

# Personal Computer World

February 1992 £1.80

\$5.95/Lire 7100/DM 12.50/Pts 475



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**Cognito  
Messenger**



**Hercules i860  
SuperStation 3D**



**Letraset  
Painter**



**Borland C++  
3.0**



## Paperback PC

World's  
Smallest  
386SX

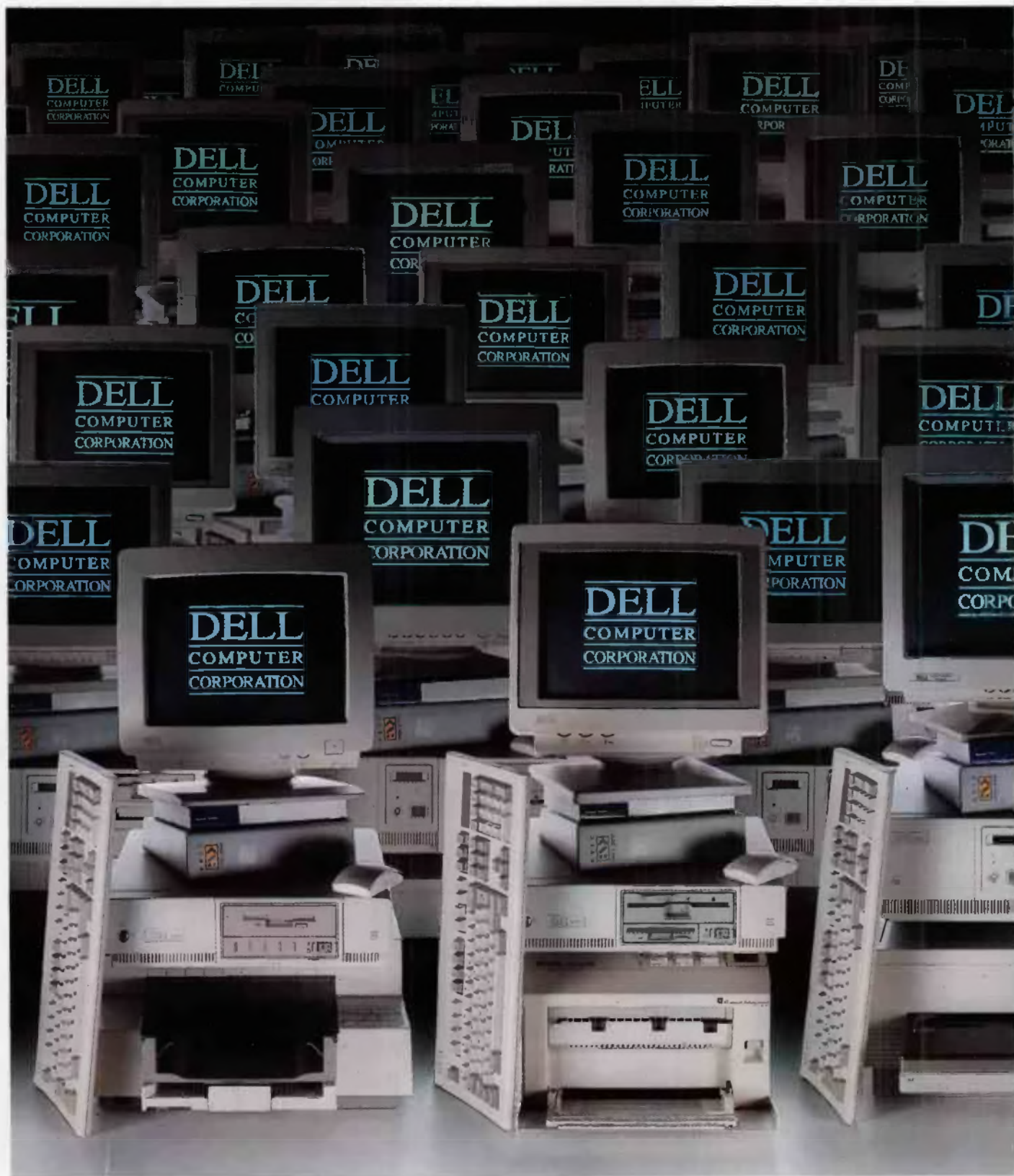


Word 5 Mac • Building a better robot • Inside Olivetti's Cambridge R&D

Comprehensive Group Tests: Comms Software and Sub-£500 Printers



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Poor Moderate Good Excellent

Characteristics	✓
Ease of use	✓
Documentation	✓
Engineering	✓
Performance	✓

Dell's dusky notebook SX is way out in front of the me-too brigade.



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PCW62



## COVER FEATURE



248

### BiDesign MicroLight

The size of a slim paperback, BiDesign's MicroLight nevertheless contains a 25MHz 386SX, a 60Mb hard disk and a 3.5in floppy drive. Rupert Goodwins was mightily impressed.

Cover photography by Chris Bell.

## HARDWARE BENCHMARKS

### Cognito Messenger

Is it a computer? Is it a pager? Is it a wireless LAN? No. And yes. Rupert Goodwins explored the possibilities that arise from the most imaginative new product to hit the world of communications since the mobile phone.

210

### Dell 486P/33

Dell has introduced a new range of upgradable PCs, and the 486 has become a standard rather than an exotic processor. Simon Rockman looks at the range-topping 486P/33 to see if evolution improves the breed.

218

### MediaVision Multimedia PC Upgrade Kit

The various kits to turn a standard PC into a multimedia workstation have existed for some time. Guy Swarbrick looks at a kit that brings them together and at the multimedia applications that are at last beginning to arrive.

230

### Hercules Superstation 3D

Hercules' first TIGA graphics board, the Graphics Station card, hasn't been the hit many people expected, despite its high power and relatively low price. The Superstation 3D is more powerful and faster but, as Rupert Goodwins asks, will that be enough?

254

## FEATURES

236

### Hello, Mr Chips

How has Intel fought back in the face of competition? Geoff Wheelwright put this question and others to Andrew Grove, Intel's CEO.

242

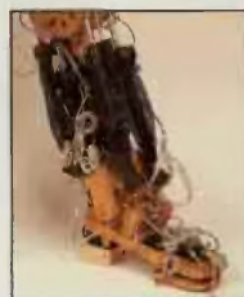
### Pandoring to Big Brother?

Olivetti's research facility in Cambridge is winning itself respect throughout the world. Ian Burley found out what they're up to.



304

### The robots are coming!



We know the science fiction dream of intelligent androids and the sad reality of industrial automatons, but what about the middle ground? Nick Beard came across robots that walk, and even robots that paint, in his quest for the answer.

310

### Memory lanes

David Morton traces the history of memory technology and looks forward to some forms of storage yet to hit the streets.

## SOFTWARE BENCHMARKS

202

### Borland C++ 3.0

Borland's language products have always been praised for the quality of their development environments. Until now though, there was no code optimisation. As David Morton found out, that has changed dramatically.

222

### Letraset Painter

The concept of an art package that doesn't present you with a hundred and one tools, but simulates different types of paper and traditional artist's materials, seems a little odd at first. Brian Larkman grew to like the idea.



258

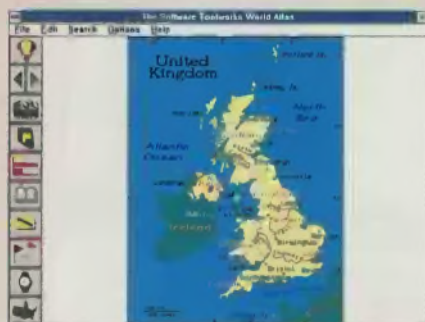
### Word 5.0 for the Mac

The more cynical observer might think the launch of a Macintosh product clearly one generation behind its Windows equivalent a deliberate attempt to wean people off the Mac. For existing users though, what does Word 5.0 offer? Jack Weber explains.



## REGULARS

- 97** News
- 130** Letters
- 134** Columns
  - Sounding Off **134**
  - In Business **135**
  - Straight Talking **137**
  - Diary **139**
- 142** Short Reviews
  - Plots Unlimited **142**
  - PagePlus **143**
  - SoundEdit 2.0.5 **144**
  - DAC DataPak 128Mb optical disk **146**
  - World Atlas for Windows **148**
  - allCLEAR **150**
  - Mavis Beacon Teaches Typing! v2.0 **151**
  - EndNote **154**
  - Acorn A5000 **158**



- 318** Long Term Tests
  - Norton Desktop for Windows **318**
  - Orchid ProDesigner IIS-HC **319**

- 321** Inside Out
- 325** Books
- 330** Screenplay & Leisure Lines
- 334** Numbers Count
- 337** Frontiers
- 341** Innovations
- 345** Hands On
  - ChipChat

## HARDWARE GROUP TEST

# 162

## Printers under £500

*Helen Johnstone & Chris Cain*



Laser printers are great, if you can afford them. But some jobs simply can't be done on a laser (printing on continuous or multi-part stationery, for example). We looked at a range of options, from traditional 9-pin through 24-pin to inkjet printers. The results aren't necessarily what you'd expect.

Epson LQ-200	<b>164</b>	Olivetti DM124C	<b>184</b>
Epson FX-850	<b>165</b>	Olivetti JP350	<b>186</b>
Facit E420	<b>166</b>	Panasonic KX-P1124i	<b>186</b>
Fujitsu DL1200	<b>170</b>	Philips NMS1433 Plus	<b>187</b>
Genicom GP10	<b>171</b>	Seikosha SP1900	<b>188</b>
HP DeskJet 500	<b>171</b>	Star LC-20	<b>189</b>
HP ThinkJet	<b>172</b>	Star LC24-200	<b>190</b>
Hyundai Pinovia 930	<b>173</b>	Colour Star SJ-48	<b>194</b>
IBM 2380	<b>178</b>	Star ZA-250	<b>195</b>
Kodak Diconix 150 Plus	<b>179</b>	Toshiba ExpressWriter 201	<b>200</b>
Mannesmann Tally MT81	<b>179</b>	Canon BJ-10ex	<b>163</b>
NEC Pinwriter P30	<b>180</b>	Citizen 224	<b>164</b>
Oki Microline 182	<b>182</b>		

## SOFTWARE GROUP TEST

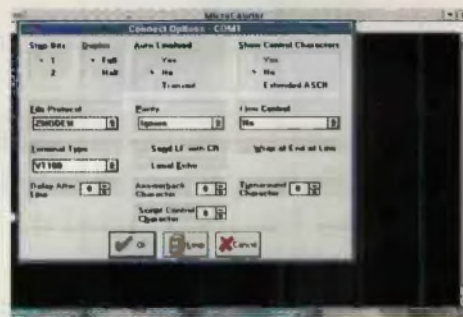
# 266

## Communications software

*Simon Rockman*

Vicom Connect	<b>267</b>
Datatalk 4	<b>269</b>
Crosstalk Mk.4	<b>270</b>
Crosstalk for Windows	<b>272</b>
Smartcom III 2.0A	<b>274</b>
MicroCourier 1.0	<b>275</b>
Relay Gold 5.0 for DOS	<b>276</b>
Relay Gold 5.0 for Windows	<b>277</b>
WinQVT	<b>286</b>
Chit-Chat	<b>287</b>
Odyssey 1.50	<b>289</b>
Mirror III	<b>290</b>
Talking Windows	<b>292</b>
MicroPhone II 3.0 for the Mac	<b>294</b>
MicroPhone II 2.0 for Windows	<b>296</b>

Connecting one computer to another, with the aid of a couple of modems and a phone line, should by now be a simple task. We looked at 15 packages, some of which make your life easier and some, sadly, which make it infinitely more difficult. If you have to go online, you have to read this test.





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## SPECIALISTS IN EXPORT

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T1000 LE	£795	T4400SX	£3035
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T2000 40	£1195	T3100SX 80	£1540
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T2000SX 40	£1495	T3200SX 120	£1660
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T2200SX	£2340	T5200 200	£2340
		T3200SX 120 colour	£4360

### ★ CAD/CAM/DTP ★

NEC Multisync 3FG 15"	£449
NEC Multisync 4FG 15"	£559
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NEC Multisync 6FG 21"	£1865
Hitachi Hi-Scan 20/FST	£POA
Sony Trinitron/Taxan/Philips	£POA

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ARTISTE, HERCULES, VEGA VIDEO-7  
INTEL CO-PROCESSORS

### ★ PRINTERS & PLOTTERS ★

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EPSON LQ400	£165
EPSON LQ570	£249
EPSON LQ1170	£475
EPSON LQ2550	£709
EPSON DFX8000	£1949
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CANON BJ10EX	£245
HP PAINTJET	£599
HP SCANJET	£639
PANASONIC 1124i	208
HP DESKJET 500 COLOUR	£495

FUJITSU, BROTHER, NEC etc etc  
ROLAND AND HP PLOTTERS

### ★ COMPAQ DESKPRO ★

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DESKPRO 286N 40	£999
DESKPRO 386N 1	£875
DESKPRO 386N 40	£1155
DESKPRO 386S 40	£1409
DESKPRO 386S 84	£1689
DESKPRO 386S/20 60	£1689
DESKPRO 386/20 120	£1999
DESKPRO 386/20E 40	£2099
DESKPRO 386/20E 110	£2539
DESKPRO 386/25E 60	£2539
DESKPRO 386/25E 120	£2799
DESKPRO 386/33L 120	£3799
DESKPRO 386/33L 320	£4699
DESKPRO 386/33L 650	£5949
DESKPRO 486/33L 120	£5599
DESKPRO 486/33L 320	£6789
DESKPRO 486/33L 650	£7969
DESKPRO 486/50L 120	£6819
DESKPRO 486/50L 340	£7899
DESKPRO 486/50L 510	£8539

### ★ COMPAQ MODULAR ★

DESKPRO 386/25M 60	£2499
DESKPRO 486s/16M 120	£3039
DESKPRO 486s/25M 60	£3079
DESKPRO 486/33M 120	£3969

### ★ COMPAQ SYSTEM PRO ★

SYSTEMPRO 386-240	£5929
SYSTEMPRO 386-420	£7039
SYSTEMPRO 386-840	£9589
SYSTEMPRO 486-240	£8139
SYSTEMPRO 486-420	£9319
SYSTEMPRO 486-840	£11799

### ★ PORTABLES/PERIPHERALS ★

LTE/286/40	£1449
LTE/386/60	£2299
SLT286/40	£1979
SLT/386/60	£2299
SLT/386/120	£2729
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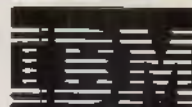
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PANASONIC 4450i	£1028
BROTHER HL-4	£715
CANON LBP8	£999
KYOCERA F800T	£944
NEC SILENTWRITER 290	£1409
QMS, STAR ETC...	

### ★ NETWORKING ★

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NOVELL NE 1000/2002/2 MCA  
3-COM 3C503/505/523  
WEST DIG ETHERCARD PLUS III/A  
ARCNET/PRONET/G-NET  
CABLING INSTALLATION & TRAINING

### ★ SOFTWARE ★

LOTUS FOR WINDOWS	£349
dBASE IV V1.1	£399
WORDPERFECT V5.1	£259
SMARTWARE II	£439
SMARTWARE II	£69
MICROSOFT WINDOWS V3.0	£429
VENTURA GOLD	£469
PAGEMAKER	

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### ★ IBM ISA BUS ★

30-286 (10 Mhz) — 45MB	£759
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40-043 (20 Mhz) — 40Mb	£1199
40-045 (20 Mhz) — 80Mb	£1399

### ★ IBM MCA BUS ★

55SX-041 (16Mhz-40MB)	£1079
55SX-081 (16Mhz-80MB)	£1269
56SX-043 (20Mhz-40MB)	£1239
57SX-045 (20Mhz-80MB)	£1549
70-081 (20MHz-80MB)	£1769
70-A16 (25MHz-160MB)	£2529
80-M81 (20MHz-80MB)	£2039
80-M16 (20MHz-160MB)	£2369
80-M21 (20MHz-320MB)	£3149
80-A16 (25MHz-160MB)	£2950
80-A31 (25MHz-320MB)	£3519
90-AJ9 (25MHz-160MB)	£5199
90-AK9 (33MHz-160MB)	£5449
90-AKD (33MHz-320MB)	£6229
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95-AKF (33MHz-400MB)	£6809

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55LS-LEO (ETHERNET)	£895
8503 12" VGA MONO MONITOR	£155
8518 14" VGA MONO MONITOR	£385
8515 14" XGA COLOUR MONITOR	£449
8513 12" VGA COLOUR MONITOR	£349
ENHANCED KEYBOARD	£145
IBM DOS 5.0	£65

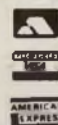
### ★ IBM PORTABLES ★

P70-K21 (20MHz-120MB)	£2599
P75-161 (33MHz-160MB)	£6675
P75-401 (33MHz-400MB)	£7945
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PROCESSOR SPEED	INTEL 386SX 16MHZ	AMD 386SX 25MHZ	INTEL 386SX 16MHZ	AMD 386SX 25MHZ
LANDMARK V2.0	16.5MHZ	32MHZ	16.5MHZ	32MHZ
FLOPPY DISK	N/A	N/A	3.5" 1.44MB	3.5" 1.44MB
HD OPTIONS	N/A	N/A	0 OR 52MB	0 OR 52MB
HDI ACCESS TIME	N/A	N/A	17MSEC	17MSEC
GAME PORT	NIL	NIL	OPTIONAL	OPTIONAL
LAN ADAPTER	NE2000 COMPATIBLE BOOT ROM	NE2000 COMPATIBLE BOOT ROM	OPTIONAL	OPTIONAL

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- SERIAL PORTS 1 X 9 WAY
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- MS DOS V5.0
- WINDOWS V3.0
- MICROSOFT COMPATIBLE SERIAL MOUSE

PRODUCT	RAM	DISKLESS	1MB	52MB
PW316	1MB	779	699	869
PW325	1MB	859	779	949

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£919



	PS316	PS325	PS333	PS340
PROCESSOR SPEED	INTEL 386SX 16MHZ	AMD 386SX 25MHZ	AMD 386DX 33MHZ	AMD 386DX 40MHZ
LANDMARK V2.0	16.5MHZ	32MHZ	57MHZ	62.4MHZ
CACHE MEMORY	N/A	N/A	64K	64K

### STANDARD FEATURES ON ALL PS MACHINES

- USER MEMORY 2MB
- FLOPPY DISK 3.5" 1.44MB
- HARD DISK OPTIONS 52/105
- HDI ACCESS TIME 17MSEC
- SERIAL PORTS 1 X 9 WAY 1 X 25 WAY
- PARALLEL PORT 1 X 25 WAY
- GAME PORT OPTIONAL
- GRAPHICS CARD TRIDENT 9000 512K
- MONITOR SUPER VGA 0.28mm DOT PITCH
- MS DOS V5.0

- WINDOWS V3.0
- MICROSOFT COMPATIBLE SERIAL MOUSE

PRODUCT	RAM	52MB	105MB
PS316	2MB	919	1019
PS325	2MB	999	1099
PS333	2MB	1049	1149
PS340	2MB	1149	1249



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## phocus DESKTOP

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PROCESSOR SPEED	AMD 386DX 33MHZ	AMD 386DX 40MHZ	INTEL 486DX 33MHZ
LANDMARK V2.0	52MHZ	62.4MHZ	111.5MHZ

### STANDARD FEATURES ON ALL PD MACHINES

- CACHE MEMORY 64K
- USER MEMORY 4MB
- FLOPPY DISK 3.5" 1.44MB
- HARD DISK OPTIONS 105 210 338
- HDI ACCESS TIME 17MSEC 15MSEC 16MSEC
- SERIAL PORTS 1 X 9 WAY 1 X 25 WAY
- PARALLEL PORT 1 X 25 WAY
- GAME PORT OPTIONAL

- GRAPHICS CARD TRIDENT 9000 512K
- MONITOR SUPER VGA 0.28mm DOT PITCH
- MS DOS V5.0
- WINDOWS V3.0
- MICROSOFT COMPATIBLE SERIAL MOUSE

PRODUCT	RAM	105MB	210MB	338MB
PD333	4MB	1249	1499	1899
PD340	4MB	1299	1549	1949
PD433	4MB	1599	1849	2249

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## phocus MINI TOWER

£1,199



	PST325	PST333	PST340	PST433
PROCESSOR SPEED	AMD 386SX 25MHZ	AMD 386DX 33MHZ	AMD 386DX 40MHZ	INTEL 486DX 33MHZ
LANDMARK V2.0	32MHZ	52MHZ	62.4MHZ	111.5MHZ
CACHE MEMORY	N/A	64K	64K	64K

### STANDARD FEATURES ON ALL PST MACHINES

- USER MEMORY 4MB
- FLOPPY DISK 3.5" 1.44MB
- HARD DISK OPTIONS 105 210 338
- HDI ACCESS TIME 17MSEC 15MSEC 16MSEC
- SERIAL PORTS 1 X 9 WAY 1 X 25 WAY
- PARALLEL PORT 1 X 25 WAY
- GAME PORT OPTIONAL
- GRAPHICS CARD TRIDENT 9000 512K
- MONITOR SUPER VGA 0.28mm DOT PITCH
- MS DOS V5.0
- WINDOWS V3.0
- MICROSOFT COMPATIBLE SERIAL MOUSE

PRODUCT	RAM	105MB	210MB	338MB
PST325	4MB	1199	1449	1849
PST333	4MB	1249	1499	1899
PST340	4MB	1299	1549	1949
PST433	4MB	1599	1849	2249

UPGRADE FROM STANDARD 338MB HARD DISK TO SCSI 338MB DISK £149

## phocus 486 TOWER

£1,849

### STANDARD FEATURES

- PROCESSOR INTEL 486DX
- PROCESSOR SPEED 33MHZ
- LANDMARK V2.0 SPEED 111.5MHZ
- CACHE MEMORY 64K
- USER MEMORY 4MB
- FLOPPY DISK 3.5" 1.44MB
- HARD DISK OPTIONS 210 338 670 SCSI
- HDI ACCESS TIME 15ms 16ms 16ms
- SERIAL PORTS 1 X 9 WAY 1 X 25 WAY
- PARALLEL PORT 1 X 25 WAY
- GAME PORT OPTIONAL
- GRAPHICS CARD TRIDENT 9000 512K
- MONITOR SUPER VGA 0.28mm DOT PITCH
- MS DOS V5.0
- WINDOWS V3.0
- MICROSOFT COMPATIBLE SERIAL MOUSE

PRODUCT	RAM	210MB	338MB	670MB SCSI
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KEYTRONIC 84 Key Keyboard	£35 F43

# BAR CODE READERS

Keyboard Emulator Bar Code Reader	£149 L38
RS-232C/422 Bus Code Reader	£169 L40
Portable Bar Code Reader	£299 L41
Bar Code Printing Software	£149 L42

# INTERFACE CONVERTERS

Serial to Parallel	£59 N11
Parallel to Serial	£59 N12
Serial to Parallel Bidirectional buffered with X-DIN/OUT support	£79 N13
RS-232C/RS-422 or RS-422/RS-232	£69 N14
RS-232C/RS-422 bi-directional	£79 N15
RS-232C/RS-485	£79 N16
RS-232C/RS-485 Current Loop	£69 N17
RS-232C/IEEE-488/Canonica Parallel	£279 N18
Signal interface only	£279 N18
Full IEEE-488 Bus and GPIB Command implementation	£359 N19

# PC BASED DEVICE PROGRAMMERS

16K 512K EPROM Programmer	£79 N20
4-Gang version	£129 N21
16K 1024K (E)PROM Prog	£149 N22
4-Gang version	£199 N23
8-Gang version	£299 N24
BPPROM Programmer	£199 N25
8748 Series Programmer	£199 N26
UV EPROM Eraser	£99 N27
Universal Device Programmer Supports EIS/PROM, BPPROM, PAL, FPL, GAL, S-GAL, PEEL, EPLD, 6745 & 6751 Series Devices	£459 N28

## IEEE-488

IEEE-488 Card including BASIC & Pascal support software	£129 M33
Enh IEEE-488 Card with DMA	£129 M34
National Instruments PC IIA compatible	£179 M34
PC Bus or MCA versions	£69 M35
BASIC, C, Pascal & Fortran support software for Ene IEEE-488 Cards	£69 M35

## RS-422

RS-422 Card	£59 L28
Dual Port RS-422 Card	£89 L29
Dual Port RS-422/RS-485 Card	£89 L30
4 Port RS-422 Card	£119 L31
8 Port RS-422 Card	£219 L32

# MISCELLANEOUS

Prototyping Interface Card	£49 F22
Extender Card + 3 Slot Board	£59 F23
PC Voice Input/Output Card	£95 F44
Speech Interfer Card	£129 F45
8-Sync Communications Card	£79 F42

8255 Digital I/O Card (48 lines)	£37 P01
64 line DIO with breadboard slot	£129 P02
64 line DIO for PS/2 MCA systems	£129 P03
144 line Digital I/O Card	£229 P31
8255 Digital I/O Card (192 lines)	£199 P04

## Analog/Digital Conversion

8 bit A/D + Digital I/O + Timer	£162 P05
12 bit A/D + Digital I/O + Timer	£249 P06
12 bit A/D + DIO, Timer & DMA	£279 P07

High Speed 12 bit A/D with DIO & DMA	£370 P08
100KHz sampling rate version	£670 P09
1 bit A/D + DIO	£149 P10
8 bit 8 channel Digital to Analog	£149 P11
12 bit 8 channel Digital to Analog	£199 P12

# Chipset PC Systems

# Please turn over

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Fax (0483) 797702







**£599**

**386SX/16**

COMPLETE WITH 1MB RAM,  
40MB DISK DRIVE,  
12" MONO MONITOR AND  
DESKTOP CASE

\* Please add £20 for  
Mini Tower case illustrated.

	40MB (20ms)	80MB (19ms)	130MB (20ms)	180MB (20ms)	210MB (16ms)	330MB (16ms)
12" Monochrome (Hercules)	599	699	779	849	909	1299
14" Mono VGA (640 x 480)	549	749	829	899	959	1349
14" Colour VGA (640 x 480)	749	849	929	999	1059	1449
14" Super VGA (1024 x 768)	799	899	979	1049	1109	1499
17" Super VGA (1024 x 768, non-interlaced)	1249	1349	1429	1499	1559	1949

For 25MHz version please add £80 to the above prices.  
Please add £50 for each additional 1MB of RAM.

All prices include 1MB RAM expandable to 16MB; 1 floppy drive (1.2MB 5.25" or 1.44MB 3.5" format); 2 serial, 1 parallel and 1 game port; small footprint desktop case with 200W power supply; 102 key enhanced keyboard and 12 months on-site maintenance (UK mainland).

