, and so on. Must be included in all programs.
Lines 175 to 285 — set up pull-down menus.
Lines 290 to 350 — move pointer and jump to subroutines for each menu.
Lines 355 to 385 — select QUIT or VERSION and jump to routine.
Lines 390 to 950 — the routines for menu 2, erase, format, and so on.
Lines 955 to 1000 — menu 3, general input/output.
Lines 1005 to 1055 — menu 4, catalogue and load.
Lines 1060 to 1100 — final menu, notebook and calculator.

This program is meant for use with microdrives and could be altered to work with disk drives.

Listing A

Main program

```
  5 CLEAR 49999
 10 LET quit=8000
 15 LET version=8090
 20 LET dwindow=8180
 25 LET gwindow=8220
 30 LET whead=8270
 35 LET topbar=8325
 40 LET box=8395
 45 LET pbox=8445
 50 LET movepoint=8485
 55 LET moveto=8590
 60 LET desk=8635
 65 LET dhead=8660
 70 LET dpull=8680
 75 LET movebar=8795
 80 LET setup=8885
 85 LET attr=9125
 90 LET nobar=0
 95 LET pull=8735
100 LET wait=9070
105 LET store=50000
110 LET restore=50050
115 GO SUB setup
```

PROGRAM FILE

```
130 INK 0
135 BORDER 0
140 PAPER 7
145 BRIGHT 1
150 LET mdrive=1
155 LET o$=""
160 INPUT ""
165 GO SUB desk
170 LET drive=1
175 LET t$=" Utils  I/O  File  Extras"
180 GO SUB topbar
185 GO SUB wait
190 LET no=1
195 LET y=2
200 LET t$="EXIT*VERSION"
205 GO SUB dpull
210 LET no=2
215 LET y=5
220 LET t$="FORMAT*ERASE*DRIVE"
225 GO SUB dpull
230 LET no=3
235 LET y=12
240 LET t$="TAPE*M/DRIVE*SCREEN*PRINTER"
245 GO SUB dpull
250 LET no=4
255 LET y=17
260 LET t$="LOAD*CAT"
265 GO SUB dpull
270 LET no=5
275 LET y=19
280 LET t$="NOTEBOOK*CALCULATOR"
285 GO SUB dpull
290 RANDOMIZE USR restore
295 LET x=5
300 LET y=5
305 GO SUB movepoint
310 IF y=2 THEN  GO TO 325
315 GO SUB movepoint
320 GO TO 310
325 IF x=2 THEN  GO SUB 355
330 IF x=5 THEN  IF drive=1 THEN  GO SUB 390
335 IF x=12 THEN  GO SUB 955
340 IF x=17 THEN  GO SUB 1005
345 IF x=23 THEN  GO SUB 1060
350 GO TO 295
355 LET no=1
360 GO SUB pull
365 GO SUB movebar
367 RANDOMIZE USR restore
370 IF D=0 THEN  RANDOMIZE USR restore: GO SUB 8000
375 IF D=1 THEN  RANDOMIZE USR restore: GO SUB 8090
380 IF D=3 THEN  RANDOMIZE USR restore: RETURN
385 GO TO 355
390 LET no=2
395 GO SUB pull
400 GO SUB movebar
405 RANDOMIZE USR restore
410 IF d=0 THEN  IF mdrive=1 THEN  GO SUB 9170: IF yes=1 TH
EN  GO SUB 660: FORMAT "m";drive;j$: GO TO 390
415 IF d=1 THEN  IF mdrive=1 THEN  GO SUB 9170: IF yes=1 TH
EN  GO SUB 435: ERASE "m";drive;x$
420 IF d=2 THEN  IF mdrive=1 THEN  GO SUB 775: GO TO 390
425 IF d=4 THEN  GO TO 295
430 GO TO 390
435 REM file
440 CLOSE #10
445 OPEN #10;"m";drive;CHR$ 0+CHR$ 1
450 CAT #10,drive
455 PRINT #10;CHR$ 5
460 PRINT #10;CHR$ 5
465 CLOSE #10
470 LET g=1
475 LET x=5
480 LET y=1
485 LET d=16
490 LET w=30
495 LET no=8
500 GO SUB dwindow
505 GO SUB gwindow
510 OPEN #10;"m";drive;CHR$ 0+CHR$ 1
515 LET z$=""
520 LET count=1
525 INPUT #10;a$
530 IF LEN a$=2 THEN  GO TO 550
535 LET count=count+1
540 LET z$=z$+a$
545 GO TO 525
550 LET k$="Free:"+a$+"K"
555 PRINT AT 20,(30-LEN k$);k$
560 OVER 0
565 PRINT AT 20,12;z$( TO 10)
570 LET z$=z$(21 TO )
575 LET c=(count-2)/2
580 IF INT (c/2)<>(c/2) THEN  LET c=c-1
585 PRINT AT 20,2;"Drive:";drive
590 FOR i=1 TO count-2
595 LET f$(i)=z$( TO 10)
600 IF LEN z$>10 THEN  LET z$=z$(11 TO ): NEXT i
605 LET count=count-2
610 IF count>26 THEN  LET count=26
615 LET files=count/2
620 LET i=0
625 FOR i=files+2 TO count
630 LET i=i+1
635 PRINT AT 5+i,16;f$(i)
640 NEXT i
645 FOR i=1 TO files
650 PRINT AT 5+i,2;f$(i)
655 NEXT i
660 CLOSE #10
665 ERASE "m";drive;CHR$ 0+CHR$ 1
670 OVER 0
675 GO SUB box
680 IF nobar=1 THEN  PAUSE 0: PAUSE 0: RANDOMIZE USR restor
e: RETURN
685 LET ox=1
690 LET oy=2
695 LET x=1
700 LET y=2
705 PRINT AT 6,2; INVERSE 1; OVER 1;"          "
710 LET count=1
715 LET a$=INKEY$
```

PROGRAM FILE

```
 720 IF a$="q" THEN  LET x=x-1: LET count=count-1: IF x=0 AN
D y=2 THEN  LET x=c: LET y=16: LET count=files*2: GO TO 740
  25 IF a$="q" THEN  IF x=0 AND y=16 THEN  LET x=files: LET
cou =files: LET y=2
 730 I  a$="a" THEN  LET x=x+1: LET cou =count+1: IF x=file
s+1 AND y=2 THEN  LET x=1: LET y=16: LET count=files+1: GO T
O 740
 735 F a$="a" THEN  IF x=c+1 AND y=16 THEN  LET x=1: LET y=
2: LET count=1
 740 I  ox<>x OR oy<>y THEN  PRINT AT ox+5,oy; OVER 1; INVER
SE 1;"          ";AT x+5,y; OVER 1; INVERSE 1;"          ":
LET ox=x: LET oy=y
 745 IF a$="n" THEN  PRINT AT x+5,y; OVER 1; INVERSE 1;"
     ": GO TO 755
 750 GO TO 725
 755 LET x$=f$(count)
 760 RANDOMIZE USR restore
 765 LET nobar=0
 770 RETURN
 775 LET no=8
 780 LET x=10
 785 LET y=11
 790 LET d=3
 795 LET w=10
 800 GO SUB dwindow
 805 GO SUB gwindow
 810 PRINT AT 11,12;"12345674"
 815 PRINT AT 11,11+drive; INVERSE 1; OVER 1;" "
 820 LET oy=11+drive
 825 LET y=oy
 830 LET a$=INKEY$
 835 IF a$="o" THEN  LET y=y-1: IF y=11 THEN  LET y=19
 840 IF a$="p" THEN  LET y=y+1: IF y=20 THEN  LET y=12
 845 IF oy<>y THEN  PRINT AT 11,oy; INVERSE 1; OVER 1;" ";AT
 11,y; INVERSE 1; OVER 1;" ": LET oy=y: GO TO 830
 850 IF a$="m" THEN  LET drive=VAL ((SCREEN$ (11,y))): RANDO
MIZE USR restore: RETURN
 855 GO TO 830
 860 REM format
 865 LET no=8
 870 LET x=10
 875 LET y=9
 880 LET d=3
 885 LET w=12
 890 GO SUB dwindow
 895 GO SUB gwindow
 900 LET j$=""
 905 PAUSE 0
 910 PAUSE 0
 915 FOR i=1 TO 10
 920 PAUSE 0
 925 LET a$=INKEY$
 930 LET j$=j$+a$
 935 PRINT AT 11,9+i;a$
 940 NEXT i
 945 RETURN
 950 STOP
 955 LET no=3
 960 GO SUB pull
 965 GO SUB movebar
 970 RANDOMIZE USR restore
 975 IF d=0 THEN  RANDOMIZE USR restore: LET tape=1: LET mdr
ive=0
 980 IF d=1 THEN  RANDOMIZE USR restore: LET mdrive=1: LET t
ape=0
 985 IF d=3 THEN  RANDOMIZE USR restore: CLOSE #2
 990 IF d=4 THEN  RANDOMIZE USR restore: OPEN #2;"p"
 995 IF d=5 THEN  RETURN
1000 GO TO 955
1005 LET no=4
1010 GO SUB pull
1015 GO SUB movebar
1020 RANDOMIZE USR restore
1025 IF d=0 THEN  IF mdrive=1 THEN  RANDOMIZE USR restore: G
O SUB 435: LOAD *"m";drive;x$
1030 IF d=0 THEN  IF tape=1 THEN  RANDOMIZE USR restore: GO
SUB 860: LOAD j$
1035 IF d=1 THEN  IF mdrive=1 THEN  RANDOMIZE USR restore: L
ET nobar=1: GO SUB 435
1040 IF d=1 THEN  IF tape=1 THEN  RANDOMIZE USR restore: GO
TO 1005
1045 IF d=3 THEN  RETURN
1050 GO TO 1005
1055 STOP
1060 LET no=5
1065 GO SUB pull
1070 GO SUB movebar
1075 RANDOMIZE USR restore
1080 IF d=0 THEN  GO SUB 9310
1085 IF d=1 THEN  GO SUB 9460
1090 IF d=3 THEN  GO TO 295
1095 GO SUB 1060
1100 RETURN
```

Listing B

WIMP subroutines

```
8000  REM Quit  LINE 8000
8005 LET NO=6
8010 LET X=10
8015 LET Y=7
8020 LET D=6
8025 LET W=18
8030 LET G=1
8035 GO SUB dwindow
8040  GO SUB gwindow
8045 PRINT AT 11,8;"Are you sure you"
8050 PRINT AT 12,11;"want to quit"
8055 PRINT AT 14,8;"     YES   NO"
8060  LET x=5
8065 LET y=5
8070 GO SUB movepoint
8075 IF X>11 AND X<15 THEN  RANDOMIZE USR restore: STOP
8080 IF X>17 AND X<20 THEN  RANDOMIZE USR restore: RETURN
8085 GO TO 8060
8090 REM Version  LINE 8090
8095 LET NO=9
8100 LET X=10
8105 LET Y=6
8110 LET D=10
8115 LET W=22
8120 LET G=1
8125 GO SUB dwindow
8130  GO SUB gwindow
```

PROGRAM FILE

```
8135 PRINT AT 11,9;"Desk version 6.1"
8140 PRINT AT 13,11;"Luke Ireland"
8145 PRINT AT 15,7;"1987 Scaler Products"
8150 PRINT AT 17,14;"click"
8155  LET x=10
8160 LET y=10
8165 GO SUB movepoint
8170 IF X>14 AND X<18 THEN  RANDOMIZE USR restore: RETURN
8175 GO TO 8155
8180  REM Dwindow no,x,y,d,w,g            LINE 8180
8185 IF X<3 THEN  LET D=D-(4-X): LET X=4
8190 LET X(NO)=X
8195 LET Y(NO)=Y
8200 LET D(NO)=D
8205 LET W(NO)=W
8210 LET G(NO)=G
8215  RETURN
8220  REM Gwindow no  LINE 8220
8225 IF G(NO)=1 THEN  RANDOMIZE USR store
8230 LET x=x(no)
8235 LET y=y(no)
8240 LET d=d(no)
8245 LET w=w(no)
8250 GO SUB attr
8255 IF H(NO)>0 THEN  GO SUB whead
8260 GO SUB box
8265  RETURN
8270  REM Whead no  LINE 8270
8275 LET L=h(no)
8280 LET K=W(NO)/2
8285 LET J=K-(L/2)
8290 LET P$=""
8295 FOR I=1 TO J
8300 LET P$=P$+"GraphicA"
8305 NEXT I
8310  PRINT AT x(no),y(no);p$+h$(no)(1 TO h(no))+p$
8315  GO SUB box
8320  RETURN
8325  REM Topbar t$  LINE 8325
8330  LET x=1
8335 LET y=1
8340 LET d=3
8345 LET w=30
8350 GO SUB attr
8355  PRINT  AT 2,2;"GraphicB "+t$
8360 LET x(9)=1
8365 LET y(9)=1
8370 LET d(9)=3
8375 LET w(9)=30
8380 LET no=9
8385 GO SUB box
8390  RETURN
8395  REM Box no  LINE 8395
8400 OVER 0
8405 LET Y=((Y(NO))*8)
8410 LET X=175-((X(NO))*8)
8415 PLOT Y,X
8420 DRAW 0,-(D(NO)*8)+1
8425 DRAW ((W(NO)*8))-1,0
8430 DRAW 0,((D(NO)*8))-1
8435 DRAW -((W(NO)*8))+1,0
8440  RETURN
8445 REM Pbox no  LINE 8445
8450 LET Y=(H(NO))*8
8455 LET X=144
8460 PLOT Y-1,X
8465 DRAW 0,-(L(NO)-4)*8
8470 DRAW 97,0
8475 DRAW 0,((L(NO)-4)*8)
8480  RETURN
8485 REM Movepoint x,y  LINE 8485
8490 LET ox=x
8495 LET oy=y
8500 PRINT AT x,y; OVER 1;"GraphicD"
8505 LET a$=INKEY$
8510 IF a$="" THEN  GO TO 8505
8515 IF a$="q" THEN  LET y=y-1: IF y=0 THEN  LET y=21
8520 IF a$="a" THEN  LET y=y+1: IF y=21 THEN  LET y=0
8525 IF a$="o" THEN  LET x=x-1: IF x=0 THEN  LET x=31
8530 IF a$="p" THEN  LET x=x+1: IF x=31 THEN  LET x=0
8535 IF a$="m" THEN  GO TO 8570
8540 OVER 1
8545 PRINT AT oy,ox;"GraphicD"
8550 PRINT AT y,x;"GraphicD"
8555 LET ox=x
8560 LET oy=y
8565 GO TO 8505
8570 PRINT AT y,x;"GraphicD"
8575 OVER 0
8580 INVERSE 0
8585 RETURN
8590  REM Moveto x,y  LINE 8590
8595 LET l=x
8600 LET k=y
8605  LET x=5
8610 LET y=5
8615 GO SUB movepoint
8620 IF X=L AND Y=K THEN  GO TO 8630
8625 GO TO 8615
8630  RETURN
8635 REM desk  LINE 8635
8640  FOR I=0 TO 21
8645 PRINT AT I,0;"GraphicEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE"
8650 NEXT I
8655  RETURN
8660  REM Dhead no,t$  LINE 8660
8665 LET h$(no)=t$
8670 LET h(no)=LEN t$
8675 RETURN
8680  REM Dpull no,y,t$  LINE 8680
8685 LET m(no)=y
8690 LET r$=""
8695 LET t$=t$+""*QUIT* "
8700 LET r=1
8705 FOR I=1 TO LEN t$
8710 IF t$(I)="" THEN  LET r=r+1: LET m$(no,r-1)=r$: LET r$
="": NEXT I
8715 LET r$=r$+t$(I)
8720 NEXT I
8725 LET l(no)=r+4
8730  RETURN
8735 REM Pull no  LINE 8680
```

PROGRAM FILE

```
8740 RANDOMIZE USR store
8745 LET x=4
8750 LET y=m(no)
8755 LET d=l(no)-4
8760 LET w=12
8765 GO SUB attr
8770  GO SUB pbox
8775 FOR i=1 TO l(no)-5
8780 PRINT AT i+3,m(no)+1;m$(no,i)
8785 NEXT i
8790  RETURN
8795  REM Movebar  LINE 8795
8800 LET d=4
8805 INVERSE 1
8810 OVER 1
8815 PRINT AT 4,m(no);"
8820 LET od=4
8825 LET a$=INKEY$
8830 IF a$="a" THEN  IF d<(l(no)-2) THEN  LET d=d+1
8835 IF a$="q" THEN  IF d>4 THEN  LET d=d-1:
8840 IF a$="a" THEN  IF d=l(no)-3 THEN  LET d=l(no)-2
8845 IF a$="q" THEN  IF d=l(no)-3 THEN  LET d=l(no)-4
8850 IF a$="m" THEN  GO TO 8865
8855 IF od<>d THEN  PRINT AT d,m(no);"            ": PRINT A
T od,m(no);"            ": LET od=d: GO TO 8825
8860 GO TO 8825
8865 OVER 0
8870 INVERSE 0
8875 LET d=d-4
8880 RETURN
8885 REM setup  LINE 8885
8890 RESTORE 9020
8895 DIM f$(26,10): REM used for catalogue
8900 OVER 0
8905 INVERSE 0
8910 DIM H$(10,10)
8915 DIM H(10)
8920 DIM M$(10,15,11)
8925 DIM M(10)
8930 DIM L(10)
8935 DIM X(10)
8940 DIM Y(10)
8945 DIM D(10)
8950 DIM W(10)
8955 DIM G(10)
8960 FOR I=USR "GraphicA" TO USR "GraphicH"+7
8965 READ A
8970 POKE I,A
8975 NEXT I
8980 FOR i=50000 TO 50011
8985 READ a
8990 POKE i,a
8995 NEXT i
9000 FOR i=50050 TO 50061
9005 READ a
9010 POKE i,a
9015 NEXT i
9020 DATA 255,0,255,0,255,0,255,0
9025 DATA 0,54,62,8,28,62,156,120
9030 DATA 31,17,125,85,95,68,124,0
9035 DATA 0,30,14,30,58,112,96,0
9040 DATA 170,85,170,85,170,85,170,85
9045 DATA 0,0,1,2,68,40,16,0
9050 DATA 0,0,68,40,16,40,68,0
9055 DATA 255,129,129,129,129,129,129,255
9060 DATA 33,0,64,17,216,214,1,0,27,237,176,201,33,216,214,1
7,0,64,1,0,27,237,176,201
9065 RETURN
9070 REM wait  LINE 9070
9075  LET no=9
9080 LET x=10
9085 LET y=6
9090 LET d=5
9095 LET w=20
9100 LET g=1
9105 GO SUB dwindow
9110 GO SUB gwindow
9115 PRINT AT 12,8;"Please wait....."
9120 RETURN
9125 REM attr  LINE 9125
9130 LET a$=""
9135 FOR i=1 TO w
9140 LET a$=a$+" "
9145 NEXT i
9150 FOR i=0 TO 1
9155 PRINT AT x+i,y; PAPER 7; INK 0; BRIGHT 1;a$
9160 NEXT i
9165 RETURN
9170 REM sure  LINE 9170
9175 LET no=9
9180 LET x=10
9185 LET y=6
9190 LET d=5
9195 LET w=20
9200 LET g=1
9205 GO SUB dwindow
9210 GO SUB gwindow
9215 PRINT AT 11,9;"Are you sure ?"
9220 PRINT AT 13,11;"Yes    No"
9225 LET x=3
9230 LET y=3
9235 GO SUB movepoint
9240 IF x>10 AND x<14 THEN  LET yes=1: LET no=0: RANDOMIZE U
SR restore: RETURN
9245 IF x>17 AND x<20 THEN  LET no=1: LET yes=0: RANDOMIZE U
SR restore: RETURN
9250 GO SUB movepoint
9255 GO TO 9240
9260 REM leftright  LINE 9260
9265 LET x=14
9270 LET y=1
9275 LET d=4
9280 LET w=30
9285 LET g=0
9290 GO SUB dwindow
9295 GO SUB gwindow
9300 PRINT AT 15,2;"Use 5 and 8 to select letter";AT 16,8;"a
nd then press 0"
9305 RETURN
9310 REM notebook  LINE 9310
9315 LET t$="Notebook"
9320 LET x=5
9325 LET y=1
9330 LET d=16
```