#### Standard Options

Mini Tower Case	Add £20
Full Size Tower Case	Add £50
Second Floppy Drive	Add £50
MS-DOS 5.0	Add £90
Microsoft Windows 3.0	Add £50
Microsoft Compatible Mouse	Add £20
Caching Disk Controller	Add £350
1MB Super VGA Video Card for 1024 x 768, 256 colours	Add £50
420MB upgrade from 330MB	Add £200

#### CHOICE OF PERIPHERALS

- CD-ROM: Hitachi
- Ethernet Cards: 3Com
- Gigabyte+ Disk Drives:  
Seagate; Maxtor
- Graphics Cards: Orchid
- Intelligent I/O: Specialix
- Math Coprocessors: Intel; Weitek
- Mice, Scanners, Digitisers:  
Genius
- Modems: Racal; Miracom
- Monitors: NEC Multisync
- Printers: Epson; Star; Canon;  
Panasonic; HP
- SCSI & ESDI Disk Drives:  
Seagate; Maxtor
- Tape Back-up: Everex; Wangtek;  
Colorado Jumbo
- Terminals: Wyse
- 5250/3270 Emulation: AST

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from Chipboards. We give you  
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Controller, your Chipset PC system  
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**286/12**

COMPLETE WITH 1MB RAM,  
20MB DISK DRIVE,  
12" MONO MONITOR AND  
DESKTOP CASE



	20MB (20ms)	40MB (20ms)	80MB (19ms)	130MB (20ms)	180MB (20ms)	210MB (16ms)
12" Monochrome (Hercules)	499	529	629	709	779	839
14" Mono VGA (640 x 480)	549	579	679	759	829	889
14" Colour VGA (640 x 480)	649	679	779	859	929	989
14" Super VGA (1024 x 768)	699	729	829	909	979	1039
17" Super VGA (1024 x 768, non-interlaced)	1149	1179	1279	1359	1429	1489

For 16MHz or 20MHz versions please add £30 or £50 respectively to the above prices.  
Please add £50 for each additional 1MB of RAM.

All prices include 1MB RAM expandable to 4MB; 1 floppy drive (1.2MB 5.25" or 1.44MB 3.5" format); 2 serial, 1 parallel and 1 game port; small footprint desktop case with 200W power supply; 102 key enhanced keyboard and 12 months on-site maintenance (UK mainland).

#### Standard Options

Mini Tower Case	Add £20
Full Size Tower Case	Add £50
Second Floppy Drive	Add £50
MS-DOS 5.0	Add £90
Microsoft Windows 3.0	Add £50
Microsoft Compatible Mouse	Add £20
Caching Disk Controller	Add £350
1MB Super VGA Video Card for 1024 x 768, 256 colours	Add £50
420MB upgrade from 330MB	Add £200

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options that none of our  
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maintenance service for every  
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mainland... a valuable benefit  
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Chipset PC system price.

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Granada maintenance contracts to  
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working life.



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## 486/33

64K CACHE

COMPLETE WITH 4MB RAM,  
40MB DISK DRIVE,  
12" MONO MONITOR AND  
FULL SIZE TOWER CASE



	40MB (28ms)	66MB (19ms)	130MB (20ms)	180MB (20ms)	210MB (16ms)	330MB (16ms)
12" Monochrome (Hercules)	1249	1349	1429	1499	1559	1949
14" Mono VGA (640 x 480)	1299	1399	1479	1549	1609	1989
14" Colour VGA (640 x 480)	1399	1499	1579	1649	1709	2099
14" Super VGA (1024 x 768)	1449	1549	1629	1699	1759	2149
17" Super VGA (1024 x 768, non-interlaced)	1899	1999	2079	2149	2209	2599

For 128K or 256K Cache models please add £78 or £150 respectively to the above prices.  
Please add £50 for each additional 1MB of RAM.

All prices include 4MB RAM expandable to 32MB; 1 floppy drive (1.2MB 5.25" or 1.44MB 3.5" format); 2 serial, 1 parallel and 1 game port;  
full size tower case with 250W power supply; 102 key enhanced keyboard and 12 months on-site maintenance (UK mainland).

Standard Options	
Desktop Case	Deduct £50
Mini Tower Case	Deduct £30
Second Floppy Drive	Add £50
MS-DOS 5.0	Add £50
Microsoft Windows 3.0	Add £50
Microsoft Compatible Mouse	Add £20
Caching Disk Controller	Add £350
1MB Super VGA Video Card for 1024 x 768, 256 colours	Add £50
420MB upgrade from 330MB	Add £200

# your own specification

# £749

## 386/25

COMPLETE WITH 2MB RAM,  
40MB DISK DRIVE,  
12" MONO MONITOR AND  
MINI TOWER CASE



	40MB (28ms)	66MB (19ms)	130MB (20ms)	180MB (20ms)	210MB (16ms)	330MB (16ms)
12" Monochrome (Hercules)	749	849	929	999	1059	1449
14" Mono VGA (640 x 480)	799	899	979	1049	1109	1499
14" Colour VGA (640 x 480)	899	999	1079	1149	1209	1599
14" Super VGA (1024 x 768)	949	1049	1129	1199	1259	1649
17" Super VGA (1024 x 768, non-interlaced)	1399	1499	1579	1649	1709	2099

A 25MHz 386SX model with 32K Cache is also available at the above prices.  
Please add £50 for each additional 1MB of RAM.

All prices include 2MB RAM expandable to 32MB; 1 floppy drive (1.2MB 5.25" or 1.44MB 3.5" format); 2 serial, 1 parallel and 1 game port;  
mini tower case with 200W power supply; 102 key enhanced keyboard and 12 months on-site maintenance (UK mainland).

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# TOSHIBA



## TOSHIBA PORTABLES

### Notebook Battery Portables

T1000LE	- 80C86/9.54 MHz - 20MB HDU 3.5" floppy drive	£799.00
T2000/20 NEW	- 80C286 12MHz - 20MB HDU 3.5" floppy drive	£1085.00
T2000/40 NEW	- As above but with 40MB HDU	£1199.00
T2000SX/20	- 80386SX/16MHz 20MB HDU 3.5" floppy drive	£1389.00
T2000SX/40	- As above but with 40MB HDU	£1509.00
T2000Sx NEW	- 80386SX/20MHz - 60MB HDU 3.5" floppy drive	£1949.00
T2200SX NEW	- 80386SX/20MHz 60MB HDU	£2355.00
T4400SX NEW	- 80486SX/25 80MB HDU	£3,055.00

### Battery Portables

T3100SX/40	- 80386SX/16MHz - 40MB HDU 3.5" floppy drive Gas plasma display	£1449.00
T3100SX/80	- As above but with 80MB HDU	£1549.00

### Mains Portables

T3200SX/40	- 80386SX/16MHz - 40MB HDU 3.5" floppy drive Gas plasma display	£1445.00
T3200SX/120	- As above but with 120MB HDU	£1669.00
T3200SXC	- 80386SX/20MHz - 120MB HDU 3.5 floppy drive, 256 colour TFT LCD Display	£4385.00
T5200/100	- 80386/20MHz - 100MB HDU 3.5" floppy drive Gas plasma display	£2129.00
T5200/200	- As above but with 200MB HDU	£2355.00
T5200C	- 80386/20MHz - 200MB HDU 3.5" floppy drive 16 colour DSTN LCD Display	£4274.00
Deskstation II	- for T1000SE/XE/LE, T1200XE, T2000SX	£455.00
Deskstation III	- for T3100SX	£599.00



## NEC PORTABLES

UltraLite 286F - 80C286/12MHz  
1MB RAM backlit LCD display, 20MB HDU £1219.00

PowerMate Portable SX - 8038SX 16MHz 2MB RAM 42MB HDU Gas Plasma Display £2375.00

ProSpeed SX20 Portable - 20MHz 1MB RAM paper-white LCD display 40MB HDU £2375.00

2MB System £2515.00  
5MB System £3055.00  
ProSpeed SX/20 Docking Station £POA  
ProSpeed 486X/C - NEW £POA

### PORTABLE PRINTERS

Toshiba ExpressWriter 201 NEW £219.00  
Canon BJ10EX £202.00  
Diconix 150 Plus £215.00  
Seikosha LT/20 NEW £259.00



## TOSHIBA ACCESSORIES

### CARRYING CASES

Standard case for T1000SE/XE/LE, T2000, T2000SX, T2000Sx, T3100SX, T1200XE, T3100e, T3200, T3200SX/SXC, T5200 and T5200C	£40.00
Leather case for T1000SE/XE/LE, T2000, T2000LE/SX/Sx	£65.00
Leather case for T1200XE	£80.00
Leather case for T3100SX, T3100e, T5200	£120.00
External 5.25" floppy drive (for all models)	£320.00

### MODEMS/FAX

Internal modem for T1000SE/LE, T1200XE, T2000, T2000SX/Sx, T3100SX, T3200SX	£399.00
Internal fax card for T3100e, T3200SX/SXC, T5200 and T5200C	£320.00

### BATTERIES

Battery Pack T1000SE/LE	£40.00
Battery Pack T1200XE, T2000, T3100SX	£65.00
Battery Pack for T3100SX/Sx	£135.00
Battery Pack for T2000SX	£155.00

## COMPATIBLE MEMORY UPGRADES

T1000SE/XE/LE	- 1MB	£99.00
	- 2MB	£149.00
T1200XE	- 2MB	£95.00
T2000/SX	- 1MB	£99.00
	- 2MB	£149.00
	- 4MB	£299.00
	- 8MB	£739.00
T2200SX	- 2MB	£149.00
	- 4MB	£259.00
T1600	- 2MB	£95.00
T3100SX	- 2MB	£95.00
	- 4MB	£199.00
T3100e	- 2MB	£95.00
T3200	- 3MB	£159.00
T3200SX	- 2MB	£95.00
	- 4MB	£199.00
T5100	- 2MB	£95.00
T5200	- 2MB	£95.00
	- 8MB	£469.00

## LASER PRINTERS

## POSTSCRIPT LASERS



# T A

# DTP

## NEW HP 95LX Palmtop PC £449.00 with Lotus 1-2-3 Connectivity Pack for HP 95LX £68.00

Brother HL-4 - 4 Pages per minute 512K RAM.	
One year on-site maintenance	£596.00
Brother HL-8-V - 8 Pages per minute 1MB RAM	£1049.00
Canon LP8-4-4 Pages per minute 512K RAM.	
One year on-site maintenance	£599.00
Canon LBP-8 III - 8 Pages per minute 1.5MB RAM.	
One year on-site maintenance	£979.00
Epson EPL-4100 - 6 Pages per minute 512K RAM.	£589.00
Epson EPL-7500 - 6 Pages per minute 2MB RAM.	£1178.00
HP LaserJet IIIP - 4 page per minute 1MB RAM	£699.00
HP LaserJet III - 8 Pages per minute 1MB RAM.	
One year on-site maintenance	£1023.00
HP LaserJet IIID - 8 Pages per minute 1MB RAM, Dual bin, Double sided printing. One year on-site maintenance	£1739.00
NEW - HP LaserJet IIISI	£2535.00
Postscript upgrade for LaserJet IIISI including installation	£POA

Mannesman Tally MT 905 - 6 Pages per minute 512K RAM	£675.00
Olivetti PG306 - 6 Pages per minute 512K RAM.	
One year on-site maintenance	£785.00
PostScript upgrade board for PG306 2MB Memory, 13 hard and 22 soft fonts	£419.00
Qume CrystalPrint WP Plus - 6 Pages per minute 256K RAM. One year on-site maintenance	£699.00
Qume CrystalPrint II - 6 Pages per minute 1.5MB RAM. One year on-site maintenance	£1049.00
Star LP-4 - 4 Pages per minute 1MB RAM.	
One year on-site maintenance	£575.00
Star LP-8 III - 8 Pages per minute 1MB RAM	
One year on-site maintenance	£929.00

EC Silentwriter2 S60P - 6 Pages per minute MB RAM. One year on-site maintenance.	£1075.00
EC Silentwriter2 290 - 8 Pages per minute 1.5MB RAM. One year on-site maintenance	£1525.00
EC LC890XL - 8 Pages per minute MB RAM. One year on-site maintenance	£2339.00

Olivetti PG312D - 12 Pages per minute 40K RAM. One year on-site maintenance	£1825.00
Qume CrystalPrint Publisher II - 6 Pages per minute 2MB RAM. One year on-site maintenance	£1525.00
Qume CrystalPrint Express - 12 Pages per minute MB RAM. Dual bin. Two year on-site maintenance	£2455.00

Star LP-4 StarScript - 4 Pages per minute MB RAM. One year on-site maintenance	£795.00
Star LP-8 II StarScript - 8 Pages per minute MB RAM. One year on-site maintenance	£1168.00

### MIRACOM EXTERNAL

WS4000 V21/23	£96.00
WS3000 & Keycard 3000	£184.00
V21/22/23	
WS3000 & Keycard 3000	
V21/22/22 bis/23	£228.00
Courier 2400e Quad with V23	£275.00
Courier PLUS2400	£329.00
Courier HST	£394.00
Courier V32	£449.00
Courier HST Dual Standard	£595.00
Courier 14.4 plus	£589.00

### MIRACOM INTERNAL

WS4000 V21/23 PC Internal	£96.00
Keycard 3000 V21/22/23	£184.00
Keycard 3000 V21/22/23/22BIS	£228.00
Keycard 1200/PC	£195.00
Keycard 2400/PC	£259.00
Courier HST	£389.00

### RACAL

Maxam IV Quad with MNP 5 V42/42bis	£279.00
Maxam V+Quin with MNP 5, V42/42bis	£549.00
Maxam VII+ 7 speeds up to 14,400 with V42/42 bis	£699.00

### WORLDPORT PORTABLE MODEM RANGE

2496i-T Internal fax/data modem	£369.00
2405 internal	£299.00
2496 NETWORK	£775.00
2423E quad modem - V21/23/22/22bis	£217.00
2400/MNP - V21/22/22bis MNP 5	£295.00
9600 - V21/23/22/22bis V32	£585.00
Acoustic couplers	£49.00

### DTP AND PRESENTATION SOFTWARE

Aldus PageMaker V 4.0	£395.00
Autodesk Animator Pro	£339.00
Corel Draw 2.0	£229.00
GEM Artline	£255.00
Harvard Graphics 3.0	£259.00
Harvard Graphics for Windows	£POA
Lotus Freelance 4.0	£238.00
Lotus Freelance for Windows	£299.00
PC Paintbrush for Windows	£239.00
Timeworks Version 2	£99.00
Ventura Gold	£419.00
Powerpoint for Windows	£239.00

### PLOTTERS HEWLETT-PACKARD

HP7440 - 8 pen A4*	£423.00
HP7475A - 6 pen A4/A3*	£599.00
HP7550 Plus - 8 pen A4/A3	
Auto sheet feed*	£1999.00
HP7570A - 8 pen A1/A2*	£1959.00
HP7575 - 8 pen A1 to A4*	£2575.00
HP7576 A0 to A4	£3599.00

### ROLAND

A4 Sketchmate	£329.00
DXV 1100 - 8 pen A3	£499.00
DXV 1200 - 8 pen A3	£629.00
DXV 1300 - 8 pen A3	£839.00
DPX 2500 - flat bed - A2 - stand included*	£2365.00
DPX 3500 - flat bed - A1 - stand included*	
GRX 300 - drum plotter - A1*	£3229.00
GRX 400 - drum plotter - A0*	£2759.00
DPX 4600 - flat bed - A0	£3615.00
LTX-321 Thermal A1	£5485.00
LTX-420 Thermal A0	£4369.00
	£5459.00

\*Including one year on-site maintenance

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### MONITORS

NEC	
3FG	£399.00
4FG	£519.00
5FG	£975.00
6FG	£1799.00
5D 20" Monitor - (1280 x 1024)	£1288.00

### TAXAN

790 14" VGA/SuperVGA	£335.00
795 14" VGA/SuperVGA/1024 x 768	£419.00
970 20" Multisync	£1189.00
Ultravision 1000S 20" Colour CAD/DTP Monitor	£1229.00
Ultravision 1150 21" Colour CAD/DTP Monitor*	£1689.00
Viking 2 (inc. display card) Mono DTP Monitor*	£1189.00

\*Including one year on-site maintenance

### SCANNERS

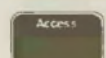
Hand Held Scanners	
Logitech ScanMan 256	£163.00
Logitech ScanMan 32	£89.00

### FLATBED SCANNERS

Canon IX30F - A4 - 300dpi	£588.00
PC Interface	£92.00
Epson GT6000 - A4 - 300dpi	£1298.00
Parallel Interface Kit	£98.00

Hewlett Packard ScanJet Plus - A4 - 300dpi	£479.00
Interface Kit	£268.00
Hewlett Packard ScanJet IIC - NEW	£1179.00

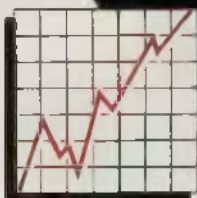
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SEE TOP FOR WORLDPORT PORTABLE MODEM RANGE





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• Control of the OPT-III from your Basic, C or Pascal programs?  
Now you can receive free city news and data including stock and share prices, company results, Wall St. unit trusts, City Newswire, takeover news etc. Also up-to-date world news, sports, what-on, TV/Radio, magazines, holidays, reviews and much more.  
Easily print out pages, or save received pages to disk as an ASCII file for use within other programs.

New advanced features include:  
• **2-Page Viewing** - optionally display two pages from a TV channel simultaneously (XGA)  
• **Share Scanning** - automatically save specified share names and their prices to disk as an ASCII file.  
• **16 Page 'Instant' Review** -  
• **Mouse Support/Page 'Click'**  
• **SetClock** - Auto-set your PCs (or net server's) system clock.  
• **Reduced Size** - now a half-card.

Many other advanced features are included - for example an advanced routine is supplied allowing you to automatically search and save to disk (as an ASCII file) specified sequences of pages on a mixture of TV channels - you can even specify the times.

Advanced users will delight in using and controlling the OPT-III Teletext receiver using the supplied device driver from their own programs - using the acquired pages for analysis, control, data distribution etc

The OPT-III package includes a precision half sized PC card, manual, easy-to-use application software, as well as sample programs in Basic and C.

• **The OPT-III is available now for £195** (+ 45 con + VAT).  
Please ask for a detailed leaflet.

#### DR SOLOMONS ANTI-VIRUS TOOLKIT

The US version of PC Magazine recently reviewed no less than twenty 'anti-virus' utilities. A British package (Yes!). Dr Solomon's Anti-Virus Toolkit, from S & S International, won the coveted PC Magazine's Editors Choice.

"Dr Solomon's Anti-Virus Toolkit is an easy-to-use, effective scanner that prevents, detects, and removes all major viruses. It comes with an excellent manual, frequent upgrades, and good technical support." **PC MAGAZINE 'OCT 1991**

Optimum Technology are an S & S Authorised Dealer. We feel that the purchase of an S & S product gives you several advantages.

• Unlike some other anti-virus manufacturers, they don't 'promise the earth' - In fact, they show a refreshing honesty with regards to claims as to what their products can and cannot do.

• Being UK based, they can react very quickly to any UK/European threats. Also, when urgent advice is needed, they are at the 'end of a UK phone', not in the US!

• They DO send out updates - you receive quarterly updates of the superb VindVirus program.

#### CORPORATE NEWS!

If you have 'corporate' anti-virus responsibility, you may wish to consider the 'Corporate' option. (We have!). In addition to monthly software updates, you also receive a monthly copy of the essential Virus News International. VNI is invaluable, in that it offers you accurate details of new viruses, superb technical snippets, articles and gossip. (How do 'stealth' viruses really work? etc...)

Although VNI appears monthly, if there is anything that needs saying in a hurry, they send out a detailed fax alert, allowing you to act immediately.

"The best way to start off, in my judgement, is to get Dr. Solomon's Anti-Virus Toolkit. That gets you started. After that, subscribe to Virus News International. ... Highly recommended."

**BYTE - NOVEMBER '91**

Regrettably, viruses are now a serious threat - S & S treat this subject sensibly and offer a superb, stable and reliable product with vital UK backup.

#### INTEL FAX CONNECTION CO-PROCESSOR

• **NEW LOW PRICE - £495**  
• **STOP PRESS** - New Network Software - Please phone for details.  
• **STOP PRESS** - For the more advanced Windows user, the new WINFAX-PRO V2 Windows fax software now available (£99)

"The Connection CoProcessor helps define a standard of excellence for other fax systems to live up to.... the Connection CoProcessor is a clear winner."

**PC MAG. 'EDITORS CHOICE'**

Whether you use DOS or Windows-3, you will be delighted with this advanced state-of-the-art fax card. With its own on-board 80188 processor with 256K RAM - it is unlike most other fax boards - you can now genuinely do your fax transmitting and receiving in the 'background', without faxes disrupting your workflow.

• 9600 Baud - full Group-III  
• On-board 80188CPU/256K RAM  
• Full LIM Expanded Memory support - only 6K RAM required (minimum EMS memory needs 62K RAM)  
• True 'background' operation  
• Multiple location transmission  
• Schedule transmissions  
• Supports most popular printers and scanners  
• Transmit compatible with any ASCII text, PCX or DCX files.

#### FAX-IT FOR WINDOWS! £45

With FAX-it for Windows-3, you can send a fax from ANY Windows application e.g. Word for Windows, Ami, CorelDraw, Superbase, Windows Write etc - a MUST for many Windows-3 users! FAX-it offers phoneBooks, groups, scheduling, cover sheets, transmit and receive log, view and print faxes etc etc. Save a fax in PCX or TIFF format (permits for subsequent manipulation e.g. OCR). You can even forward a received fax!

#### WINFAX PRO £99

Winfax Pro is for the more serious user - it offers the same facilities as FAX-it and much more. Advanced features include ASCII phonebook import, the customisation of cover sheets, with Time, Date, Recipients name etc. Full D.D.E. support allows automated use with say Word for Windows, etc

"The fax card comes of age with the Intel Connection CoProcessor" **PC USER**  
Please phone for a 'fax' datapak.

#### CBT SOFTWARE TRAINING

A selection of superb training software offering you product from the best training software producers, including American Training International, individual Training, Intelliance etc. In addition to the individual use, these packages have been extremely popular with training organisations, support departments, colleges, universities etc. Optimum CBT (Computer Based Training) offers you an attractive alternative to 'normal' training. (Most standard training companies offer tutor-based training, with 5-10 students per class, and typically charge £150-£300 per day per person). Optimum CBT is the fast way to learn, teaching you to use your package to its full potential. With Optimum's CBT training, your own PC becomes a highly qualified personal teacher - it teaches you individually at your own pace. You can also go back for a refresher whenever you like. It can be used again and again, and train many people. Ideal for training, R&D and support departments.

A full range of quality training software is available - please phone for a copy of our free detailed training leaflet.

• Advanced 1-2-3 Rel-2	£139
• Advanced 1-2-3 Rel-3	£139
• Advanced dBase-III Plus	£139
• Advanced dBase-IV	£139
• Advanced WordPerfect v.1	£139
• How to Use your PC/AT	£59
• How to Use your IBM PS/2	£59
• Individual Training - LAN5	£99
• Individual Training - Excel	£89
• Intro to Business Software	£59
• Intro to Database Mgmt	£59
• Intro to Word Processing	£59
• LAN Administrators Kit	£195
• Manage Business with 1-2-3	£89
• Professor DOS	£69
• Professor Windows	£69
• Teach Yourself 1-2-3 V2.2	£89
• Teach Yourself 1-2-3 V2.3	£89
• Teach Yourself 1-2-3 V3.1	£89
• Teach Yourself 1-2-3 Macros	£89
• Teach Yourself dBasease V4	£89
• Teach Yourself dBase-III Plus	£89
• Teach Yourself dBase-IV	£89
• Teach Yourself DisplayWrite 4	£89
• Teach Yourself DOS 3.3	£59
• Teach Yourself DOS 4	£59
• Teach Yourself DOS-5	£59
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• Teach Yourself MS Word V5	£89
• Teach Yourself M'Mate Adv+	£89
• Teach Yourself Multiplan V2	£89
• Teach Yourself Open Access-II	£89
• Teach Yourself Paradox3	£89
• Teach Yourself Pagemaker3	£99
• Teach Yourself Q&A	£89
• Teach Yourself Quattro V3	£89
• Teach Yourself PC Tools V7	£89
• Teach Yourself RBase for DOS	£89
• Teach Yourself SuperCalc 5	£89
• Teach Yourself Symphony	£89
• Teach Yourself Ventura	£99
• Teach Yourself Windows-3	£69
• Teach Yourself W'Perfect 5.1	£89
• T.Yself W'Perf for Windows	£89
• Teach Yourself Wordstar 3.3	£89
• Teach Yourself Wordstar Prof-4	£89
• Teach Yourself Wordstar 2000	£89
• Unix/C Course (also available)	£995

# OPTIMUM TECHNOLOGY LTD

Sunny Gardens Parade, Great North Way,  
London NW4 1JA ENGLAND



LISTED BELOW IS JUST A SELECTION  
FROM OUR WIDE RANGE OF PRODUCTS  
(from legitimate UK sources - NO 'GREY' IMPORTS!)

## WORD PROCESSORS

*AMI V1.2 (Lotus)	£95
*AMI Prof V2 - New! (Lotus)	£295
*DisplayWrite V5	£295
*Grammatik for Windows	£89
*Grammatik-V-UK (Grammar Check)	£89
*JustWrite - New Symantec	£189
*Manuscript V2.1	£275
*Multimate 4.0 (UK)	£289
*PerFORM V2.1	£99
*PerFORM PRO For Windows	£369
*Prof Write Plus - New!	£195
*Word V5.5 UK - MS (UK)	£259
*Word V5.5 Network	£895
*Word for Windows V2 UK	£289
*Word for Windows Net	£1295
*Word for Windows Professional	£95
*Word for Word Pro Windows	£95
*WordPerfect for Windows	£229
*WordPerfect V5.1 (UK)	£229
*WordPerfect Executive	£149
*WordPerfect LetterPerfect	£149
*WordPerfect Office 3-PC	£95
*WordPerfect Office 3-Net	£POA
*Wordstar for Windows	£235
*Wordstar V6 UK	£235
*Wordstar Net Server/Users	CALL
*Wordstar 2000+ Rel3.5 (UK)	£295

## SPREADSHEETS

*Excel V3 Microsoft	£249
*Excel Lan (3 User Pack)	£1145
*Impress V2L	£125
*Logistix V1.3	£135
*Lotus 1-2-3 for Windows	£319
*Lotus 1-2-3 2.3	£249
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*Lotus 1-2-3 2.3 Net User	£239
*Lotus 1-2-3 3.1+ 286/386/486	£299
*Lotus 1-2-3 3.1+ Net Server	£489
*Lotus 1-2-3 3.1+ Net User	£289
*Multiplan V4.2 - Microsoft	£129
*PlanPerfect V5.1 (WordPerfect)	£269
*Quattro Pro V3	£195
*Quattro Pro V3 Competitive Upgrade	£65
*Supercalc 5.1 (UK)	£77
*Supercalc 5.1 LAN (3 User Pack)	£195
*Wingz V1.1 (UK) - Informa	£329

## INTEGRATED PACKAGES

*CA SuperOffice - New!	£125
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*Works V2.0 - MS	£129
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## DATABASES

*ACT 2.0 Contact Management - NEW!	£369
*Agenda V2	£289
*Cardbox Plus	£295
*DataEase V4.5 (UK)	£489
*DataEase Network (3 User)	£579
*DataPerfect V2.2 (WordPerfect)	£289
*dBase III Plus V1.1 (UK)	£POA
*dBASE-4 V1.1 (UK)	£POA
*dBASE-4 V1.1 Dev Ed. (UK)	£POA
*dBASE-4 V1.1 Lan Pak	£POA
*Clipper V5.01 (UK)	£349
*Delta-V Rel2 - Compsort	£439
*FormBase (Xerox)	£369
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*Foxbase Plus V2.1 MultiUser	£389
*Foxbase Plus V2.1 Developer	£449
*Foxbase Plus/386 V2.1	£349
*Foxbase+/386 V2.1 Devel.	£549
*FoxPro V2 UK	£449
*FoxPro V2 UK Multi-User	£649
*FoxPro Distribution Kit	£295
*Object-Vision special Offer - NEW!	£89
*Omnis-5 for Windows	£529
*Paradox V3.5 (UK)	£289
*Paradox Network Node	£145
*Professional File V2	£169
*Q & A V4 - NEW!	£269
*Q & A V4 Network - 3 User Pack	£249
*Rapidfile V1.2	£239
*rBase V3.1	£439
*rBase Personal - New!	£139
*Reflex V2.0	£195
*Superbase-2 (Windows)	£239
*Superbase-4 V1.3 (Windows)	£395
*Superbase-4 V1.3 Developers Ed.	£795
*Superbase-4 5-user Runtime	£179
*Superbase-4 V1.3 LAN (5 user)	£745
*TAS Professional - Single User	£445

## PROJECT

*ABC Flowchart V1.1	£249
*Harvard Project Manager-III	£539
*Logistix V1.3	£135
*Instant Org-Charting - New!	£185
*Microsoft Project V4	£245
*MS Project for Windows NEW!	£369
*ON-TARGET - NEW! Symantec	£279
*Quick Schedule Plus	£79
*SuperProject Expert V2	£589
*SuperProject for Windows	£589
*Time-Line V4 NEW (UK) Symantec	£489

## DATA MANAGEMENT

*ABC Flowchart V1.1	£249
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*Access Dragnet (Disk Retrieval)	£95
*Access Prompt (Disk Manager)	£95
*Agenda V2 (UK) - Lotus	£289
*Grandview V2 UK - NEW! Symantec	£269
*IBM Current V1.1	£289
*Lotus Magellan V2.0	£99
*Lotus SmartText Builder Dev Sys	£445
*Lotus SmartText Reader	£95
*PC Guide V3 - Hypertext	£449
*PC Guide Reader	£95
*Portex Professional	£129
*Portex Prof Net 8 User	£795
*Statgraphics V5 - New!	£529
*VP Expert V2.0	£185

W - signifies a Windows or a Windows associated product.

# FEBRUARY'S OPTIMUM CHOICE

## FREE 'FLOPPY CALC' IS BACK!

Back by popular demand is the 'Floppy Calc', a great free gift, a 'thank you' for your custom, from Optimum. It is not really hardware - it is not really software! The unique 'limited edition' Optimum Floppy Calculator - a superb seven function solar powered calculator with a unique attractive hi-tech design. Free with your order over £50 (+ carr & VAT one per customer while stocks last).

## THE OPT-III TELETEXT CARD

\*\*\* STOP PRESS! \*\*\*  
Do you have a PS/2, portable or non-IBM/PC computer and also wish to receive Teletext data? - Coming soon! - the exciting new OPT-III/S Teletext Receiver, an external unit that communicates through a standard RS232 serial port. Although supplied with PC software, it will also supply Teletext data in either 'raw' or ASCII data, thus allowing its use with any computer with an RS232 serial port. Please call for pricing and availability.

The OPT-III Teletext receiver card, allows you to receive and use Teletext data, from Ceefax and Oracle etc. Features now include:

- **Twin Page Viewing** - you can now optionally watch two pages from a TV channel simultaneously (EGA/VGA) - and Yes! - they both continually update. So you can watch the news headlines on the left with share prices on the right.
- **Share Scanning** - you can scan the teletext share pages for share names previously specified - and automatically save the share names and prices to disk as an ASCII file.

- **Page Review** - instant 16-page review.
- **Mouse Support**
- **SetClock** - set internal PC (net?) Clock from the Teletext accurate clock signal (perhaps from AutoClock?).
- **Page Click**
- **Reduced Size** - now a half-sized card.

The OPT-III is a unique advanced Teletext receiver that fits inside your IBM-PC. Why the OPT-III Teletext Card? - Perhaps 'live' data for use within your applications? Possibly automatic keyword search (and manipulation) of 'live' data. Perhaps automatic share portfolio monitoring?

Now you can gain from free city news and data including stock and share prices, company results, Wall St, foreign exchanges, world markets, unit trusts, City Newsfile, takeover news etc. As well as up-to-date world news, sports, whats-on, TV/Radio, magazines, holidays, reviews etc.

Simply insert this precision half-sized card into your IBM/PC. (into PS/2 model 30+ AT, '386 or 486, and plug in a television antenna.

Fully featured advanced circuitry includes software controlled 'closed-loop' digital tuning ensuring both accuracy and reliability.

Advanced software allows you to save a received page to disk as an ASCII file for use within other programs. You can print out pages. You can save the data to disk (as raw data or as an ASCII file).

An advanced routine allows you to automatically search and save to disk (as an ASCII file) specified sequences of pages and sub-pages on a mixture of TV channels - you can even specify times.

If your interest is the financial pages, you can scan specified pages for share names of interest - the OPT-III software will produce an ASCII file, clearly listing the names of the shares and their prices.

Advanced users will delight in using and controlling the OPT-III Teletext receiver using the supplied device driver from their own programs - using the acquired pages for analysis, control, data distribution or other processing.

Typical applications include:  
• **'Prices-on-the-Move'** - one user is automatically 'bleeped', via modem, on his RadioPager every hour with his shares portfolio pricing.  
• **'Network News'** - one network manager has delighted users by offering a free 'real-time' news service down the network.

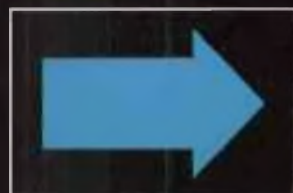
The OPT-III package includes a precision half sized PC card, manual, easy-to-use application software, as well as sample programs for the programmers amongst you in Basic and C.

The OPT-III is available now for only £195 (+£5 carr + VAT). A comprehensive DataPak is available on request. cont...

# OPTIMUM SALES DESK

Telephone: 081-203 0220

Fax: 081-203 7004



See next page.....





# OPTIMUM

## OPTIMUM TECHNOLOGY

### MORE THAN JUST LOWER PRICES!

#### UTILITIES/MISC

386Max V6 - New!	£65
Adobe Type Mgr/Plus	£79/£139
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AutoRoute Products - call for prices	
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DESQview 386 V2.4 inc QEMM	£145
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Dr Solomons Anti Virus V5	£95
Dr Solomons "Corporate"	£289
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Lap-Link Pro V4 - New!	£99
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Norton Anti-Virus V1.5 (UK)	£135
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Norton Editor V2	£59
Norton Utilities V6	£115
PC KWIK POWER PACK V2.1	£89
PC Tools Deluxe V7 - NEW!	£99
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WINDOW/3-3 Dev Toolkit	£295
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Xtree Pro Gold V2.5 - NEW!	£95
Xtree Network (Novell only)	£295

#### SOUND/VIDEO BOARDS

Hercules Graphics Plus	£185
Hercules Graphics Station	£695
Hercules G/Station 2MB w/c	£365
Hercules G/Station 2MB w/c	£1095
Hercules Graph.Station PS/2	£979
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Video-7 VGA 1024i 512K	£145
Video-7 VRAM-II 512K	£245
Video-7 VRAM-II 1MB	£295

#### CAD / DTP & GRAPHICS

ABC Flowchart V1.1	£249
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DeskPRESS (Fireworks Prof.) - NEW!	£189
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DR WordChart	£125
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Freelance for Windows	£325
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Harvard Graphics V3 - New!	£295
Harvard Graphics for Windows	£295
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Import for Windows	£189
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Micrograph Clip-Art	£POA
Micrograph Designer-V3.1	£379
Micrograph Draw for Win	£99
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PC Publishers Paintbrush V2	£289
PC Publishers Typefoundry	£289
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Per-FORM V2.1	£99
Persuasion for PC - Aldus	£295
PowerPoint for Windows	£295
StoryBoard Level	£345
SuperPrint V2 for HP	£119
TimeWorks V2 NEW inc OEM	£125
Ventura Gold Gem	£495
Ventura V4 for Windows - New!	£495
Ventura Accessories	£CALL
WordScan Plus OCR	£679
ZSoft SoftType (Fonts)	£139

#### LOTUS cc:MAIL

Call for pricing/advice on other cc:MAIL products	
MS-DOS Platform Pack	£139
Windows Platform Pack	£349
Gateway	£895
Remote	£195
cc:FAX	£1395

#### OPT-III TELETEXT CARD

OPT-III Teletext Receiver	£195
Many new features in new 1/2 size card design with 2-page display (EGANAL), mouse support, spare retrieval etc etc - Ask for Leaflet.	

#### MICE/SCANNERS

Logi ScanMan 256 - NEW!	£199
Logi ScanMan 256/PS2	£269
Logi Scanman 32+ PS/2	£119
Logi CatchWord V1.1 OCR	£139
ReadRight for Windows	£379
WordScan OCR	£495
WordScan Plus OCR	£679
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RS232 or PS/2 or Bus Left-Handed or Right-Handed	
Logitech MouseMan Radio	£115
Logitech TrackManBus, RS232 or PS/2	£79
from Logi - Hi-Tech Trackerbak '15,000dpi' + Software	
Logitech Trackman 'Portable'	£95
MS BallPoint - Trackerball	£119
MS Mouse - Standard RS232/PS2	£89
MS Mouse - Standard - Bus	£89
MS Mouse+Windows 3 RS232	£129
MS Mouse+Windows 3 - Bus	£129
PC Mouse-III - RS232 Mouse Systems	£89
PC Mouse-III - Bus Mouse Systems	£89
PC Mouse-III - Optical Hi-Resolution up to 30000 C.P.I.	
PC TrackBall Serial or Bus	£95
Sharp Colour Mini-Scanner	£479
miniatured, 200dpi, 100mmx160mm scan area	

#### PROGRAMMING

<b>BORLAND:</b>	
Turbo C++ V2/+T-Vision	£65/£89
Turbo C++ for Win	£99
Borland C++ V3 (Windows-3)	£249
Borland C++ V3 + AFX	£395
Turbo Debug+Tools	£99
Turbo Pascal V6/Prof	£79/£149
Turbo Pascal for Windows	£125
<b>MISC:</b>	
Toolbook V1.5	£249
BridgeBatch - New!	£119
<b>MICROSOFT:</b>	
Basic V7.1 PDS	£269
C Compiler V6 PDS	£239
Cobol V4 PDS	£445
Fortran V5.1	£279
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Quick-Basic V4.5	£69
Quick C for Windows	£129
Quick-CV2.5/Pascal	£69/£69
VISUAL-BASIC - NEW!	£125
Windows-3 Software Dev Kit	£295

#### TECMAR

Please call for pricing on the full range of Tecmar backup products, Novell backup interface cards etc.	
QT-40e 40MB External	£569
QT-40i 40MB Internal	£445
QT-40e Floppy Adapter	£149
QT-100e 100MB External	£1095
QT-100i 100MB Internal	£995
QT-250e 250MB External	£1495
QT-250i 250MB Internal	£1395
Host Adapter QT1 00i/250e	£179
DataVault 1.3GB DAT	£3795
PROLINE - Novel!	£POA
DC2000A Tape	£22
DC6150 Tape	£29
DC6250 (TwinPack)	£79

#### MATHS CO-PROC & MEMORY

<b>Maths Co-Processors</b>	
Cyrix offers full IEEE compatibility and up to three times normal co-processor performance. Supplied complete with instructions and diagnostic disk.	
Cyrix FastMath 287XL 6-20MHz	£89
Cyrix FastMath 287XLT 6-20MHz	£89
Cyrix FastMath 387SX 16-25MHz	£129
Cyrix FastMath 387 16-40MHz	£189
Intel offers you the 'original' with a full 5 year UK warranty.	
Intel 8087	£75
Intel 8087-1	£135
Intel 8087-2	£99
Intel 80287XL	£99
Intel 80287-XLT	£99
Intel 80387-SX 16-20MHz	£139
Intel 80387 16-33MHz	£149
Intel 80487-SX	£395
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Standard Above Board for PCs, ATs etc running up to 12.5MHz PS/2 Model 80, Compaq 386 etc with EMS	
Above Board Plus 512K	£345
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Above Board Plus-8 6MB	£695
Above Board Plus-8 8MB	£795
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Adv Board MC50/60 512K	£365
Adv Board MC50/60 2MB	£495
Adv Board MC50/60 4MB	£595
Adv Board MC50/60 6MB	£695
Adv Board MC50/60 8MB	£795
MC70/80 for PS/2 Models 70 & 80 - fast zero-wait state, EMS etc	
Adv Board MC70/80 2MB	£569
Adv Board MC70/80 4MB	£669
Adv Board MC70/80 8MB	£869
<b>'386 UPGRADE</b>	
(for IBM PC/XT only)	
INBOARD 386/PC 1MB	£495
1MB Piggyback Card	£379
MemoryExpansion and Co-Processor for 386/PC SCALL	
<b>SNAP-IN 386 - NEW!</b>	£425
386/20MHz + 16K Cache. Just released from Intel is this unique, easy-to-fit upgrade for PS/2 Model 50 and Model 60 users. Offers stunning speed improvements. Please call for a leaflet.	
<b>NETPORT - New!</b>	
The self-contained print server for Network from Intel. Please phone/write for leaflet.	
NetPort	£479
<b>CONNECTION COPROCESSOR</b>	
This is perhaps the 'ultimate' fax card, with a built-in 80188 CPU and 256K RAM for genuine 'background' operation. Requires on 6K of RAM (expanded) or 62 conventional. Please phone/write for a leaflet.	
Connection Co-Processor	£495
FAXit for Windows	£45
<b>WINFAX PRO V2</b> - New from Deling - Advanced Fax Windows Software for Intel	£99
FAXcess 10-user (for Novell)	£750
FAXcess 25-user (for Novell)	£1150

\* signifies a Windows or a Windows associated product.

**OPTIMUM TECHNOLOGY LTD**  
Sunny Gardens Parade, Great North Way,  
London NW4 1JA ENGLAND

**Sales Desk: Phone 081-203 0220 Fax 081-203 7004**

See previous page.



LISTED BELOW IS JUST A SELECTION  
FROM OUR WIDE RANGE OF PRODUCTS  
(from legitimate UK sources - NO 'GREY' IMPORTS!)

## COMMS NOTES

\* MODEM CODES & SPEEDS (B.P.S.)  
a = V21 - 300bps (CCITT)  
b = V23 - 1200/75 (CCITT)  
c = V23 - 1200bps (CCITT)  
d = V22bis - 2400bps (CCITT)  
e = V-Series Hayes 'Express' 9600 Special  
f = HST - 9600bps US Robotics 'Special'  
g = V32 - 9600bps (CCITT)  
h = V32bis - 14400bps (CCITT)  
i = HST - 14400bps US Robotics 'Special'

\* ERROR CORRECTION/COMPRESSION  
MNP-4 = Error Correction  
MNP-5 = Compression - up to 2:1  
V42 = Error Correction (CCITT) - +MNP-4  
V42bis = Compression (CCITT) - up to 4:1

### MODEMS FEATURES:

All our modems feature Auto Dial & Auto Answer and they have full BSI approval. As Hayes Authorised Dealers, we supply genuine Hayes modems - they really are 'Hayes Compatible', and may well be your first choice. All other modems are HayesAT compatible. i.e. they are broadly compatible with the Hayes AT/Dial Command Set. Please feel free to phone/write for advice on your 'dial-up' modem/comms requirements - let us help you choose your modem and comms software.

## COMMS SOFTWARE

Carbon Copy Plus V6 - NEW! £125  
cc:Mail - see previous page  
Chit-Chat - Sage £89  
Crosstalk-M4 - V2 £129  
Crosstalk-16 V3.71 UK £95  
Crosstalk for Windows V1.1 £95  
DataTalk V3.3 £125  
DATATALK V4 + MNP £179  
MIRROR-III UK with MNP-5 £169  
Mirror-III Takeover (remote) £189  
PC Anywhere V4 £129  
Procom Plus V2 - New! £95  
Reflections ECALL  
Smartcom Exec V2.1 (Hayes) £79  
Smartcom-III V2 (Hayes) £129  
Smartterm 240 V3.0 £225  
Smartterm 320 £149  
Smartterm 400 £125  
Smartterm 470 £225  
TALKING WINDOWS - NEW £239

## FAX for the PC

Intel Connection CoProcess. £495  
FAXite for Windows £45  
WinFax Pro V2 Prof. Fax Software £99  
FAXcess 10 User (for Novell) £750  
FAXcess 25 User (for Novell) £1150  
JT-FAX PLUS - BSI Approved £295  
JT-FAX PLUS MCA for PS/2 £395  
WorldPort 2496 Fax/Modem £479  
FaxNOW! for 2496 £145  
FaxNOW! if purchased with 2496 £95

## OPT-III TELETEXT CARD

OPT-III Teletext Card £195

## COMMS HARDWARE

a selection of available modems

Modem to PC cable (25w) £15 AT (9w) £23

DACOM: (Full Dacom product range available)  
GOLD PC4 (a,b,c,d) +MNP5 Int. Software £529  
GOLD PC4/FAX - as above + send-only fax £595  
GOLD MCA4 as PC4 for MCA & Software £575  
GOLD MCA4/FAX as above + send-only fax £675  
FASTLANE DIAL (c,d,g) +MNP5/V42 £795

DATAFLEX: (Full Dataflex product range available)  
PC Stradcom (a,c) Internal £145  
Pocket Stradcom-II + Software (a,c) £175  
PC Biscorn (a,c,d) +Software £195  
Pocket Biscorn (a,c,d) +Software £289  
Pocket Cornfax (a,c,d) + send-only fax £375  
PC Quadcom (a,b,c,d) Internal-Int. £285  
Pocket Quadcom (a,b,c,d) - software £375  
PC Rapler (a,c,d,g) +MNP5+V42bis Internal £495

DOWTY: (Full Dowty product range available)  
Quattro/Ext "Classic" (a,b,c,d) +MNP2 £495  
QuattroCard Int. "Classic" (a,b,c,d) +MNP2 £545  
Quattro/PC - NEW! (a,b,c,d) +MNP5/V42/V42bis £579  
TrailBlazer Plus V32 (18000,a,b,c,d,g) £995

### HAYES™ SMARTMODE™ MODEMS:

Optimum Technology Ltd are Hayes Authorised Dealers. We stock the full range of Hayes comms products.  
1200 (a,b,c) £289  
1200B (a,b,c) Internal PC Card £289  
2400 (c,d) £325  
2400 Quad (a,b,c,d) £389  
V-Series™ 2400+Quad (a,b,c,d) +MNP5/V42/V42bis/V32 £469  
V-Series 9600+Quad as V-Series 2400 - with (d) £589  
V-Series Ultra 9600 as 9600-Quad plus V32 (g) £689

\* Hayes, Smartmodem and V-Series are registered trademarks of Hayes Microcomputer Products, Inc.

MIRACOM: (Full Miracom product range available)  
WS4000 (a,b) available as External or Internal £145  
COURIER 2400e Quad (a,b,c,d) +MNP5 £379  
COURIER 2400e Quad/PC Internal £349  
COURIER 2400 Plus - NEW! (a,b,c,d) with MNP5/V42/V42bis £445  
COURIER HST (a,c,d,f,i) upto 2400bps +MNP5+V42/V42bis Internal to US Robotics HST £495  
COURIER HST Internal £495  
COURIER V32 (a,c,d,g) +MNP5/V42/V42bis £495  
COURIER 14.4 Plus NEW! (a,b,c,d,g,h) with MNP5/V42/V42bis £795  
COURIER HST DUAL as HST + g.h £845

### OPT-III TELETEXT CARD

£195

New Model with many advanced features - Ask for leaflet.

### PACE: (Full Pace product range available)

Uninet (a,b) available as external or internal £145  
Uninet 1200 (a,b,c) also as internal £225  
Uninet 2400 (a,b,c,d) also as internal £295  
UltraLink Quad (a,b,c,d,g) +MNP5/V42 £449  
UltraLink V32 (a,b,c,d,g) +MNP5/V42 £845

### RACAL: (Optimum - an Authorised Retail Dealer)

Maxam-4 (a,b,c,d) +MNP5/V42/V42bis £389  
Maxam-4/PC as above + internal £389  
Maxam-5+ (a,b,c,d,g) +MNP5/V42/V42bis throughout up to 19200 bps, Async/Sync £749  
Maxam-5+/PC as above but internal £749  
Maxam-7+ (a,b,c,d,g,h) +MNP5/V42/V42bis £945  
Maxam-7+ PC as above but internal £945

### WORLDPORT: (Full product range available)

2423 Pocket (a,b,c,d) £295  
2400 Pocket MNP-5 (a,c,d) £389  
2496 Pocket Fax/Data Modem with group 1 9600 bps fax and V22bis/V22M21 - Special Offer - Free Transcom MNP-5 Software £479  
FaxNOW! for 2496 £145  
9600 (a,c,d,g) NEW! £769

# FEBRUARY'S OPTIMUM CHOICE cont....

## EVERY LABELPRO - NEW!

The impression a sharp stunning laser printed label can make is recognised. Avery laser labels are freely available from most office stationary suppliers - however the problem has always been how to print on them. Avery have just launched this new product.

"Labelling software for use with HP and Postscript printers. Supports .PCX and .PCC graphic files and WordPerfect, Word, Wordstar and dBase formats.... Easy to use with a good range of templates, library of clip-art, and selection of scalable fonts. Prints well on a variety of labels."

**PERSONAL COMPUTER MAGAZINE**  
LabelPro does only one thing. It enables you to design labels and print them on a laser printer - many packages can output to laser labels - in theory anyway! - LabelPro does it easily - and it does it extremely well - even bar codes!

The ability to merge databases with label designs is a handy feature. Data entered in dBase, WordPerfect, Word, Wordstar or comma-delimited files can be combined with a label design, so you don't have to create a separate label for each piece of data.

The software is compatible with HP LaserJet, Deskjet, Xerox 4045, Canon, Postscript printers etc etc.

## ZORTECH C++ FROM SYMANTEC

Yes! - Symantec liked the product so much... Yes! - so they bought the company!! Zortech C++ is the only C++ compiler that provides professional tools for Windows, DOS and OS/2 in a single package.

Zortech C++ provides absolutely everything you need to edit, compile, link and debug any Windows application. You don't need to buy the MS SDK kit. It includes a Help compiler and engine, a resource compiler etc etc. The unique WING library automatically converts DOS command line programs to true Windows applications. It even includes royalty-free 32bit and 16bit Dos extenders, for the cost effective development of programs with advanced memory requirements. Please call for a detailed leaflet.

## STACKER 2.0 DISK DOUBLER

Is your hard disk too small? Stacker 2.0 instantly and safely doubles your disk capacity so you can do more with your personal computer today. Stacker saves you money by avoiding costly and difficult hard disk upgrades. Stacker works invisibly. The built-in Stacker Cache improves performance.

Stacker is available as software only, or with dedicated compression cards for the fastest possible operation and best compression. Please phone for a detailed leaflet.

## CYRIX LOW COST 'POWER' MATHS CO-PROCESSORS

As well as being Authorised Intel Dealers, we have now started supplying the high performance Cyrix Maths CoProcessors.

### "Top Rated CoProcessor" PC WEEK

If you use Lotus 1-2-3, or one of the thousands of other packages that support a maths co-processor, you can now afford this efficient upgrade. Prices now range from \$89 to \$189 pounds. The Cyrix co-processors offers you blinding speed up to three times normal coprocessor performance. If you have a 286 or 386sx portable, their product offers a unique 'automatic idle' for low power consumption.

All units are shipped with full instructions and an IEEE Test and Diagnostic disk. Please phone for details.

## FREE! - Optimum Shortform Catalogue!

# YES!

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☐ The following good(s):

\* IMPORTANT! - PLEASE SPECIFY DISK SIZE i.e. 5.25" or 3.5"

☐ A FREE Datapak on:

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☐ I enclose £

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UK Carriage: Standard carriage for single items usually £5+VAT. Certain larger or fragile items have a £10+VAT charge (e.g. modems, dBASE, Symphony, Smart, MS C Compiler etc). Please phone to confirm carriage charges.

An Express service is sometimes available for 'that urgent order'. Please phone for pricing.

Export Carriage: Please contact us for charges. No VAT

Please Note: Remember to specify disk format - 3.5" or 5.25". All goods are for IBM-PC & 100% compatibles. Prices/specifications are liable to change without notice.

The above is just a sample of goods that we supply. Please ask for a copy of our FREE latest shortform catalogue. We welcome posted or faxed official orders from 'quoted' PLC's, MOD, Government, Educational, Local Authority and Major Organisations. Proforma Invoices available on request if required. Prices are ex-carriage and VAT. We accept Access/Visa. All our products are only from legitimate UK sources - WE DO NOT SELL 'GREY' IMPORTS! Always specify disk format! 3.5" or 5.25" (IBM). Please telephone before visiting/collecting goods.





## ENGINEERED FOR EXCELLENCE

People think that all PC companies are alike.

In truth, there are not many that can offer

a range of high quality personal computers from XT to 486 with the specification of your choice at a price that cannot be ignored. Add to this professional technical support both before and after purchase and you have the ideal solution to your PC needs.

All systems have one year back-to-base warranty, fast turn around service and optional on-site maintenance (8-hour response). Delivery for most of UK for one system is £15.00. Prices exclude VAT. All VGA systems come with 256KB of memory on the VGA card (640x480/16 colours). DAN TECHNOLOGY Systems prices and specifications are subject to change without notice.

### IDE HDD CACHE CONTROLLER

£285

This is an intelligent controller that uses its own 80186 microprocessor to free your computer's CPU from sitting around and waiting for the disk. Cache memory size 1MB (max 16MB).

Average HDD speed: **0.3ms** (Core test on a 20ms hard disk)

**COMPUTER  
BUYER  
EDITOR'S  
CHOICE**

"The addition of the hard disk caching controller gives the balance that you'd otherwise need an EISA-based system for, but at considerably lower cost. You could opt not to buy the caching hard disk controller, and save £285. But that'd be a false economy. You'd be the first to kick yourself if you experienced what the machine is capable of with it."