PROGRAM FILE

```
9335 LET w=30
9340 LET g=1
9345 LET no=7
9350 GO SUB dhead
9355 GO SUB dwindow
9360 GO SUB gwindow
9365 PRINT AT 7,2;o$
9370 LET w$=""
9375 LET x=7
9380 LET y=2
9385 PAUSE 0
9390 LET a$=INKEY$
9395 IF CODE a$=12 THEN  IF y>2 THEN  LET y=y-1: LET a$=" ":
 LET w$=w$( TO (LEN w$)-1): IF LEN w$>0 THEN  PRINT AT x,y;"
 ": GO TO 9385
9400 IF CODE a$=12 THEN  IF y=2 THEN  LET x=x-1: LET y=29: L
ET a$=" ": LET w$=w$( TO (LEN w$)-1): IF LEN w$>0 THEN  PRIN
T AT x,y;a$: GO TO 9385
9405 IF LEN w$<1 THEN  LET w$=" ": LET x=7: LET y=2: GO TO 9
385
9410 IF CODE a$=13 THEN  LET o$=w$: RANDOMIZE USR restore: R
ETURN
9415 LET w$=w$+a$
9420 PRINT AT x,y;a$
9425  IF x=19 AND y+1>29 THEN  GO TO 9445
9430 IF y+1>29 THEN  LET x=x+1: LET o$=o$+CHR$ 13: LET y=2:
GO TO 9385
9435 LET y=y+1
9440 GO TO 9385
9445 LET x=7
9455 GO SUB 9385
9460 REM calculator  LINE 9460
9465 LET no=9
9470 LET x=6
9475 LET y=10
9480 LET d=14
9485 LET w=12
9490 LET t$=""
9495 GO SUB dhead
9500 GO SUB dwindow
9505 GO SUB gwindow
9510 PRINT AT 6,10;"GraphicS"
9515 GO SUB box
9520  LET x(9)=(8-.250)
9525 LET y(9)=(11-.125)
9530 LET d(9)=(1+.375)
9535 LET w(9)=10.250
9540 LET no=9
9545 GO SUB box
9550 PRINT AT 10,11;"GraphicH";AT 12,11;"7  8  9  /";AT 14,1
1;"4  5  6  *";AT 16,11;"1  2  3  -";AT 18,11;"0  .  =  +"
9555 PRINT AT 8,19;"0"
9560 LET total=0
9565 GO SUB 9630
9571 LET number1=VAL n$
9575 PRINT AT 8,12,"        0"
9580 GO SUB 9630
9585 LET number2=VAL n$
9590 IF s$="-" THEN  LET total=total+(number1-number2
9595 IF s$="+" THEN  LET total=total+(number1+number2
9600 IF s$="*" THEN  LET total=total+(number1*number2
9605 IF s$="/" THEN  LET total=total+(number1/number2
9610 PRINT AT 8,11+(9-LEN (STR$ (total+1)));total
9615 PAUSE 0
9620 PAUSE 0
9625 PRINT AT 8,12;"        0"
9630 REM loop
9635 LET n$=""
9640 LET x=10
9645 LET y=10
9650 LET x=9
9655 LET y=9
9660 GO SUB movepoint
9665 LET i$=SCREEN$ (y,x)
9670 IF i$="." THEN  GO TO 9725
9675 LET i$="0+-/"
9680 FOR i=1 TO 4
9685 IF i$=i$(i) THEN  LET s$=i$: RETURN
9690 NEXT i
9700 IF x=10 AND y=6 THEN  RANDOMIZE USR restore: GO TO 9060
9715 IF i$="=" THEN  RETURN
9720 IF i$<"0" AND i$>"9" THEN  LET i$=""
9725 LET n$=n$+i$
9730 PRINT AT 8,11+(9-LEN n$);n$
9735 GO TO 9650
9770 STOP
```

BBC Interrupt-Driven Breakout

by Andrew Rolands

This program is a machine code version of the game Breakout. The keys used to play are 'Z', 'X' and the space bar; ESC is used to leave the program. The program is controlled by interrupts and runs at such a speed that it doesn't interfere with the normal operation of the computer. Consequently it can be used while the BBC is doing something else like loading another program from cassette or disk. This is what the example program has been set up to do. Other uses are also possible — for example, while recalculating a very large and complex spreadsheet — but these may be difficult to implement.

The object code for the program is under 1k in length and can be located anywhere in memory.

To try the program, type in the two short Basic programs, saving the second as 'NEXTPRO'; then type in the assembly language listing. Save it before running it in case anything goes wrong, then run it and correct any errors. When all errors have been removed, save the machine code and data as in lines 1880 and

PROGRAM FILE

1890. If you are using tape, save the first Basic program followed by the machine code and finally the second Basic program.

When everything is working correctly, you can swap NEXTPRO for any Basic program of your own and even alter the first program to suit yourself. You must insert lines 50 to 300 of the first program and 60 to 150 of the second program in whatever you replace them with.

The program uses standard operating system calls that are well-documented elsewhere, and should work on all the BBC machines without modification. The only exception is that users with Basic 1 have to alter the EQUB and EQUS statements. These can be replaced in the following manner by leaving the assembler temporarily, using indirection operators and POKEing the data directly into memory. For example:

replace EQUS "TODAY" by

```
JMP label1
]
$P%="TODAY"
P%=P%+LEN("TODAY")+1
[
```

replace EQUB 10:EQUB 20:EQUB 66 by

```
JMP label2
]
?P%=10
P%?1=20
P%?2=66
P%=P%+3
[
```

The program makes use of the vertical sync interrupt and uses several of these per cycle of movement within the program: the first interrupt will move the bat, the next the ball, and so on. The only way the author could achieve the movement quickly enough was to use character graphics.

Operating system calls are used throughout the program to print characters, and so on. These are made to addresses from &FF00 to &FFFF and redirected back to &200 to &2FF.

```
   10 REM INTERRUPT DRIVEN BREAKOUT
   20 REM (c) ANDREW ROWLANDS 1986
   30 REM FOR ALL BBC's OR ELECTRON
   40 :
   50 VDU 23,224,0,254,254,254,254,254,254,254 :REM USER DEFINED CHARACTER FOR B
RICK
   60 VDU 23,226,255,255,0,0,0,0,0,0 :REM BAT
   70 VDU 23,225,0,24,60,60,60,60,24,0 :REM BALL
   80 :
   90 REM LOAD MACHINE CODE AND SWITCH OFF ESCAPE KEY
  100 *LOAD zerodat 70
  110 *LOAD code 5000
  120 *FX 14,6
  130 :
  140 REM SET THE INTERRUPT VECTORS TO POINT TO THE START OF THE MACHINE CODE
  150 ?&220 = &5000 MOD 256
  160 ?&221 = &5000 DIV 256
  170 :
  180 MODE 5
  190 VDU 23;8202;0;0;0; :REM SWTCH FLASHING CURSOR OFF
  200 VDU 19,2,2,0,0,0 :REM CHANGE LOGICAL COLOUR 2 (YELLOW) TO ACTUAL COLOUR 2
(GREEN)
  210 REM ENABLE START OF VERTICAL SYNC EVENT
  220 *FX 14,4
  230 :
  240 TIME=0 :REPEAT UNTIL TIME > 1000 :REM WAIT FOR A BIT BEFORE LOADING THE PR
OGRAM (ARBITRARY)
  250 :
  260 REM FOR CASSETTE PUT *TAPE AND *OPT1,2 ON SEPARATE LINES HERE
  270 REM *OPT1,2 SWITCHES OFF THE CASSETTE MESSAGES
  280 :
  290 REM THE NAME OF THE PROGRAM TO BE LOADED WHILST THE GAME IS PLAYING
  300 CHAIN"NEXTPRO"
  310 :
  320 END
)
   10 REM INTERRUPT DRIVEN BREAKOUT
   20 REM (c) ANDREW ROWLANDS 1986
   30 REM FOR ALL BBC's OR ELECTRON
   40 :
   50 REM DATA HELD IN ZERO PAGE REDUCE SIZE OF CODE AND INCREASE ITS SPEED
   60 oswrch=&FFEE:osword=&FFF1:osbyte=&FFF4:osasci=&FFE3
   70 P% = &70
   80 [OPT 2
   90 .pixelcolour
  100 EQUB 0:EQUB 0:EQUB 0:EQUB 0:EQUB 0      \PIXEL COLOUR
  110 .ballposit EQUB 31
  120 .xball EQUB 10:.yball EQUB 27:EQUB 225:EQUB 31
  130 .oldxball EQUB 0:.oldyball EQUB 0:EQUB 32
  140 .xincball EQUB 255:.yincball EQUB 255
  150 .score EQUB 0:EQUB 0
  160 .lives EQUB 3
  170 .batposit
  180 EQUB 31:EQUB 0:EQUB 30:EQUB 0:EQUB 0
  190 .xbat EQUB 10
  200 .temp EQUB 0:.temp2 EQUB 0
  210 .numbrik EQUB
  220 ]
  230 :
  240 REM MAIN CODE FOR PROGRAM
  250 FOR PASS = 0 TO 2 STEP 2
  260 P% = &5000
  270 [OPT PASS
  280 .boundary      \DRAW THE BOUNDARY AND PRINT THE SCORE etc
  290 PHP:PHA:TXA:PHA:TYA:PHA
  300 LDA xbat:STA initX:LDX #0
  310 .jum1 LDA bound,X
  320 JSR oswrch:INX:CPX #51:BNE jum1
  330 LDA #(bricks MOD 256):STA &220
  340 LDA #(bricks DIV 256):STA &221
```

PROGRAM FILE

```
350 PLA:TAY:PLA:TAX:PLA:PLP:RTS
360       \DRAW THE BRICKS ON THE SCREEN USING ONE INTERRUPT PER ROW
370 .bricks
380 PHP:PHA:TXA:PHA:TYA:PHA
390 LDA £30:JSR oswrch:LDA £10:JSR oswrch
400 LDA £0:STA numbrik:LDA £1:STA temp:STA temp2
410 LDA £(bricks2 MOD 256):STA &220:LDA £(bricks2 DIV 256):STA &221
420 PLA:TAY:PLA:TAX:PLA:PLP:RTS
430 .bricks2 PHP:PHA:TXA:PHA:TYA:PHA
440 LDA temp:CMP £5:BNE forw2:INC temp2
450 .forw2 LDA temp:CMP £10:BNE forw3:INC temp2
460 .forw3 LDA £17:JSR oswrch:LDA temp2:JSR oswrch:LDA £9:JSR oswrch
470 .bak1 LDX £1
480 .bak2 LDA £224:JSR osasci:INX:CPX £19:BNE bak2
490 LDA £9:JSR oswrch:INC temp:LDA £15:CMP temp:BCC forw1
500 PLA:TAY:PLA:TAX:PLA:PLP:RTS
510 .forw1
520 LDA £(codebat MOD 256):STA &220:LDA £(codebat DIV 256):STA &221
530 PLA:TAY:PLA:TAX:PLA:PLP
540 .exit5 RTS
550 .bound      \DATA FOR THE BOUNDARY etc
560 EQUB 18:EQUB 0:EQUB 1
570 EQUB 25:EQUB 4:EQUB 40 MOD 256:EQUB 40 DIV 256:EQUB 0:EQUB 0
580 EQUB 25:EQUB 5:EQUB 40 MOD 256:EQUB 40 DIV 256:EQUB 1000 MOD 256:EQUB 1000
DIV 256
590 EQUB 25:EQUB 5:EQUB 1232 MOD 256:EQUB 1232 DIV 256:EQUB 1000 MOD 256:EQUB
1000 DIV 256
600 EQUB 25:EQUB 5:EQUB 1232 MOD 256:EQUB 1232 DIV 256:EQUB 0:EQUB 0
610 EQUB 31:EQUB 1:EQUB 31
620 EQUS "LI 3   SCORE 0000":EQUB 31
630 .initX EQUB 10:EQUB 30:EQUB 226
640 .ball      \SECTION TO MOVE AND DISPLAY BALL
650 PHP:PHA:TXA:PHA:TYA:PHA
660 JSR forw3
670 LDA £(ballhitbat MOD 256):STA &220:LDA £(ballhitbat DIV 256):STA &221
680 PLA:TAY:PLA:TAX:PLA:PLP:RTS
690 .forw3 LDA xball:PHA:STA oldxball:LDA yball:STA oldyball
700 CLC:ADC yincball:STA yball
710 PLA:CLC:ADC xincball:STA xball
720 PHA:CMP £1:BNE j1:LDA £1:STA xincball
730 .j1 PLA:CMP £18:BNE j2:LDA £255:STA xincball
740 .j2 LDA yball:CMP £1:BNE j3:LDA £1:STA yincball
750 .j3 JMP printball
760 .pixpoi      \CHECK FOR A COLLISION BETWEEN THE BALL AND A BRICK BY CHECKIN
G THE COLOUR NEAR IT
770 PHP:PHA:TXA:PHA:TYA:PHA
780 JSR forw7:LDA £(codebat MOD 256):STA &220:LDA £(codebat DIV 256):STA &221
790 PLA:TAY:PLA:TAX:PLA:PLP:RTS
800 .forw7
810 LDA xball:ROR A:ROR A:ROR A:PHA:AND £&C0:STA pixelcolour
820 PLA:ROL A:AND £&1F:STA pixelcolour+1:LDA £31:SEC:SBC yball
830 ROR A:ROR A:ROR A:ROR A:PHA:AND £&E0:STA pixelcolour+2:PLA
840 ROL A:AND £&1F:STA pixelcolour+3:CLC:LDA pixelcolour+2:ADC £32
850 STA pixelcolour+2
860 LDA £0:ADC pixelcolour+3:STA pixelcolour+3
870 LDX £pixelcolour MOD 256:LDY £pixelcolour DIV 256:LDA £9:JSR osword
880 LDA pixelcolour+4:BEQ exit1:      \ADD SCORE
890 EOR £3:TAX:INX:TXA:CLC:SED
900 ADC score:STA score:LDA £0:ADC score+1:STA score+1:CLD:JSR pscore
910 LDA yincball      \IF THE BALL HITS A BRICK THEN CHANGE ITS VERTICAL DIRECT
ION
920 EOR £&FF:CLC:ADC £1:STA yincball:LDA £32:STA ballposit+3:DEC yball
930 LDX £0:.jum9 LDA ballposit,X:JSR oswrch:INX:CPX £4:BNE jum9
940 INC yball \3 LINES RESTORE REG
950 LDA £225:STA ballposit+3:LDA yball:AND £&FE:ASL A:ASL A
960 EOR £&FF:CLC:ADC 100
970       \IF THE BALL HITS A BRICK THEN MAKE A SOUND, THE PITCH OF WHICH DEPEN
DS ON THE VERTICAL POSITION OF THE BRICK
980 STA soundbrick +4:LDX £soundbrick MOD 256:LDY £soundbrick DIV 256
990 LDA £7:JSR osword:INC numbrik
1000 .exit1 RTS
1010 .soundbrick EQUB 1:EQUB 0:EQUB &F7:EQUB &FF:EQUB &C0
1020 EQUB 0      \PITCH OF SOUND
1030 EQUB 1:EQUB 0
1040 .printball LDX £0
1050 .jump
1060 LDA ballposit,X:JSR oswrch:INX:CPX £8:BNE jump:RTS
1070 .pscore      \PRINT THE CURRENT SCORE AT THE BOTTOM OF THE SCREEN WITH LEAD
ING ZERO'S REPLACED WITH THE LETTER O
1080 LDA £31:JSR oswrch:LDA £14:JSR oswrch:LDA £31:JSR oswrch
1090 LDX £ASC"0":LDY £&FF:LDA score+1:JSR printscore:LDY £&FF
1100 LDA score:JSR printscore:RTS
1110 .printscore:PHA:LSR A:LSR A:LSR A:LSR A
1120 JSR printit:PLA:AND £&0F
1130 .printit BNE validch:TYA:BNE leadz
1140 .validch LDY £0:ORA £ASC("0"):JMP osasci
1150 .leadz TXA:JMP osasci
1160       \MOVE AND PRINT THE BAT
1170 .codebat PHP:PHA:TXA:PHA:TYA:PHA
1180 JSR forw4
1190 LDA £(ball MOD 256):STA &220:LDA £(bal. DIV 256):STA &221
1200 PLA:TAY:PLA:TAX:PLA:PLP:RTS
1210 .forw4 LDX £156:JSR inkey:BNE zkey:LDX £189:JSR inkey:BEQ exit2
1220 LDA £1:CMP xbat:BCC great
1230 .exit2 RTS
1240 .great
1250 LDA £226:STA batposit+3:LDA £32:STA batposit+4:DEC xbat:LDA xbat
1260 STA batposit+1:JMP print
1270 .zkey LDX £189:JSR inkey:BEQ next:RTS
1280 .next LDA xbat:CMP £18:BCC less:RTS
1290 .less LDA £32:STA batposit+3:LDA £226:STA batposit+4:LDY xbat:INC xbat
1300 STY batposit+1
1310 .print LDX £0
1320 .ret LDA batposit,X:JSR oswrch:INX:CPX £5:BNE ret:RTS
1330 .inkey LDA £129:LDY £&FF:JSR osbyte:CPY £&FF:RTS
1340       \CHECK FOR A COLLISION BETWEEN THE BALL AND BAT AND IF SO MAKE A SOUN
D AND CHANGE THE DIRECTION OF THE BALL
1350 .ballhitbat PHP:PHA:TXA:PHA:TYA:PHA
1360 JSR checkend:LDA yball:CMP £16:BCC no_newwall
1370 LDA numbrik:CMP £130      \NUMBER OF BRICKS HIT BEFORE THE WALL IS REBUILT
(1 TO 135)
1380 BCS newwall
1390 .no_newwall
1400 LDA £(checksp_bar MOD 256):CMP &220:BEQ nopixpoi
1410 LDA £(pixpoi MOD 256):STA &220:LDA £(pixpoi DIV 256):STA &221
1420 .nopixpoi PLA:TAY:PLA:TAX:PLA:PLP:RTS
1430 .checkend LDA yball:CMP £29:BNE exit3:JSR check3:LDA yincball
1440 CMP £255:BNE spaceb:LDX £soundbatball MOD 256:LDY £soundbatball DIV 256
1450 LDA £7:JSR osword
1460 .exit3 RTS
1470 .newwall      \IF THERE ARE ONLY A FEW BRICKS LEFT THEN PRINT A NEW WALL WA
ITING UNTIL THE BALL IS LOW ENOUGH SO THAT IT IS NOT TRAPPED WITHIN THE WALL
1480 LDA £(bricks MOD 256):STA &220:LDA £(bricks DIV 256):STA &221
```

PROGRAM FILE

```
1490 JMP nopixpoi
1500 .spaceb
1510 LDX £soundbatball MOD 256:LDY £soundbatball DIV 256:LDA £0
1520 STA soundbatball:LDA £7:JSR osword:LDA £1:STA soundbatball
1530 LDA £31:JSR oswrch:LDA xball:JSR oswrch:LDA yball:JSR oswrch
1540 LDA £32:JSR oswrch:LDA £29:STA yball:LDA £255:STA yincball:DEC lives
1550      \CHANGE X&Y REGISTERS
1560 LDA £31:JSR oswrch:LDA £4:JSR oswrch:LDA £31:JSR oswrch
1570 LDA lives:ORA £ASC("0"):JSR osasci
1580 LDA £(checksp_bar MOD 256):STA &220
1590 LDA £(checksp_bar DIV 256):STA &221
1600 RTS
1610      \CHECK TO SEE IF THE SPACE_BAR IS PRESSED AND IF SO START THE BALL MO
VING OR BEGIN A NEW GAME
1620 .checksp_bar PHP:PHA:TXA:PHA:TYA:PHA
1630 LDX £157   \-99 (THE SPACEBAR)
1640 JSR inkey:BNE exit4:LDA lives:CMP £0:BNE notend1
1650 LDA £(boundary MOD 256):STA &220:LDA £(boundary DIV 256):STA &221
1660 LDA £0:STA score:STA score+1:LDA £3:STA lives:JMP exit4
1670 .notend1
1680 LDA £(codebat MOD 256):STA &220:LDA £(codebat DIV 256):STA &221
1690 .exit4 PLA:TAY:PLA:TAX:PLA:PLP:RTS
1700 .check3
1710 LDA xball:CMP £18:BNE next1:LDA xbat:CMP £17:BMI next1
1720 LDA £255:STA yincball:STA xincball:RTS
1730 .next1
1740 LDA xball:CMP xbat:BNE next2:LDA £255:STA yincball:RTS
1750 .next2
1760 LDY xbat:DEY:CPY xball:BNE next3:LDA xincball
1770 CMP £255:BEQ skip1:LDA £255:STA xincball
1780 .skip: LDA £255:STA yincball
1790 .exit13 RTS
1800 .next3
1810 LDY xbat:INY:CPY xball:BNE exit13:LDA xincball
1820 CMP £1:BEQ skip2:LDA £1:STA xincball
1830 .skip2 LDA £255:STA yincball:RTS
1840 .soundbatball
1850 EQUB 1:EQUB 0:EQUB-&F6:EQUB &FF:EQUB 150:EQUB 0:EQUB 1:EQUB 0
1860 ]NEXT
1870 :
1880 REM *SAVE zerodat 70 +1B
1890 REM *SAVE code 5000 +3CB
  10 REM THIS IS AN EXAMPLE OF THE TYPE OF PROGRAM WHICH CAN BE LOADED WHILST P
LAYING THE GAME
  20 REM THE PROGRAM CAN BE ANY LENGTH AND CAN BE LOADED AT ANY VALID ADDRESS S
O LONG AS THE INTERRUPT MACHINE CODE OR THE SCREEN MEMORY IS NOT OVERWRITTEN
  30  REM THIS PROGRAM IS SAVED AS 'NEXTPRO'
  40 :
  50 REM RE_ENABLE THE ESCAPE KEY
  60 *FX 13,6
  70 :
  80 ON ERROR GOTO 130
  90 GOTO 90      :REM WAIT HERE UNTIL USER PRESSES ESCAPE KEY
 100 REM THE PROGRAM CAN BE CHANGED SO SOME TASK IS BEING PERFORMED WHILST WAIT
ING FOR THE ESCAPE KEY TO BE PRESSED
 110 :
 120 REM DISABLE THE START OF VERTICAL SYNC EVENT
 130 *FX 13,4
 140 :
 150 ON ERROR OFF :REM SWITCH ERROR TRAPPING OFF
 160 :
 170 REM THE MAIN PROGRAM LOADED STARTS HERE
 180 MODE6
 190 PRINT' SPC(3);"The main program has NOW LOADED !"
 200 PRINT SPC(7);"I hope you enjoyed playing"
 210 PRINT SPC(11);"interrupt breakout"
 220 PRINT SPC(1);"Prepare yourself for the next program"
```