Computer Buyer, AUG 91

### Dan-486c/33s <sup>SUPER VGA</sup> 8MB 210MB

- 486-33MHz MAINBOARD
- AMI BIOS (with password)
- 64K CACHE (256K max)
- 8MB RAM (32MB max)
- 1.2 and 1.44MB FDD
- 210MB/15ms HDD
- 1MB VGA CARD (with 1MB)
- 14" COLOUR MONITOR (1024X768, 256 COLS)
- MINI TOWER CASE
- 102 UK KEYBOARD
- 1 PARALLEL PORT
- 2 SERIAL PORTS
- SERIAL MOUSE
- WINDOWS 3.0
- MS DOS 5.0

**COMPUTER  
BUYER  
EDITOR'S  
CHOICE**

£1744



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Dan-486c/33

WHICH  
COMPUTER?  
BEST  
BUY

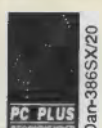
Dan-386c/33



Dan-386c/33

WHAT,  
MICRO?  
BEST BUY

Dan-386c/33



Dan-386SX/20

WHICH  
COMPUTER?  
BEST  
BUY

Dan-386sx/16

PC TODAY  
EDITORS  
CHOICE

Dan-286/20

WHAT,  
MICRO?  
RECOMMENDED

Dan-286/12

IDE Cache  
Controller**Dan-486c/33**  
64K CACHE SYSTEM

£776

• 33MHz Main board with i80486-33 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM (32MB max)

MONITOR	14" mono VGA	14" colour SVGA	17" colour SVGA non-interlaced
NO HDD	£ 890	1044	1519
40MB/28ms IDE	£1061	1215	1690
88MB/19ms IDE	£1145	1298	1773
125MB/19ms IDE	£1227	1380	1855
210MB/15ms IDE	£1388	1541	2016
420MB/14ms IDE	£1742	1895	2370
660MB/15ms SCSI	£2026	2180	2655

Subtract £40.00 from mono VGA price for mono Hercules.  
Add £42.00 for every additional 1MB RAM.

**Dan-486SX/20**  
64K CACHE SYSTEM

£594

• 20MHz Main board with i80486SX-20 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM (32MB max)

MONITOR	14" mono VGA	14" colour SVGA	17" colour SVGA non-interlaced
NO HDD	£ 708	862	1337
40MB/28ms IDE	£ 879	1033	1508
88MB/19ms IDE	£ 963	1116	1591
125MB/19ms IDE	£1045	1198	1673
210MB/15ms IDE	£1206	1359	1834
420MB/14ms IDE	£1560	1713	2188
660MB/15ms SCSI	£1844	1998	2473

Subtract £40.00 from mono VGA price for mono Hercules.  
Add £42.00 for every additional 1MB RAM.

**Dan-386c/40**  
64K CACHE SYSTEM

£527

• 40MHz Main board with 80386-40 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM (32MB max)

MONITOR	14" mono VGA	14" colour SVGA	17" colour SVGA non-interlaced
NO HDD	£ 641	795	1270
40MB/28ms IDE	£ 812	966	1441
88MB/19ms IDE	£ 896	1049	1524
125MB/19ms IDE	£ 978	1131	1606
210MB/15ms IDE	£1139	1292	1767
420MB/14ms IDE	£1493	1646	2121
660MB/15ms SCSI	£1777	1931	2406

Subtract £40.00 from mono VGA price for mono Hercules.  
Add £42.00 for every additional 1MB RAM.

**Dan-386c/33**  
64K CACHE SYSTEM

£516

• 33MHz Main board with 80386-33 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM (32MB max).

MONITOR	14" mono VGA	14" colour SVGA	17" colour SVGA non-interlaced
NO HDD	£ 630	784	1259
40MB/28ms IDE	£ 801	955	1430
88MB/19ms IDE	£ 885	1038	1513
125MB/19ms IDE	£ 967	1120	1595
210MB/15ms IDE	£1128	1281	1756
420MB/14ms IDE	£1482	1635	2110
660MB/15ms SCSI	£1766	1920	2395

Subtract £40.00 from mono VGA price for mono Hercules.  
Add £42.00 for every additional 1MB RAM.

**Dan-386/25**  
SYSTEM

£431

• 25MHz Zero wait state main board with 80386-25 Microprocessor, AMI BIOS, Shadow RAM for System & Video BIOS • 1MB RAM (8MB).

MONITOR	14" mono VGA	14" colour SVGA	17" colour SVGA non-interlaced
NO HDD	£ 545	699	1174
40MB/28ms IDE	£ 716	870	1345
88MB/19ms IDE	£ 800	953	1428
125MB/19ms IDE	£ 882	1035	1510
210MB/15ms IDE	£1043	1196	1671
420MB/14ms IDE	£1397	1550	2025
660MB/15ms SCSI	£1681	1835	2310

Subtract £40.00 from mono VGA price for mono Hercules.  
Add £42.00 for every additional 1MB RAM.

**Dan-386sx/25**  
SYSTEM

£343

• 25MHz Zero wait state main board with 80386SX-25 Microprocessor, AMI BIOS, Shadow RAM for System & Video BIOS • 1MB RAM on board (16MB).

MONITOR	14" mono VGA	14" colour SVGA	17" colour SVGA non-interlaced
NO HDD	£ 457	611	1086
40MB/28ms IDE	£ 628	782	1257
88MB/19ms IDE	£ 712	865	1340
125MB/19ms IDE	£ 794	947	1422
210MB/15ms IDE	£ 955	1108	1583
420MB/14ms IDE	£1309	1462	1937
660MB/15ms SCSI	£1593	1747	2222

Subtract £40.00 from mono VGA price for mono Hercules.  
Add £42.00 for every additional 1MB RAM.

**Dan-286/12s**  
SPECIAL OFFER SYSTEM

£315

• 12MHz Zero wait state main board with 80286-12 Microprocessor & AMI BIOS, EMS LIM 4.0 • 1MB RAM on board (expandable to 4MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

14" MONITOR	mono	mono VGA	Colour VGA
NO HDD	£ 315	360	473
40MB/28ms MS DOS 5	£488	£588	

All systems include the following as standard:

• Small footprint case • 200W Power supply • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

**Dan-386SX/20NB**  
NOTEBOOK

£1199

VGA  
4MB  
40MB

• 20MHz Zero wait state main board with 80386SX-20 Microprocessor, AWARD BIOS, Shadow RAM for System & Video BIOS • Backlit LCD VGA display • Nap & Sleep mode for battery saving • 1.44MB Floppy drive • 1

Serial, 1 Parallel & 1 mouse port • Mains adaptor/charger (110-240V) • MS-DOS 5 • Size: 5.5(H)x28.5(W)x22(D) • Weight: 3Kg • Options for maths co-processor, external keyboard, monitor & scanner.

**ADDONS WITH SYSTEM**

12 Months on-site maintenance (Application form will be provided with system)	£ 30.00
5.25" 1.2Mb Floppy Disk Drive	£ 50.00
Dan Microsoft compatible Serial Mouse	£ 19.00
Monitor & Keyboard extension leads (pair)	£ 20.00
SVGA card memory upgrade 1024x768/256 cols	£ 30.00
IDE Caching hard disk controller using 80186 CPU with 1MB (max 16MB)	£285.00
1GB/15ms SCSI HDD Upgrade from 420MB IDE	£766.00
60/120MB Tape Streamer (DC600 tape type)	£369.00
150/250/500MB Tape Streamer (DC6150/DC6250 tape type)	£475.00
MS-WINDOWS Version 3.0	£ 57.00
MS-DOS Version 5.0	£ 50.00
Workstation Case Upgrade (DxWxH 39x31.5x10.5cm)	£ 40.00
Mini Tower Case Upgrade	£ 19.00
Full Tower Case Upgrade	£ 59.00
Maths co-processors for all systems	P.O.A

All 14" VGA systems come with 256KB of memory on the VGA card. (640x480/16 colours).

**ALL SYSTEMS SOLD WITH HARD DISK DRIVE INCLUDE MS DOS 5.0.**

Delivery to most of UK for one system is £15.00.

**Prices exclude VAT.**

**14 DAY MONEY BACK GUARANTEE IF NOT SATISFIED** (excludes printers).

DAN TECHNOLOGY Systems prices and specifications are subject to change without notice.

NOVELL  
Authorised Dealer**GUARANTEE**

All systems have one year back-to-base warranty, fast turn around service and optional on-site maintenance (8-hour response).

All sales are subject to DAN TECHNOLOGY plc. terms and conditions. Please call for detailed price list and specifications or visit our showroom.

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PLEASE SEND ME FULL DETAILS ON THE FOLLOWING SYSTEMS  
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NAME: \_\_\_\_\_  
COMPANY: \_\_\_\_\_ POSITION: \_\_\_\_\_  
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### MEMORY UPGRADES

#### IBM PS/1

512K Upgrade	£148
2M Upgrade	£148

#### IBM PS/2

Model 30/285	512K Upgrade	£28
	2M Upgrade	£88

Model 50, 50Z	512K Upgrade	£88
	2M Upgrade	£88

Model 55SX, 60, 65SX	10M Upgrade	£440
	2M Upgrade	£220

Model 70/80	1M Upgrade	£220
	2M Upgrade	£220

Model 75/85	1M Upgrade	£220
	2M Upgrade	£220

Model 75/85	1M Upgrade	£220
	2M Upgrade	£220

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Model 75/85	1M Upgrade	£220
	2M Upgrade	£220

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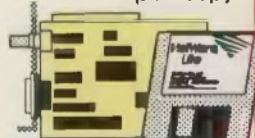
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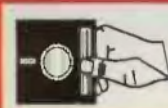
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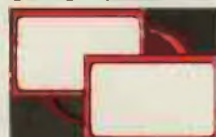
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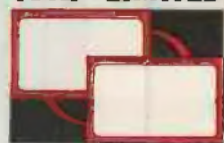
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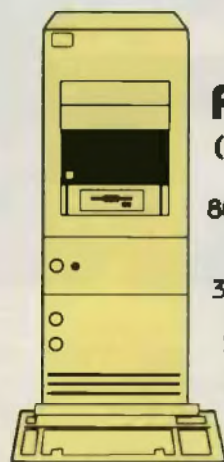
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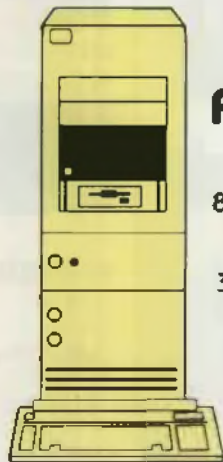
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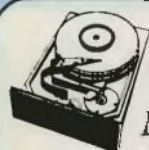
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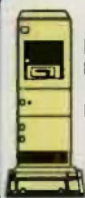
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LQ2550	24 Pin, 270/90 cps	£699
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LC15	9 Pin, 136 Col, 180/45 cps	£177
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LC24-15	24 Pin, 136 Col, 200/67 cps	£297
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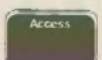
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T2000SX-20	16MHz	20Mb	1 x 3.5"	1.44Mb	£1295
T2000SX-40	16MHz	40Mb	1 x 3.5"	1.44Mb	£1399
T2000SXE-60	20MHz	60Mb	1 x 3.5"	1.44Mb	£1795
T2200SX-60	20MHz	60Mb	1 x 3.5"	1.44Mb	£2189
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T3100SX-40	16MHz	40Mb	1 x 3.5"	1.44Mb	£1349
T3100SX-80	16MHz	80Mb	1 x 3.5"	1.44Mb	£1439
T3200SX-40	16MHz	40Mb	1 x 3.5"	1.44Mb	£1349
T3200SX-120	16MHz	120Mb	1 x 3.5"	1.44Mb	£1555
T3200CSX-120 Col.	16MHz	120Mb	1 x 3.5"	1.44Mb	£4069
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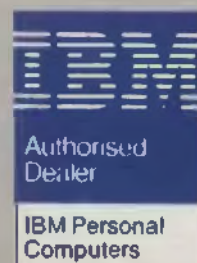
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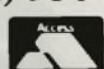
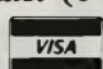
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## WORD PROCESSING

**Bratford** - prints Wordstar and ASCII files in over 30 high quality fonts.  
**By Design** - desktop publishing and graphics design capabilities for WordPerfect, including design tools, clip art etc. (req. WordPerfect - Shareware).  
**Children's Wordprocessor** - menu driven, large on-screen fonts, includes sample stories.  
**Fasttype** - typing tutor with good graphics, test speed and accuracy.  
**Flex** - professional editor with optional BAK files, autosave, macros, up to 10 windows (Williams).  
**Fontastic** - fancy fonts with font designer.  
**Galaxy Lite V1** - latest version of formerly Galaxy V2.4, ideal for small WP tasks, and easy to use.  
**LQ V8** - memory resident print enhancement, works alongside your word-processor.  
**Mindreader** - guesses your next word, suitable for scientists, doctors etc.  
**Multilingual WP (11 disks)** - intent WP with support for Arabic, European, Latin, Persian, Greek, Hindi, Greek, Hebrew, Polish, Russian, Turkish, Urdu & Yugoslavian.  
**Multisort** - electronic thesaurus, which can operate as a standalone program, or as TSR.  
**Text** - fully functional text editor with large characters, suitable for visually-impaired users, includes 30 Wordstar commands and 60,000 word dictionary.  
**PC Outline** - memory resident thoughts organiser, up to 9 outlines on-screen with re-sizeable windows.  
**PC Type 4** (4 disks) - latest version of Buttermere favourite can now work on up to 10 files, with boxes, lines and calculations. Hard disk req.  
**PC Write** - can display mathematical formulae, characters, split-screen editing. Uses ASCII files, menu disk.

## DATA BASE MANAGEMENT

**Card Index** - simple filing system. Can print out 3x5 cards.  
**Celest** (2 disks) - powerful mailing list manager, over 30,000 names and addresses per list, duplication, distribution, post code, formatting for over 100 countries, merge split, output on labels up to 8 wide. Rolodex cards. Hard disk req.  
**DBase III** (2 disks) - well, not quite, but Whamup reads Dbase files, does reports, supports networking and more. Requires hard disk.  
**Hypersheet** (3 disks) - multi-file Hypertext reference system, help system and menuing system. Has intelligent text file viewer, directory browser file manager and applications user interface prototyping with pop-up menus etc.  
**PC File V** (3 disks) - latest version of Buttermere's popular database system. Many powerful features but friendly and easy to use, replaces PC File 4 and PC File-CD. Hard disk required.  
**Speciality Database Software** - store up to 1,000,000 records with sort search and report. 1 disk each subject (available separately). Record collections, Book Members, Photographers, Antiques, Coins, Comics, Films & Videos, Home Inventory Insurance, Memorabilia, Stamp (Homecraft).  
**SR-Info** (2 disks) - dBase compatible database system with programming language, MVS/VS screen designs, 6 databases open simultaneously, 65,000 records per file, versatile report writer (Hard disk req. - 5MB free).

## SPREADSHEETS

**As Easy As** - amazing Lotus 123 compatible spreadsheet, reads 123 files, macros etc.  
**Lotus 123 Workbooks & Macros** - includes cash flow, line-of-credit tracker, ratio analysis, stats calculator, growth capacity calc, queue analysis, new venture budget, quote generator.  
**Lotus 123 Workbooks (3 disks)** - includes financial analysis, import units, linear stats, bar/charts, travel business expenses, flowchart symbols, stock portfolio analysis, rental property analysis.  
**Lotus 123 Tutorial** - covers menus, printing and databases (release 2 ONLY).  
**PC Calc v8** (3 disks) - new features, more powerful, still integrates with PC File 4 & PC Type 4, extensive manual. Hard disk required.  
**Print** - high quality Epson printed output 'addon' for As Easy As, with normal or landscape, & H.Q. fonts, complete page layout control etc. (Hard disk req.).  
**Slide Writer** - print out ASCII files on their slide, ideal for world spreadsheets.

## GAMES/TRIVIA

**AirStrike** - fighter aircraft shoot-em-up with vector graphics, mach speed, right and left, design capabilities for WordPerfect, including design tools, clip art etc. (req. WordPerfect - Shareware).  
**Amulet Games (4 disks)** - includes Bugsi, Jump, Demons, Nuclear Attack Simulation, 3-Demon, Kong, Bricks, Pyramid, Piffle, PC-Golf.  
**Backgammon** - Bernoulli Triangle - sailing quest (EGA ONLY).  
**Blackjack** - accurate simulation.  
**Casino Games** - includes Bridge, Onello, Roulette.  
**Casino** - Popular adventure.  
**Game Quest** - fantasy role-playing game.

**EGA Wheel/VGA Wheel** - like popular wheel of fortune game, please state VGA or EGA.

**Football Forecast** - Pools prediction system has support for 214 teams in English & Scottish leagues showing form, predictions and commentary.  
**Ford Simulator II** (2 disks) - 16 models, 4 events including Grand Prix, also buyers guide and ordering information.  
**Grand Prix** - from authors of Popstar Soccer Game etc.

**Mad** - adventure. DND style.  
**Games 15** - Star Wars, Sea Wolf, Frogger etc.  
**Games 16** - Soccer, Bricks, NIGHTMARE Games 17 - Pac Man, Poker, Castle, Invaders etc.

**Get Lucky!** - adult games.  
**Manborg** - like original runny with RUNGS, KONGS & CHOWS!

**Monopoly/Tune Time** - US version of famous board game. Tune Time like 'Name This Tune'.

**PC Chess** - play the computer or a friend, save load etc.  
**Pharaoh's Tomb** - archeological arcade action.

**Pinball Rally** - three versions of popular game.  
**Scrabble** - computer version of popular board game.

**Sea Battle** - naval game spanning World War I & World War II. No save or load in this version (Rooney).  
**Starlord** - 40 level adventure. In a distant galaxy. The Popstar cope with pressures of sex, drugs and rock 'n' roll as you tour the world. Stealth & murder adventure.

**Spacewar** - shoot 'em up with good graphics.  
**Squid** - yell game of one of several teams and their homeworld glory.

**Super Power** - Set-a-game of super hero economics, trade and military conflict.  
**Trivia (3 disks)** - The Trivia Machine has several categories and levels.  
**Way The Worm** - ladders, rolling barrels.

**Word** - word game of one of several teams and their homeworld glory.

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**Service Plus (2 disks)** - Maintenance and Service, Call Tracing, suitable for electrical, plumbing, heating services etc.

**Superstock** - stock control including suppliers, movements, PO orders, stocktake, usage, backup, enquiries etc. (Michaels).

**The Controller (3 disks)** - powerful project organiser. (Hard disk required).

**Ultimate Sales Program (2 disks)** - fully integrated Sales, Invoicing, retail price list system with period statements and invoices (Eboni).

**Accounts/Finance**

**Billing/Invoicing System (2 disks)** - itemising invoices/bills with balance forward, finance charges, subtotals, balance due, also reports.

**Cashbook (3 disks)** - 5 bank accounts, 5 cash accounts, payments/receipts posting, 100 nominal accounts/VAT codes, VAT summaries (Freeway UK).

**Corporate Financial Analyst (2 disks)** - company accounts analysis and planning, needs no modelling or spreadsheet experience, (Computer Financial Models UK).

**Home Accounts** - features checking, savings, credit cards and loan accounts with bill payments, calculator & calendar (FGS).

**Home Finance Manager** - Keep a record of Bank/Building Society accounts with monthly balances and details of standing orders, also loan calculator with repayments/interest (Blackwood Software - UK).

**Ledgermaster** (4 disks) - Combines features of both previous popular packages, Accounts and Accounts Plus into one, includes both Normal and Analysis options (Freeway UK).

**Pete Financial Controller (2 disks)** - shareware clone of the similarly named package. Includes sales ledger & statements, invoicing with discounts, purchase ledger with remittances, nominal ledger, cashbook & VAT. Stock/order processing & job costing, network ready (Pete Consultants UK). Hard disk required.

**Payroll (3 disks)** - latest legislation, (Freeway UK).

**Simple Accounts** - includes sales, purchase and nominal ledgers, cashbooks and bank reconciliation, VAT etc. (Novus).

**GRAPHICS**

**Altamira** - design posters, cards, logos, garden floor plans.

**Clip Art 1 (3 disks)** - approx 150 trade logos/computer motifs for use with Times/Times Verdana.

**Clip Art 2 (3 disks)** - approx 300 images including Dollar, Pound, Euro, Pounds, Scissors etc. for use with Times/Times Verdana.

**Dancead (5 disks)** - from simple letterheads to complex 3D cog-wheels with animation & rotation, now has support for post-script laser printers (hard disk req.).

**DROBE (2 disks)** - Printed Circuit Board Design.

**Draft Choice** - one of the easier to use CAD systems which includes drop-down menus, on-line help, drawing, editing, viewing, measurement/query options plus more from the authors of As Easy As (Thus).

**Express Graph** - 3D bar charts, pie charts, line graphs etc. from entered or imported data.

**Finger Paint** - paint program with Mac-like screen.

**Gem Drawings/Paintings** - Fun collection of images including Dinosaur, Ghost Busters Logo, Star Ship Enterprise etc.

**Northcod 30** (formerly Quest 3D) - Is a new version of this wire frame modelling system with view, zoom etc, now support CGA, EGA and VGA.

**PC Ray Draw (4 disks)** - latest version of popular CAD package now includes library disks, tutorial, and manual disks with superb demo and utility to convert graphics to IWS format for DTP.

**Quickdraw** - multi-layer PCB design with autorouter, zoom, pan, redraw, menus, windows (Frost).

**Slide Presentation** - use camera to take snapshots of screen, then display as at a slide-show, ideal for training, demonstrations etc.

**Smart Art (2 disks)** - clip art collection in 'IWS' format including Animals, Insects, Reptiles, People, Vehicles, Business etc. (Bernett).

## EDUCATIONAL/STATISTICS

**Amey's First Primer (ages 4-8)** - new compiled version, is a collection of fun games for young children that help them with skills like counting, letter recognition, simple problem solving, pattern recognition and keyboard use.

**Arcus Professional (4 disks)** - Statistical package including Student's T-Test, F-Test, Z-Test, also linear, geometric & exponential regression analysis, Chi-Square/Inch etc. (Burch).

**Children's Games (ages 4-8)** - hangman, alphabet, animals etc.

**Eclipse** - word and grammar game like hangman except guess words from document rather than letters from a word (J Higgins).

**Flash Cards (4 disks)** - 7,500 word vocabulary builder and spelling teacher (Advanced).

**French Tutor** - 1,648 French/English word combinations, 3,900 verb conjugations and 150 French/English phrase combinations.

**Funnels & Buckets** - Simple arithmetic tuition with arcade type action.

**Fun with Designs** - creative drawing program for the young children (Wiscot).

**Fun with Letters & Words** - Educational games for the young children (Wiscot).

**GCSE Physics / Computer Science / Mathematics (3 disks available separately)** - exam revision.

**German Tutor** - 1,600 German/English word combinations, 3,875 verb conjugations and 160 German/English phrase combinations.

**Italian Tutor** - intelligence testing.

**Italian Tutor** - 816 Italian/English word combinations, 1500 verb conjugations and 114 Italian/English phrase combinations.

**User's Adding & Quiz Machine** - quiz generator and practice program for addition, subtraction.

**Maths/Statistics** - 80 maths routines including prime factors, vector analysis, linear interpolation, gaussian quadrature etc., plus 18 stats calculations including Mann-Whitney, Chi-square, students, T-test, multiple regression etc.

**Memory Master** - improve memory powers with these techniques.

**PC CAL** - a computer assisted learning language that allows you to write tutorials, tests, rolling demos, etc.

**PC Learning Games (4 disks)** - series of programs for 2-8 year olds includes simple arithmetic, word & letter recognition, basic keyboard skills, colour & shapes (Protein).

**PC Prompt** - pop-up help with DOS commands.

**Play 'n' Learn (ages 8-14)** - for the very young, alphabet recognition, computer reaction etc, including Amnesia Letter Lotto.

**Spanish Tutor** - 1,550 Spanish/English word combinations, 3,576 verb conjugations and 150 Spanish/English phrase combinations.

**Tutor** - introductions to computers, binary numbers and the CPU, input/output devices, Disk Operating System, subdirectory structures, batch files etc.

**While Quiz** - arithmetic/elementary mathematics, self grading according to age of user.

**Word Gallery** - flashcards with matching, missing letters, spelling, word guessing (EGA/VGA - Kinderwise).

**World Atlas** - products views and maps for areas around a chosen point, allowing selection of resolution size etc.

## LANGUAGES/PROGRAMMING

**ASB/DLS** - probably the best 8086 assembler/disassembler around.

**Basic ADS (4 disks)** - G.V. Basic.

**B-Window/C-Window** - windowing units for Basic & C.

**C Tutorial** - for beginners to advanced.

**C Spot Run (2 disks)** - window and menu units for C programming.

**Hyperpad (5 disks)** - similar to the Apple Mac's Hypercard, an object-oriented application development system, complete with more than two dozen personal applications (hard disk req. - Brightbill - Roberts).

**Logo** - Java version of turtle-based graphics language, popular with children.

**Module 8 Compiler (3 disks)** - new version (2.0A) of this flexible but very powerful programming language.

**Module 8 Tutorial (2 disks)** - companion to the above.

**MVP Fort (2 disks)** - full implementation Pascal - three compilers on one disk, Tiny, facts & Visable.

**Phrog** - ADA implementation of 5th generation AI language.

**QBasic** - BASIC tools and utilities.

**SDA (2 disks)** - design screens for data input (Basic).

**Turbo C Tutor (2 disks)** - Turbo Pascal Tutor (2 disks).

**Turbo Pascal Library (12 disks)** - routines, programs, utilities, statistics, animation, tools and much more.

**UTILITIES**

**Ample Notice** - appointments calendar, pop-up alarm clock, sideways addressing unit for envelopes, can use data directly from the screen.

**Automenu** - popular front end allowing multiple levels of menu, password, user minimum memory, network support etc. (Nage).

**Label Maker/News Editor** - design labels and include graphics from NewsMaster graphics editor (Desa UI).

**Professional Masterkey** - disk utility like Norton's including file recovery, unerase etc.

**Run Test** - chip diagnostics.

**SimGA** - colour graphics simulator for Hercules cards, runs most CGA software.

**System Utilities (2 disks)** - including Amdisk for analysing where REALION on a disk.

**Teledisk** - which can make an image of a complete disk with sub-directories etc. (even some protected disks) which you can then download or upload with the help of a modem, and its emulator to handle over 100 CPM formats on your PC.

**Vmb (2 disks)** - multi-user operating system along the lines of Unix, adjusts itself to 8088 or 8086.

**Zapcode** - (optionally) Memory resident printer control utility to select fonts, margins etc for use with dot-matrix, laser, inkjet etc. (Moran Utilities).

## SPECIAL INTEREST

**Astrology/Horoscopes** - birth signs, zodiac, etc.

**Bible (7 disks)** - includes Semindex to allow quick search and retrieval of words, phrases etc. (Beyless UK). Hard disk required.

**Crystal Ball** - a computerized "psychic" makes predictions and answers (R.K. West).

**ESIE** - configurable expert system including example which works out child's illness from questions and answers.

**Fortune Teller** - divination system including One Card Fortune, Three Card, Detailed Card Layout, Quick Numerology, Dice etc. (J.K. West).

**Genealogy** - EZ tree traces and plots your ancestral roots.

**Handwriting Analyst** - personality analyses system of graphology, often used when evaluating job candidates (Carson).

**Handwriting Numerology** - Handwriting and numbers analysis for those who can feel the "vibrations". Also includes birthdays.

**Personal Teller** - enjoy professional quality Tarot card readings on your PC, easy to use, flexible, customizable with professional looking reports.

**Phantom** - play, enter and save tunes, also construct stand alone tunes.

**Proton Fortune** - analysis of personality according to both Western & Eastern astrology. Also compatibility ratings, etc.

**The Diet Disk** - has several calculations for average weight loss, calories needed etc. and shopping list showing calories.

**COMMUNICATIONS**

**Radio** - very popular bulletin board system with E-mail facilities and network capabilities, several in use throughout UK/Europe/USA.

**Remix (2 disks)** - file transfer between mainframes/PCs, many non-IBM machines catered for.

**PC VT - DEC VT 100/105/2 terminal emulation with file transfer.**

**Odyssey** - powerful but flexible package with many extras.

**Whicker (2 disks)** - new bulletin board system which is easy to set up but very impressive.

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**Support** - We will be pleased to help you to load and run all the programs we distribute, but we cannot give support, or written documentation/manuals etc for unregistered shareware, as this would be a breach of the author's copyright.



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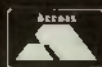
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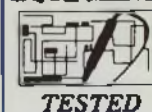
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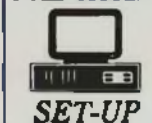
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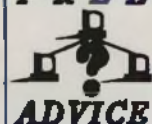
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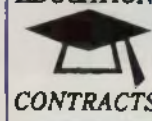
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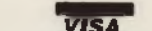
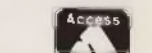


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- \* Small Footprint Metal Case
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MONITOR	NONE	HERC MONO	MONO VGA	14" SVGA	17" SVGA
NO HDD	£445	£525	£575	£699	£1379
44MB	£565	£639	£699	£815	£1485
89MB	£639	£719	£769	£895	£1575
124MB	£695	£775	£825	£949	£1625
211MB	£859	£939	£985	£1115	£1795
337MB	£1309	£1415	£1439	£1549	£2249



**0244 281025 (5 Lines)**



HOT FOR 92

**HOBBY II 386DX/C128-40Mhz**

- \* 40Mhz 80386 Main Board
- \* 128K On Board Cache
- \* 1Mb Ram Expandable to 32Mb
- \* 3.5inch 720K/1.4Mb Disc Drive
- \* 2 Serial, 1 Parallel & 1 Game ports
- \* Full 102 UK Keyboard
- \* 200 Watt power supply
- \* Fully LIM 4.0 Compatible
- \* IDE Hard Disc Controller
- \* Small Footprint Metal Case
- \* Landmark 67.0Mhz

FROM  
**£495.00**  
PLUS VAT

MONITOR -	NONE	HERC MONO	MONO VGA	14" SVGA	17" SVGA
NO HDD	£495	£575	£625	£749	£1429
44MB	£615	£689	£739	£865	£1535
89MB	£609	£769	£819	£945	£1625
124MB	£745	£825	£875	£999	£1675
211MB	£909	£989	£1035	£1165	£1845
337MB	£1359	£1465	£1489	£1599	£2299

**HARRIER II 486DX/C64-33Mhz**

FROM  
**£695.00**  
PLUS VAT

- \* 33Mhz 80486 Main Board
- \* 64K On Board Cache
- \* 1Mb Ram Expandable to 32Mb
- \* 3.5inch 720K/1.4Mb Disc Drive
- \* 2 Serial, 1 Parallel & 1 Game ports
- \* Full 102 UK Keyboard
- \* 200 Watt power supply
- \* Fully LIM 4.0 Compatible
- \* IDE Hard Disc Controller
- \* Small Footprint Metal Case
- \* Landmark 140.3Mhz

MONITOR -	NONE	HERC MONO	MONO VGA	14" SVGA	17" SVGA
NO HDD	£695	£775	£825	£949	£1629
44MB	£815	£889	£939	£1065	£1735
89MB	£809	£969	£1019	£1145	£1825
124MB	£945	£1025	£1075	£1199	£1875
211MB	£1109	£1189	£1235	£1365	£2045
337MB	£1559	£1665	£1689	£1799	£2499

HOT FOR 92

**FALCON II 486DX/C256-33Mhz**

FROM  
**£825.00**  
PLUS VAT

- \* 33Mhz 80486DX Main Board
- \* 256K On Board Cache
- \* 4Mb Ram Expandable to 32Mb
- \* 3.5inch 720K/1.4Mb Disc Drive
- \* 2 Serial, 1 Parallel & 1 Game ports
- \* Full 102 UK Keyboard
- \* 200 Watt power supply
- \* Fully LIM 4.0 Compatible
- \* IDE Hard Disc Controller
- \* Small Footprint Metal Case
- \* Landmark 151.9Mhz

MONITOR -	NONE	HERC MONO	MONO VGA	14" SVGA	17" SVGA
NO HDD	£825	£905	£955	£1079	£1759
44MB	£945	£1019	£1069	£1195	£1865
89MB	£1019	£1099	£1149	£1275	£1955
124MB	£1075	£1155	£1205	£1329	£1999
211MB	£1239	£1319	£1365	£1495	£2175
337MB	£1689	£1795	£1819	£1929	£2629

**EAGLE II 486DX/C512-33Mhz**

FROM  
**£1375.00**  
PLUS VAT

- \* 33Mhz 80486DX Main Board
- \* 512K On Board Cache
- \* 16Mb Ram Expandable to 32Mb
- \* 3.5inch 720K/1.4Mb Disc Drive
- \* 2 Serial, 1 Parallel & 1 Game ports
- \* Full 102 UK Keyboard
- \* 200 Watt power supply
- \* Fully LIM 4.0 Compatible
- \* IDE Hard Disc Controller
- \* Small Footprint Metal Case
- \* Landmark 170.6Mhz

MONITOR -	NONE	HERC MONO	MONO VGA	14" SVGA	17" SVGA
NO HDD	£1375	£1455	£1505	£1629	£2309
44MB	£1495	£1569	£1619	£1745	£2415
89MB	£1569	£1649	£1699	£1825	£2505
124MB	£1625	£1705	£1755	£1879	£2555
211MB	£1789	£1869	£1915	£2045	£2725
337MB	£2239	£2345	£2369	£2479	£3179

HOT FOR 92

MICRO SURGEONS



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## DOVE II 286-16Mhz STARTER PACK



Mono Herc  
**£499.00**

Colour SVGA  
**£649.00**

PLUS VAT

- \* 16Mhz 80286 Main Board
  - \* 1Mb Ram Expandable to 4Mb
  - \* 3.5" 720K/1.4Mb Disc Drive
  - \* 2 Serial 1 Parallel & 1 Game ports
  - \* Full 102 UK Keyboard
  - \* 200 Watt power supply
  - \* Fully LIM 4.0 Compatible
  - \* IDE Hard Disc Controller
  - \* Small Footprint Metal Case
  - \* Landmark 21.0Mhz
  - \* Hercules Mono/Graphics Monitor
  - \* Colour Super VGA Monitor (Option)
  - \* 44Mb Seagate Hard Disc Drive
  - \* 80 Col. LQ Dot Matrix Printer
  - \* Parallel Printer Lead
  - \* MS/Dos 5.0 Software
- (All prices shown exclude VAT and Delivery.)

The DOVE Starter Pack was the first in a series of "MICRO SOLUTIONS" to be advertised and it's massive success has given rise to the others shown here. The Starter Pack offers the best value computer package for the first time user. Whether you are writing a letter or using a spreadsheet it's letter quality printer and 44Mb hard disc allows you to do it all.

## NETWORK WORKSTATIONS

FROM  
**£445.00**  
PLUS VAT



- \* Robin 286-16Mhz Lan Workstation
- \* Stork 386SX-25Mhz Lan Workstation
- \* Heron 386DX-33Mhz Lan Workstation
- \* Kestrel 486DX-33Mhz Lan Workstation

- All fitted with:-
- \* 1Mb Main Ram
  - \* 16 Bit 300-Mbit Lan Card
  - \* 2 Serial 1 Parallel port
  - \* Full 102 Keyboard
  - \* Optional 3.5"/5.25" Disc Drive
  - \* Low profile Case

MONITOR:-	NONE	HERC MONO	MONO VGA	14" SVGA	17" SVGA
ROBIN 286-16	£445	£525	£575	£699	£1379
STORK 386SX-25	£565	£639	£699	£815	£1485
HERON 386DX-33	£639	£719	£769	£895	£1575
KESTRAL 486DX-33-C64	£695	£775	£825	£949	£1625

Working from standard DOS you can now share data, Hard disc drives and printers with one of our workstations, by installing our LAN card kit into your own PC. Simple telephone style cables (supplied) allow connection of each workstation to the host PC. Workstations can be discless or have an optional disc drive. Please phone or write for more details.

**0244 281025 (5 Lines)**



NAME:-

ADDRESS:-

PRODUCT OF INTEREST

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## SWIFT II 386SX-25Mhz SUPER SAVER



Mono VGA

£799.00

Colour SVGA

£949.00

PLUS VAT

- \* 25Mhz 80386SX Main Board
- \* Super VGA 1Mb graphics card
- \* 2Mb Ram Expandable to 8Mb
- \* 3.5" 720K/1.4Mb Disc Drive
- \* 2 serial 1 Parallel & 1 Game ports
- \* Full 102 UK Keyboard
- \* 200 Watt power supply
- \* Fully LIM 4.0 Compatible
- \* IDE Hard Disc Controller
- \* Small Footprint Metal Case
- \* Landmark 33.1Mhz
- \* 14" Mono VGA Monitor
- \* Colour Super VGA Monitor (option)
- \* 44Mb Seagate Hard Disc Drive
- \* Cannon BJ10ex Bubble Jet Printer
- \* Parallel Printer Cable
- \* MS/DOS 5.0 Software
- \* Windows 3 Software
- \* MS-Compatible Mouse

(All prices shown exclude VAT and Delivery)

The SWIFT 2 Super Saver's powerful 25Mhz-386SX CPU with 2Mb main memory allows Windows based applications room to run at usable speeds. The package includes all you need for running the Windows operating system, e.g. Mouse, Hard disc and Large Screen memory. With the added bonus of printing out with the high quality Cannon bubble Jet printer. Whether you are a business or a home based user this package is a good all rounder.

## FALCON II 486DX/33Mhz SUPER SAVER

Mono VGA

£1199

Colour SVGA

£1349

17" SVGA

£1649



- \* 33Mhz 80486DX Main Board
- \* 256K On Board Cache
- \* 4Mb Ram Expandable to 32Mb
- \* 3.5" 720K/1.4Mb Disc drive
- \* 2 Serial 1 Parallel & 1 Game ports
- \* Full 102 UK Keyboard
- \* 200 Watt power supply
- \* Fully LIM 4.0 Compatible
- \* IDE hard Disc Controller
- \* Small Tower Metal Case
- \* Landmark 151.9Mhz
- \* Hercules Mono VGA Monitor
- \* Colour Super VGA Monitor (option)
- \* 44Mb Seagate hard disc drive
- \* Cannon BJ10ex Bubble Jet Printer
- \* Parallel Printer cable
- \* MS/Dos 5.0 Software
- \* Windows 3 Software
- \* MS-Compatible Mouse

(All prices shown exclude VAT and Delivery)

Offering you yet more "Micro Solutions" the FALCON II SUPER SAVER gives you powerful software and hardware in a useful value packed combination. Designed for the power user running complex drawing programs with ample spare capacity to print out your daily work load. Complete with the Windows operating system the 486 CPU with built in maths co-processor will make small work of all your Windows based applications.



Credit card line 0244 281230

MICRO SURGEONS



# SEMAPHORE

## PC ADD-ON CARDS MODULES & SIMMS

### Memory Card AT

The Best Memory Card on the Market for the PC/AT and compatibles. Offers from 512K up to 8Mb of high speed memory on a single card and uses standard 256K or 1Mb SIMMs.

- ▼ Suitable for 286/386 systems
- ▼ EMS 4.0 and/or Extended Memory
- ▼ Start address from 512K up to 16Mb in 128K steps
- ▼ 2Mb Memory on-board

**£220**

Other options

Memory Card AT + 1Mb on-board £160  
Memory Card AT + 4Mb on-board £320  
Memory Card AT + 8Mb on-board £520

### Memory Card XT

High performance Memory Card for the PC/XT, Amstrad 1512/1640, Olivetti M24, PS/2 Model 30 and other 8 bit compatible machines.

- ▼ Suitable for 8088/8086 systems
- ▼ EMS V3.2 or V4.0 and conventional memory
- ▼ Start address from zero up to 640K in 128K steps
- ▼ 2Mb Memory on-board

**£175**

Other Options

Memory Card XT + 512K on-board £99  
Memory Card XT + 1Mb on-board £125

### 384K Memory Card

The cost effective solution for topping up the base memory from 256K to 640K on your PC or XT.

- ▼ Short card 4 x 5"
- ▼ 384K Memory installed

**£75**

Also 384K Memory Card with serial, parallel, games, clock. £115

### 128K Memory Card

Top up the base memory on your PC/AT from 512K to 640K. No switches to set, just slot the card in and power on!

- ▼ Short Card
- ▼ 16 bit bus interface
- ▼ 128K Memory installed

**£69**

### PS/2 MCA Cards

Multi I/O Cards  
MCA Parallel Card £69  
MCA Dual Serial & Parallel Card £99  
MCA Games Port Card £69  
MCA Dual RS422 Card £225

MCA Memory Cards (up to 8Mb)  
Model 50, 50z, 60 + 2Mb on-board £299  
Model 70 or 80 + 4Mb on-board £399

Planar Memory  
PS/2 SIMM 32 bit 2Mb £99  
PS/2 SIMM 32 bit 4Mb £195

### PC, XT Speedcard

Powerful Universal Accelerator. Supercharge your IBM PC, XT, Amstrad 1512/1640, Olivetti M24, PS/2 Model 30 and compatibles.

- ▼ Short Card 4 x 5"
- ▼ 80286 16MHz processor
- ▼ 10 times processing power
- ▼ Socket for maths co-processor
- ▼ Detailed Manual

**£229**

### IBM Processor Upgrades

Simply remove the 286 processor from your motherboard and insert a powerful 386 processor module. Provides true multitasking and background operation for Windows 3.0, OS/2 and 386 specific software. Only IBM Machines are supported i.e. IBM PC/AT and PS/2 range.

- ▼ 386sx 25MHz processor
- ▼ On-board 25MHz clock
- ▼ On-board 64K cache
- ▼ Socket for co-processor
- ▼ Simple installation

**£295**

### Multi I/O Card

A short size card providing standard input/output functions.

- ▼ Printer port
- ▼ One serial port, 2nd optional
- ▼ Games port
- Add £10 for 2nd serial port
- Also Clock-calendar option

**£39**

### Dual Serial Card RS422

Offering 2 high speed serial ports for transmissions up to 4000 feet.

- ▼ Short card
- ▼ 2 RS422 serial ports
- ▼ Up to 56K baud
- ▼ COM1 to COM4 selectable
- ▼ IRQ3 or IRQ4 selectable

**£89**

Also available with 16550 UARTs £99

### 16550 Serial Card

Ideal for V32 Modems and other hardware requiring high speed serial communications, the serial ports on this card are fitted with 16550 UARTs.

- ▼ One serial port, 2nd optional
- ▼ COM1 to COM4 selectable
- ▼ IRQ2 to IRQ5 selectable

**£55**

Add £20 for 2nd serial port

## Q U A L I T Y



## R E L I A B I L I T Y

### 4-Port Serial Card

The simple solution to your serial port expansion needs.

- ▼ Short card
- ▼ 4 RS232 serial ports
- ▼ COM1 to COM8 selectable
- ▼ IRQ2 to IRQ5 selectable

**£99**

### Display Cards

Mono Graphics Card, printer port (Hercules compatible) £39  
CGA Colour Card, printer port £39  
EGA Colour Card, 256K £99  
VGA Colour Card, 256K £49  
VGA Colour Card, 256K, half card £69  
Super VGA Card, 1Mb £169

### 4-Port Multi User Card

Ideal for Xenix, CDOS and other multi-user software requiring four RS232 serial ports serviced by a single interrupt line.

- ▼ Short card
- ▼ AST 4-port compatible
- ▼ Shared interrupt line for IRQ2 to IRQ5, and IRQ7
- ▼ Interrupt and I/O port selectable

**£150**

### DigiBoard Serial Cards

The Best Engineered Multi-Channel Boards on the market today. The DigiCHANNEL PC/X is ideal for use in multi-user systems, multiple point data acquisition, office and factory automation and other applications requiring multiple I/O.

PC/4 4-Port RS232 Card £295  
PC/8 8-Port RS232 Card £395  
PC/16 16-Port RS232 Card £750

### 2400/2400 Modem Card

Superb quality low cost Telecom approved modem card.

- ▼ V21/V22/bis Full Duplex
- ▼ Hayes compatible
- ▼ Auto dial & Auto answer
- ▼ COM1 to COM4 selectable
- ▼ Built in speaker
- ▼ Short card

**£169**

V21/V22/bis external Modem £199

### Compaq Memory

Deskpro 386/20/25/e 1Mb Module £69  
& 386S 4Mb Module £199  
1Mb Board £105  
4Mb Board £240  
Deskpro 386/33/L 2Mb Module £120  
& 486/25/33/50 8Mb Module £495  
Deskpro 386s/20 2Mb Module £99  
& 386N 4Mb Module £195  
Portable 386 1Mb Kit £99  
4Mb Board £280  
SLT 386 2Mb Board £149  
SLT 386 & SLT 286 1Mb Board £99  
4Mb Board £295  
LTE 286 2Mb Board £125  
LTE 386 1Mb Board £185  
4Mb Board £495

### Toshiba Memory

T1000SE & XE 1Mb Card £89  
T2000SX & SXE 2Mb Card £149  
4Mb Card £275  
T3200SXC 2Mb Card £119  
4Mb Card £219  
T3100SX, T3200SX 2Mb Card £99  
4Mb Card £189  
T1600, T1200XE 2Mb Card £99  
T5100, T3100E 2Mb Card £99  
T3200 3Mb Card £160  
T5200, T8500 2Mb Module £99

### Laser Printer Memory

HP LaserJet IIP, III 1Mb Board £75  
& IIID, IIP 2Mb Board £120  
4Mb Board £199  
HP LaserJet II & IID 1Mb Board £75  
2Mb Board £120  
4Mb Board £199



# SEMAPHORE

## PC ADD-ON CARDS MODULES & SIMMS

### Memory Card AT

The Best Memory Card on the Market for the PC/AT and compatibles. Offers from 512K up to 8Mb of high speed memory on a single card and uses standard 256K or 1Mb SIMMs.

- ▼ Suitable for 286/386 systems
- ▼ EMS 4.0 and/or Extended Memory
- ▼ Start address from 512K up to 16Mb in 128K steps
- ▼ 2Mb Memory on-board

**£220**

Other options

- Memory Card AT + 1Mb on-board £160
- Memory Card AT + 4Mb on-board £320
- Memory Card AT + 8Mb on-board £520

### Memory Card XT

High performance Memory Card for the PC/XT, Amstrad 1512/1640, Olivetti M24, PS/2 Model 30 and other 8 bit compatible machines.

- ▼ Suitable for 8088/8086 systems
- ▼ EMS V3.2 or V4.0 and conventional memory
- ▼ Start address from zero up to 640K in 128K steps
- ▼ 2Mb Memory on-board

**£175**

Other Options

- Memory Card XT + 512K on-board £99
- Memory Card XT + 1Mb on-board £125

### 384K Memory Card

The cost effective solution for topping up the base memory from 256K to 640K on your PC or XT.

- ▼ Short card 4 x 5"
- ▼ 384K Memory installed

**£75**

Also 384K Memory Card with serial, parallel, games, clock. £115

### 128K Memory Card

Ideal for upgrading your PC/AT from 512K to 640K. No switches to set, just slot the card in and you are ready to go.

- ▼ Half Card
- ▼ 16 bit bus interface
- ▼ 128K Memory installed

**£69**

### PS/2 MCA Cards

- Multi I/O Cards
- MCA Parallel Card £69
- MCA Dual Serial & Parallel Card £99
- MCA Games Port Card £79
- MCA Dual RS422 Card £225

MCA Memory Cards (up to 8Mb)

- Model 50/60 386sx 20MHz £299
- Model 70 or 80 + 4Mb on-board £399

Processor upgrades

- Model 50z 386sx 20MHz £375
- Model 50z 386sx 20MHz £375

### PC, XT Speedcard

Powerful Universal Accelerator. Supercharge your IBM PC, XT, Amstrad 1512/1640, Olivetti M24, PS/2 Model 30 and compatibles.

- ▼ Short Card 4 x 5"
- ▼ 80286 16MHz processor
- ▼ 10 times processing power
- ▼ Socket for maths co-processor
- ▼ Detailed Manual

**£260**

### Compaq Deskpro Memory

Deskpro 386/20/25	1Mb Module	£79
	4Mb Module	£239
Deskpro 386/20e/25e & 386S	1Mb Module	£79
	4Mb Module	£239
	1Mb Board	£125
	4Mb Board	£275
Portable 386	1Mb Kit	£125
	4Mb Board	£325
SLT/286	1Mb Board	£125
	4Mb Board	£395
SLT/386	1Mb Board	£125
	2Mb Board	£220
	4Mb Board	£395

### Laser Printer Memory

HP LaserJet IIP, III & IIID, IIIP	1Mb Board	£89
	2Mb Board	£135
	4Mb Board	£249
HP LaserJet II & IID	1Mb Board	£89
	2Mb Board	£135
	4Mb Board	£249
IBM 4019/4019E	1Mb Board	£99
	2Mb Board	£149
	3.5Mb Board	£249

### Toshiba Portable Memory

T3200SXC	2Mb Card	£139
	4Mb Card	£299
T3100SX, T3200SX	2Mb Card	£119
	4Mb Card	£229
T1600, T1200XE	2Mb Card	£119
T5100, T3100E	2Mb Card	£119
T3200	3Mb Card	£189
T5200, T8500	2Mb Module	£119

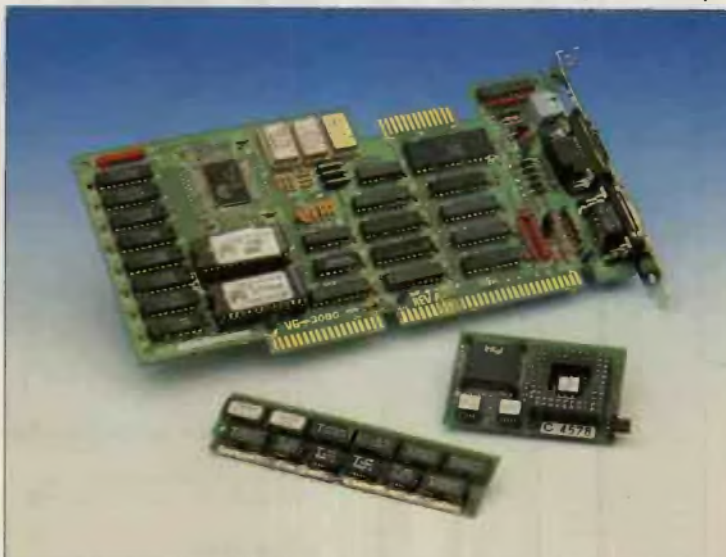
### Display Cards

Mono Graphics Card, printer port (Hercules compatible)	£39
CGA Colour Card, printer port	£39
EGA Colour Card, 256K	£99
VGA Colour Card, 256K	£99
Super VGA Card, 512K	£129
Super VGA Card, 1Mb	£169

### SIMMs & Co-Processors

SIMMs 1Mbx9 80ns 1pc	£50
SIMMs 256Kx9 80ns 1pc	£20
Intel80287 10MHz	£99, 12MHz £99
Intel80387 16MHz	£149, 20MHz £149
Intel80387 16MHz	£199, 20MHz £199
Intel80387 25MHz	£199, 33MHz £199

## Q U A L I T Y



## R E L I A B I L I T Y

### Multi I/O Card

A short size card providing standard input/output functions.

- ▼ Printer port
- ▼ One serial port, 2nd optional
- ▼ Games port
- Add £10 for 2nd serial port
- Also Clock-calendar option

**£39**

### Dual Serial Card RS422

Offering 2 high speed serial ports for transmissions up to 4000 feet.

- ▼ Short card
- ▼ 2 RS422 serial ports
- ▼ Up to 56K baud
- ▼ COM1 to COM4 selectable
- ▼ IRQ3 or IRQ4 selectable

**£89**

Also above with 16550 UARTs £99

### 4-Port Serial Card

The simple solution to your serial port expansion needs.

- ▼ Short card
- ▼ 4 RS232 serial ports
- ▼ COM1 to COM8 selectable
- ▼ IRQ2 to IRQ5 selectable

**£99**

Also 4-Port Serial Xenix/CDOS £150

### DigiBoard Serial Cards

The Best Engineered Multi-Channel Boards on the market today. The DigiCHANNEL PC/X is ideal for use in multi-user systems, multiple point data acquisition, office and factory automation and other applications requiring multiple I/O.

PC/4 4-Port RS232 Card	£295
PC/8 8-Port RS232 Card	£395
PC/16 16-Port RS232 Card	£895

### 2400/2400 Modem Card

Remarkable high performance short size Modem Card.