Amstrad CPC Large Printing Tip

by Vaclav Skala

This short program shows just how easy it is to create simple, large banners by printing characters several times. The character shapes are obtained from the character definitions in ROM.

```
10 INPUT a$
20 CLS
30 GOSUB 100
40 GOTO 10
100 SYMBOL AFTER 0
110 N=LEN(a$)
120 IF N=0 THEN RETURN
130 FOR j=0 TO 7
140 FOR i=1 TO N
150 p=ASC(MID$(a$,i,1))
160 adr1=&A400+8*p+j
170 k=PEEK(adr1)
180 b$=BIN$(k,8)
190 FOR k=1 TO 8
200 IF MID$(b$,k,1)="1" THEN PRINT£8,CHR$(p); ELSE PRINT£8," ";
210 NEXT k
220 NEXT i
230 PRINT£8
240 NEXT j
250 RETURN
```

PROGRAM FILE

BBC Cover-up

by Ross Hunter

This game is based on an old pub game played with two dice and a card marked with the numbers from 1 to 9. The first player throws the dice and covers any numbers that total the same as the dice throw. This process is continued until the number thrown cannot be totalled from the numbers remaining. If at any time before a throw the total of the numbers remaining is less than 6, only one die is thrown. When a player can no longer go, the score is read from left to right (the numbers are placed in descending order). So, if 6, 3 and 2 were left, the score would be 632. The same procedure is followed by all players, and the one with the lowest score wins.

The program gives a choice of two versions of the game and can be played by two players or against the computer. The two versions are LowLine and Knockout. In LowLine, the first player is given a row of black numbers and a random number. The player must change the black numbers to red by totalling them up to the random number. When player one can no longer go, it's player two's turn to try to turn a line of red numbers to black. The winner is the player with the lowest score.

Knockout is similar except that the game continues until all the numbers' colours are changed.

The program uses a relocation routine because of the lack of space on BBC B and DFS systems; this is in lines 50 and 3230 to 3340. The routine moves the program from &1900 to &E00. Those using the BBC B with a cassette and PAGE set to &EOO should delete the relocation routine and change line 110 from VDU22,1 to MODE 1.

```
10REM Cover Up.
20REM (C) Ross Hunter 1986.
30REM For the BBC model B / B+ micro.
40:
50GOTO 3240 :REM Relocation routine.
60:
70DIM N%(9)
80G%=0:G2%=0:P%=1
90computer%=FALSE:P2$="Player 2 "
100:
110VDU22,1 :REM If relocation routine is deleted change line 110 to MODE 1
120REM *FX 4,1 Disables cursor editing.
130*FX 4,1
140VDU23,1,0;0;0;0;:REM Turn flashing cursor off.
150VDU19,3,4;0;    :REM White = Blue.
160COLOUR131:CLS   :REM Blue background.
170ON ERROR GOTO 3170
180PROCgraphics
190:
200REM Choose whether or not to have computer as player 2.
210COLOUR129:COLOUR2
220PRINTTAB(3,3)"   COVER UP   "
230COLOUR130:COLOUR3
240PRINTTAB(23,18)"Against Computer" TAB(29,22)"Y/N"
250*FX 21,0
260REPEAT:K%=GET OR 32
270UNTIL K%=ASC"y" OR K%=ASC"n"
280IF K%=ASC"y" computer%=TRUE:P2$="Computer "
290:
300REM Main loop. Repeats until ESCAPE or BREAK pressed.
310REPEAT
320
330lowline%=FALSE:knockout%=FALSE
340P1%=987654321:P2%=P1%
350
360REM Clear game title and print games played and wins.
370COLOUR129:COLOUR2
380PRINTTAB(21,3)SPC(17)
390PRINTTAB(1,16)"Games played    ";G1%+G2%
400PRINTTAB(1,18)"Games player 1   ";G1% TAB(1,22)"Wins "P2$"  ";G2%
410PRINTTAB(1,25)SPC(19) TAB(1,28)SPC(19)
420
430REM Choose Low Line or Knockout game.
440PROCcleartext
450COLOUR130:COLOUR7
460PRINTTAB(23,18)"Choose Your Game"
470PRINTTAB(23,21)"L.......LOW LINE" TAB(23,23)"k.......KNOCKOUT"
480*FX 21,0
490REPEAT:K%=GET OR 32
500UNTIL K%=ASC"k" OR K%=ASC"l"
510IF K%=ASC"l" lowline%=TRUE ELSE knockout%=TRUE
520
530REM Print text relevant to game chosen.
540COLOUR129:COLOUR2
550PRINTTAB(26,3);
560IF lowline% PRINT"LOW LINE" ELSE PRINT"KNOCKOUT"
570PRINTTAB(1,25);
580IF lowline% PRINT"Player 1  ";P1% ELSE PRINT"Player 1 make   Red"
590PRINTTAB(1,28);
600IF lowline% PRINT P2$" ";P2% ELSE PRINT P2$"make black"
610
620REM Print numbers 9 to 1 in colour P%-1 ready for player P% to play.
630FOR count%=1 TO 9
640N%(count%)=P%-1
650NEXT
660PROCprintnums
670PROCcleartext
680*FX 21,0
690PRINTTAB(25,18)"PRESS RETURN"
700REPEAT UNTIL GET=13
710
720REM Play chosen game until a player wins.
```

PROGRAM FILE

```
730REPEAT
740PROCcleartext
750PROCrandom
760win%=FALSE
770IF knockout% PROCknockout ELSE PROClowline
780UNTIL win%
790
800REM Player P% wins.
810IF P%=1 G1%=G1%+1 ELSE G2%=G2%+1
820PROCcleartext
830PRINTTAB(23,18);
840IF NOT computer% OR P%=1 PRINT"Player ";P%;" wins"
850IF computer% AND P%=2 PRINT"computer wins"
860PRINTTAB(23,22)"PRESS RETURN KEY"
870*FX21,0
880REPEAT UNTIL GET=13
890
900REM Back to choose next game.
910REM P%=winner the winner plays next game first.
920UNTIL FALSE
930
940END
950:
960REM Knockout game.
970DEF PROCknockout
980PROCcheck(num%)
990IF P%=1 col%=1 ELSE col%=0
1000IF NOT play% PROCnoplay
1010IF play% PROCmove
1020
1030REM If all displayed numbers have been made red for player 1 or black for
1040REM player 2 then that player wins.
1050win%=TRUE
1060FOR pos%=1 TO 9
1070IF N%(pos%)=P%-1 win%=FALSE
1080NEXT
1090IF NOT win% P%=P%+1:IF P%=3 P%=1:REM Next player to play.
1100ENDPROC
1110:
1120REM low line game.
1130DEF PROClowline
1140PROCcheck(num%)
1150IF NOT play% PROCnoplay
1160IF P%=1 col%=1 ELSE col%=0
1170IF play% PROCmove
1180
1190REM Set P1% or P2% to total of numbers changed reading from left to right.
1200P$=""
1210FOR pos%=9 TO 1 STEP -1
1220IF N%(pos%)=P%-1 P$=P$+STR$(pos%)
1230NEXT
1240IF P%=1 P1%=VAL(P$) ELSE P2%=VAL(P$)
1250COLOUR129:COLOUR2
1260PRINTTAB(11,25)SPC(9-LEN(STR$(P1%)));P1%
1270PRINTTAB(11,28)SPC(9-LEN(STR$(P2%)));P2%
1280
1290IF play% ENDPROC: REM Until player can not play.
1300
1310REM Print numbers 9 to 1 ready for next player.
1320FOR C%=1 TO 9
1330IF P%=1 N%(C%)=1 ELSE N%(C%)=0
1340NEXT
1350PROCprintnums
1360
1370REM If both players played set P% to winner and win%=TRUE.
1380win%=FALSE
1390IF P1%<987654321 AND P2%<987654321 win%=TRUE
1400IF NOT win% P%=P%+1:IF P%=3 P%=1: REM Swap players.
1410IF win% AND P%=1 AND P1%>P2% P%=2 :REM P%=Winning player.
1420ENDPROC
1430:
1440REM move cursor to choose numbers until numbers chosen total num%.
1450DEF PROCmove
1460PROCcleartext
1470PRINTTAB(23,18);:IF P%=2 PRINTP2$"to play"ELSE PRINT"Player 1 to play"
1480IF NOT computer% OR P%=1 PRINTTAB(23,21)"<-  ->   TO MOVE"
1490IF NOT computer% OR P%=1 PRINTTAB(23,23)"RETURN   TO PICK"
1500IF computer% AND P%=2 FOR delay%=1 TO 10000:NEXT
1510
1520REM Cursor EORed with background and drawn under 9.
1530Y%=595:X%=64:pos%=9
1540GCOL3,1:MOVE X%,Y%:DRAW X%+96,Y%
1550
1560REM Until numbers chosen total num%.
1570REPEAT
1580
1590REM Until chosen number(pos%) is colour P%-1 AND pos% is not > num%
1600REPEAT
1610
1620REM Until a number is chosen by player P% or computer.
1630REPEAT
1640IF computer% AND P%=2 K%=13 ELSE K%=GET
1650UNTIL K%=136 OR K%=137 OR K%=13
1660
1670IF computer% AND P%=2 PROCcomputer
1680MOVE X%,Y%:DRAW X%+96,Y%
1690IF K%=137 pos%=pos%-1:X%=X%+128:IF pos%=0 pos%=9:X%=64
1700IF K%=136 pos%=pos%+1:X%=X%-128:IF pos%=10 pos%=1:X%=1088
1710MOVE X%,Y%:DRAW X%+96,Y%
1720UNTIL K%=13 AND N%(pos%)=P%-1 AND num%-pos%>=0
1730
1740N%(pos%)=col%
1750PROCcheck(num%-pos%)
1760IF NOT play% N%(pos%)=P%-1
1770IF computer% AND P%=2 FOR delay%=1 TO 5000:NEXT
1780IF play% num%=num%-pos%
1790PROCprintnums
1800COLOUR3:PRINTTAB(30,28);
1810IF num%>9 PRINT;num% ELSE IF num%>0 PRINT"0";num%
1820UNTIL num%=0
1830
1840MOVE X%,Y%:DRAW X%+96,Y%
1850ENDPROC
1860:
1870REM Computer sets pos% and moves cursor.
1880DEF PROCcomputer
1890pos%=10
1900REPEAT
1910pos%=pos%-1
1920UNTIL N%(pos%)=P%-1 AND num%=pos% OR pos%<=6
1930IF pos%<=6 pos%=RND(9)
1940MOVE X%,Y%:DRAW X%+96,Y%
1950X%=64+ABS(pos%-9)*128
```

PROGRAM FILE

```
1960MOVE X%,Y%:DRAW X%+96,Y%
1970K%=13
1980ENDPROC
1990:
2000REM Get and print random number num%.
2010DEF PROCrandom
2020rnd%=0
2030FOR count%=1 TO 9
2040IF N%(count%)=P%-1 rnd%=rnd%+count%
2050NEXT
2060REM rnd%=total value of numbers player P% can change.
2070
2080COLOUR130:COLOUR3
2090IF rnd%>6 rnd%=12 ELSE rnd%=6
2100FOR count%=0 TO 10
2110num%=RND(rnd%)
2120SOUND 1,-5,150,1
2130PRINTTAB(30,28);:IF num%>9 PRINT;num% ELSE PRINT"0";num%
2140FOR delay%=0 TO 500:NEXT
2150NEXT
2160ENDPROC
2170:
2180REM Print the numbers 9 to 1 in colours N%(count%).
2190DEF PROCprintnums
2200COLOUR130
2210count%=9
2220FOR tab%=3 TO 35 STEP 4
2230COLOUR N%(count%)
2240PRINTTAB(tab%,11);count%
2250count%=count%-1
2260NEXT
2270ENDPROC
2280:
2290REM Print the no play text.
2300DEF PROCnoplay
2310PROCcleartext
2320IF NOT computer% OR P%=1 PRINTTAB(27,18)"Player ";P%
2330IFcomputer% AND P%=2 PRINTTAB(27,18)"COMPUTER"
2340PRINTTAB(25,21)"CAN NOT PLAY" TAB(23,23)"PRESS RETURN KEY"
2350*FX21,0
2360REPEAT UNTIL GET=13
2370PROCcleartext
2380ENDPROC
2390:
2400REM Draw screen graphics. See PROCbox.
2410DEF PROCgraphics
2420PROCbox(131,129,4,863,634,100,20):REM Tital box left.
2430PROCbox(131,129,640,863,635,100,20):REM Tital box right.
2440PROCbox(131,130,703,224,572,160,20):REM Instruction box bottom.
2450PROCbox(131,130,703,384,572,96,20):REM Instruction box top.
2460PROCbox(131,130,927,64,128,96,20):REM Random number box.
2470REM Boxes for numbers 9 to 1.
2480FOR X%=64 TO 1120 STEP 128:PROCbox(131,130,X%,611,96,96,20):NEXT
2490REM Bottom information boxes.
2500FOR Y%=64 TO 160 STEP 96:PROCbox(131,129,4,Y%,672,96,20):NEXT
2510REM Top information boxes.
2520FOR Y%=256 TO 448 STEP 96:PROCbox(131,129,4,Y%,640,96,20):NEXT
2530ENDPROC
2540:
2550REM Draw a box with a border.
2560REM O%=Border colour. I%=Inner colour.
2570REM X%=Coordinate across. Y%=Coordinate up.
2580REM W%=Width. H%=Hight. B%=Border size.
2590DEF PROCbox(O%,I%,X%,Y%,W%,H%,B%)
2600VDU 24,X%;Y%;X%+W%;Y%+H%;18,0,O%,16
2610VDU 24,X%+B%;Y%+B%;X%+W%-B%;Y%+H%-B%;18,0,I%,16
2620VDU 26,18,0,0
2630MOVE X%,Y%:DRAW X%+B%,Y%+B%
2640MOVE X%,Y%+H%:DRAW X%+B%,Y%+H%-B%
2650MOVE X%+W%,Y%+H%:DRAW X%+W%-B%,Y%+H%-B%
2660MOVE X%+W%,Y%:DRAW X%+W%-B%,Y%+B%
2670MOVE X%,Y%:DRAW X%,Y%+H%:DRAW X%+W%,Y%+H%
2680DRAW X%+W%,Y%:DRAW X%,Y%
2690MOVE X%+B%,Y%+B%:DRAW X%+B%,Y%+H%-B%:DRAW X%+W%-B%,Y%+H%-B%
2700DRAW X%+W%-B%,Y%+B%:DRAW X%+B%,Y%+B%
2710ENDPROC
2720:
2730REM Clear all text in the instruction boxes.
2740DEF PROCclrartext
2750COLOUR130:COLOUR3
2760PRINTTAB(23,18)SPC(16)
2770FOR tab%=21 TO 23
2780PRINTTAB(23,tab%)SPC(16)
2790NEXT
2800ENDPROC
2810:
2820REM Check that (for%) can be used to play.
2830DEF PROCcheck(for%)
2840IF for%=0 play%=TRUE:ENDPROC
2850play%=FALSE
2860RESTORE 3060
2870
2880REM Locate start of data giving all possible combinations of the digits
2890REM 1 to 9 that can total (for%).
2900REPEAT
2910READ E%
2920UNTIL E%-100=for%
2930
2940REM P%-1=numbers being the colour player P% may change.
2950REM If one combination in the colour is found play%=TRUE.
2960H%(0)=P%-1
2970I%=P%-1
2980REPEAT
2990READ E%,F%,G%,H%
3000IF E%>100 GOTO3020 :REM IF END OF DATA FOR for%
3010IF N%(E%)=I% AND N%(F%)=I% AND N%(G%)=I% AND N%(H%)=I% play%=TRUE
3020UNTIL E%>100
3030ENDPROC
3040:
3050REM Data for PROCcheck
3060DATA 101,1,0,0,0 ,102,2,0,0,0 ,103,3,0,0,0,2,1,0,0 ,104,4,0,0,0,3,1,0,0
3070DATA 105,5,0,0,0,4,1,0,0,3,2,0,0 ,106,6,0,0,0,5,1,0,0,4,2,0,0,1,2,3,0
3080DATA 107,7,0,0,0,6,1,0,0,5,2,0,0,4,3,0,0,1,2,4,0 ,108,8,0,0,0,7,1,0,0
3090DATA 6,2,0,0,5,3,0,0,1,2,5,0,1,3,4,0 ,109,9,0,0,0,8,1,0,0,7,2,0,0
3100DATA 6,3,0,0,5,4,0,0,1,2,6,0,1,3,5,0 ,110,9,1,0,0,8,2,0,0,7,3,0,0
3110DATA 6,4,0,0,1,2,7,0,1,3,6,0,1,4,5,0,1,2,3,4,2,3,5,0 ,111,9,2,0,0
3120DATA 8,3,0,0,7,4,0,0,6,5,0,0,1,2,8,0,1,3,7,0,1,4,6,0,5,4,2,0,6,3,2,0
3130DATA 1,2,3,5 ,112,9,3,0,0,8,4,0,0,7,5,0,0,1,2,9,0,1,3,8,0,1,4,7,0
3140DATA 1,5,6,0,1,2,3,6,1,2,4,5 ,113,0,0,0
3150:
3160REM Error routine from line 170.
3170*FX4,0
3180COLOUR0:COLOUR130
```

PROGRAM FILE

```
3190PRINTTAB(0,31)
3200REPORT:PRINT" at line ";ERL
3210END
3220:
3230REM Relocation routine from line 50
3240MODE7
3250PRINT'''"Relocating Cover up";
3260*TAPE
3270LOMEM=&E00+(TOP-PAGE)
3280FOR R%=PAGE TO TOP
3290IF(R%-PAGE)MOD256=0PRINTTAB(25,3);~R%-PAGE;
3300?(R%-&B00)=?R%
3310NEXT
3320PAGE=&E00
3330HIMEM=&3000
3340GOTO60
```

IBM MBasic DIRSIZE Tip
by DA Lawson

This short Basic program allows you to determine the size of individual sub-directories — their size is not displayed in ordinary directory lists. To use the program, type in the Basic program and save it as DIRSIZE.BAS. Then type in the second file from the DOS command prompt using COPY CON; this should be saved as DIRSIZE.BAT. Copy both files into the directory where you keep BasicA or GW-Basic.

To run the program, type DIRSIZE xxx where xxx is the name of the directory whose size you want to know. After a short wait, you will be asked to enter the extension of the files to be totalled within the directory. The program will then tell you the number of files and the number of bytes they all take up. Simply press Return if you want to add up all the files in the directory.