- ▼ V21/V22/V22bis Full Duplex
- ▼ Compatible with Hayes AT command set
- ▼ Auto dial & Auto answer
- ▼ COM1 to COM4 selectable
- ▼ Built-in speaker
- ▼ Telecom approved

**£169**

Also V21/V22 Modem Card £129  
Also V21/V22 External Modem £149  
Also V21/V22/V22bis Ext. Modem £199

### Miscellaneous

Hard/Floppy Controller AT	£99
Hard Disk Controller XT	£69
Floppy Disk Unit 1.2Mb 5.25"	£80
Floppy Disk Unit 1.44Mb 3.5"	£90
PC/AT Keyboard	£80
PC/AT Lithium Battery, 7.2V	£20
Mouse 400dpi	£39
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## PRINTERS

### BROTHER

M1309*	£149
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M1818 18 Pin*	£253
M1918 24 Pin*	£359
M1824 24 Pin*	£284
M1924 24 Pin*	£444
HJ770	£458

### CANON

BJ-10EX	£187
BJ-300*	£342
BJ-330*	£388

### DICONIX

150 PLUS Parallel	£214
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### EPSON

LX-400	£104
LX-850 +	£145
FX-850	£270
FX-1050	£342
OFX-5000	£1089
OFX-8000	£1949
LQ-200 24 pin	£167
LQ-450 24 pin	£170
LQ-570 24 pin	£211
LQ-870 24 pin	£361
LQ-860 24 pin Colour	£451
LQ-1010 24 pin	£276
LQ-1070 24 pin	£320
LQ-1170 24 pin	£442
LQ-1060 24 pin Colour	£604
LQ-2550 24 pin Colour	£683
SG-850 Ink Jet	£439
SG-2550 Ink Jet	£634

### HEWLETT PACKARD

Deskjet 500	£276
Deskjet 500C	£482
Deskwriter (MAC)	£320
Paintjet*	£437
Paintjet XL*	£1053

### IBM

Proprinter 24P	£210
Series II 2380/2381	£272/£338
Series II 2390/2391	£312/£373
Quickwriter III	£485
Quickwriter	£493
Execjet 4072	£449

### MANNESMAN TALLY

MTB1	£91
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### NEC

P20 24 pin	£185
P30 24 pin	£249
P60 24 pin	£342
P70 24 pin	£422
P90 24 pin	£642

### PANASONIC

KXP 1170	£106
KXP 1695	£279
KXP 1123 24 pin	£134
KXP 1124i 24 pin	£179
KXP 1624 24 pin	£279
KXP 1654 24 pin*	£381
KXP 2624 24 pin*	£350

### STAR

STARJET SJ48	£179
LC20	£104
LC200 Colour	£148
LC15	£179
LC24-10 24 pin	£139
LC24-200 24 pin	£169
LC24-200 24 pin Colour	£209
LC24-15 24 pin	£249
ZA200 Colour*	£241
ZA250 Colour*	£304
XB24-200 24 pin Colour*	£301
XB24-250 24 pin Colour*	£362
Full range of Sheet feeds, Tractors, Acces. & Consumables for all Printers	
All printers marked with an * includes 1 year on-site maintenance	

## COMPUTERS

### AMSTRAD - All Genuine Amstrad Products (no upgrades)

PCW 9256 Dot Matrix Printer	£289
PCW 9512 + and Daisywheel Printer	£374
PCW 9512 + and Canon BJ10e Printer	£455

	MONO	COLOUR	14" W-Res COL VGA
PC5086 SD 3.5"	£237	£315	£394
PC5086 DD 3.5"	£276	£354	£515
PC5086 HD40Mb 3.5"	£432	£511	£670
All 5086's include Microsoft Works			
PC3086 HD30Mb 3.5" + 5.25" Drives	£429	£507	£586
PC3286 SD 5.25"	£386	£472	£555
PC3286 SD 3.5"	£433	£516	£595
PC3286 HD40Mb 5.25"	£587	£667	£743
PC3286 HD40Mb 3.5"	£629	£703	£779
PC3286 HD40Mb 3.5" + 5.25" Drives	£672	£748	£826
PC5286 SD 3.5"	£431	£506	£589
PC5286 HD40Mb 3.5"	£628	£704	£782
All 3286 & 5286 3.5" Computers include Lotus 123 V2.2			
PC3386sx HD40Mb 3.5"	£804	£879	£955
PC3386sx HD80Mb 3.5"	£1083	£1155	£1245
All 3386sx Computers include Microsoft Excel V3, Windows 3 & Mouse			
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1 Year on-site maintenance £30

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		8503	8513
		Mono	Colour
		£1069	£1139
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386/20C		386sx	£975	£1119	£1149
486/20		486sx	£1199	£1335	£1365
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MCS pro Range					
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486/33		486 33	£1549	£1679	£1709
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T2000SX-20	£1295
T2000SX-40	£1399
T2000SX-60	£1795
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T4400SX-60	£2839
T3100SX-40	£1348
T3100SX-60	£1438
T3200SX-40	£1348
T3200SX-120	£1555
T3200SX-120 Colour	£4069
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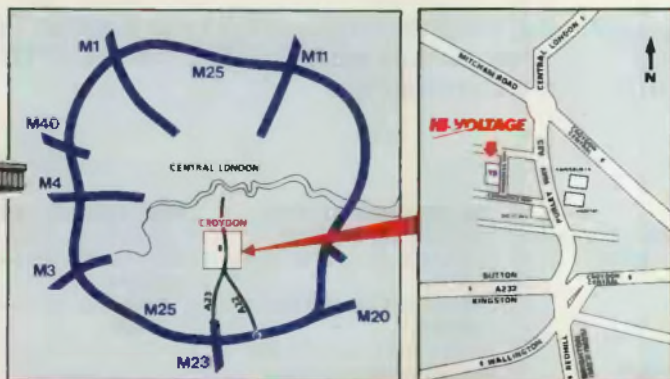
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PCW2



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Multiscan 17" 0.31mm

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### PANASONIC

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TX1703 Multiscan 17" \*\*

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BM7749 VGA Paper White 14" PST \*  
CM8833-II CGA 14" 0.42mm  
CM8809 VGA Colour 14" 0.29mm \*

CM3209 SuperVGA 14" 0.28mm \*  
CM3279 LR SuperVGA 14" 0.28mm \*

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10445 VGA White 14"  
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780 VGA Colour 14" 0.31mm  
780LR VGA Colour 14" 0.31mm  
790 SuperVGA Colour 0.28mm  
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\* = 1 Year On-site Maintenance  
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MouseMan Serial - left or right handed **£42**  
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### Naksha

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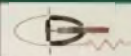
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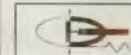
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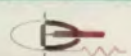
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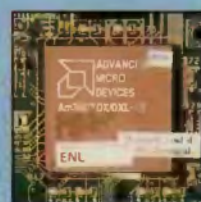
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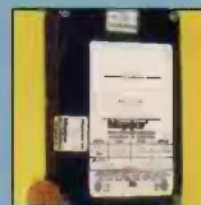


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				PaintJet/Blad 51606C	£26.00	£24.00	£22.00	CP80 MS	£2.45	£2.20	£2.00
C. ITOH				Quiet/Think Plan 51604A	£9.00	£8.00	£7.00	CP80 FA	£3.35	£3.30	£3.00
7500/8510/9515	£2.85	£2.60	£2.35	Quiet/Think HP 92261A	£9.00	£8.00	£7.00				
				Rugby/Printer 3 Pack 9215A5	£11.00	£10.00	£9.00	SMITH CORONA			
CANON								D300	£4.60	£4.20	£3.80
B110E	£18.00	£17.00	£16.00	IBM				EL1000/TP1 FA	£2.50	£2.40	£2.20
B1130/130E	£12.00	£11.00	£10.00	PROPRINT XL/24XL/4210	£5.00	£4.60	£4.20	EL1000/TP1 CO	£5.00	£4.70	£4.50
P11080 Black	£9.75	£9.00	£8.50	PROPRINT 24/4201/4204	£3.40	£3.10	£2.75	FASTEX 80	£11.70	£11.20	£10.90
P11080 Colour	£15.00	£14.50	£14.00	JUKI				SILVER REED			
PW1080/1150/50/55	£2.60	£2.30	£2.20	B100 SS	£1.85	£1.75	£1.50	EXP400/500/550 MS	£3.00	£2.85	£2.65
PW1080/1150/55/8/R	£2.70	£2.50	£2.30	B100 MS	£3.30	£3.00	£2.70	EXP400/500/550 CO	£2.80	£2.60	£2.40
				B100 CO	£1.80	£1.70	£1.45				
				6200/6300/6500 FA	£2.20	£2.00	£1.75	STAR			
				6200/6300/6500 MS	£2.00	£1.80	£1.60	DP510/DP515	£1.15	£1.05	£0.95
				2200/6000 CO	£2.50	£2.30	£2.10	GEMINI 10X/SG10/15	£1.15	£1.05	£0.95
CENTRONICS				KAGA				LC10/CL10/NX1000	£2.50	£2.35	£2.10
GLP1/JP2	£2.60	£2.50	£2.40	KP B10/910	£2.60	£2.30	£2.10	LC10 Colour/Rainbow	£6.00	£5.50	£5.00
				KP B10/910 6/R	£2.70	£2.50	£2.30	LC15/PR10/PR15	£2.50	£2.40	£2.25
CITIZEN				M/TALLY				LC200	£6.00	£5.50	£5.00
1200/180E/124D	£2.60	£2.35	£2.10	M1420/440/1000/1800	£3.00	£2.70	£2.50	LC240 Colour	£11.00	£10.00	£9.00
HQP40/Prodal 24	£7.20	£6.40	£6.10	M1800/MT81 MS	£2.45	£2.20	£2.10	LC240/CL2415	£2.50	£2.40	£2.25
HQP40 Colour	£18.00	£16.50	£15.00	M1800/MT81 FA	£3.35	£3.30	£3.10	N824-10	£4.10	£3.70	£3.45
HQP45	£9.90	£8.90	£8.30	M1800/MT81 FA	£3.70	£3.40	£3.10	N824-15/NB-15	£4.50	£4.15	£3.85
MSP10E/40/50	£2.60	£2.35	£2.10	M1800/MT81 FA	£3.70	£3.40	£3.10	N810/NL10/NR10	£3.60	£3.25	£3.00
MSP15E/25/45/55	£2.85	£2.50	£2.25	M1800/MT81 FA	£3.70	£3.40	£3.10	N815/NR15/NR15	£4.00	£3.65	£3.40
PREMIERE 35	See Diablo Hytype II			NEC				POWERTYPE	See Diablo Hytype II		
SWIFT 95/95WFT 24	£2.60	£2.35	£2.10	P1/P2/JP6	£3.50	£3.30	£3.00	RADIX 15	£4.00	£3.60	£3.30
SWIFT 95WFT 24	£2.60	£2.35	£2.10	P2+/P2200	£4.50	£4.20	£3.80	XB2410/XB2415	£2.50	£2.40	£2.25
SWIFT 95WFT 24	£11.00	£10.00	£9.00	P3/P7	£4.00	£3.70	£3.20	XB2410/XB2415 Colour	£13.00	£12.00	£11.00
				P5/P5XL/PPXL	£4.10	£3.80	£3.20				
COMMODORE				P6+/P7+/P60/P70 FA	£9.00	£8.60	£8.20				
DPS1101	See Juki 8100			P6+/P7+/P60/P70 MS	£13.50	£13.00	£12.50				
MP5801	£2.30	£2.10	£1.90	P6+/P7+/P60/P70 Col.	£2.15	£2.05	£1.80				
MP5802 MS	£2.45	£2.20	£2.00	SPN 5500/7700 FA	£2.10	£1.95	£1.70				
MP5802 FA	£3.55	£3.30	£3.00	SPN 5500/7700 MS							
MP5803	£2.60	£2.50	£2.40								
MP51000	£1.95	£1.80	£1.60	OKI							
MP51200	£2.60	£2.35	£2.10	80182/83/92/93	£1.15	£1.05	£0.95				
				1821/1831/1921/193	£3.70	£3.40	£3.10				
				320/321	£3.70	£3.40	£3.10				
				390/391	£6.50	£6.00	£5.50				
DAISYTECH/UCHIDA/QUENDATA				OKIMATE 20 Black	£6.00	£5.60	£5.20				
2000/1120/PW/X MS	£2.50	£2.20	£2.00	OKIMATE 20 Colour	£6.40	£6.00	£5.60				
2000/1120/PW/X FA	£3.25	£3.00	£2.70								

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3.5" D/ided H/density 1.44Mb	£20.00	£47.00	£90.00	£215.00
5.25" 55/DD DS/DD DS/QD	£5.00	£11.00	£20.00	£48.00
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MD-2HD 3.5" D/Sided H/Density 1.44Mb	£19.00	£16.50	£14.50	£14.00
MD-2D 5.25" D/Sided D/Density 40TR	£5.30	£5.00	£4.60	£4.30
MD-2DD 5.25" D/Sided D/Density 80TR	£8.50	£7.70	£7.30	£7.10
MD-2HD 5.25" D/Sided H/Density 1.6Mb	£8.50	£8.00	£7.50	£7.20
DYSAN				
MD-2DD 3.5" D/Sided D/Density	£7.00	£6.90	£6.80	£6.40
MD-2D 5.25" D/Sided D/Density 40TR	£4.90	£4.80	£4.70	£4.60
SONY				
MD-2DD 3.5" D/Sided D/Density	£7.00	£6.50	£6.00	£5.70
MD-2HD 3.5" D/Sided H/Density 1.44Mb	£10.50	£10.00	£9.50	£8.90
TDK				
MD-2DD 3.5" D/Sided D/Density	£5.70	£5.50	£5.20	£5.00
MD-2HD 3.5" D/Sided H/Density 1.44Mb	£10.00	£9.80	£9.50	£9.00
MD-2D 5.25" D/Sided D/Density 40TR	£4.20	£4.00	£3.80	£3.60
MD-2HD 5.25" D/Sided H/Density 1.6Mb	£6.50	£6.20	£6.00	£5.50
VERBATIM				
MD-2DD 3.5" D/Sided D/Density	£7.30	£6.90	£6.50	£6.00
MD-2HD 3.5" D/Sided H/Density 1.44Mb	£17.00	£16.00	£14.00	£13.00
MD-2D 5.25" D/Sided D/Density 40TR	£3.20	£2.90	£2.50	£2.10
MD-2DD 5.25" D/Sided D/Density 80TR	£8.30	£7.80	£7.30	£7.00
MD-2HD 5.25" D/Sided H/Density 1.6Mb	£8.40	£7.90	£7.40	£7.10

3.5" Labels 1000 per roll

3.5" Disk head cleaner with fluid

5.25" Disk head cleaner with fluid

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CF2 10 Disks £1.70 Each £17.00 Pack CF2 50 Disks £1.50 Each £75.00 Pack

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11 x 9.5MP	70	1000	£12.00	£11.00
11 x 9.5MP	70	2000	£18.00	£17.00
EXACT A4MP	70	1000	£13.00	£12.00
EXACT A4MP	70	2000	£22.00	£20.00
EXACT A4MP	90	1000	£15.00	£13.00
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6 NE2000 compatible cards &  
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**£7799**

## 10 User System

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EISA 340Mb 17Mb RAM VGA  
Mono  
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10 NE 2000 compatible cards,  
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386SX-20	VGA Mono	Super VGA Colour
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- ◆ Two 8-Bit expansion slots
- ◆ Two serial ports
- ◆ One parallel port
- ◆ Games port
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- ◆ Switchable 6/12Mhz clock speed
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**£536**

40Mb, 14" VGA Mono

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- ◆ Two serial ports
- ◆ One parallel port
- ◆ Games port
- ◆ Selectable 0/1 Wait States
- ◆ Switchable 20/25Mhz clock speed
- ◆ Desktop or Tower case
- ◆ Supplied with MS-DOS 5 and operation manuals
- ◆ 14" VGA monochrome display

**£721**

40Mb, 14" VGA Mono

386DX-25	VGA Mono	Super VGA Colour
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100Mb	£859	£1021
200Mb	£1057	£1208

## NESS 386-33C

- ◆ 33Mhz clock speed and 64Kb cache memory, other features as the 386-25

386-33C	VGA Mono	Super VGA Colour
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100Mb	£945	£1107
200Mb	£1127	£1291

## NESS 386-40C

- ◆ 40Mhz clock speed and 64Kb cache memory, other features as 386-25

386-40C	VGA Mono	Super VGA Colour
40Mb	£848	£1001
100Mb	£991	£1134
200Mb	£1168	£1311

## NESS 486SX-20

- ◆ Intel 80486SX 20Mhz Processor
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- ◆ Eight 16-Bit Expansion Slots
- ◆ Two serial Ports
- ◆ Games port
- ◆ AMI BIOS
- ◆ 64Kb Burst mode secondary cache on/off selectable
- ◆ Tower Case
- ◆ 14" VGA monochrome Display
- ◆ MS-DOS 5

**£928**

40Mb, 14" VGA Mono

486SX-20	VGA Mono	Super VGA Colour
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100Mb	£1061	£1219
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## NESS 486-33

- ◆ 33Mhz clock speed, 486 processor with 64Kb cache memory, other features as 486SX-20

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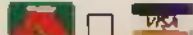
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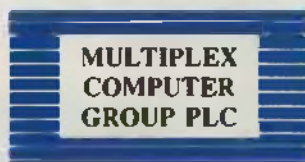
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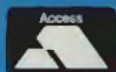


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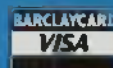
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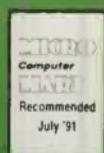
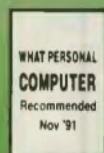
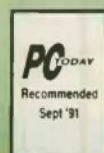
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80287 XLt for SLTs	£54	3C87-sx-20 20MHz	£81
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7576AU EXL	* A0		
7595C SX PLUS		<b>ROLAND</b>	
7596C RX PLUS		SKETCHMATE	A4
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<b>CALCOMP</b>		DX1 1200	A3
Model 83	A3	DX1 1300	A3
1023	* A1	DPX 2500	* A2
1025	* A0	DPX 3500	* A1
1026	* A0	DPX 4600	* A0
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STRADCOM + SOFT	<b>DOWTY</b>	
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SOFT	TRAILBLAZER V32	£969
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QUATTROCARD	SMART 2400 QUAD	£299
QUATTRO CARD PLUS	SMART 2400 + QUAD	£349
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SMARTMODEM 1200B	ULTRA SMART 9600	£559
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WS4000 + SOFT	WS4000	£95
K/CARD 3000 + SOFT V22	WS3000 V22 BIS	£224
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UNINET QUAD + SOFT	UNINET PLUS	£97
UNINET 32 + SOFT	UNINET 1200	£149
ULTRALINK QUAD + SOFT	UNINET 2400	£187
<b>WORLD PORT FAX/MODEM</b>	UNINET QUAD	£225
24961	UNINET 32	£365
<b>EXTERNAL</b>	ULTRALINK QUAD	£249
<b>AMSTRAD</b>	ULTRALINK 32 PLUS	£559
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LBP-4 1Mb Memory	HP LASERJET IIP/IIP/II/III/IIID	
LBP-4 Lower Cost/Tray	1Mb Memory	£63
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QS5000 512K Modules	4Mb Memory	£154
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M = MFM, R = RLL, I = IDE, S = SCSI

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AMSTRAD FX5050*	£356	SAMSUNG SF2300*	£435
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## IBM

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
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PS/1	286	10	40Mb	3.5"	1Mb	£659	£789

286 Computers complete with Microsoft Works V2, Mouse & DOS

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
30-H41	286	10	45Mb	3.5"	1Mb	£503	£513
35-040	386ix	20	—	3.5"	2Mb	£899	£989
35-043	386ix	20	40Mb	3.5"	2Mb	£1059	£1129
55-041	386ix	16	40Mb	3.5"	4Mb	—	£1419
55-081	386ix	16	80Mb	3.5"	4Mb	—	£1569
55-161	386ix	16	160Mb	3.5"	4Mb	—	£1899
40-043	386ix	20	40Mb	3.5"	2Mb	£1229	£1329
40-045	386ix	20	80Mb	3.5"	2Mb	£1399	£1499
57-045	386ix	20	80Mb	3.5"	4Mb	—	£1909
57-A49	386ix	20	160Mb	3.5"	8Mb	—	£2669

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Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
PCS286	286	16	40Mb	3.5"	1Mb	£695	£775
PCS286	286	16	80Mb	3.5"	1Mb	£855	£935
PCS286	286	16	120Mb	3.5"	1Mb	£1016	£1094
PCS386ix	386	16	40Mb	3.5"	1Mb	£985	£1065
PCS386ix	386	16	100Mb	3.5"	1Mb	£1137	£1213

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Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
N/Range	286	12	40Mb	3.5"	1Mb	£745	£869
286	386ix	16	40Mb	3.5"	1Mb	£795	£919
386	386ix	16	110Mb	3.5"	1Mb	£849	£969

N/Workstation Range

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
286	286	12	Ethernet	3.5"	1Mb	£599	£699
386	386ix	16	Ethernet	3.5"	1Mb	£699	£799

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Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
MCS Range	286	16	—	3.5"	2Mb	£749	£889
286/16	386ix	20	—	3.5"	2Mb	£895	£1024
386ix/20	386ix	20	—	3.5"	2Mb	£970	£1112
386ix/20C	486ix	20	—	3.5"	2Mb	£1192	£1328
486/20	486	33	—	3.5"	2Mb	£1495	£1635

MCS Pro Range

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
386/33C	386	33	—	3.5"	4Mb	£1419	£1549
486/33	486	33	—	3.5"	4Mb	£1859	£1989

Hard Disks for MCS Range—

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
40Mb	—	—	40Mb	£130	—	—	—
200Mb	—	—	200Mb	£434	—	—	—
3.5"	—	—	3.5"	£69	—	—	—

Extra Floppy Disk—

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
386/20C	386ix	20	—	—	2Mb	£1063	£1195
486/20	486ix	20	—	—	2Mb	£1278	£1415
486/33	486	33	—	—	2Mb	£1545	£1676

DataPac for Pacil Range—

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
40Mb	—	—	40Mb	£217	—	—	—
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Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
386/33 Range	386	33	110Mb	5.25"	1Mb	£1699	£1799
386/33	386	33	200Mb	5.25"	1Mb	£2019	£2159
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386/33 Tower Range

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
386/33T	386	33	110Mb	Dual	4Mb	£2019	£2159
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486/33 Range

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
486/33	486	33	110Mb	3.5"	4Mb	£3069	£3209
486/33	486	33	200Mb	3.5"	4Mb	£3425	£3559
486/33	486	33	300Mb	3.5"	4Mb	£3649	£3829

486/33 Tower Range

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA	VGA
486/33T	486	33	110Mb	Dual	8Mb	£3469	£3599
486/33T	486	33	200Mb	Dual	8Mb	£3739	£3879
486/33T	486	33	300Mb	Dual	8Mb	£3999	£4139
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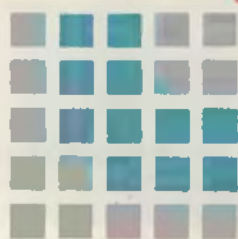
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All 5086's include Microsoft Works

PC3286 SD 5.25"	<b>£394</b>	<b>£470</b>	<b>£553</b>
PC3286 SD 3.5"	<b>£431</b>	<b>£513</b>	<b>£593</b>
PC3286 HD40Mb 5.25"	<b>£585</b>	<b>£665</b>	<b>£739</b>
PC3286 HD40Mb 3.5"	<b>£626</b>	<b>£700</b>	<b>£776</b>
PC3286 HD40Mb 3.5" + 5.25" Drives	<b>£669</b>	<b>£746</b>	<b>£824</b>
PC5286 SD 3.5"	<b>£429</b>	<b>£503</b>	<b>£586</b>
PC5286 HD40Mb 3.5"	<b>£625</b>	<b>£699</b>	<b>£778</b>

All 3286 & 5286 3.5" Computers include Lotus 123 V2.2

PC3386sx HD40Mb 3.5"	<b>£800</b>	<b>£875</b>	<b>£950</b>
PC3386sx HD80Mb 3.5"	<b>£1080</b>	<b>£1150</b>	<b>£1241</b>

All 3386sx Computers include Microsoft Excel V3, Windows 3 & Mouse

PC4386sx HD80Mb 3.5" inc Windows 3	<b>£1089</b>	<b>£1241</b>	—
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N/Range	VGA MONO	VGA COL.	SUPER VGA COL.
286 286 40Mb	<b>£746</b>	<b>£870</b>	<b>£890</b>
386 386sx 40Mb	<b>£796</b>	<b>£920</b>	<b>£940</b>
386 386sx 110Mb	<b>£850</b>	<b>£970</b>	<b>£990</b>

N/Workstation Range			
286 286	<b>£600</b>	<b>£700</b>	—
386 386sx	<b>£700</b>	<b>£800</b>	—

N/Workstation computers complete with an Ethernet network card

MCS Range			
286/16 286	<b>£750</b>	<b>£890</b>	<b>£920</b>
386sx/20 386sx	<b>£896</b>	<b>£1025</b>	<b>£1055</b>
386/20C 386sx	<b>£971</b>	<b>£1113</b>	<b>£1143</b>
486/20 486sx	<b>£1193</b>	<b>£1329</b>	<b>£1359</b>
486/33 486	<b>£1496</b>	<b>£1636</b>	<b>£1666</b>

MCS pro Range			
386/33C 386	<b>£1420</b>	<b>£1550</b>	<b>£1580</b>
486/33 486	<b>£1860</b>	<b>£1990</b>	<b>£2020</b>

Hard Disks for MCS Range:-	40Mb	110Mb	200Mb
	<b>£131</b>	<b>£260</b>	<b>£435</b>
	<b>£69</b>	<b>£69</b>	<b>£869</b>

Extra Floppy Disks:-  
MCS computers complete with Windows 3, Mouse & DOS

PacII Range			
386/20C 386sx	<b>£1064</b>	<b>£1196</b>	<b>£1226</b>
486/20 486sx 20	<b>£1279</b>	<b>£1416</b>	<b>£1446</b>
486/33 486 33	<b>£1546</b>	<b>£1677</b>	<b>£1700</b>

DataPacII for PacII Range:-  
40Mb **£218** 100Mb **£345** 200Mb **£522** 400Mb **£1086**

Floppy Disk:- 3.5" **£96**

PacII computers complete with Windows 3, Mouse & DOS

	Hard Disk	Floppy	RAM	VGA Mono	VGA Colour	Super VGA Colour
386/33 Range						
386/33 110Mb 5.25"	1Mb			<b>£1699</b>	<b>£1799</b>	<b>£1859</b>
386/33 200Mb 5.25"	1Mb			<b>£2020</b>	<b>£2160</b>	<b>£2210</b>
386/33 300Mb 5.25"	1Mb			<b>£2299</b>	<b>£2500</b>	<b>£2520</b>
386/33 Tower Range						
386/33T 110Mb Dual 4Mb				<b>£2020</b>	<b>£2160</b>	<b>£2200</b>
386/33T 200Mb Dual 4Mb				<b>£2339</b>	<b>£2479</b>	<b>£2539</b>
386/33T 300Mb Dual 4Mb				<b>£2630</b>	<b>£2770</b>	<b>£2830</b>
386/33T 600Mb Dual 4Mb				<b>£3149</b>	<b>£3289</b>	<b>£3349</b>
486/33 Range						
486/33 110Mb 3.5" 4Mb				<b>£3070</b>	<b>£3210</b>	<b>£3270</b>
486/33 200Mb 3.5" 4Mb				<b>£3425</b>	<b>£3559</b>	<b>£3619</b>
486/33 300Mb 3.5" 4Mb				<b>£3650</b>	<b>£3830</b>	<b>£3850</b>
486/33 Tower Range						
486/33T 110Mb Dual 8Mb				<b>£3469</b>	<b>£3599</b>	<b>£3659</b>
486/33T 200Mb Dual 8Mb				<b>£3739</b>	<b>£3879</b>	<b>£3939</b>
486/33T 300Mb Dual 8Mb				<b>£4000</b>	<b>£4140</b>	<b>£4200</b>
486/33T 600Mb Dual 8Mb				<b>£4440</b>	<b>£4580</b>	<b>£4646</b>
486/33T 1000Mb Dual 8Mb				<b>£4880</b>	<b>£5020</b>	<b>£5080</b>

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PCS 286 286 120Mb	<b>£1017</b>	<b>£1095</b>
PCS 386sx 386 40Mb	<b>£913</b>	<b>£989</b>
PCS 386sx 386 100Mb	<b>£1140</b>	<b>£1217</b>

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\* models include O.S.M.