The program works by the crude method of listing the directory to a file and adding up the byte fields.

```
10 CLS:C = 0:CNT=0
15 ON ERROR GOTO 250
20 INPUT "Enter Extension of Files you wish to Total --> ",EXT$
30 LOCATE 4,10:PRINT"**** Calculating Directory Size ****"
50 OPEN "i",1,"DATA.DAT"     ' OPEN FILE THAT CONTAINS DIRECTORY.
60 INPUT £1,A$:INPUT £1,A$:INPUT £1,A$  'EXCLUDE DIRECTORY HEADER.
70 INPUT £1,A$
80 IF EOF(1) THEN GOTO 160
90 B$ = MID$(A$,13,9)        ' GET FILE SIZE.
100 E$ = MID$(A$,10,3)       ' GET FILE EXTENSION.
110 IF EXT$ = "" THEN 130
120 IF EXT$ <> E$ THEN 70
130 B = VAL(B$)
140 C = C + B:CNT = CNT + 1
150 GOTO 70
155 REM Print directory size and number of files.
160 LOCATE 7,1:PRINT "The size of the Directory = ";C;" bytes"
165 LOCATE 9,1:PRINT"The Number of Files Counted = ";CNT
170 LOCATE 23,1:PRINT"Press Any Key to Return to D.O.S."
180 K$=INKEY$:IF K$="" THEN 180
190 SYSTEM
240 REM If Data File not found print error message.
250 LOCATE 7,1:PRINT "**** S Y S T E M   E R R O R ****"
260 LOCATE 23,1:PRINT"Press Any Key to Return to D.O.S."
270 K$=INKEY$:IF K$="" THEN 180
280 SYSTEM
echo off
cls
echo      **** Creating Data File ****
dir \%1 > data.dat
basica dirsize
cls
```

BBC Hints and Tips
by Jonathan Temple

Finding what mode you are in

It is sometimes useful to find out what mode you are in from within a program. A good way to do this is to define a function:

```
DEFFNmode:A%=135:!&70=USR(&FFF4):=?&72
```

Decoding USR call results

Usually USR calls return a 32-bit number representing the 6502 registers P, A, X and Y. This requires complex calculations to discover what values are in the registers you need to know about. If you use a statement like !&70=USR(address) then A will be returned in &70, X in &71, Y in &72 and P in &73.

Listing variables

The key definition below will list the names of all the currently defined variables in memory. If you are using it with a program, you will have to run the program first and only the variables used will be printed. Press f0 to use it.

```
*KEY 0 F.F%=&482TO&F4S.2:A%=!F%A.&FFFF:IFA%>&FF REP.V.10,13,-512+F%/2:M%=A%+1:REP.M%=M%+1:V.?M%:UN.?M%=0:A%=!A%A.&FFFF:UN.A%<&FF:N.EL.N.|M
```

PROGRAM FILE

Memotech Tips

by David Martin

These tips are for the MTX range but might work on the RS128.

Program lines

All program lines are stored in memory as follows: length (2 bytes), line number (2 bytes), line contents, end-of-line marker (#FF).

The length marker points to the first character of the nest line. CODE lines are shown by #C2 followed by the length of the machine code (stored as lsb/msb).

User routines

User routines can be set up by loading the following bytes of memory:
#FA87 — return byte (#C9)
#FA88 — check byte (normally #07)
#FA89 — jump (#C3)
#FA8A/B — address

When a user routine is called, the DE register pair points to the character after the user statement, allowing names to be checked, and so on.

ROM calls

Print to screen — #1907
Set HL to the start of data and OR the final byte with #0, then CALL #1907 to print the data.
Convert decimal number to hex word — #121D
Set DE to start of data (stored as a sequence of ASCII codes of the number). CALL #121D and the hex value will be placed in the BC register pair.
List line — #29AF
Set HL to the start of the data and set the last byte to #FF. CALL #29AF will convert the data into a basic line and print the result.
Write data to tape — #0AAE
Set HL to the start of the data and DE to the length of the data. Data item 1 should go at #FD68 and item 2 at #FD67. If data item 1 and 2 are both 0, then the operation will be SAVE. If data item 1 is 1 and data item 2 is 0, it will LOAD. If both are 1, it will VERIFY.

Z80 Tracker Ball Control Routines

by Robin Luxford

In many computer applications such as word processing and graphics, it is a great convenience to be able to move the cursor around the screen quickly and freely. Some business systems use a mouse — a device which, when moved across the desk, sends signals to the computer to move the cursor by the corresponding amount in the same direction. The snag with the mouse is that you need desk space close to the keyboard to move it around, and many users prefer the tracker ball. Since the base of this device stands on the desk and the ball itself moves, it requires much less space to operate.

A popular example of the tracker ball, which is advertised for use with the BBC Micro, is the Marconi RB2. This has a heavy, highly polished ball, similar to a billiard ball, which sits on two ground steel shafts running in roller bearings with another roller bearing to provide a third support point. The two shafts are at right angles to each other and interpret the movements of the ball in the X and Y directions. On the ends of the shafts are thin metal discs with slots cut in them, rather like the spokes of a wheel; and on one side of the disc are two light or infra-red emitting diodes, and in line with these, two sensors. The diodes and their respective sensors are displaced slightly so that as the disc revolves, the path to one sensor is interrupted or restored before the path to the other one, which makes it possible for the electronics to determine in which direction the disc is revolving. The whole assembly of disc, emitting diodes and sensors is known as an 'optical encoder'.

The output of the four sensors goes to some electronics in the tracker ball which shape the pulses to give four trains of square pulses, two X and two Y, from which the direction can be determined. The ball housing also has three button switches which can be polled by the software and converted into any desired ASCII characters such as carriage return, space, backspace, and so on.

As the RB2 is marketed for the BBC Micro, it comes complete with programs in BBC Basic and 6502 machine code for use with that machine. However, there doesn't seem to be anything available in Z80 code and I decided that if I wanted to use the RB2 with a micro running CP/M, I would have to write the code myself.

Before considering the software, however, it is necessary to look at the physical connection to the com-

puter. It is supplied with a metre of cable terminating in a 20-way connector to fit the BBC user port, and if this will not fit your machine, you can either make an adaptor or cut the user port off and fit a plug compatible with your user port. If your computer uses a PIO (Programmable Input/Output), the parallel I/O controller of the Z80 family, interfacing is very simple. Fig 1 shows the way I have connected the tracker ball to my machine's user port B. You can modify these connections to suit your own requirements.

The software

Three separate routines are required, the first of which is only run once, sets the CPU to interrupt mode 2, loads the interrupt register and then initialises the port. The other two routines are: an interrupt routine which is called whenever the ball is moved; and another which is called whenever convenient, usually before or after polling the keyboard. The reason an interrupt is required is because whenever the ball is moved, the computer must immediately stop whatever it's doing and see whether the other pulse-train is ahead or behind the one that caused the interrupt, in order to determine the direction of motion (as explained above).

Division of the pulses is necessary because the device is designed so that a very slight movement of the ball generates a pulse, and by this means the sensitivity can be adjusted in the software.

There is less urgency to detect when a button has been pressed than to detect a movement of the ball, so the routine to do this and also to return any cursor move characters can be called on a regular basis along with the keyboard scanning, outputting to the screen, and the other housekeeping chores which the operating system carries out. As this polling can take place many times per second, the button routine ensures that a button, once operated, is released before it responds to the second press.

Listing 1 shows the source code for the initialisation routine, and Listing 2 the interrupt and polling routines. The location of the routines and the addresses referred to by them will almost certainly need changing to incorporate them into a different system, as will the port addresses; the only other changes that might be necessary are to the 'set carry flag' instruction at the end of the polling routine and the ASCII codes for the cursor move characters. The system that this program was written for has a routine (called 'inscan' in these listings) which scans the input sources such as keyboard, RS232 interface, and so on, and any routine returning an input sets the carry flag to indicate that it has done so. Consequently the tracker ball polling routine follows this convention, but other systems may need a different indication that a valid input is being supplied. The cursor move codes in the listing are to the commonly used ADM3 protocol.

There are several ways in which these routines could be incorporated into your existing software. Since a CP/M system is booted from disk, it is likely to be one of the easiest to modify. The CP/M BIOS always starts with a jump table, and the fourth one, the console input jump, will lead to the input scanning routine. The interrupt and the polling routines must be placed in RAM where they will not be overwritten; one place is in high memory, as in Listing 2.

```
; LISTING 1 - Z80 TRACKER BALL PROGRAM
; Initialisation routine
; This routine can be placed anywhere in memory and is called
;  once from the operating system.

        .z80
        ORG 100H

pdat    equ 5h          ; Port B, data
pcon    equ pdat+2      ;         control

hivec   equ 0FEH        ; high byte of interupt vector
livec   equ 00H         ; lo byte

; Prog CPU, but do not enable interupt yet
start:  di
        ld a,hivec
        ld i,a
        im 2

; Prog PIO
        ld hl,pstr
        ld c,pcon
        ld b,pstre-pstr
        otir

; Enable CPU
        ei
        reti            ; ensuring interrupt latch reset

; PIO initialisation string
pstr:   defb livec      ; lo byte vector address
        defb 0cfh       ; bit control mode
        defb 0ffh       ; all bits input
        defb 097h       ; int control
        defb 0f5h       ; mask bits 765420
pstre:

        end
```

PROGRAM FILE

```
; LISTING 2 - Z80 TRACKER BALL PROGRAM
; Interrupt and polling routines

        .z80

pdat    equ 5h          ; Port B, data
pcon    equ pdat+2      ;         control

; 62k BIOS addresses, will be different in other systems
inscan  equ 0f02bh      ; patch to 'poll' (see text)
scankb  equ 0f044h      ; this was the address at inscan

; Interrupt vector - this address must be an even number
;  see books on Z80 interrupt programming for explanation.
        ORG 0FB00H
ivec:   defw irout

xcount: defb 8
ycount: defb 8
chstor: defb 0          ; character stored here until polled
butflg: defb 0          ; flag for buttons pressed/released
buttab: defb 8,0dh,20h  ; button table - backspace, CR, space

        defs 4
stack:  defs 2

irout:  ld (stack),sp   ; save old SP
        ld sp,stack     ; set new SP
        push af
        push hl

; Find which bit caused interrupt
        ld hl,ycount
        in a,(pdat)
ty:     bit 1,a
        jr nz,tx
        bit 0,a
        jr nz,ty1
        inc (hl)
        jr ty2
ty1:    dec (hl)
ty2:    ld a,1eh        ; cursor up
        bit 7,(hl)      ; test for -9 Y moves
        jr nz,storch
        inc a           ; 1fh - cursor down
        bit 4,(hl)      ; test for +8 Y moves
        jr nz,storch

tx:     dec hl          ; now points to xcount
        bit 3,a
        jr nz,eint
        bit 2,a
        jr nz,tx1
        inc (hl)
        jr tx2
tx1:    dec (hl)

tx2:    ld a,1ch        ; cursor left
        bit 7,(hl)      ; test for -9 X moves
        jr nz,storch
        inc a           ; 1dh - cursor right
        bit 4,(hl)      ; test for +8 X moves
        jr z,eint

; Store cursor move for polling
storch: ld (hl),8
        ld (chstor),a
eint:   pop hl
        pop af
        ld sp,(stack)
        reti


; Polling routine

poll::  ld hl,chstor
        bit 4,(hl)
        jr z,buts       ; no cursor move waiting
        ld a,(hl)
        res 4,(hl)
        scf
        ei
        ret

; Test buttons
buts:   ei
        inc hl          ; HL = butflg
        in a,(pdat)
        bit 0,(hl)
        jr z,but2
        and 70h         ; button flag set
        xor 70h
        jr nz,but1      ; buts not restored so ignore
        res 0,(hl)
but1:   jp scankb

but2:   inc hl          ; now points to button table
        bit 6,a         ; right button
        jr z,but3
        inc hl
        bit 5,a         ; centre button
        jr z,but3
        inc hl
        bit 4,a         ; left button
        jr z,but3
        xor a           ; no buttons pressed
        jp scankb

but3:   ld a,(hl)
        ld hl,butflg
        set 0,(hl)
        scf             ; see text
        ret

        end
```

TABLE 1 - Z80 TRACKER BALL PROGRAM

BBC user-port designation	20 way conn. pin number	T-ball function	PIU port bit no.
CB1	2	X1	2
CB2	4	Y2	1
PB0	6	Left sw.	4
PB1	8	Centre sw.	5
PB2	10	Right sw.	6
PB3	12	X2	3
PB4	14	Y1	0
+5V	1 & 3	+5V	+5V
0V	5-13 odd	0V	0V
PB5,6,7 not used			bit 7 ciel to CV

QL File Extensions

by D Marsh

File Executive is a utility that allows all file/housekeeping operations for microdrives to be performed very easily. When a directory has been obtained, each program on the drive is given a number such that operations which are to be carried out on that file can be done by simply entering its number when asked.

The program makes use of the extension **OPEN-WIND** from the program QL Windows by Jonathan Bowring, as published in the February issue of *PCW*; and it also makes use of the extension to SuperBasic, **RENAME**. If you do not have these extensions, don't worry — the procedures which use these extra commands can be omitted from the listings. The appropriate points are stated in the listing.

The use of **RENAME** in the program is obvious. **OPEN-WIND** is used as a simple notepad facility with SAVE, LOAD and PRINT OUT commands, and also to change the default devices at any time when the program is in use.

Explanation of commands

DIR= This takes a directory from the chosen master drive and displays the files in an orderly fashion in the main window. Note that some commands will appear to do nothing if a directory isn't obtained first — that is, COPY, KILL, CLONE. Only the commands that do not require a directory will operate without it.

COPY= Copy a single file from master to slave.

KILL= Delete a single file on master.

ALL_CLONE= Clone files from master to slave automatically.

HDIR= Hard copy of directory of master drive to printer.

LISTING= Hard copy of program on master to printer.

TYPE= Shows contents of any file in main display from master. Press <space> to exit type at any time, and <ctrl> & <F5> to pause.

FORMAT= Format master drive. Press keys 1 to 9 for the number of formats you require.

QUIT= Leave file executive and return to SuperBasic.

PAGE= For large directories that cannot be displayed all at once. Press this to page through files.

EXTEND= Add extension to a filename on master drive (remove rename procedure if no **RENAME** command added).

RENAME= Change name of a file on master drive (remove rename procedure if no **RENAME** command added).

If you do not have the **OPEN-WIND** extension, the following does not apply.

Notepad

INPUT= Take a new note.

DISPLAY= Show a note made earlier.

LOAD= Load a previous note from master drive.

SAVE= Save current note in memory to master drive.

PRINT= Print out note in memory to SER1 or SER2.

Use command

F1 MDV1 — USE= MDV1 is the master drive and MDV2 the slave drive.

F2 MDV2 — USE= MDV2 is the master drive and MDV1 the slave drive.

SER1 — USE= Any print goes to SER1.

SER2 — USE= Any print goes to SER2.

PROGRAM FILE

```
1 REMark EXECUTIVE
2 REMark D.MARSH 1987,GTR. MANCHESTER
3 :
4 REMark IF NO RENAME EXTENSION REMOVE (R)ENAME AND (E)XTEND
5 REMark COMMANDS IN LINE 16, IF NO OPEN_WIND COMMAND REMOVE
6 REMark (U)SE AND (N)OTE COMMANDS IN LINES 15 AND 16.
7 :
8 DIM PROG$(100,20):DIM LETTER$(400,1):SETUP:CHOOSE
9 :
10 DEFine PROCedure SETUP
11 LI=0:PI=0:BAUD 600:DM$="MDV1_":DS$="MDV2_":RNAME%=0:TP1=0:PORT$="SER1M"
12 MODE 4:WINDOW 512,256,0,0:PAPER 4,7,3:CLS:BLOCK 448,232,34,13,0:WINDOW 448,232,31,16:PAPER 0,7,3:CLS
13 WINDOW 115,15,358,228:PAPER 2:CLS:BORDER 1,0:INK 7:CSIZE 1,0:PRINT' EXECUTIVE'
14 WINDOW 437,25,36,20:PAPER 4:CLS:BORDER 1,0:CSIZE 0,0:INK 0
15 PRINT' (D)IR (C)OPY (A)LL_CLONE (F)ORMAT (M)DIR (L)ISTING (U)SE'
16 PRINT' (K)ILL (R)ENAME (E)XTEND (T)YPE (Q)UIT (P)AGE (N)OTE'
17 WINDOW 437,177,36,48:PAPER 7:CLS:BORDER 1,0
18 OPEN#3,CON_318x15a36x228:PAPER#3,7:CLS#3:BORDER#3,1,0:INK#3,2
19 END DEFine
20 :
21 REMark REMOVE PROCEDURE CALLS RNAME AND EXTEN IN NO RENAME COMMAND
22 REMark REMOVE PROCEDURE CALLS NOTEPAD AND DRIVEUSE IF NO OPEN_WIND
23 REMark IN LINES 30 AND 31
24 :
25 DEFine PROCedure CHOOSE
26 POKE 163976,1
27 REPeat SCAN
28 GETKEY
29 SELect ON K
30 =68:DIRR:=75:KILL:=67:COPY:=65:CLONE:=70:FORMT:=72:MDIRR:=60:PAGE:=76:LISTING
31 =82:RNAME:=69:EXTEN:=84:TYPE:=81:QUIT:=65:DRIVEUSE:=78:NOTEPAD
32 END SELect
33 END REPeat SCAN
34 END DEFine
35 :
36 REMark DELETE DRIVEUSE,PADCOMM,FILENAME AND NOTEPAD PROCEDURES
37 REMark IF NO OPEN_WIND COMMAND
38 :
39 DEFine PROCedure DRIVEUSE
40 OPEN#10,SCR:OPEN#11,SCR
41 OPEN_WIND#10,172,96,148,88,2,2,2,0:OPEN_WIND#11,182,86,148,88,0,7,0,1
42 PRINT#11,\\" (F1) MDV1_MASTER\" (F2) MDV2_MASTER\" (F3) SER1_USE'\" (F4) SER2_USE":GETKEY
43 IF K=232:DM$="MDV1_":DS$="MDV2_"
44 IF K=236:DM$="MDV2_":DS$="MDV1_"
45 IF K=248:PORT$="SER1M"
46 IF K=244:PORT$="SER2MHC"
47 CLOSE_WIND:CLOSE_WIND:CLOSE#10:CLOSE#11
48 END DEFine
49 :
50 DEFine PROCedure PADCOMM
51 CLS#3:INK#3,0:PRINT#3,' COMMANDS: (I)NPUT (D)ISPLAY (P)RINT (S)AVE (L)OAD":INK#3,2
52 END DEFine
53 :
54 DEFine PROCedure NOTEPAD
55 OPEN#10,SCR:OPEN#11,SCR
56 OPEN_WIND#10,62,86,328,118,2,2,2,0:OPEN_WIND#11,72,76,328,118,0,7,0,1
57 PADCOMM
58 REPeat MAIN
59 GETKEY:IF K<83 AND K<73 AND K<80 AND K<68 AND K<76:CLOSE_WIND:CLOSE_WIND:CLOSE#10:CLOSE#11:CLS#3:RETurn
60 I=5:Y=1
61 IF K=73
62 CLS#11:FOR I=0 TO LI:LETTER$(I)=""
63 LI=0
64 REPeat TAKENOTE
65 AT#11,Y,X:PRINT#11,"_":GETKEY:IF K=27:AT#11,Y,X:PRINT#11," ":EXIT TAKENOTE
66 IF K=194 OR K=192
67 AT#11,Y,X:PRINT#11," "
68 IF X>5:X=X-1:ELSE IF Y>1:X=44:Y=Y-1
69 AT#11,Y,X:PRINT#11,"_":IF LI>0:LI=LI-1:LETTER$(LI)=""
70 END IF
71 IF K=10
72 AT#11,Y,X:PRINT#11," "
73 REPeat BLANK:LETTER$(LI)=' ":LI=LI+1:X=X+1:IF X=45:EXIT BLANK
74 X=5:Y=Y+1:IF Y>18:AT#11,Y,X:PRINT#11,"_"
75 END IF
76 IF K>127 OR K<32:GO TO 79
77 AT#11,Y,X:PRINT#11,CHR$(K):LETTER$(LI)=CHR$(K)
78 LI=LI+1:X=X+1:IF X=45:X=5:Y=Y+1
79 IF Y=18:EXIT TAKENOTE
80 END REPeat TAKENOTE
81 END IF
82 IF K=68
83 CLS#11
84 FOR I=0 TO LI
85 AT#11,Y,X:PRINT#11,LETTER$(I):X=X+1
86 IF X=45:X=5:Y=Y+1
87 END FOR I
88 END IF
89 IF K=80
90 OPEN#15,PORT$:LI=0:A$=""
91 IF PORT$="SER1M":BAUD 2400:PRINT#15,CHR$(13);:CHR$(0):ELSE BAUD 600:PRINT#15,CHR$(13)
92 REPeat PRINTOUT
93 FOR I=1 TO 40:A$=A$&LETTER$(LI):LI=LI+1
94 IF PORT$="SER1M":PRINT#15,A$;CHR$(13):ELSE PRINT#15,A$
95 A$="":IF LETTER$(LI+1)="":EXIT PRINTOUT
96 END REPeat PRINTOUT
97 CLOSE#15
98 END IF
99 IF K=83 AND LI>0
100 FILENAME:IF F$="":GO TO 112
101 DELETE F$:OPEN_NEW#15,F$:PRINT#15,LI
102 FOR I=0 TO LI:PRINT#15,LETTER$(I)
103 CLOSE#15
104 END IF
105 IF K=76
106 FILENAME:IF F$="":GO TO 112
107 FOR I=0 TO LI:LETTER$(I)=""
108 OPEN_IN#15,F$:INPUT#15,LI
109 FOR I=0 TO LI:INPUT#5,LETTER$(I)
110 CLOSE#15:K=68:GO TO 82
111 END IF
112 END REPeat MAIN
113 END DEFine
114 :
115 DEFine PROCedure FILENAME
116 CLS#3:INPUT#3,' ENTER FILENAME=":F$:PADCOMM:IF F$="":RETurn
117 F$=DM$&F$&"_PAD"
118 END DEFine
119 :
120 DEFine PROCedure DIRR
121 PRINT#3,' DIRECTORY OF"!DM$!"(CONFIRM Y/N)":GETKEY
122 IF K<>89:CLS#3:RETurn
123 PI=0:OPEN_NEW#10,DM$&"DIR_TMP":DIR#10,DM$:CLOSE#10:OPEN_IN#10,DM$&"DIR_TMP"
```

PROGRAM FILE

```
124 INPUT#10,DRIVE$:FOR I=0 TO TP%:PROG$(I)=""
125 REPeat LOOP
126 IF EOF(#10):EXIT LOOP
127 INPUT#10,A$:IF "DIR_TMP" INSTR A$:GO TO 126
128 POS%="/" INSTR A$:IF POS%:SP$=A$(1 TO POS%-1)+1:GO TO 126
129 A%=CODE(A$):IF A%<32 OR A%>127:GO TO 126
130 PROG$(P%)=A$:P%=P%+1
131 END REPeat LOOP
132 CLOSE#10:DELETE DM$&"DIR_TMP":CLS#3:TP%=P%:P%=0:PAGE
133 END DEFine
134 :
135 DEFine PROCedure GETKEY
136 K=CODE(INKEY$(-1))
137 END DEFine
138 :
139 DEFine PROCedure FILENUM
140 INPUT#3," ENTER FILE NUMBER="!F$:IF F$="":NONE%=1:CLS#3:RETurn
141 IF CODE(F$)<49 OR CODE(F$)>58:NONE%=1:CLS#3:RETurn
142 IF F$>TP%:NONE%=1:CLS#3:RETurn
143 F$=PROG$(F$-1):CLS#3
144 END DEFine
145 :
146 DEFine PROCedure PAGE
147 IF TP%=0:RETurn
148 X%=2:Y%=2:INK 2:CLS:PRINT" FREE SECTORS="!SP$:INK 0
149 REPeat DISPLAY
150 IF PROG$(P%)="":P%=0:EXIT DISPLAY
151 AT Y%,X%:PRINT"(";P%+1;")"!PROG$(P%):P%=P%+1
152 IF PROG$(P%)="":P%=0:EXIT DISPLAY
153 IF X%=2 AND Y%=16:X%=25:Y%=1
154 IF X%=25 AND Y%=16:X%=48:Y%=1
155 IF X%=48 AND Y%=16:EXIT DISPLAY
156 Y%=Y%+1
157 END REPeat DISPLAY
158 END DEFine
159 :
160 DEFine PROCedure KILL
161 IF TP%=0:RETurn
162 FILENUM:IF NONE%:NONE%=0:RETurn
163 PRINT#3," KILL"!F$!"ON"!DM$!"(CONFIRM Y/N)":GETKEY
164 IF K<>89:CLS#3:RETurn
165 DELETE DM$&F$:CLS#3
166 END DEFine
167 :
168 DEFine PROCedure COPP
169 IF TP%=0:RETurn
170 FILENUM:IF NONE%:NONE%=0:RETurn
171 PRINT#3," COPY"!F$!"FROM"!DM$!"(CONFIRM Y/N)":GETKEY
172 IF K<>89:CLS#3:RETurn
173 DELETE DS$&F$:COPY DM$&F$ TO DS$&F$:CLS#3
174 END DEFine
175 :
176 DEFine PROCedure FORMT
177 PRINT#3," FORMAT"!DM$!"(PRESS ANY KEY 1 TO 9)":GETKEY
178 IF K<49 OR K>57:CLS#3:RETurn
179 FOR I=1 TO CHR$(K):CLS#3:PRINT#3,"FORMAT NUMBER"!I:FORMAT#3,DM$
180 CLS#3
181 END DEFine
182 :
183 DEFine PROCedure CLONE
184 IF TP%=0:RETurn
185 PRINT#3," CLONE"!DM$!"TO"!DS$!"(CONFIRM Y/N)":GETKEY
186 CLS#3:IF K<>89:RETurn
187 FOR I=0 TO TP%-1:F$=PROG$(I):PRINT#3," COPYING"!F$:COPY DM$&F$ TO DS$&F$:CLS#3
188 END DEFine
189 :
190 DEF... PROC... MDIR2
19. ... 3," ... COP. DIRRECTORY OF"!DM$!"(CONFIRM Y/N)":GET...
... K<>89:... 3:RETurn
..3 OPEN#15... AT$:DIR#15,DM$:CLOSE#15:CLS#3
194 END ...
195 :
196 DEFine PROCedure LISTING
197 IF TP%=0:RETurn
198 FILENUM:IF NONE%:NONE%=0:RETurn
199 PRINT#3," PLEASE WAIT WHILE PRINTING"!F$
200 COPY ..&F$ TO PORT$:CLS#3
201 END DEFine
202 :
203 DEFine PROCedure TYPE
204 IF TP%=0:RETurn
205 FILENUM:IF NONE%:NONE%=0:RETurn
206 PRINT#3," PRESS SPACE TO ABANDON"!F$:CLS
207 OPEN_IN#15,DM$&F$
208 REPeat GETLINES
209 IF EOF(#15):EXIT GETLINES
210 IF CODE(INKEY$)=32:EXIT GETLINES
211 INPUT#15,L$:PRINT L$
212 END REPeat GETLINES
213 CLOSE#15:PAUSE:CLS#3:PAGE
214 END DEFine
215 :
216 REMark DELETE PROCEDURES RNAME AND EXTEN IF NO RENAME COMMAND
217 :
218 DEFine PROCedure RNAME
219 IF TP%=0:RETurn
220 FILENUM:IF NONE%:NONE%=0:RETurn
221 INPUT#3," NEW NAME FOR "&F$&" ON "&DM$&" ="!NF$:IF NF$="":CLS#3:RETurn
222 FOR I=0 TO TP%:IF PROG$(I)=F$:PROG$(I)=NF$:P%=0:PAGE:GO TO 223
223 RENAME DM$,F$ TO NF$:CLS#3
224 END DEFine
225 :
226 DEFine PROCedure EXTEN
227 IF TP%=0:RETurn
228 FILENUM:IF NONE%:NONE%=0:RETurn
229 INPUT#3," EXTENSION FOR "&F$&" ON "&DM$&" ="!EXT$:IF EXT$="":CLS#3:RETurn
230 FOR I=0 TO TP%:IF PROG$(I)=F$:PROG$(I)=F$&EXT$:P%=0:PAGE:GO TO 231
231 RENAME DM$,F$ TO F$&EXT$:CLS#3
232 END DEFine
233 :
234 DEFine PROCedure QUIT
235 PRINT#3," QUIT (CONFIRM Y/N)":GETKEY
236 IF K<>89:CLS#3:RETurn
237 WINDOW 512,256,0,0:PAPER 0:CLS:OPEN#2,CON:PAPER#2,2:CLS#2
238 OPEN#1,CON:PAPER 2:INK 7:NEW
239 END DEFine
```

BBC Mandelbrot Wallpaper

by Tom Standage

This is a very unusual and interesting variation on the standard Mandelbrot program. Mandelbrot Wallpaper plots any chosen region of the Mandelbrot set, a line at a time on an 80-column printer. When left to run, this produces a sheet of print. If the program is run again, more sheets can be produced which can be hung vertically next to each other like wallpaper. In this way, huge plots of the Mandelbrot set can be made.

When the program is run, it asks for the X and Y (or real and imaginary) coordinates for the plot. A good place to try for a first plot is −1.05 for X and 0.39 for Y. The program then asks how many lines are to be plotted; with about ⅛in line spacing there are around 80 lines to a piece of printer paper, and if you have continuous tractor feed paper you can enter larger numbers. A good number is about 300, which produces a large plot. However, it takes several hours and is best left on overnight.

When the program has finished, you can plot the strip to the left or right of the one you've just done. To print the strip to the left, keep the Y coord the same but subtract 0.04 from the X coord. Enter these new coordinates back in and ask for the same number of lines. To plot the strip to the right, just add 0.04 to the X coord and again keep Y the same.

After a few all-night runs you will have enough strips to stick together. Printing 4 adjacent strips of 300 lines produces a plot about a metre square. However, you could ask for 1000 lines, do 12 plots and start wallpapering!

The program as it stands is very simple in order to make conversion to other machines simpler. One modification the reader might like to try is:

Changing the grey scale.

The data statements at the end of the program define the grey scale; by altering the characters you can change the appearance of the plot.

Cutting down on noise

If, like me, you have your printer and computer in your bedroom, then the printer's movements every 30 seconds or so are going to prevent you from sleeping! One solution is to get the computer to POKE the characters it generates to memory, and then save it all to disk when finished. The disk access is, therefore, the only noise, but with only 32k on a BBC B you can only fit 300 lines or so in the memory. (With a Master this could be increased. A Turbo Master would also cut down on the plot time!) To print the plot, just do VDU2,1,27,65,1,8 and *TYPE the file.

The printer codes in the program to set the line spacing are for Epson and compatible printers. VDU 1,27,1,65,1,8 is equivalent to PRINT CHR$"ESC"; CHR$(65); CHR$(8).

Due to the way the grey scale is set, it is not possible to change the scale of plots without redefining the arrays. For more information see *Scientific American*, August 1985, which includes a map of the Mandelbrot set to help you find some good regions to plot. Here are two places to try:

X: −0.76 to −0.68 in steps of 0.04 (3 plots)
Y: 0.40

X: −1.09 to −0.93 in steps of 0.04 (5 plots)
Y: 0.39

```
1000 REM Mandelbrot Wallpaper
1010 REM
1020 REM Tom Standage July 1986
1030 REM
1040
1050 MODE3
1060 REM 80 column mode
1070
1080 INPUT"X co-ord (-2.00 to 0.50): "x
1090 INPUT"Y co-ord (-1.25 to 1.25): "y
1100 INPUT"Number of lines to plot ? "L
1110 PROCarray
1120 REM x-width of dump is 0.04
1130 REM y value is TOP of dump
1140
1150 VDU2
1160 REM printer on-line
1170 VDU1,27,1,65,1,8
1180 REM set line spacing to 1/8 inch
1190
1200 FORline=1TOL
1210 PROCdrawline(x,y)
1220 y=y-0.0005
1230 NEXT
1240
1250 VDU3
1260 REM printer off-line
1270 END
1280
1290 DEFPROCdrawline(x,y)
1300 FOR J=0 TO 79
1310 XX=x+(J*0.0005)
1320 YY=y
1330 MM=FNm(XX,YY)
1340 PRINTCHR$(char(MM));
1350 NEXT
1360 ENDPROC
1370
1380 DEFPROCarray
1390 DIM col(100),char(7)
1400 FORF=1TO3:col(F)=1:NEXT
1410 FOR F=4 TO 7:col(F)=2:NEXT
1420 FOR F=8 TO 14 STEP2:col(F)=(F/2)
     -1:col(F+1)=(F/2)-1:NEXT
1430 FOR F=15TO29:col(F)=6:NEXT
1440 FOR F=30TO50:col(F)=7:NEXT
1450 char(0)=32
1460 FOR f%=1 TO 7
1470 READ a$:char(f%)=ASC(a$)
1480 NEXT
1490 ENDPROC
1500
1510 DEFFNm(X,Y)
1520 C=0:D=0:co=0
1530 REPEAT
1540 co=co+1
1550 C2=C^2 - D^2
1560 D2=2*C*D
1570 C=C2+X:D=D2+Y
1580 UNTIL co>50 OR (C^2 + D^2)>4
1590 IF co>50 =0
1600 =col(co)
1610
1620 DATA +,0,o,:,.,*,@
1630 REM substitute your own grey
     scale here
```

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Please find enclosed my cheque/PO for £5 for the following Transaction File ad.

USER GROUPS

Rupert Steele's column gets a new look this month as he broadens his coverage of the club scene.

This month sees this column change its name from 'ACC News' to 'User Groups' with a wider coverage of clubs to include a select few 'commercial' organisations as well as the cheerful hobbyists we all know and love. The main idea of this is that somebody with a problem will be able to consult my column for information on the computer Agony Aunt who may have the solution. From next month, I shall be publishing a short directory, classified by subject, of user groups related to machines, software packages, and other specialities. This information will be regularly checked but reader feedback will be appreciated.

The news section of my column will continue, and I hope that it will be possible to run feature articles within the page on particular clubs, user groups or other support organisations. As always, groups wanting to be in the directory or the subject of a feature should contact me. While I shall be sniffing around the industry for items to include, it is obviously much harder for me to miss a group that writes to me. Do send in any black and white pictures that may be relevant — I can't guarantee that we'll be able to print them all, but they will give me a better idea of what's going on.

I shall be building up the directory over a few months, and as I have to submit my copy some time before publication, don't be too disappointed if your club doesn't appear immediately. Obviously, if space gets tight, I may have to be selective, so the more information you send the better I'll be able to appreciate the importance of your group.

Local clubs: keep on writing with your news. While I won't be putting local clubs in the directory list, I shall still be reporting news items from you.

Club news

I have received a package of information from the Lincolnshire Microprocessor Society. The name is a dead giveaway that the club has been in existence for some years — when I started writing this column back in 1981 clubs often had 'Microprocessor' in their name — now, of course, it's 'Computer' or 'Amstrad'. Having been around for some time, the Lincolnshire Society has managed to get itself organised in some detail. It is a registered charity and is parent to a more recent creation, the Lincoln Computer Club. The Society meets every six weeks on a specific subject. Recent events include 'Starting a small business', a demonstration of computers in use at the Royal Observer Corps HQ, a talk at the Institute of Electrical Engineers, and an evening at the computerised phone exchange which includes computer Directory Enquiries in action).

The club meets more informally from 7.30-10.30pm on the first and third Wednesdays of each month except August. The venue is the extraordinarily named pub 'The Cardinal's Hat', 286 High Street, Lincoln, and you should enter through the oak door in Grantham Street! Annual membership is only £5 and the club has a bundle of computers and printers for hire to its members; all in all, a most impressive set-up. It does seem that it is possible to run very large and successful groups in the areas away from London; perhaps the bustle of the Metropolis makes it difficult for club members to find the time — even though the distances are much shorter than in less pressured areas.

'Yes, Brian — I'm not just a talking computer. I can sing! I can dance.'

The contact for both Lincoln(shire) groups is Douglas Griffiths on Lincoln 680578. You can write to him at 659 Newark Road, Swallowbeck, Lincoln LN6 8SA.

Bob Waixel has written to me about Cambridge Computer Town which has regrettably suffered many of the problems that I described last month as afflicting the Kensington & Chelsea Club. Bob's letter points to just the trend that I have mentioned before (that is: the switch of interest to user groups) and states that meetings of the Cambridge Computer Town are being suspended until interest picks up. I don't know what the position will be when this is published, so if you're interested in Cambridge Computer Town, why not send an sae to Bob at 4 Manhattan Drive, Cambridge CB4 1JL and I'm sure he'll let you know the latest position.

Down in Bracknell, I have heard from the Crown Wood Computer Club. It has opened up a new venture on the Forest Park Estate. The meetings are from 7-9pm each Wednesday at the Community House, 26 Bere Road. There is a weekly charge of 40p a meeting, and members are welcome from all over the Bracknell area. You can bring your own equipment along, but small mono TVs and plenty of power points are available. The club sees its main role as teaching beginners through use of the machines and contact with experienced users.

Moving on to Harpenden, I have had a note from HUMBUG — the Harpenden Microcomputer Users Group. The club meets on alternate Mondays from 8pm in The Silver Cup public house which is at the north end of Harpenden Common on the A1081. The club Secretary is Peter Cowley on Harpenden 5127, and recent meetings have included a session on APL, and word processing on the BBC Micro and Amstrad systems. The group also has a regular news sheet, which includes a 'For Sale' section. Peter Cowley's address is 36 Southdown Road, Harpenden, Herts AL5 1PG.

Another local group in the South East is the Commodore Co-op Computer Club. It meets fortnightly at Davenport Hall, Davenport Road, Catford, London SE6 and is affiliated to ICPUG (the Independent Commodore Products User Group). Further information is available via the club's answerphone on (01) 304 4529 or send an sae to Marvin Hoskin at 8 Ramillies Road, Sidcup, Kent DA15 9HY.

And, finally, I have a club for Atari ST users in Portugal who are interested in international contact. My correspondent is Maria Teresa Pachoco of the ST ATARI CLUB, Apartado 374, 3002 Santarem Codex, Portugal. Let me know if you make it to any of the meetings!

If you would like your user group or club to have a mention in this column or you wish to be considered for the directory of user and support groups, please write to Rupert Steele, 12 Philbeach Gardens, London SW5 9DY. Tel: (01) 370 0601

END ZONE

NUMBERS COUNT

Mike Mudge continues his investigation into W-Sequences.

In the April 'Numbers Count' the definition and origin of W-Sequences appeared together with a number of simple problems. For completeness the definition is reproduced here and a further, independent set of problems is then formulated.

The Definition of a W-Sequence

Consider five positive integers a,b,c,d_1 and d_2 satisfying $2 \leq a \leq b$, $c \geq 0$, $d_1, d_2 \neq 0$.

The sequence $W(a,b,c,d_1,d_2)$ is defined by the following rules:

(i) the first term $W_1 = c$.

(ii) The even terms $W_{2n} = aW_n + d_1$.

(iii) The odd terms (other than the first defined at (i) above)

$W_{2n+1} = bW_n + d_2$.

(iv) The sequence calculated as above is *then* rearranged so that the terms are in increasing numerical order. Thus in general the subscripts n will no longer be in numerical order.

Note: If $d_1 = d_2 = 1$ we write W(a,b,c) and if further c = 1 we write W(a,b). For an example of a W—Sequence see last month's column for detailed calculation.

W(2,3,1): 1, 3, 4, 7, 9, 10, 13, 15, 19, 21, 22, 27, 28, 31, 39, 40 . . .

W(2,3,2): 2, 5, 7, 11, 15, 16, 22, 23, 31, 33, 34, 45, 46, 47, 49, 63 . . .

W(2,3,7): 7, 15, 22, 31, 45, 46, 63, 67, 91, 93, 94, 127, 135, 136 . . .

Revision Note

Two positive integers A and B are said to be CONGRUENT MODULO a third positive integer C if and only if they leave the same remainder when divided by C, thus A — B must be an integer multiple of C.

We write $A \equiv B \pmod{C}$ and understand that there exists a positive integer k such that A — B = kC where it is assumed that $A \geq B$.

Problem I

What values may W(a,b) take modulo any given integer?

Hint. Produce a chart expressing the values of W(a,b) (mod ab) as a percentage for values $2 \leq a < b \leq 9$. Where the values to be charted are the RESIDUES MODULO ab — that is: the remainders upon division by ab.

Extend the chart as far as practicable. For example: $2 \leq a < b \leq 50$.

Extend the results to include W(a,b,c) (Mod ab) for $1 \leq c \leq ab$.

Problem II

What proportion of the terms of a W-Sequence are congruent to each of the possible residues modulo N?

Hint. Determine the proportion of the terms of W(2,3,1) which are congruent to each of 0,1,2 and 3 modulo 4 at intervals of, say, 20000.