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ALT 286-20	<b>£951</b> TM2000-20	<b>£696</b> T4400sx-80	<b>£2830</b>
ALT 286-40	<b>£1170</b> TM3000sx-20	<b>£1400</b> T3100sx-40	<b>£1340</b>
ALT 386sx-40	<b>£1245</b> TM3000sx-40	<b>£1580</b> T3100sx-80	<b>£1434</b>
ALT 386sx-80	<b>£1460</b> TM3000sx-60	<b>£1740</b> T3200sx-40	<b>£1340</b>
		<b>£1980</b> T3200sx-120	<b>£1546</b>
SANYO		T3200sxc-120 Col	<b>£4056</b>
NB17 286-60 with FREE		T5200-100	<b>£1975</b>
Diconix 150 Printer	<b>£1196</b>	T5200-200	<b>£2179</b>
NB18 386sx-20	<b>£1290</b>		
NB18 386sx-60	<b>£1390</b>		
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T1000le-20			
T2000-20			
T2000-40			
T2000sx-20			
T2000sx-40			
T2000sxe-60			
TANDON			
NB/386sx-40	<b>£1310</b>		
NB/386sx-60	<b>£1486</b>		
ZENITH			
£1286 MastersPORT 286-30			<b>* £1190</b>
£1397 MastersPORT 386sx-60			<b>* £1890</b>
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4214 LR 14" Multiscan	<b>* £372</b>	
6116 LR 16" Quadscan	<b>* £785</b>	
6120 LR 20" Quadscan	<b>* £1109</b>	
NEC		
3FG 15" Multisync	<b>£390</b>	
4FG 15" Multisync	<b>£480</b>	
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CI 381 14" Multiscan	<b>£219</b>	
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TX2103 21" Multiscan	<b>£1426</b>	
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CM8833/II 14" CGA	<b>* £167</b>	
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3CM3279 14" VGA/SVGA LR	<b>* £305</b>	
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KX445 14" VGA FST WH	<b>£110</b>	
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VIKING III/PC + Card	<b>£1190</b>	
VIKING III/PS2 + Card	<b>£1190</b>	
785 14" VGA	<b>£288</b>	
780 14" VGA	<b>£311</b>	
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790 14" VGA	<b>£326</b>	
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775 14" Multisync	<b>£365</b>	
795 14" Multisync	<b>£405</b>	
875 17" Multisync	<b>£689</b>	
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WS4000 + Soft	<b>£96</b>
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Linnet Plus + Soft	<b>£98</b>
Linnet 1200 + Soft	<b>£150</b>
Linnet 2400 + Soft	<b>£188</b>
Linnet Quad + Soft	<b>£226</b>
Ultralink Quad + Soft	<b>£250</b>
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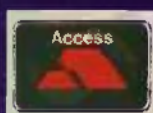
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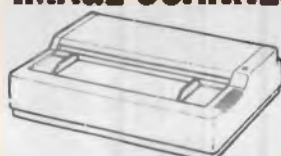
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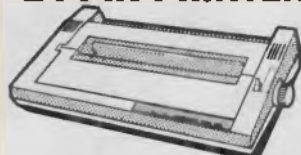
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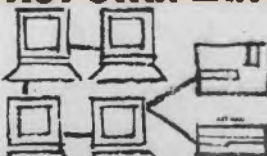
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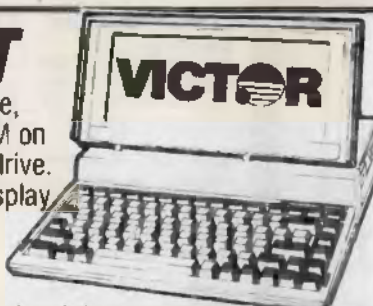
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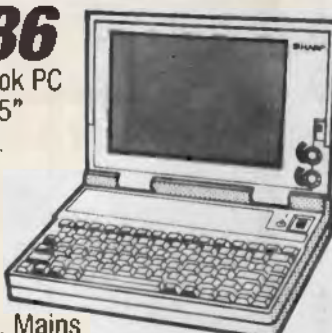
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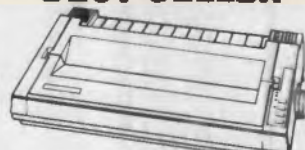
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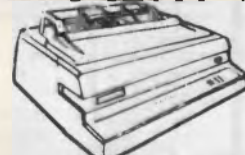
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Developer kit for F800T/800/820	£85	Legal kit for paper feeder	£45
Developer kit for F1800/3300/5000	£139	IC Card reader/writer	£279
Developer kit for others	£109	IC Card	£32
Sorter/Collector for F2200/2200S/3000/3300	£489	Font editor	£209
		Paper cassette tray (A4,B5,Letter or Legal)	£47

## TEXAS INSTRUMENTS

### MicroLaser Plus

9 Pages per minute. 512k RAM. Expandable to 4Mb. Laserjet II Emulation. Parallel interface. 250 Sheet input tray. 8 Resident fonts. One year on-site maintenance.

**£719**

### MicroLaser PS17 Plus

Adobe Postscript. 1.5Mb RAM. 17 Resident fonts. Other features as MicroLaser.

**£1099**

### MicroLaser PS35 Plus

Adobe Postscript. 1.5Mb RAM. 35 Resident fonts. Other features as MicroLaser.

**£1239**

Serial interface	£29	Auto Envelope feeder	£227
Appletalk interface	£87	OPC Cartridge	£109
Dual bin feeder	£235	Developer kit	£87

## CANON

LBP-4+ 4 Pages per minute. 512K RAM. 50 Sheet paper tray. Bitmap and Scalable fonts. Parallel/Serial and Video interfaces. 16 Character LCD display. One year on-site maintenance.

**£588**

LBP-8 III+ 8 Pages per minute. 1.5Mb RAM. 200 Sheet paper tray. 14 Resident fonts. Parallel/Serial interface. One year on-site maintenance.

**£975**

## HEWLETT PACKARD

### Laserjet IIIP

4 Pages per minute. 1Mb RAM. 70 Sheet multi-purpose input tray. 8 Scalable typefaces and 14 bitmapped fonts. Parallel and Serial interfaces. HP PCL5 printer language. 1 year on-site maintenance.

**£699**

### Laserjet IIIP Apple Mac

**£1129**

### Laserjet IIID

8 Pages per minute. 1Mb RAM. Two sided (Duplex) printing. Two 200 sheet paper trays. 24 Resident fonts. 1 year on-site maintenance.

**£1749**

### Laserjet IIID Apple Mac

**£2399**

### LASERJET IIP & IIP ACCESSORIES

Jetpage	£229	ProPrinter/Epson Emulation cart.	£175
Appletalk interface for IIP/IIP	£145	HP Postscript cartridge	£349
Lower A4 paper cassette IIP/IIP	£90	International collection font cartridge	£198
Extra paper trays for lower cassette		Tax 1 Font cartridge	£119
Letter	£39	WordPerfect font cartridge	£119
Legal	£44	Jetfont 425 in 1 Font cartridge	£219
A4	£39	Jetfont Superscript international	£101
Executive	£41	Pacific headlines cartridge	£149
Envelope	£49	Pacific page XL	£579
		HCF-1000 1000 Sheetfeeder	£99

### Laserjet IIISI

16 Pages per minute. 2Mb RAM expandable to 17Mb. 2x500 sheet input trays. 14 Bitmapped fonts. 13 Scalable typefaces. Serial/Parallel and high speed parallel. HP PCL5 printer language. Optional two-sided (Duplex) printing. 1 year on-site maintenance.

**£2535**

### Laserjet IIISI Apple Mac

**£3549**

### LASERJET III & IID ACCESSORIES

Jetpage	£229	WordPerfect font cartridge	£119
Appletalk interface for IIP/IID	£145	Jetfont 425 in 1 Font cartridge	£219
Letter paper tray	£38	Jetfont Superscript international	£131
Legal paper tray	£45	Pacific headlines cartridge	£149
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## PANASONIC

KX-P4420 512K RAM. 8 Pages per minute. 512K RAM expandable to 4.5Mb. 250 Sheet paper tray. HP II Emulation. 22 Resident fonts. Parallel interface. One year on-site maintenance.

**£628** Model illustrated KX-P4450i

KX-P4450i 11 Pages per minute. 512K RAM. Two 250 Sheet paper trays. 5 Emulations. 22 Resident fonts. Parallel/Serial interface. One year on-site maintenance.

**£934**

KX-P4455 Adobe Postscript. 11 Pages per minute. 2Mb RAM. Expandable to 4Mb. 39 Resident Adobe fonts and 26 emulation fonts. HP Laserjet II and Diablo 630 emulations. Two 250 Sheet A4 input trays. RS232C, RS442A, Parallel and Appletalk interfaces. One year on-site maintenance.

**£1459**

Drum unit for 4420	£59	Transfer corona for 4420	£8
Drum unit for 4450i/4455	£79	Fanis for 4420/4450i/4455	£98
Developer for 4420	£39	Serial interface for 4420	£69
Developer for 4450i/4455	£39	Envelope paper tray 4420	£55
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Ozone filter for 4450i/4455	£17		

## PENTAX

16 Pages per minute. Continuous form using tractor fed paper. 241mm x 280mm Adjustable tractor feed. 102mm x 235mm for special needs. Parallel and Serial interfaces as standard with the option of Coax or Twi-nax. IBM Proprinter emulation.

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## BROTHER

HL-8e 8 Pages per minute. 512K RAM. 200 Sheet paper tray. 6 Emulations. 30 resident fonts. Parallel/Serial interface. One year on-site maintenance.

**£949**

HL-4 4 Pages per minute. 512K RAM. Parallel and Serial interfaces. 5 Printer emulations. 50 Sheet input tray. 30 fonts. Scalable font card (from 4 to 120 points) available. 16 character LCD display. One year on-site maintenance.

**£603**

HL-4PS 4 Pages per minute. 2Mb RAM. Postscript compatible. 35 Resident fonts. Parallel, RS232C/RS442A and Appletalk interfaces. 50 Sheet input tray. Other features as HL-4.

**£1087**

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**£1055**

HL-8D 8 Pages per minute. 1Mb RAM. Double sided printing. Two 200 Sheet paper trays. Other features as HL-8e.

**£1485**

HL-8PS Postscript compatible. 8 Pages per minute. 2Mb RAM. 200 Sheet paper tray. 3 Emulations. 35 Resident Fonts. Other features as HL-8e.

**£1395**

HCF-1000, 1000 Sheet sheetfeeder for HL8 series except HL8D £99 Full range of fonts available POA For other accessories please call for details

## EPSON

EPL-4100 6 Pages per minute. 512K RAM expandable to 5.5Mb. 11 Bitmap and 13 Scalable fonts. 100 Sheet paper tray. Micro Art printing. Epson GQ, LG, FX & HP emulations. Simultaneous use of both Parallel and Serial interfaces when used as a shared resource. Resolution improvement technology. One year on-site maintenance.

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## OKI

**Okilaser 400**  
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## STAR

**LP-8 III**  
8 Pages per minute. 1Mb RAM upgradable to 5Mb. 200 Sheet paper tray. 4 Emulations. 14 Resident fonts. 8 Scaleable fonts. Parallel/Serial interface. One year on-site maintenance. **£919**



**LP-4**  
4 Pages per minute. 1Mb RAM upgradable to 5Mb. 50 Sheet paper tray. 14 Resident fonts. HP & Epson emulation. Parallel and Serial interfaces. One year on-site maintenance. **£576**

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Postscript compatible. 2Mb RAM upgradable to 5Mb. 35 fonts. 50 Sheet input tray. HP & Epson emulation. Parallel, Serial and AppleTalk interfaces as standard. One year on-site maintenance. **£789**

**LP-8 II DUAL BIN (DB)**  
8 Pages per minute. 1Mb RAM. Two 200 Sheet paper tray. Other features as LP-8. **£1189**

**LP-8 II DUAL BIN DUPLEX (DX)**  
8 Pages per minute. 1Mb RAM. Double sided printing. Two 200 sheet paper tray. Other features as LP-8 II Dual Bin. **£1359**

**LP-8 III STARSRIPT**  
Postscript compatible. 2Mb RAM. 8 Pages per minute. 5 Emulations. 14 Resident fonts. 8 Scaleable fonts. 35 Postscript fonts. Other features as LP-8 III. **£1155**

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## NEC

**Silenwriter 2 S60P**  
Adobe Postscript. 2Mb RAM. 6 Pages per minute. 35 fully scalable built-in fonts. High performance MC68000 Processor. Parallel, Serial and AppleTalk interfaces. One year on-site maintenance. **£1089**

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**Silenwriter LC890XL**  
Postscript. 8 Pages per minute. 4Mb RAM expandable to 8Mb. Two 250 Sheet paper bins with collated output. 3 Emulations. 35 Resident fonts. Parallel/Serial and AppleTalk interfaces. Built-in SCSI interface for optional NEC 20Mb Hard disk. One year on-site maintenance. **£2339**

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8 Pages per minute. 512K RAM. 35 Resident fonts. 3 Emulations. 200 Sheet input tray. Parallel and Serial interfaces. 32 Character LCD display. One year on-site maintenance. 512K Single bin **£869**

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Features as Okilaser 800 but with 2 x 200 Sheet input tray. One year on-site maintenance. 512K Dual bin **£1049**

1.5Mb Dual bin **£1199**  
2.5Mb Dual bin **£1299**  
4.5Mb Dual bin **£1499**

**Okilaser 840**  
PostScript. 8 Pages per minute. 2Mb RAM. 35 Adobe (Laserwriter compatible fonts). 3 Emulations. 200 Sheet input tray. Parallel/Serial/AppleTalk/RS422 interfaces. 32 Character LCD display. One year on-site maintenance. 2Mb Single bin **£1199**

4Mb Single bin **£1489**

**Okilaser 840 Dual bin**  
Features as Okilaser 840 but with 2 x 200 Sheet input tray. One year on-site maintenance. 2Mb Dual bin **£1379**

4Mb Dual bin **£1649**

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Font cartridges from **£78**  
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## QMS

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Postscript. 4 Pages per minute. 2Mb RAM. 45 Adobe Postscript fonts. HP Laserjet II emulation. 68020 Processor running at 16.67MHz. Simultaneous interface operation receives data from all three interfaces simultaneously. Parallel/Serial and AppleTalk interfaces. Emulation sensing processing. QMS driver for Windows 3. **£1329**

**PS810**  
Postscript. 8 Pages per minute. 2Mb RAM. 35 Adobe postscript fonts. HP LJ+ /HP7475A Plotter and Diablo 630 emulations. Serial/Parallel/RS422/AppleTalk interfaces. **£1999**

**PS815**  
Postscript. 8 Pages per minute. 2Mb RAM. 68020 Processor running 20MHz. 200 Sheet input tray. Other features as PS410. **£2199**

**PS825**  
Postscript. 8 Pages per minute. 2Mb RAM. Features as PS815 but with two 200 sheet input trays. **£2589**

**PS1500**  
Postscript. 15 Pages per minute. 4Mb RAM. 68020 Processor running at 16.67MHz. 35 Adobe postscript fonts. Two 250 sheet input trays and a 500 sheet face down output tray with offset stacking. Parallel/Serial/RS422/AppleTalk and SCSI interfaces. QMS driver for Windows 3. **£4279**

**PS2210**  
Adobe Postscript. 22 Pages per minute. 4Mb RAM. 39 Adobe postscript fonts. A3 to A6 Paper sizes supported. HP Laserjet and HP7475 emulations. SCSI interface for additional QMS Hard disk. Parallel/Serial/RS422/AppleTalk and SCSI interfaces. QMS driver for Windows 3. **£7109**

**PS2220**  
Adobe Postscript. 22 Pages per minute. 4Mb RAM. Features as PS2210 but with two 250 sheet input trays. **£9199**

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**ColorScript 100 Model 10**  
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## MEMORY

	1Mb	2Mb	3Mb	4Mb
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	HL-4/E/O	£125	£250	—
	HL-8V Total 2Mb	£69	—	—
	HL-PS	—	£319	—
CANON	LBP-4	£127	£270	—
	LBP-8	£139	£145	—
	LBP-8 B/R/T	£195	£175	£229
EPSON	EP-1106/7500	—	£145	£160
HP LASERJET	II/PS	£99	£145	—
	II/PS/II/PS	£65	£95	£129
	II/PS	£79	—	£299
IBM	4019/4019E	£91	£165	£235
KYOCERA	F8001/F8001/F820	£169	£209	£279
	F1000	£145	—	—
	F1200S/2200S	£199	—	—
	F3000/F5000	—	£239	£309
NEC	S60/266	£149	—	—
	S60P/290	—	£219	—
	LC890XL	—	—	£369
OKI	400	£75	£109	—
	800	£95	£179	£199
PANASONIC	KDP4420/4450	£69	£109	—
	KDP4455	—	£185	—
QMS	PS-410	—	£109	—
	PS810/815/825	POA	POA	POA
STAR	LP-4	POA	POA	POA
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<b>HP Laserjet IIID</b>	<b>£1,725(2xa)</b>
Duplex Printer As III but with two trays	
<b>HP Laserjet IIISi</b>	<b>£2,549(2xa)</b>
16ppm; two Trays. HP's workhorse, 2MB RAM (exp 17Mb). Options: PostScript/Duplex/Networking	
3 year on-site maintenance available on HP lasers.	

### EPSON

<b>EPL4100</b> 6ppm	<b>£575(a)</b>
scaleable fonts	
LQ/FX/HP Emul. Par/Ser Ports	
<b>EPL7500</b> 6ppm Postscript	
Par/Ser/Apple ports. £1,189(a)	

### CANON

<b>LBP4plus</b> 4ppm,	
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Scaleable/bitmap fonts	
<b>LBP8-IIIplus</b> 8ppm	
1.4Mb RAM	<b>£975(a)</b>

### PANASONIC

<b>KXP4420</b> 8ppm, HP II emulation	<b>£625(a)</b>
<b>KXP4450i</b> 11ppm, Twin Tray	<b>£949(a)</b>
<b>KXP4455</b> 11ppm PostScript	<b>£1,469(2xa)</b>
Twin Tray, HP II emulation	

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### OKI

<b>OL400</b> 4ppm 512K RAM	<b>£489(a)</b>
Par or Ser. HP/Diablo Emulations	
<b>OL830</b> 8ppm, Postscript	<b>£949(a)</b>
17 scaleable fonts. Par/Apple	
<b>OL840</b> 8ppm Postscript	<b>£1,199(a)</b>
Single bin, Scaleable fonts, HP Emulation, Parallel/Serial/AppleTalk	



### NEC

<b>SilentWriter2 S60P</b> 6ppm	<b>£1,189(a)</b>
PostScript Par/Ser/AppleTalk ports	
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<b>HP Deskjet 500C</b> Colour	<b>£499(a)</b>
<b>HP Paintjet 80</b> col, 180 x 180 res Parallel or Serial i/face	<b>£439(a)</b>
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<b>HP</b>			
1Mb	£56	£89	£72
2Mb	£87	£149	£189
4Mb	£145	£189	£189
<b>CANON</b>			
LBP4	£129	£115	£119
1Mb	£249	£115	£185
2Mb	£249	£115	£185
<b>PANASONIC</b>			
4420	£450i	£455	£455
1Mb	£65	£65	£65
2Mb	£119	£119	£129
4Mb	£189	£189	£189
<b>EPSON</b>			
EPL7100	£49	£49	£69
0.5Mb	£139	£139	£129
1.5Mb	£139	£139	£129
<b>OKI</b> OL400/800/840	1Mb £75	2Mb £105	
<b>BROTHER</b> for HL8e/HL8PS/HL8	1Mb £119	2Mb £209	

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<b>HP Laserjet IIISi</b>	<b>£99(b)</b>
<b>Canon LBP4</b>	<b>£55(b)</b>
<b>Canon LBP8II/IIIT/R</b>	<b>£59(b)</b>
<b>Panasonic 4420/50i/55</b>	<b>£19(c)</b>
<b>NEC S60/S60P</b>	<b>£69(b)</b>
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Printer Accessories and Consumables on page 7.

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EDUCATIONAL DISCOUNTS are available on some of our ranges to bonafide educational establishments. Do not miss this opportunity. QUANTITY DISCOUNTS considered on volume purchases. CORPORATE Registration welcome. UK GOVT/Local Authorities/Corporations/NHS orders welcome. EXPORT ORDERS from overseas government depts, universities welcome.

Please state disc size when ordering. i.e. 3.5 or 5.25

All software for IBM PCs & 100% Compatibles.





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Fax: 081-205 0190

# TECHNOMATIC

## BUSINESS SOFTWARE

### UNIX POWER

SCO Unix/Xenix OS 286/386  
SCO Unix/Xenix Dev System  
SCO Open Desktop  
SCO TCP/IP  
SCO VP/ix  
SCO Foxbase Plus 286/386  
SCO Smart System  
SCO Wordperfect  
dBASE IV XENIX/UNIX  
Lotus 123 Unix  
QuickSilver Unix/Xenix  
XTREE for Unix  
*Prices on application*

### UTILITIES

386 Max v5 £60(b)  
Above Utilities £61(c)  
Anti-Virus/Dr. Solomon £42(b)  
Battery Watch Prof £24(c)  
Central Point Anti Virus £58(b)  
Central Point Backup £59(b)  
Check It v3 Diagnostic £52(b)  
Desqview 386 v2.4 Qemm 386 £108(b)  
Desqview v2.4 NEW £60(b)  
Qemm 386/v6 NEW £54(b)  
Qemm 386/PS2-50-60 £54(c)  
QRam & Manifest/286 £42(b)  
Fastback Plus 3.0 £76(b)  
File Director 5th Gen £49(b)

File Recovery (dBase) £49(b)  
Laplink PRO NEW £78(b)  
Win Connect £57(b)  
Desklink v2.2 £77(b)  
Mace 1990 Utilities £69(b)  
Norton Desktop Windows £66(b)  
PC Tools v7.1 £69(b)  
Sideways v3.3 £38(b)  
Spinrite II £46(b)  
Stacker v2 £65(b)  
Superstor-Disk Maximiser £97(b)  
System Sleuth Prof £65(b)  
XTree Gold v2.5 £57(b)  
XTree Easy £42(b)  
Xtree Net Novell £235(a)

### WINDOWS & MOUSE

Asymetrix Toolbook £198(a)  
GeoWorks Ensemble £115(a)  
HDC 1st Apps £52(b)  
HDC File Apps £89(b)  
HDC Windows Express £52(b)  
MS Ball Point Mouse £80(b)  
MS Mouse + Paint B/S £73(b)  
MS Mouse B/S plain £61(b)  
MS Win 3 Dev Toolkit £245(a)  
MS Win 3 Mouse B/S £88(b)  
MS Windows v3.0 £58(b)  
Norton Desktop Windows+  
MS Windows v3 £99(a)

### MICROSOFT SPECIALIST CENTRE

**Microsoft**

**"MS DOS VERSION 5.0 UPGRADE"**

**Latest Operating System**

*No PC should be without MS DOS 5*

### AUTHORISED DEALER

*Central Point Software*

**"PC TOOLS 7.1"**

**Many In-One Utilities**

*No MS DOS 5 user should be without PC Tools 7.1*

### AUTHORISED DEALER DIGITAL RESEARCH "DR DOS 6"

**Compatible Operating System  
with Advanced features:**

- Memory Management up to 627K available
- Disc Cacheing - Increases speed 5 times
- Disc Compression - Doubles hard disc capacity
- Task Switcher - Loads upto 20 applications
- Graphical User Interface
- Undelete & Password protection

### Microsoft Trade-in Deal @ £98 per pack

**MS WORD  
FOR WINDOWS  
Word Processor**

**MS EXCEL 3.0  
FOR WINDOWS  
Spreadsheet**

**MS POWERPOINT  
FOR WINDOWS  
DTP**

**MS PROJECT  
FOR WINDOWS  
Project Management**

### LOTUS TRADE-INS @ £99

AMI PRO V2.0  
Word Processor

Lotus 123 for Windows  
Spreadsheet

Freelance  
Graphics for Windows

Against selected WPs

After purchase of AMI Pro v2

### BORLAND TRADE-INS

PARADOX 3.5  
Database £149

QUATTRO PRO 3  
Spreadsheet £69

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## TECHNOMATIC as AUTHORISED DEALER

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INFORMIX

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WordPerfect  
CORPORATION

SAGE

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## A4 FLATBED SCANNERS

HP SCANJET PLUS 300dpi	£485(a)
256 grey levels/12 months on site warranty	
Interface Kit (PC/XT or MCA)	£269(b)
incl ScanGallery plus/Paintbrush/V	
Auto Document Feeder	£289(a)
PANASONIC FX-RS 506U 400dpi	£595(a)
16 grey levels/SCAN-DO software incl.	
Interface Card (XT/AT)	£129(b)
(PS2)	£199(b)
PANASONIC FX-RS307U 600dpi	£795(a)
16-256 grey levels	
Interface Card XT/AT incl s/ware	£129(b)
CANON IX30F 300dpi	£599(a)
Interface Card XT/AT	£95(b)

## COLOUR SCANNERS

### HP SCANJET IIC

A4 Colour Scanner 400 dpi Includes PC/AT or PS/2 i/face, DeskScanII and Publishers Paintbrush. Single pass scanning ensures superior col registration and fast scanning. 24 bit col. recognition of over 16 million colours. Spot colour recognition/grey scale scanning on print path calibration for high quality output. High level of OCR accuracy through HP's AccuPage Technology. Spec on request. £1,069(a)

## GS-FC30 A4 Flatbed Colour Scanner

A new A4 colour scanner complete with SCSI interface and powerful, friendly software for use under DOS or Windows.