Determine the proportion of the terms of W(2,3,1) congruent to each possible residue modulo 100 at intervals of, say, 20000.

Repeat each of the above for W(2,3,2) and then turn the investigation to W(6,9) modulo 54 at intervals of, say, 100000.

Why is it only necessary to consider 7, 10, 37 and 43 as possible residues?

Problem III

For what distinct values of c is a given N a term in $W(a,b,c,d_1, d_2)$ when a,b, d_1 and d_2 are specified?

Problem IV

What terms are common to $W(a_1,b_1,c_1)$ and $W(a_2,b_2,c_2)$ and are these terms all in $W(a_3,b_3,c_3)$ for some suitable choice of the parameters?

Hint. Examine the case of W(2,3,1); W(2,3,2) and W(2,3,7) for which a few terms are given above.

'It says: "Would you be interested in a little romantic novel I've written?" '

Readers are encouraged to send their thoughts, together with complete or partial attempts at the solutions to the above problems, to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Staffordshire WV4 5NF, tel (0902) 892141, by 1 August 1987.

It would be appreciated if such submissions contained a brief summary of results together with thoughts relating to these problems, in a form suitable for future publication in *PCW*.

Please note that submissions can only be returned if a stamped addressed envelope is provided.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or particular, for future 'Numbers Count' articles.

Review: November '86

The postage stamp problem attracted a wide spectrum of readers. Mention must be made of the experts based in Norway, whose correspondent was Christoph Kirfel of The Mathematics Institute, Universitetet I Bergen, Avd. B, 5014 Bergen, Norway.

Readers with detailed enquiries regarding the state of the art and mathematical background are encouraged to contact Christoph directly.

Readable, but slightly out of date references include: *A Postage Stamp Problem* by Ronald Alter and Jeffrey Barnett (American Mathematical Monthly, March 1980, pp206-210) with a further 47 references; *Algorithms for Computing the h-Range of the Postage Stamp Problem* by Svein Mossige (from Bergen) (Mathematics of Computation, vol 36, no 154, April 1981 pp575-582); and *Unsolved Problems in Number Theory*, by Springer Verlag 1980, p68-70.

Within the spirit of The Numbers Count column and its associated vague criteria, this month's prizewinner is Peter Cameron of 70 Godstow Road, Wolvercote, Oxford OX2 8NY who programmed a ZX Spectrum using Hisoft's Pascal Compiler and Devpac Assembler/Monitor. Included in Peter's results is a table of n(s,3) for $s \leq 50$ compared with the upper and lower Hofmeister Bounds and Guy's conjectured value.

Readers should note that Guy's Conjecture is now, in fact, a proven result.

For further information please contact Christoph, Peter or Mike Mudge.

Calling all C Programmers . . .

Michael Scott, of The National Institute for Higher Education, Dublin 9, has produced the MIRACL library (Multiprecision Integer and Rational Arithmetic C Library) which runs under the IBM PC (MS-DOS/PC-DOS). It comes with some 50-plus A4 sides of documentation and Michael is anxious 'for the widest possible distribution of this software to help me debug/improve it'. Any interested readers prepared to undertake field trials of this software and to report back on their experiences should either write to Michael at The School of Computing and Quantitative Methods of The NIHE or to the author, Mike Mudge

MICROCHESS

Get your chess news here! Kevin O'Connell knows where it's at.

What should you read if you want to keep up to date with goings-on in the world of computer chess? Obviously, your first step must be to take out a subscription to *PCW*! However, there are several other good sources of information.

You can join the International Computer Chess Association. For 50 Dutch florins a year (approx £16) you not only become an individual member of the game's governing body, but you will also receive the *ICCA Journal*, a handsomely produced 64-page quarterly full of news, games and articles, including some very technical ones of use to chess programmers. The content covers all aspects of computer chess and is by far the best source of information about progress in the area of mainframes and other non-commercial chess programs. For further information write to the *Journal*'s editor, Dr H I van den Herik, Delft University of Technology, Faculty of Mathematics and Infomatics, Julianlaan 132, Room 2.115, 2628 BL Delft, Netherlands.

From the US, there is the annual *Computer Chess Reports*. The latest of these, for 1986, is a bumper 145 pages, although it is a little expensive at approx £10 including postage. However, it does contain a lot of information, including all the games of the 1985 World Micro and the 1986 World Computer Championship. The emphasis here is in the microcomputer world, but there is also coverage of mainframes. For more information write to the editor, Robert Sostack, PO Box 474, Merrick, NY 11566, USA.

Returning to the UK, there are two newsletters, one new and one well-established. The new one, a quarterly at £6 per year, is *Chess Computer World* from the self-styled British Computer Chess Advisory Service. This is the more general of the two newsletters, with a good mix of games, articles and news. For more information write to the editor, Bryan Whitby, BCCAS, 16 Manse Field Road, Kingsley, Warrington, Cheshire WA6 8BZ. The older established newsletter is that published by Eric Hallsworth, which has now reached issue No 12. The emphasis here is on the ratings of commercially available chess computers and the results of private matches between the leading brands of such machines.

It is from this newsletter, called *News Sheet*, that I have selected this week's game. For more information on *News Sheet* write to the editor, Eric Hallsworth, 12 Turnpike Close, Peacehaven, East Sussex BN9 8BU.

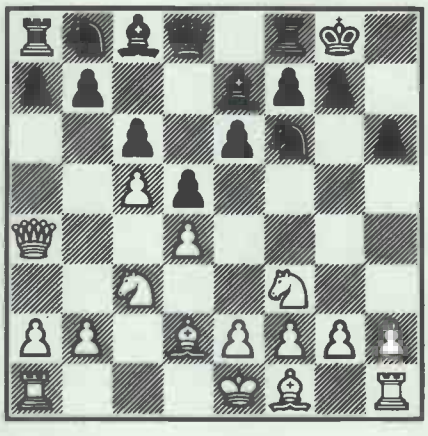
The following game was played at the rate of 30 minutes for the complete game (very similar to the recently concluded London Docklands Speed Chess Challenge between Kasparov and Short that was shown on Channel 4).

White: Fidelity Avant Garde. Black: Mephisto Super Dallas. Opening: Queen's Gambit Declined

1	d2-d4	Ng8-f6
2	c2-c4	e7-e6
3	Ng1-f3	d7-d5
4	Bc1-g5	h7-h6
5	Bg5-d2	

This is rather a strange move. 5 Bg5xf6 would be more normal, but presumably the Fidelity program has been told to value bishops more highly than knights.

5	...	Bf8-e7
6	Qd1-a4+	c7-c6
7	Nb1-c3	0-0
8	c4-c5	



This move, though tempting, is very bad. The temptation is provided by the desire to clamp down on the dark squares in Black's position and to gain space. However, the drawback of ossification of the pawn structure, providing Black with firm, and brittle targets, is more important.

8	...	Nb8-a6
9	e2-e3	b7-b5

In fact it is to be Black who will now be able to benefit from queenside expansion.

10	Qa4-b3	Qd8-c7
11	Bf1-e2	b5-b4!

An excellent pawn sacrifice. This is just the kind of move that strong humans still employ in order to trample over computer opposition. It is impossible to calculate any line that regains the material, but it is obvious positionally that the gains made by Black are worth at least a pawn.

12	Nc3-a4	Nf6-e4
13	Bd2xb4	Na6xb4
14	Qb3xb4	Ra8-b8
15	Qb4-a3	Qc7-a5+
16	Ke1-f1	Bc8-a6
17	Be2xa6	Qa5xa6+
18	Kf1-g1?	

The smoke has cleared and the results of the pawn sacrifice are clear: White's king is badly placed, Black's pieces are more active and play along the half-open b-file guarantees equality with good chances of obtaining more since it is very difficult for White to get his pieces coordinated. 18 Kf1-e1 might have drawn, but White was playing to win.

18	....	Qa6-e2
19	Ra1-f1	Be7-f6
20	h2-h4	Rb8-b7
21	Nf3-e5	

Both machines thought they stood better here. One of them (Black) was right.

21	...	Bf6xe5
22	d4xe5	f7-f6!

To open another line of attack against the white king.

23	e5xf6	Ne4-d2!

An important zwischenzug (in-between move) that weakens White's defence of the f2 square.

24	Rf1-c1	Rf8xf6
25	Rh1-h3	

25 f2-f4 fails to 25 . . . Rf6-g6 (26 Rh1-h2 Nd2-f3+).

25	...	Qe2xf2+
26	Kg1-h2	Nd2-f3+
27	Kh2-h1	Rf6-g6!
28	Rh3-h2	Rg6xg2!

More accurate than taking the rook. Now 29 Rh2xg2 fails to 29 . . . Qf2xh4+ 30 Rg2-h2 Qh4xh2 mate.

29	Rh2-h3	Rg2-g1+
30	Rc1xg1	Qf2xg1 mate

An almost effortless victory for the Microcomputer World Champion.

END ZONE

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MF:6pm-8am ; WE:24 hrs. 3/1275
Radio Hams' area
(0482) 859 169 Forum-80, Hull
MF:7pm-11pm ; WE:1pm-11pm 3/1275
Midnight - 8am on Bell 103 tones.
(0483) 573 337 Compulink CIX, Guildford
24hrs. 3-24. Multi-user. CoSy system.
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(04862) 25 174 PBBS 'Adult' BBS, Mitcham
24hrs. 3/1275
(0492) 49 194 Cymrutel, Colwyn Bay
24hrs. 1275
(0506) 38 526 Livingstone BBS
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(051) 428 8924 Liverpool Mailbox, Liverpool
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24hrs. 300
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(0532) 600 749 L.E.M.S Fido, Leeds
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(0534) 39 389 Jersey Fido
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9.30pm-8am every day. 300
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24hrs. 3-24
For Macintosh users
(0602) 817 696 MacTel HQ, Nottingham
24hrs. 3-12
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(0604) 20 441 Norview, Northants
24hrs. 1275v
(061) 427 1596 OBBS Manchester
24hrs. 3/1275
(061) 494 6938 Fido TeePee link, Manchester
24hrs. 3-24
(061) 773 7739 Fido Manchester
24hrs 3/1275
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24hrs. 3/1275
(0628) 824 852 C.A.T.S. Fido, Maidenhead
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24hrs. 300
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24hrs 1275v
(0705) 524 805 Gosport Apricot BBS
24hrs. 300
(0705) 736 025 BBS09, Portsmouth
Weds:7pm-7am ; WE:24hrs 300
OS9, Sci-Fi sections
(0707) 52 242 RSGB, London
24hrs. 1275v
(0734) 484 847 Trinity 3, Reading
24hrs. 3/1275 TBBS system
(0742) 350 319 MacTel Sheffield
24hrs. 3-24 For Macintosh Users
(0762) 333 872 PBBS1 Portadown, N.Ireland
10pm-1am RING BACK every day. 300
(0766) 4154 Prometheus (Opus), Porthmadog
24hrs 3-24. ANSI colour graphics
(0767) 50 511 Fido Gamlingay, Sandy, Beds
24hrs. 3-24

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(0782) 265 078 Stoke ITeC
24hrs. 1275v
(0792) 203 953 FBBS Swansea
24hrs. 300
(0792) 297 845 Bulletin AT Fido,
MF:6pm-9pm WE:24hrs 3-12
(0832) 73 003 Intel-Ace, Oundle
Swansea
MF:6pm-8am WE:24hrs 1275v
(0865) 882 872 Banat Board, Oxford
24hrs. 3-24
Opus - colour graphics for ANSI
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24hrs 300
(0883) 844 164 LABBS
24hrs. 3/1275
The Prisoner - 2 lines
(08926) 61 149 PD-Sig Fido 1,
Crowborough
24hrs 3/1275
PD software interest group
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24hrs 300
(0895) 52 685 London West Tech
24hrs. 3/1275 TBBS system
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24hrs. 3/12
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24hrs 3-24
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MF:8pm-8am exc.Tue and Thurs.
WE:12h
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(091) 477 3339 Log On the Tyne Fido
10pm-7am every day. 3/1275
(0923) 676 644 SBBS - Watford
MF:9pm-11pm ; WE:11pm-6am 3/1275
(0924) 442598 Kirklees ITeC, Batley
24hrs 1275v
Information Technology Centre
(0925) 411 265 OSI Health Line,
Warrington
24hrs 3-24
(0934) 29 570 Avon Fido, Weston S/Mare
24hrs 3/1275
(0936) 77 025 NBBS Cheshire
24hrs 3/1275
(0942) 609 611 Pyramid, Leigh, Lancs
24hrs 300

Note to sysops

If you want your BBS to appear in the list please send all the above details to Peter Tootill either by post or on Telecom Gold to 83:VNU202. Include a voice telephone number for verification purposes (this will not be published.) Any additions or updates will be gratefully received.

Key to baud rates, etc

300 = 300 (V.21)
1275 = 1200/75 (V.23)
h = half duplex
v = viewdata graphics
12 = 1200/1200 (V.22)
24 = 2400/2400 (V.22bis)
3-12 = V.21,V.23,V.22
3-24 = V.21,V.23,V.22,V.22bis
MF = Monday-Friday times
WE = weekend times

LEISURE LINES

Brainteasers courtesy of JJ Clessa.

Quickie
A painter has to paint the numbers on the houses in a street. The houses are numbered 1-100. Which digit does he paint most frequently, and which, least frequently?

Prize puzzle
The five-digit combination number on my safe begins with the digits '79'. The remaining digits are all even.

My home telephone number begins with '90' and ends with '17'. My business telephone number begins with '491' and ends with '4'.

The three missing digits from both telephone numbers are the same as the last three digits of my safe combination.

All three numbers — the safe combination, and the two telephone numbers — have a common factor. What is it, and what are the missing three digits?

Answers on postcards, please, or backs of envelopes only, to reach *PCW*, Leisure Lines May 1987, 32-34 Broadwick Street, London, W1A 2HG, no later than 31 May 1987.

February prize puzzle
A slightly harder than usual puzzle this time. The problem results in a Diophantine equation which can readily be solved by trial and error methods using a micro.

Although 252, 280, and 288 are all feasible solutions, the answer 288 is the one required, since it is the most satisfactory in terms of the cartesian '. . . There are now getting on for 300 members . . .'

Most entrants gave the correct solution but the winning entry drawn at random came from Mr J F Raper of Worthing, Sussex.

Congratulations, Mr Raper, your prize is on its way. Keep puzzling.

DIARY DATA

THE ATARI COMPUTER SHOW Novotel, Hammersmith — Database Exhibitions (061) 456 8383	**24-26 April 1987**
CITY COMMUNICATIONS '87 Barbican, London — Online International Ltd (01) 868 4466	**28-30 April 1987**
ELECTRON & BBC MICRO USER SHOW New Horticultural Hall, London — Database Exhibitions (061) 456 8835	**8-10 May 1987**
MACINTOSH INDEPENDENT CONFERENCE & EXHIBITION (MICE '87) Westminster Exhibition Centre, London — Quantum Research (01) 403 1473	**14-16 May 1987**
COMPUTER NORTH G-MEX Complex, Manchester — Cahners Exhibitions (061) 832 4242	**27-29 May 1987**
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Here wordprocessing and data storage, financial management and computer-aided design, networking and terminal emulation are all in a day's work.

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Even with a starting price of £499 the PC II Turbo faced some cheaper competitors but, when it came to speed, compatibility and expandibility, it proved to be in a class of its own. Now its in every class from electronic engineering to administrative studies and from computer services to humanities and social sciences.

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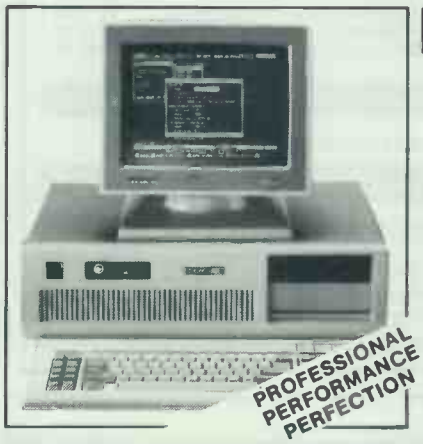

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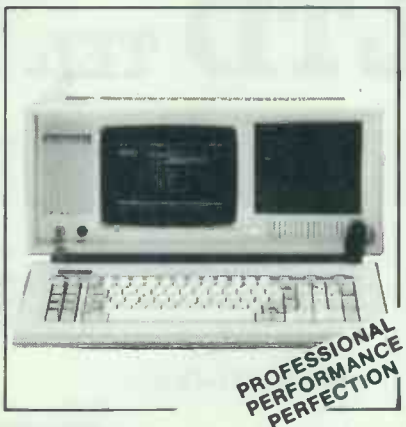

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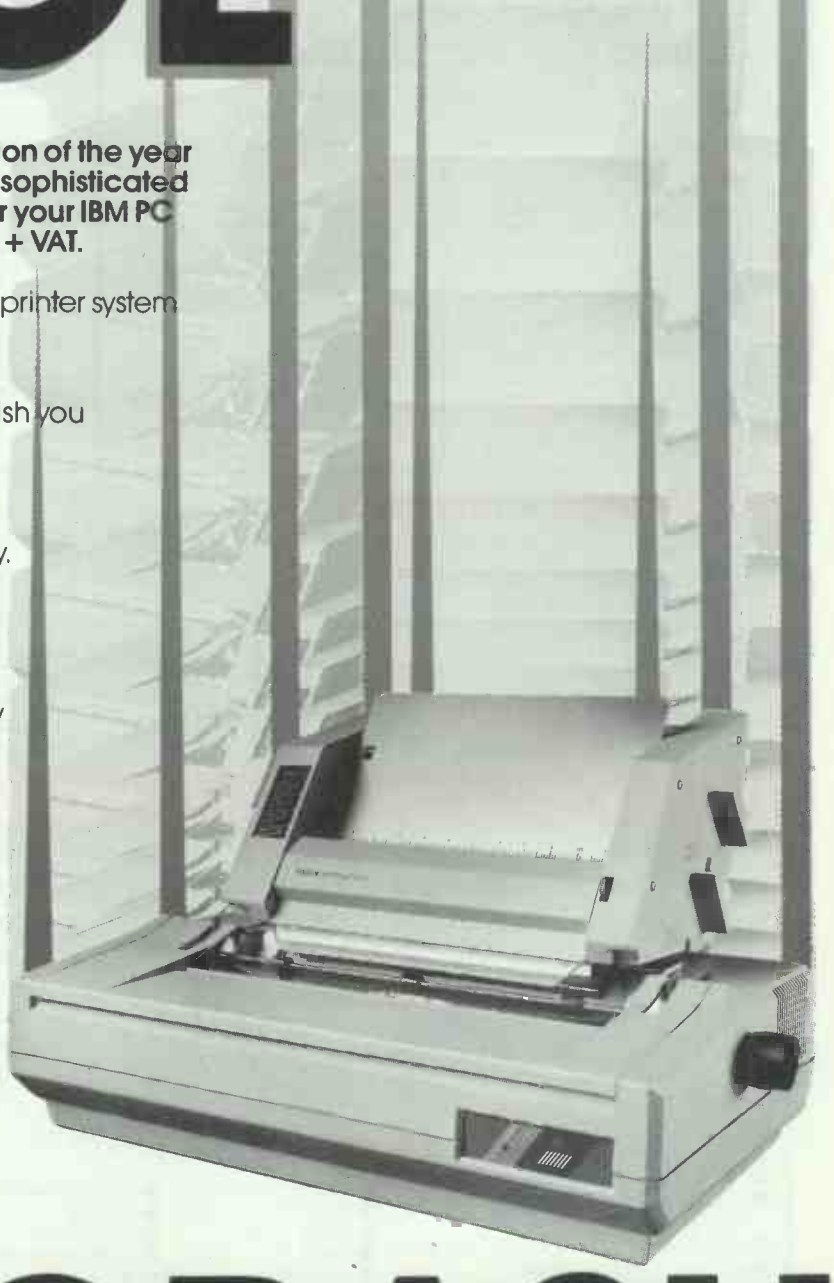

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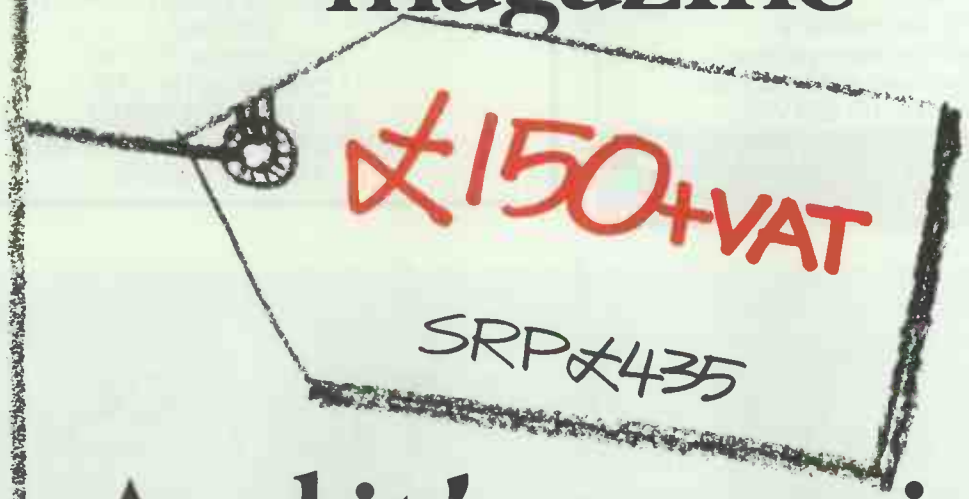

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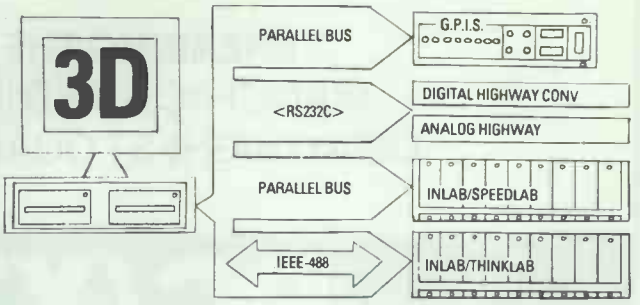

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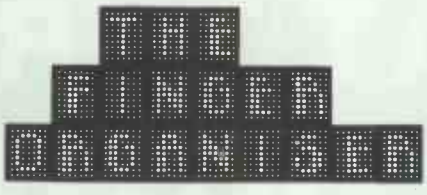

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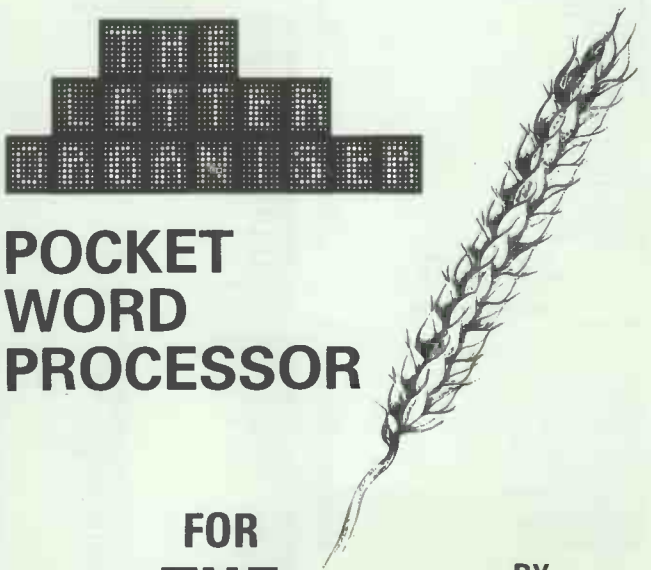

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TECHNOLOGY SO ADVANCED ...

MEMORY
* 512Kbytes RAM (520ST-M, FM)
* 1024Kbytes RAM (1040ST-F)
* 192Kbytes ROM
* 128Kbytes external plug-in ROM option

ARCHITECTURE
* Motorola 68000 Central Processing Unit (CPU) with a clock speed of 8MHz
* 16-bit external data bus
* 32-bit internal data bus
* 24-bit address bus
* 8x32-bit data & address registers
* 7 levels of interrupts
* 56 instructions
* 14 addressing modes
* 5 data types
* DMA (Direct Memory Access)
* real time clock as standard

GRAPHICS
* full bit-mapped display
* palette of 512 colours

Using Atari Monitors (on 520 & 1040):
* 640x400 high resolution - monochrome
* 640x200 medium resolution - 4 colours
* 320x200 low resolution - 16 colours
* 80 column text display (40 col low res)

Using Domestic TV (on 520):
* 640x200 medium resolution - 4 colours
* 320x200 low resolution - 16 colours
* 40 columns x 25 line text display

SOUND AND MUSIC
* 3 programmable sound channels
* frequency programmable 30Hz - 125KHz
* programmable volume
* wave & dynamic envelope shaping
* programmable attack, decay, sustain, release
* Musical Instrument Digital Interface (MIDI)
* MIDI allows connection of synthesisers etc.

MOUSE
* high precision
* 2 button control
* free with 520ST-FM/1040ST-F
* non slip ball motion sensor
* removable ball for easy cleaning

STANDARD SOFTWARE
* GEM desktop + TOS operating system
* ST BASIC interpreter/language system

INPUT/OUTPUT
* MIDI out ..... (5 pin DIN) 31.25K baud
* MIDI in ..... (5 pin DIN) 31.25K baud
* audio out .. 1.0V DC peak to peak, 10K ohm
* audio in ..... 1.0V DC peak to peak, 10K ohm
* RGB monitor ..... 1.0V DC, 75 ohm
* mono monitor ..... 1.0V DC, 75 ohm
* mono horizontal scan rate 35.7KHz
* mono vertical scan rate 71.2KHz
* sync ..... 5V DC (active low) 3.3K ohm
* modem/serial ..... RS232C, 50 to 19,200 baud
* floppy disk ..... 250 Kbits/s
* hard disk ..... 11.3 Mbits/s
* mouse ..... standard Atari connector
* joystick ..... standard Atari connector
* cartridge port ..... 128K capacity
* RF output (520ST-FM) ..... for TV use

OPERATING SYSTEM
* TOS with GEM environment in ROM
* hierarchical file structure with sub-directories and path names
* user interface via GEM, with self explanatory command functions
* multiple windows + icons
* window resizing, re-positioning and erasing
* drop down menus (selected by mouse)
* GEM virtual device interface

COMMUNICATIONS
* RS-232C serial modem port
* 8-bit parallel printer port
* MIDI port (also for networking use)
* VT52 terminal emulation

KEYBOARD
* standard QWERTY typewriter format
* 95 full stroke keys
* 10 function keys
* 18 key numeric keypad + cursor keys
* variable auto-repeat & key click response
* keyboard processor reduces CPU overhead

... IT'S AFFORDABLE

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Finally, there's a personal computer that not only solves problems like other computers, but also solves the one problem that other computers have created. Affordability. Silica Shop are pleased to present the ST range of personal/business computers from Atari. The ST was designed utilizing the most recent breakthroughs in semiconductor technology, producing a personal computer that performs tasks with fewer parts. Which means it costs less to make. And less to buy. The latest ST computers now include built in power supplies and built in disk drives. The TOS operating system and GEM window environment are now on ROM chips which are already installed in the ST keyboard. This enables automatic instant booting when you switch on. Silica Shop are pleased to offer the complete Atari ST range. Our mail order department is situated in Sidcup and we have 4 retail outlets at Sidcup, Orpington, Lion House (Tottenham Court Rd) and Selfridges (Oxford Street). We have eight years experience of Atari products, longer than any other UK company, and are well established as the UK's No.1 Atari specialist. With a group turnover of over £5 million and in excess of 70 staff, we provide unbeatable service and support. We provide several facilities which you will find invaluable during your Atari computing life and most of these facilities are available ONLY FROM SILICA. We suggest that you read through what we have to offer, before you decide where to purchase your Atari ST.

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When you purchase any Atari ST keyboard, you will not only receive the best value for money computer on the market, but you will also receive the following from Atari Corporation as part of the package:

** BASIC Language Disk * BASIC Manual * ST Owners Manual * TOS/GEM on ROM*

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** NEOchrome - colour graphics program * 1st Word - Word Processor*

In addition, we at Silica would like to see you get off to a flying start with your new computer, so we have put together a special ST STARTER KIT worth over £100, which we are giving away FREE OF CHARGE with every ST computer purchased at our normal retail prices. This kit is available ONLY FROM SILICA and is aimed at providing users with a valuable introduction to the world of computing. We are continually upgrading the ST Starter Kit, which contains public domain and other licensed software, as well as books, magazines and accessories all relevant to ST computing. Return the coupon below for full details.

DEDICATED SERVICING - Only From Silica

At Silica Shop, we have a dedicated service department of five full time Atari trained technical staff. This team is totally dedicated to servicing Atari computer products. Their accumulated knowledge, skill and experience makes them second to none in their field. You can be sure that any work carried out by them is of the highest standard. A standard of servicing which we believe you will find ONLY FROM SILICA. In addition to providing full servicing facilities for Atari ST computers (both in and out of warranty), our team is also able to offer memory and modulator upgrades to ST computers.

1Mb RAM UPGRADE: Our upgrade on the standard Atari 520ST-M or 520ST-FM keyboard will increase the memory from 512K to a massive 1024K. It has a full 1 year warranty and is available from Silica at an additional retail price of only £86.96 (+VAT = £100).

TV MODULATOR UPGRADE: Silica can upgrade the 1040ST-F to include a TV modulator so that you can then use it with your TV set. This is an internal upgrade and does not involve any untidy external boxes. A cable to connect your ST to any domestic TV is included in the price of the upgrade which is only £49 (inc VAT). The upgrade is also available for early 520ST computers at the same price.

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We aim to keep stocks of all Atari related products and our warehouse carries a stock of £½ million. We import many software titles direct from the USA and you will find that we have new releases in advance of many of our competitors. Unlike dealers who may only stock selected titles, we have the full range. In addition, we carry a complete line of all books which have been written about the Atari ST. A range as wide as ours is something you will find is available ONLY FROM SILICA.

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Rest assured that when you buy your ST from Silica Shop, you will be fully supported. Our free mailings give news of releases and developments. This will help to keep you fully up to date with what's happening in the Atari market. And in addition, our sales staff are at the end of a telephone line to service all of your Atari requirements. If you purchase an ST from Silica and would like any programming or technical advice, we have a full time technical support team to help you get the best from your computer. Because we have both the staff and the systems specifically dedicated to providing after sales service on Atari ST computers, we are confident that our users enjoy an exceptionally high level of support. This can be received ONLY FROM SILICA.

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At Silica Shop, we recognise that serious users require an in-depth information service, which is why we mail free newsletters and price lists to our ST owners. These are up to 48 pages long and are crammed with technical details as well as special offers and product descriptions. If you have already purchased an ST and would like to have your name added to our mailing list, please complete the coupon & return it to us. The information service is available ONLY FROM SILICA.

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520ST-M

The affordability of Atari computers is reflected in the price of the 520ST-M keyboard, which is a mere £259 (inc VAT). This version of the ST comes with 512K RAM, as well as a modulator and lead for direct connection to any domestic TV. The price does not include a mouse. In addition, when you buy your 520ST-M from Silica, you will also receive the FREE Silica 'ST Starter Kit'. During 1987, many software houses will be producing games software on ROM cartridges, which will plug directly into the cartridge slot on the 520ST-M keyboard, giving instant loading without the expense of purchasing a disk drive. With the enormous power of the ST, you can expect some excellent titles to be produced, making this the ultimate games machine! If your requirement is for a terminal, then the 520ST-M can fulfill this role too. Leads are available to connect the ST to a variety of monitors, and with the imminent introduction of terminal software on ROM cartridge, the ST provides a low price terminal for business use. If you wish to take advantage of the massive range of disk software available for the ST range, you will need to purchase a disk drive. Atari have two floppy disk drives available, a ½ Mbyte model £149 and a 1Mbyte model £199. Full details of these drives, as well as the Atari 20Mbyte hard disk are available on request. If required at a later date, the mouse may be purchased separately.

£259

520ST-FM

The 520ST-FM with 512K RAM and free mouse, represents a further breakthrough by Atari Corporation in the world of high power, low cost personal computing. This model is the latest addition to the ST family, and is not only powerful, but compact. It is priced at only £399 (inc VAT) a level which brings it within the reach of a whole new generation of computer enthusiasts. When purchased from us, it comes with the FREE Silica 'ST Starter Kit' see paragraph on the left. To make the 520ST-FM ready for use straight away, Atari have built into the keyboard a ½ megabyte disk drive for information storage and retrieval, allowing you easy access to the massive range of disk based software which is available for the ST. This new computer comes with all the correct cables and connections you will need to plug it straight into any standard domestic television set. You do not therefore have to purchase an Atari monitor. If you do require a monitor however, these are available with the 520ST in the following money saving packages:

520ST-FM Keyboard Without Monitor - £399 (inc VAT)
520ST-FM Keyboard + High res mono monitor - £499 (inc VAT)
520ST-FM Keyboard + Low res colour monitor - £599 (inc VAT)
520ST-FM Keyboard + Med res colour monitor - £699 (inc VAT)

Because the 520ST-FM has its own power transformer built into the keyboard, there are no messy external adaptors to clutter up your desk space. You are left with only one mains lead, serving both the disk drive and the computer. You couldn't ask for a more stylish and compact unit.

£399

1040ST-F

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST-F with 1028K RAM. This low cost powerhouse can be introduced into a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F not only features twice as much memory as the 520ST-FM, but also includes a more powerful built-in disk drive. The drive featured on the 1040ST-F is a one megabyte double sided model. The extra memory facility of the 1040ST-F makes it ideal for applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has a mains transformer built into the console to give a compact and stylish unit with only one mains lead. The 1040ST-F is also supplied from Silica Shop with a free software package and 'ST STARTER KIT'. In the USA, the 1040ST-F has been sold with a TV modulator like the 520ST-FM. However, for the UK market, Atari are manufacturing the 1040ST-F solely with business use in mind and it does not currently include an RF modulator, this means that you cannot use it with a domestic TV (Silica Shop do offer a modulator upgrade for only £49). The 1040ST-F keyboard costs only £599 (inc VAT) and, unless a modulator upgrade is fitted, will require an Atari or third party monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

1040ST-F Keyboard Without Monitor - £599 (inc VAT)
1040ST-F Keyboard + High res mono monitor - £699 (inc VAT)
1040ST-F Keyboard + Low res col monitor - £799 (inc VAT)
1040ST-F Keyboard + Med res col monitor - £899 (inc VAT)

The 1040ST-F comes with a mouse controller and includes 1Mbyte of RAM. It has a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one mains lead.

£599

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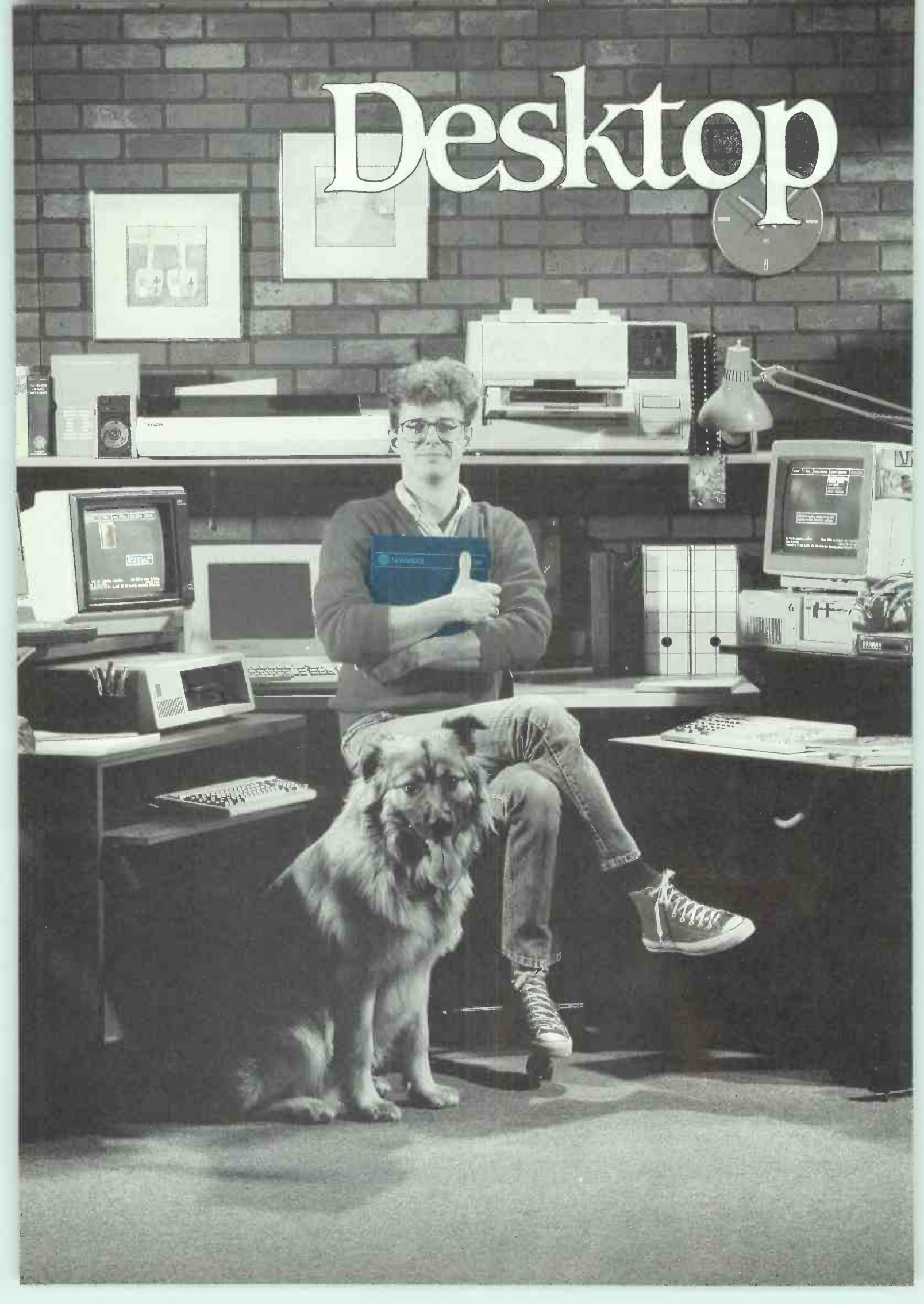
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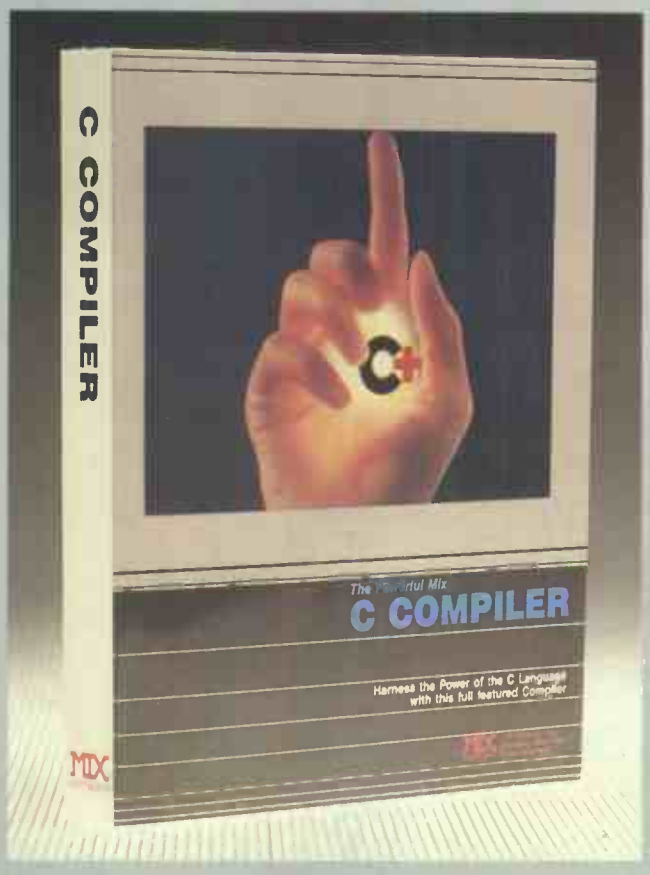

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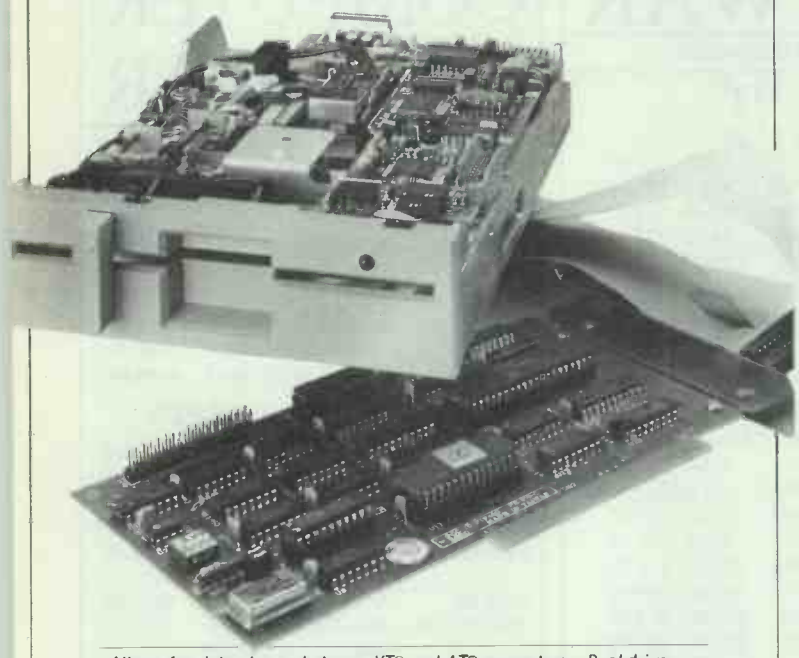

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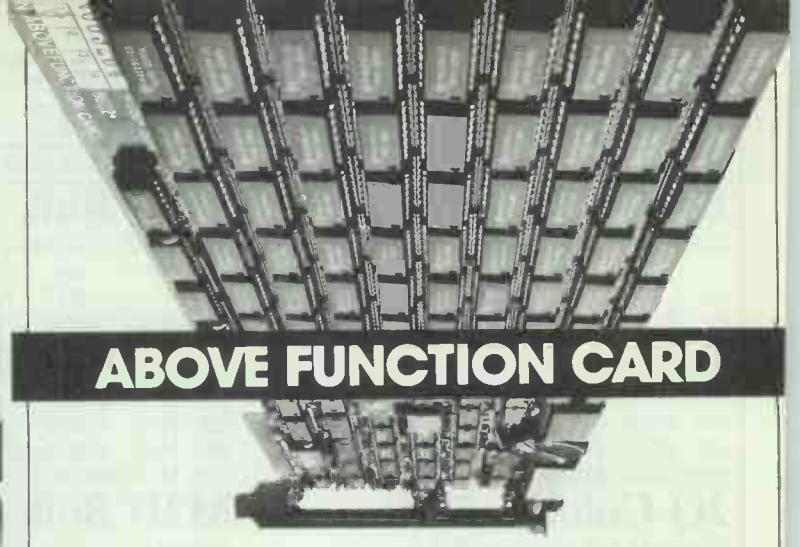

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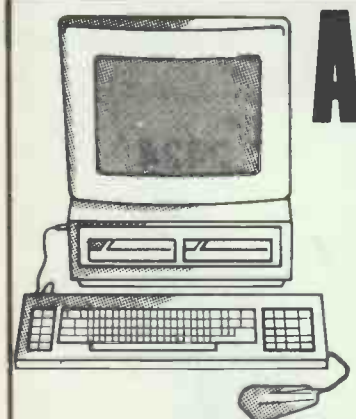

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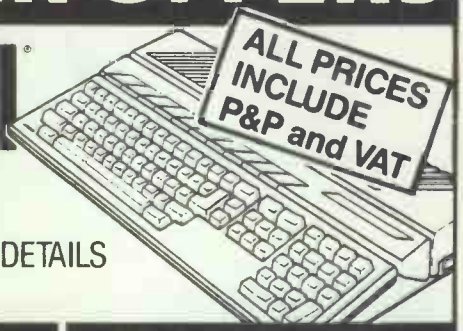

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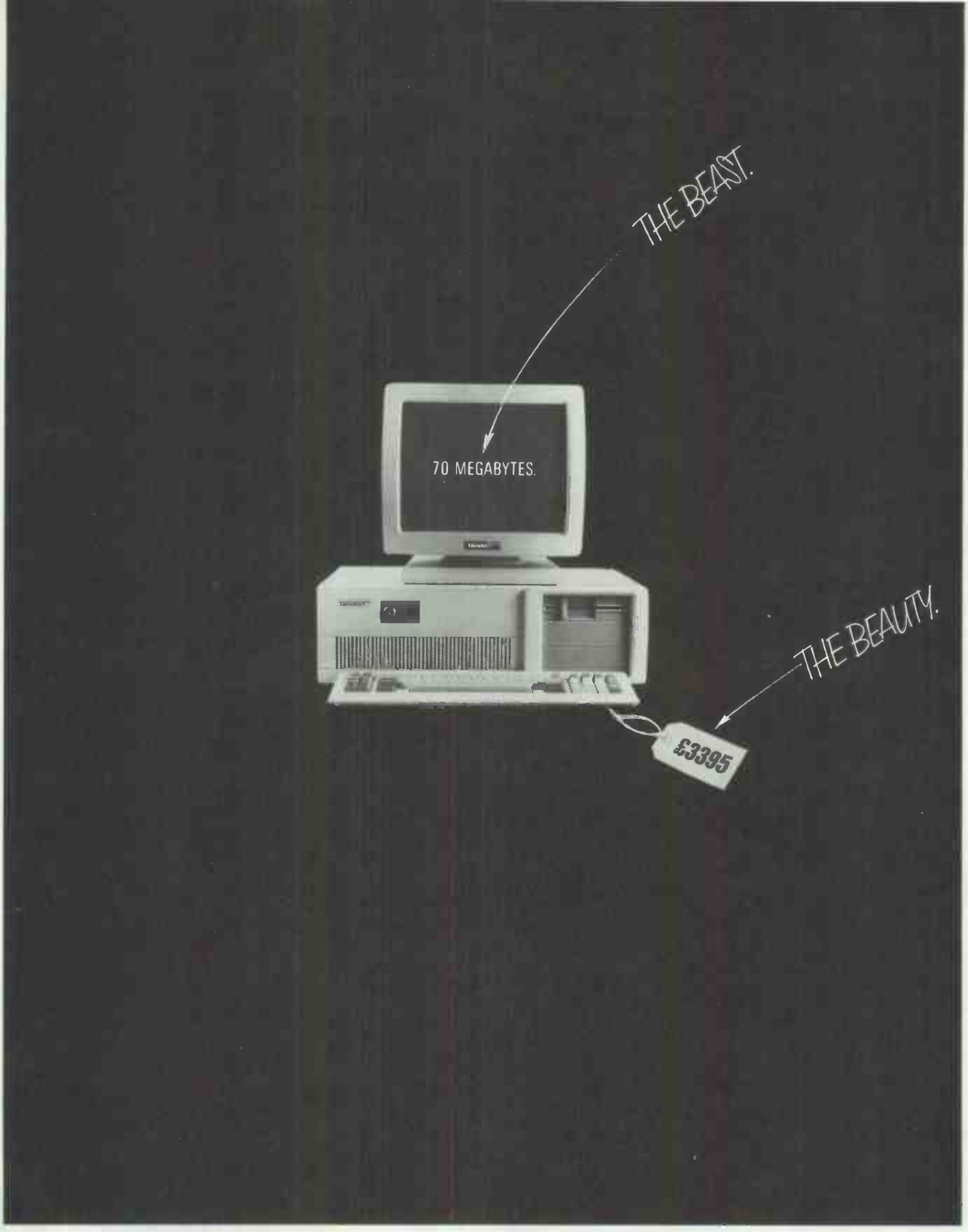

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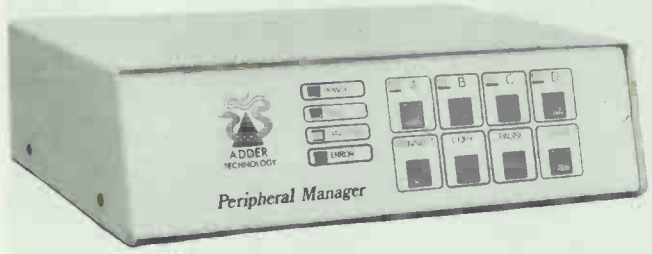

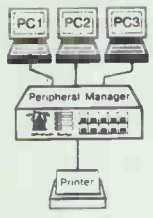

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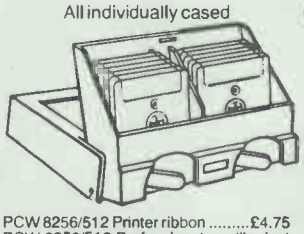

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We stock many items for which there is no space in these advertisements.

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Prices do not include VAT or other local taxes but do include delivery in UK and Europe. Please check prices at time of order, ads are prepared some weeks before publication.

For other products in our range see our other page in this issue or ask us to send you a complete price list.

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PROLOG COMPILERS

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CHIP CHAT

It's been networking time in the *PCW* editorial office. We tried to connect up an Arc XT, our Hewlett-Packard Vectra, a Victor V286 and a Walters AT using D-Link.

D-Link is a cheap network that gives access to peripherals and disk drives on other machines as well as your own.

When it worked, it was wonderful. But most of the time it didn't. The HP lost its real-time clock, the Walters lost its disk drives, and D-Link wouldn't work at all on the Arc — whose manufacturer had supplied the network. Arc assures us that D-Link does work in most circumstances.

As for the Victor, all of a sudden that started to work *properly*, and to lose the spurious control-Cs that kept appearing at boot-up time . . .

The computer which runs Barclaycard's direct mail service has run riot. David Tebbutt, one of our consultant editors, has two Barclaycard accounts, one of which is known as his 'A' account.

Thus his envelope arrived addressed to Mr DC Tebbutt A Acc, and of course, in true mailmerge fashion, the letter started 'Dear Mr Acc . . .'

Technological gobbledygook gets everywhere these days.

We've had a press release from stationery manufacturer Rexel about a new stapler called the 'Rexel Laser' which reflects 'the very latest in stapling technology'. It even talks about how it can be used in the hand or on the desktop. Just like the latest laptop computers, you see. Roll on hole punchers with built-in Transputers . . .

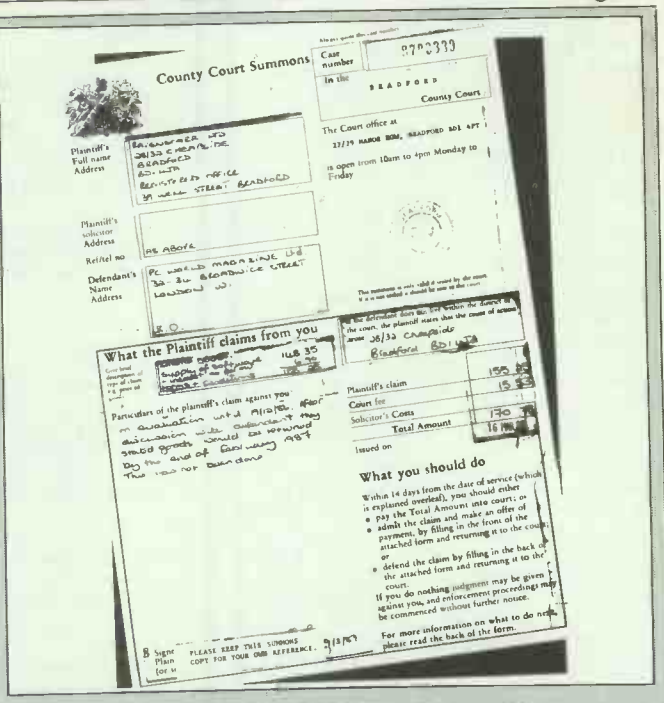
Our comms columnist Peter Tootill is very wise sticking to electronic communication. He received one of those nice, solid, supposedly unbendable cardboard floppy disk transporter boxes in the post containing some much-needed software.

The words 'Do Not Bend' on the outside must have been taken as a challenge by some budding Arnold Schwarzenegger postman — the disk box came through the door folded in half . . .

The launch of the new Macintosh machines in the UK was held at a grand conference centre in Surrey called the Anugraha. To 'help' with the arrangements, the PR company laid on a coach and allowed 30 minutes for the journey from central London to the site.

Anyone with an ounce of sense knows that 30 minutes at any time of the day barely gets you past Hyde Park Corner. And those who had driven directly to the Anugraha were rewarded with a 45-minute wait while 50 leading computer journalists sat it out on the M4 . . . Next time, most of us are likely to refuse the offer of transport . . .

You may remember the item we ran last month about Stuart Greenfield doing his impersonation of a Playboy Bunny on First Computer's press releases. This self-advertisement has finally paid off — he's left the company to set up on his own. It pays to advertise.


County Court Summons

Case number 8703339

In the BRADFORD County Court

The Court office at 27/29 MARSH ROW, BRADFORD BD1 4PT is open from 10am to 4pm Monday to Friday

Plaintiff's Full name Address

Plaintiff's solicitor Address

Ref/tel no

Defendant's Name Address

What the Plaintiff claims from you

Particulars of the plaintiff's claim against you

Plaintiff's claim

Court fee

Solicitor's Costs

Total Amount

Issued on

What you should do

Within 14 days from the date of service (which is explained overleaf), you should either
- pay the Total Amount into court; or
- admit the claim and make an offer of payment, by filling in the front of the attached form and returning it to the court; or
- defend the claim by filling in the back of the attached form and returning it to the court.

If you do nothing judgment may be given against you, and enforcement proceedings may be commenced without further notice.

For more information on what to do next, please read the back of the form.

PLEASE KEEP THIS SUMMONS COPY FOR YOUR OWN REFERENCE.

A rigorousness with English grammar seems to go hand-in-hand with an over-zealous attention to the law. Software company Ravenscarr, which supplied us with the Grammatik package mentioned on page 144, sent us a County Court summons for not returning its product. We wouldn't have minded but the product was only nine days late. Still, that's what one must expect from people who insist that any sentence over 22 words must be too long . . .

Forget style checkers, ditch your syntax correctors; now there's knitting pattern checkers.

Sirdar has installed a batch of Apricot computers to check its knitting patterns for errors. The program understands such terms as 'K2tog' and will ensure that the number of stitches in one row add up correctly.

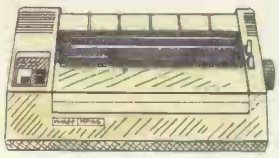
So, next time you end up with a sweater with one arm three inches longer than the other, just blame it on those damned computers . . .

This month . . .

The new IBM range of machines launched on 2 April look likely to have even more impact on the personal computer market than the first PCs. New operating systems, much increased memory access and proper multi-tasking are just some of the goodies now possible.

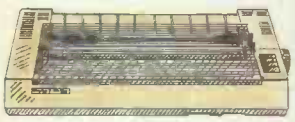
Unfortunately, there was just too much announced in Greenock for us to do more than scratch the surface. But future issues will be bristling with new products from IBM and its followers to liven up all our computing lives. And you can be sure that we'll show you the insides, outsides, good and bad sides of the software and hardware that will complement them.

Our art director, Martyn Rowbotham (seen here being swallowed by a hyperactive bubble bath) has certainly been dropped in the deep end. After his first cover — the Z88 — had him working with Heidi the chimp, this month's Mission Impossible had to be easy — producing a cover of the new IBM 286 in a mere 24 hours.

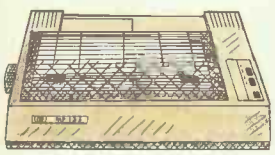


MP 165 DOT MATRIX
This proven best selling NLQ printer offers the user the very best in low cost matrix printing.
Speed: 160cps (Draft), 35cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £229.**

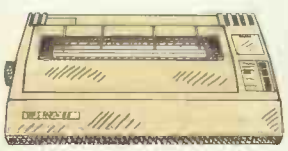
MP 200 DOT MATRIX
A fast NLQ quality printer, using the latest state of the art technology – IC Font Cards.
Speed: 200cps (Draft), 40cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £329.**



MP 201 DOT MATRIX
This 136 column, 200cps, NLQ printer offers the best value in the market place – you can't buy better. A range of Font Cards are available.
Speed: 200cps (Draft), 40cps (NLQ). **Columns:** 136. **Compatibility:** IBM/ Epson. **Price: £349.**



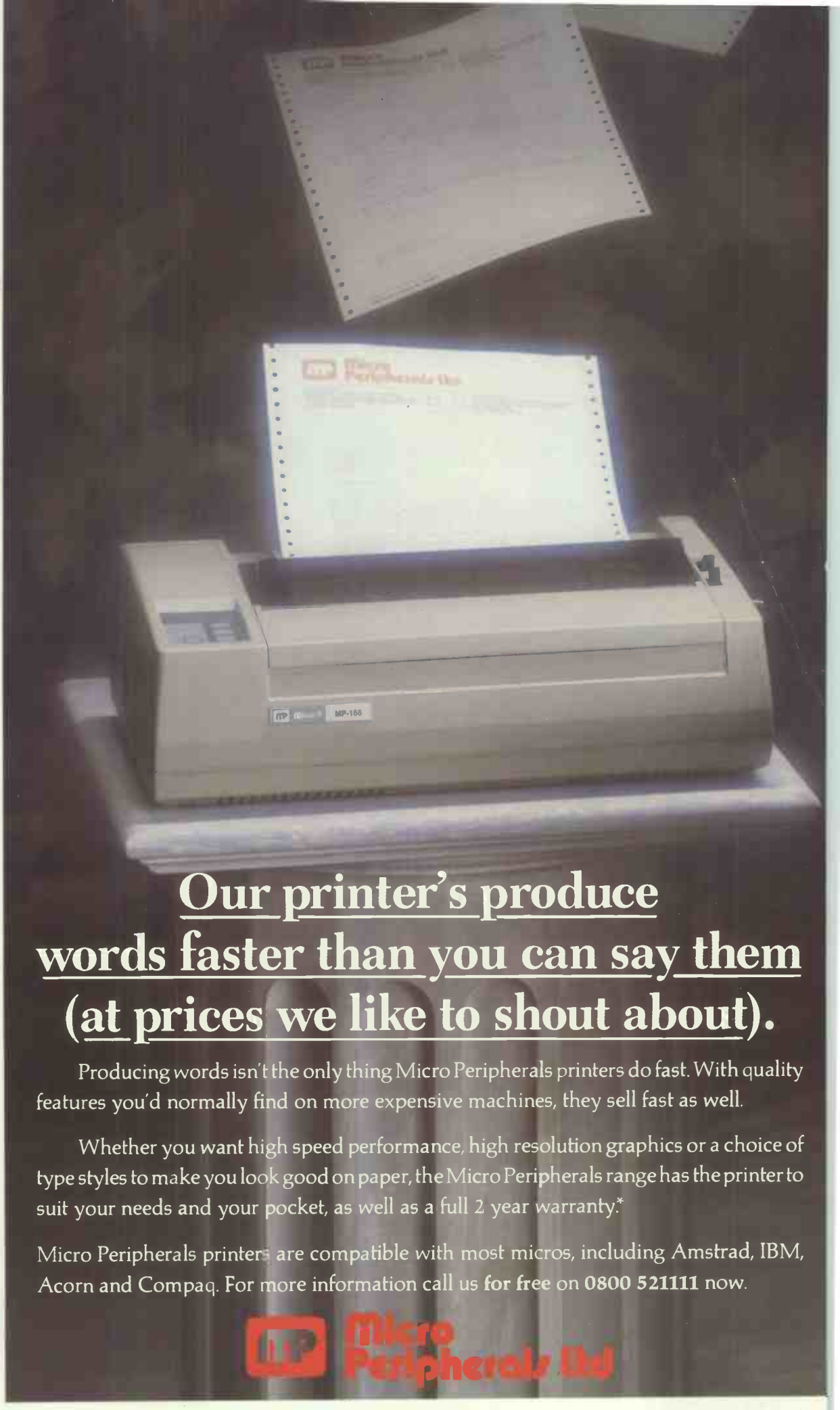
MP 135 DOT MATRIX
A low cost, high performance printer using the latest technology to produce print that makes draft quality look like NLQ.
Speed: 135cps (Draft), 27cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £169.**



MP 480 DOT MATRIX
Another prime example of Micro Peripherals bringing fantastic value for money in a 480cps dot matrix printer at less than a pound per character per second.
Speed: 480cps (Draft), 74cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £369.**

MP 26 DAISYWHEEL
A feature rich very quiet (57dB) printer. Universal compatibility with almost all personal computers at an unbeatable price.
Speed: 26cps. **Columns:** 132. **Compatibility:** Diablo 630 Interface: Parallel + serial. **Price: £259.**

MP 40 DAISYWHEEL
A very fast, quiet printer packed with features and compatible with virtually all computers and at a fantastic price.
Speed: 40cps. **Columns:** 132. **Compatibility:** Diablo 630 Interface: Parallel + serial. **Price: £379.**



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