- 300 dpi at up to 24 bits per pixel
- Gray scale scanning to 256 levels
- Colour scanning to 16.7 million shades
- Complete with SCSI interface for PC AT
- Colorshop 24 software for Windows
- IMS ver 1.0 software for DOS

GS-FC30 Flatbed Colour Scanner **£869(a)**

## MIRACLE PIANO TEACHING SYSTEM

This PC based system is the first piano that teaches you how to play. Teaches with a series of progressive lessons devised and written by professional educators. Uses video games to make learning fast, fun and enjoyable, using artificial intelligence to monitor each lesson and build a series of personalised excises. The keyboard supplied comes with sensitive full size keys that respond to touch like a piano. Comes with a musical repertoire of over 50 pieces, with over 100 instruments and sound effects. MIDI compatible. As seen on TV. **£249(a)**

## HP FONT CARTRIDGES AND SOFT FONTS

HP Premier Font Collection (5.25")	£29(c)
(TypeDirector 2, + 7 scaleable typefaces)	
HP Master Type Font Cartridge for MicroSoft, Word Perfect, Presentations, Bar Codes, Global Forms	each: £99(b)
HP Print Cache (Speeds up output)	£79(b)
HP Polished Worksheets	£99(b)
HP Great Start	£49(b)
HP PrintaPlot (Emulates HP Plotter)	£179(b)
JetFont: SuperSet 216 fonts	£129(b)
SuperSet+ 425 fonts	£239(b)
JetWare 4 in 1 (WP/Spreadsheets)	£69(b)
JetFont R, Z fonts	each set £49(b)

## HP HP/IIIP Lower Cassette Tray £99(b)

## INKJET ACCESSORIES/CONSUMABLES

### For HP Deskjet Plus & HP Deskjet 500

HP FX80 Emulation Cartridge	£49(b)
JetRAM 256K Cartridge	£69(b)
Jet RAM 256K+	
Premier Font Collection (5.25")	£89(b)
HP WordPerfect Cartridge	£79(b)
HP TmsRmn Collection 30pts	£47(b)

### For HP Deskjet

HP Presentations	£47(b)
HP TmsRmn 4-10pts	£47(b)
HP Helv 4-10pts	£47(b)
HP Helv ASCII (4/14pts)	£47(b)

### Ink Cartridges

HP Deskjet	£14(b)
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new insoluble ink for all Deskjets

HP Paintjet Colour	£25(d) Black £22(d)
HP Deskjet 500C Colour	£25(d) Black £14(d)
HP Paintjet XL (Cyan/M/Y/Blk)	each £22(d)
Canon BJ10e/x	£16(d) BJ300/330 £11(d)

### Canon Sheet Feeders

BJ10e/300/330	£45(b)/£99(b)/£129(a)
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Enquired for consumables/accs not listed

Dust Covers are available for HP lasers and inkjets

## SEAGATE HARD DISKS

IDE					
ST125A	21.5MB	28ms	3.5"HH	£139	
ST138A	32.1MB	28ms	3.5"HH	£179	
ST157A	44.7MB	28ms	3.5"HH	£125	
ST351AX	42.0MB	16ms	3.5"x1"H	£159	
ST3096A	89.0MB	16ms	3.5"x1"H	£239	
ST3102A	107.0MB	16ms	3.5"HH	£259	
ST3144A	130.7MB	19ms	3.5"HH	£285	
MFM					
ST225	21.4MB	65ms	5.25"HH	£127	
ST125	21.4MB	28ms	3.5"HH	£145	
ST151	42.5MB	24ms	3.5"HH	£229	
ST251	42.8MB	28ms	3.5"HH	£169	
ST4096/7	80.0MB	28ms	5.25"HH	£359	

ESDI					
ST2182E	160.0MB	16ms	5.25"HH	£619	
ST1201E	177.8MB	15ms	3.5"HH	£539	
ST2383E	338.0MB	16ms	5.25"HH	£809	

SCSI					
ST125N	21.5MB	28ms	3.5"HH	£157	
ST138N	32.2MB	28ms	3.5"HH	£175	
ST157N	48.6MB	28ms	3.5"HH	£169	
ST177N	60.8MB	20ms	3.5"HH	£239	
ST296N	84.9MB	28ms	5.25"HH	£225	
ST2125N	107.0MB	18ms	5.25"HH	£479	
ST4182N	155.0MB	16.5ms	5.25"HH	£549	
ST1186N	158.8MB	15ms	3.5"HH	£479	
ST1201N	171.9MB	15ms	3.5"HH	£439	
ST2209N	183.0MB	18ms	5.25"HH	£539	
ST1239N	204.2MB	15ms	3.5"HH	£469	
ST2383N	337.0MB	14ms	5.25"HH	£795	
ST2502N	442.0MB	16ms	5.25"HH	£1055	
ST4702N	513.0MB	16.5ms	5.25"HH	£1049	
ST4767N	676.0MB	11.9ms	5.25"HH	£1339	

## PLUS HARD CARDS

Plus Hard Card IIAT	50Mb	9ms	£289(a)
Plus Hard Card IIXT	80Mb	9ms	£369(a)
Plus Hard Card IIAT	105Mb	9ms	£439(a)

## SUPERSTORE

Why not expand your drive capacity? For a small cost, drive capacity can be expanded up to 3 times (depending on data type) by installing SuperStore **£85(b)**

## NETWORKING SOLUTIONS

### RPTI's Low Cost Networking Solution

RPTI 10Mbit/sec Ethernet system provides a simple and elegant solution for setting up a local area network at minimum cost. Simple, detailed instructions for installation enable you to get the network set up and working. The network operating system is menu driven thus making it very simple to operate.

A dedicated file server is not required, thus reducing the cost. Fast 10Mbit/sec data transfer makes the network as fast as any other for the pcs. All standard networking applications can be run on the RPTI network. As the RPTI cards are fully Novell compatible, the network can be upgraded to work with Novell software without hardware changes, an ideal solution for a low cost start. RPTI network operations can be enhanced by installing optional software for E-MAIL to provide office electronic mail system. Remote boot server can provide facilities to install discless station in the network. RPTI cards are available for 8 bit, 16 bit and MCA systems and these cards can be mixed in a network. Networks can be extended by simply installing an additional card in the new station.

### COMPLETE KITS FOR THREE STATION NETWORK

NET3000 8 bit	£349(b)	NET4000 16 bit	£399(b)
Kits include 3 cards, Network Operating System, Manuals & Cables			

NET3000 Card	£115(b)	NET4000 Card	£129(b)	NET3000M MCACard	£175(b)
Longer cables and other Ethernet accessories available					

Detailed spec sheets available on request

### NOVELL/COMPATIBLE CARDS

Novell NE1000 Card 8 bit	£119(c)
Novell NE2000 Card 16 bit	£159(c)
Novell MCA Card 16 bit	£159(c)
E001 (NE1000 compatible)	£69(c)
E002 (NE2000 compatible)	£85(c)

### WESTERN DIGITAL CARDS

8 bit card with Boot ROM skt	£109(b)
16 bit card with Boot ROM skt	£149(b)
MCA card with Boot ROM skt	£159(b)
Wide range of ethernet accs in stock	

### ARCNET CARDS 2.5Mb/sec (Star or Bus Topology)

8 bit card	£39(c)	16 bit card	£65(c) pse specify STAR or BUS
8 Port Active Hub	£85(b)	4 Port Passive Hub	£9(c)

## JUMBO TAPE STREAMERS

### PC Week's "BEST BUY"

120Mb Internal tape drive	£169(b)
250Mb Internal tape drive	£219(b)
CK-38 Internal I/F Cable	£15(c)
KE-10 Ext Kit for above drives	£89(b)
TC-15 Tap Cont + Compression PCs	£149(b)
FC-10 Tape Controller	£79(b)
AB-11 Ext Tape Port Kit	£25(b)
700Mb Int. Drive & Card (AT)	£829(a)
700Mb Ext. Drive & Card (AT)	£950(a)

PS/2 Models Available

Software for UNIX/XENIX systems available

## DRIVE CONTROLLERS

FD Controller 2 drives AT	£20(c)
MFM Cards	
ST11M HD Controller XT	£35(c)
ST21M HD Controller AT	£29(c)
ST22M HD/FD Controller AT	£35(c)
ST01 SCSI HD Adaptor XT/AT	£19(c)
ST02 SCSI HD Adapt/FDC XT/AT	£29(c)
IDE HD Adaptor AT	£19(c)
IDE HD Adap/FDC AT	£29(c)
IDE HD Adap/FDC AT	£29(c)
IDE HD Adap/FDC/	
Multi I/O AT	£39(c)
WD 1009-SE2 HD/FDC	
ESDI AT	£179(c)
FUTURE DOMAIN Controllers	
TMC 1660 16 bit SCSI 2HD	£179(b)
TMC 1680 16 bit SCSI 2HD/FD	£195(c)
FD Cable: Single	£6(d) Dual £9(d)
HD Cable: Single	£8(d) Dual £12(d)

## I/O/MISC CARDS & PARTS

Parallel Port Card (2 ports)	£14(d)
XT 1 par/1 Serial Port	£16(d)
XT 1 par/2 Serial Ports	£21(c)
XT 1/2 Serial Ports	£12/£17(c)
AT 1/2 Serial Ports	£14/£19(c)
AT 1 Par/1 Serial Port	£18(c)
AT 1 Par/2 Serial Ports	£23(c)
AT 200W power supply	£52(a)
XT 150W power supply	£45(a)
Cherry 102 key k/bd (AT/XT)	£52(a)

## BARE FLOPPY DRIVES

360K 5.25	£39(b)	1.2Mb 5.25	£45(b)
720K 3.5 + 5.25 adaptor kit	£37(b)		
1.44Mb 3.5 + 5.25 adaptor kit	£42(b)		
CANON Two in One Drive: 5.25" 1.2Mb + 3.5" 1.44Mb Drives in one 5.25" half height frame. Only one power and one i/face cable reqd. Can replace a single drive to provide instant dual drive system. £109(b)			

Those ordering HD/FD drives must ensure their system is capable of handling them.

## FLOPPY DISCS

3M/SONY/TDK		3M/SONY/TDK	
3.5" 720K	£7.00	5.25" 360K	£5.00
3.5" 1.44MB	£12.00	5.25" 1.2Mb	£7.50
10 discs/pl	Carr (d)/pct	Add 10¢/pl for 3M formatted discs.	

### DATA CARTRIDGES Carr (d)

DC2000	£13	DC2080	£16	DC2120	£16
DC2120R	£17	DC300XLP	£14	DC600A	£14
DC6150	£17	DC6250	£20		

CARTRIDGE CLEANER KITS carr (d)  
Clean your tape cartridges regularly to ensure the security of your data on tapes.  
DC600/6000 Series £35 Refills: £8  
DC2000 Series £30 Refills: £7.50

### DRIVE CLEANING ACCESSORIES

Allsops Hi Quality Cleaning Kits (d)	
3.5" + 5.25" drive head cleaning kits	£7
5.25" cleaning kit + storage box	£9
5.25" drive head cleaning kits	£5
5.25" disc drive + monitor cleaning kits	£6.25
3.5" disc drive + monitor cleaning kits	£7.25
3.5" drive head cleaning kit	£5.50

ANTI GLARE SCREEN  
Universal screen filters which fit all 12" or 14" monitors. They enhance the screen resolution, brighten the colours, improve clarity and virtually eliminate glare and reflection. Conductive liner provides static and VLF radiation protection.  
12" Universal Filter £75(b)  
14" Universal Filter £89(b)



## COMPUTER MEMORY UPGRADES

COMPAQ			
386/20E 20 25 25E 286E	1MB 113131	£56(b)	
386S	1MB 113646	£56(b)	
386/20E 20 25 25E 286E	4MB 113132	£179(b)	
386S	4MB 112534	£179(b)	
386/20E 25E	1MB 113644	£95(b)	
386S	1MB 113633	£95(b)	
386/20E 25E	4MB 113645	£205(b)	
386S	4MB 113634	£205(b)	
386/33 486/25/33L	2MB 115144	£99(b)	
486/25/33L 386/33/L	8MB 116561	£279(b)	
DP286.386N & 386s	1MB 118688	£52(b)	
DP386N & 386s M20	2MB 118689	£90(b)	
DP286.386N & 386s	4MB 118690	£159(b)	
PORTABLE LTE286	2MB 117081-2	£109(b)	
PORTABLE LTE286	4MB 117081-3	£209(b)	
PORTABLE LTE/386s 20	1MB 121125-001	£119(b)	
PORTABLE LTE/386s 20	2MB N/A	£199(b)	
PORTABLE LTE/386s 20	4MB 121125-002	£299(b)	
PORTABLE SLT286	1MB 110235	£95(b)	
PORTABLE SLT286	4MB 110237	£349(b)	
PORTABLE SLT386	1MB 118303	£85(b)	
PORTABLE SLT386	2MB 118304	£159(b)	
PORTABLE SLT386	4MB 118305	£249(b)	
386/16 1Mb + Exp Bd	1MB 108069	£199(b)	
386/18 2Mb + Exp Bd	2MB 108069-71	£299(b)	
386/16 4Mb + Exp Bd	4MB 108070	£469(b)	
DESKPRO 386a/486, 486/25M, 486s/33M			
M Series	0-64MB 129160-001	£219(b)	
M Series	2-64MB 129160-002	£299(b)	
M Series	4-64MB 129160-004	£449(b)	
M Series	8-64MB 129160-008	£749(b)	
PORTABLE 486 Colour/M			
M Series	1MB 118688-001	£79(b)	
M Series	2MB 118689-001	£149(b)	
M Series	4MB 118690-001	£229(b)	
M Series	8MB 128277-001	£469(b)	

DELL			
200/210 Series	1/2MB	£36/£72(b)	
300 Series	1/2MB	£36/£72(b)	
310/316SX/320LS/325	1MB 3102104	£59(b)	
320LX/325D/325P/333D	1/2MB 3102505	£59/109(b)	
325D/325P/333 D/425/433	4MB 3102507	£219(b)	
425E/425TE/433E/433TE	2MB 3102389	£119(b)	
320N/LP	1/2MB	£79/£119(b)	

TOSHIBA			
T1000/E & XE/SE/LE	1MB PA8311	£72(b)	
T1000/E & XE/SE/LE	2MB PA8312	£129(b)	
T1200XE/E	2MB PA8306	£92(b)	
T1600T	2MB PA8302	£95(b)	
T2000SX	1MB PA8316	£85(b)	
T2000SX	2MB PA8317	£129(b)	
T2000SX/T1000LE	4MB PA8314	£239(b)	
T2000SX/T1000LE	8MB PA8315	£529(b)	
T2000SX/T2200SX	2MB PA2000	£174(b)	
T2000SX/T2200SX	4MB PA2001	£279(b)	
T2000SX/T2200SX	8MB PA2002	£599(b)	
T3100SX	2MB PA8308	£90(b)	
T3100SX	4MB PA8310	£169(b)	
T3100E	2MB PA8341	£89(b)	
T3200SX	2MB DA8307	£87(b)	
T3200SX	4MB PA8909U	£185(b)	
T3200SXC	2MB PA8318U	£95(b)	
T3200SXC	4MB PA8319U	£189(b)	
T3200	3MB PA7137	£159(b)	
T4400	2MB PA2003	£219(b)	
T4400	4MB PA2004	£399(b)	
T4400	8MB PA2005	£729(b)	
T5100	2MB PA8301	£95(b)	
T5200/T5200C	2MB PA8304	£80(b)	
T5200/T5200C	8MB PA8313	£369(b)	

ZENITH			
Supersport 286/286E	1MB ZA-180-66	£109(b)	
Supersport SX/286E/Slima't	2MB ZA-180-64	£159(b)	
Z-386/20/25/33/33E	1MB ZA3800ME	£63(b)	
Z-286/25/33	2MB ZA3800MG	£109(b)	
Z-386SX/286-LP+/Z-LS	2MB Z-605-1	£99(b)	
Masterport 386SX	2MB ZA-360-T	£169(b)	
Masterport 386SL	2MB ZA-4-4	£169(b)	

APPLE			
Powerbook 100/T340/170	2MB M1032LL/A	£249(b)	
Powerbook 100	4MB M1033LL/A1	£399(b)	
Powerbook 100	6MB M1034LL/A1	£699(b)	
Powerbook 140/170	4MB M1033LL/A	£429(b)	
Powerbook 140/170	6MB M1034LL/A	£669(b)	
Classic	1MB M6311LL/A	£59(b)	
Classic	2MB MA219	£109(b)	

IBM			
PS/2 30/286	2 MB 30F5360	£98(b)	
PS/2 ADAPT 6450367	2 MB 6450372	£101(b)	
PS/2 70 E61 121	1 MB 6450603	£49(b)	
50Z 55SX 65SX P70	2 MB 6450604	£89(b)	
PS/2 70A21 A61 B21 B61	2 MB 6450608	£89(b)	
PS/2 55SX 031 061 65SX	4 MB 34F2933	£165(b)	
PS/2 80-041	1 MB 6450375	£69(b)	
PS/2 80 111 311 121 321	2 MB 6450379	£85(b)	
PS/2 80 A21 A31	4 MB 6451060	£199(b)	
PS/2 50 50Z 55SX 60	2-14 MB 6450609	£249(b)	
NOTEBOOK L40SX	2 MB 79F0999	£99(b)	
NOTEBOOK L40SX	4 MB 79F1000	£199(b)	
PS/2 M579X	2 MB 6450902	£129(b)	
PS/2 M579X	4 MB 6450128	£189(b)	
PS/2 P76/90/95 in pairs	2 MB 6450902	£139(b)	
PS/2 P76/90/95 in pairs	4 MB 6450128	£219(b)	
386 Memory Exp Option	2-8 MB N/A	£199(b)	
386 Enh Memory Opt 85ns	2-14 MB 34F3077	£249(b)	
386 Enh Memory Opt 85ns	4-16 MB 34F3011	£369(b)	

SANYO			
17NB/18NB	2MB -	£109(b)	

COMMODORE			
Laptop	2MB	£119(b)	

AMSTRAD			
ALT286	4MB	£120(b)	
ALT386SX	4MB	£120(b)	

HP95LX - POQET			
HP95LX	128K F1002A	£95(b)	
HP95LX	512K F1003A	£179(b)	
HP95LX	1MB -	£279(b)	

PANASONIC			
CF170	1 MB	£59(b)	
CF270	2 MB/4MB	£110/£200(b)	
CF370	4 MB	£200(b)	

SHARP			
PC 6220/PC 6240	1MB CE-621B	£98(b)	
PC 6220/PC 6240 2nd Kit	2MB CE-621B	£190(b)	

## MISC. MEMORY AND CO-PROCESSORS

DRAMs (b)			
4164-120	£1.40		
4164-100	£1.40		
41256-120	£1.80		
41256-100	£1.80		
41256-80	£2.00		
44256-100	£3.50		
44256-80	£4.00		
44256-70	£4.50		
1Mb x 1-100	£3.50		
1Mb x 1-80	£4.00		

EPROMS (b)			
2764-20/25	£3.00	27256-20/25	£3.50
27128-20/25	£3.50	27512-200ns	£7.50

CACHE RAM (b)			
8K X 8-25	£7.00		
32K X 8-25	£15.00		

RAM CARDS			
XT Base Memory Exp Card	£25(d)		
from 64/128/256/384 to 640K			
AT Base Memory Exp Card	£32(d)		
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# TECHNOMATIC



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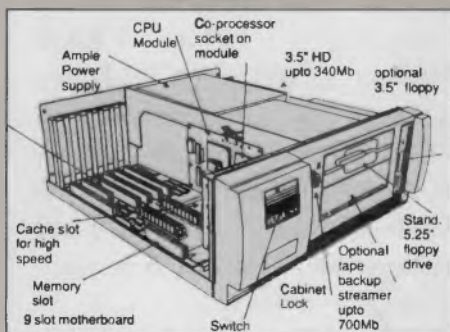
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## Imperial College Choose NAGA to Supply the New Generation 486-33 Systems

*NAGA ELECTRONICS LIMITED, LONDON, was awarded a contract to supply one hundred 486-33 personal computers to Imperial College of Science, Technology and Medicine, University of London.*

Imperial College and the CCTA, part of HM Treasury which advises on procurements in Information Technology, chose Naga to supply the systems after evaluating the products of more than a dozen leading micro-computer suppliers. According to Guy Saunders, Naga's Sales Manager, the contract to supply the one hundred systems was awarded to Naga at the end of June 1991, but the systems have proved to be so popular with the academic staff at the College that by mid-October, no less than two hundred and seventy systems had been purchased and installed in over twenty of the College's departments. A significant number have been installed in clusters of between ten and forty in teaching classrooms in departments as diverse as the Management School, Mathematics, Biochemistry, Environmental Technology, various Engineering schools and St. Mary's Medical School.

The Centre for Computing Services is responsible for developing a highly distributed computing environment, dispersing the Naga micro-computers and UNIX workstations throughout the campus, with every machine connected to the College campus network, an extensive ethernet based system using coaxial and fibre cable. The micro-computers are able to communicate with systems on the campus using TCP/IP protocols and the Vista-eXceed X-server software.

A wide variety of software applications are used on the Naga systems as befits the demanding requirements of a College with such outstanding research and teaching commitments. The machines are fully compatible with, and will run all programs that operate on, the equivalent IBM systems.

NAGA claims that the machines not only outperformed other contenders for the contract in terms of quality, performance and compatibility, but also in price.



### Standard Features

The Naga 486-33 systems supplied to Imperial College use the 33 MHz Intel 80486 chip with an 64k external cache and have a minimum of 4 MBytes of RAM (expandable to 64 MBytes), 85 MByte IDE hard disk, 3.5" floppy disk, 14" Super VGA colour monitor with 1 MByte card (1024 by 768 pixels by 256 colours), Western Digital 16 bit ethernet card, 102-key UK keyboard, Naga three button mouse, MS DOS 5 and MS Windows 3. Many optional features, such as bigger monitors and disks, are also available.

### Unique Security Protection

One of the unique features of the Naga system is a development of the standard Award BIOS to increase the security of the system. This BIOS prevents unauthorised personnel from gaining access to the system and prevents students from altering the configuration of the system.

A simple physical steel loop on the back of the base unit can also be used to prevent the keyboard, mouse and monitor from being removed.

Naga is committed to 'Quality and Value for Money', and all machines supplied emphasise this philosophy. The sales staff at Naga are always available to answer any enquiry for Naga systems.

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We even give you our service manager's home telephone number in case you are ever really stuck, and we will refund your money in full if your new HQ personal computer does not do everything we promise.

This exciting new machine takes its place alongside the equally impressive HQ486-33, which is available in ISA or EISA versions. The standard ISA model, the HQ486-33i, offers superb processing power. It includes an Intel 33MHz 486 processor with built-in maths co-processor, a 64KB cache, 4MB RAM, a 125MB hard disk, a 1MB Super VGA card, and two floppy disk drives (1.2MB and 1.44MB). There are six free slots for future expansion.

You also get a 14-inch 0.28mm colour multi-scanning monitor, a high quality keyboard, and either an attractive metal desktop or mini-tower case.

If your programs need to save and retrieve information to and from your hard disk continually, like Windows, CAD/CAM, DTP or busy multi-user and network applications, you will be

stunned how much faster they run on the HQ486-33e, thanks to the built-in 1MB (expandable to 8MB) intelligent bus-master SCSI hard disk controller - a powerful computer in its own right.

The HQ486-33e is supplied with a full 256KB of cache memory, a 200MB 15ms 64KB read-look ahead buffers SCSI hard disk, five free EISA BUS slots for future expansion, and a stylish tower case.

Both 486 models are supplied with genuine MS-DOS 5, Microsoft Windows 3.0 and a Microsoft Mouse, (all available as low cost options for the HQ386SX-25). Other options on all three models include 17-, 20-, or 21-inch colour monitors, extra RAM (up to 64MB on the 486s), additional hard disk drives, CD-ROM and optical disk drives, and tape streamers.

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# Mega I/O and chips with mips threaten mainframes

The mips war is over: microprocessors can now perform more millions of instructions per second than mainframes, and developments in multiprocessing mean buyers can have as many processors as they can pay for. Indeed, they're almost certain to get more than they can use. The problem now is to provide input/output (I/O) capabilities that match the mips. But while there are lots of 'compute servers' — transputer farms, Intel iPSC hypercubes and so on — there aren't many real file servers around. Most are just bog-standard PCs or workstations repackaged in boxes big enough to hold a few extra disk drives and back-up tapes.

Enter Auspex Systems Inc. This American start-up has just launched itself on the UK market, via Thame Microsystems, with the beautifully-styled NS 5000. NS stands for Network Server: it is optimised to deliver not the most bangs for the buck, but the most I/O. US customers include Adobe, Amdahl, Compaq, Cray, Stratus and Xerox — plus a wedge of semiconductor manufacturers including Intel, Motorola and Texas Instruments.

## Dedicated I/O cards

The Auspex design is based on using dedicated cards to handle I/O services, with each card having its own microprocessor — usually a Motorola 68020. You can have up to four Ethernet cards, each handling two networks, two file processor cards handling NFS, and three parallel SCSI cards, handling up to 60 disks in RAID arrays (that is, 81 gigabytes of storage assembled from racks of cheap PC-style drives). The various cards fit on an enhanced VME backplane bus that runs at 55 megabytes/second. The whole caboodle is managed by a Motorola or Sun Sparc host processor running the appropriate version of SunOS (Unix).

The design goal was to achieve 1000 NFS read IOPS (Network File System input/output operations per second), which means driving eight Ethernets at 90% utilisation. Auspex claims a bench-

mark result of 1306 NFS IOPS. At this rate, you wouldn't notice the difference between accessing files across a busy network and on a local disk. In fact, with many workstations, the built-in hard drive would be slower.

## Parallel move

The point of all this is not that you should run out and buy an Auspex server. Unless you've got a big network of Unix workstations, probably in multiple LANs, you don't need one. If you don't have £100,000 or so to spare, you can't afford one either. The point is that a dedicated file server, optimised for I/O, can blow the doors off a traditional mainframe that costs 10 to 100 times the price. (That is, of course, why Amdahl is an Auspex customer.)

And clearly, the techniques used by Auspex Systems — and Pyramid in its MServers, and other firms — will soon be applied to file servers aimed at PC networks. In fact, firms such as NetFrame and Parallan have already begun to apply them.

The fly in the ointment is that the PC LAN market is dominated by a monolithic, single-processor operating system, Novell NetWare. That's why Compaq has just, in effect, removed one of the two processors in its latest SystemPro servers — NetWare doesn't get any real benefit out of it. But it is no secret that the writing of a parallelised version of NetWare is well on the way. Indeed, Novell has recently announced deals with Sequent, Stratus and Hewlett Packard which mean NetWare will end up on a variety of multiprocessor machines. The effects could be dramatic.

At the moment a lot of old iron is kept going because otherwise, as data processing managers point out, 'Well, you can't get the I/O, dear boy'. If you take a single-user desktop design, it's blindingly obvious that you can't get the I/O. But you can, using cheap PC processors and cheap PC drives, get the I/O if you design it in. Auspex proves it.

Jack Schofield

## 2.2Gb in CD-ROM form at your fingertips

Instant access to 2.2Gb of data would improve anyone's life, even if it's 'dead' storage in CD-ROM form. Hitachi offers just that in a nicely-packaged desktop system called, with typical finesse, the CI4000. It's a mini-tower with two or four CDR3600 or CD3650 CD-ROM drives built in, and you can link two mini-towers if you want access to eight discs at the same time.

The two-drive system costs £1195 plus VAT, and the four-drive version costs £1995. The price includes an AT-bus card and software to use it from a

DOS-based PC. MCA-bus cards and SCSI versions of the CI4000 are due.

Attica Cybernetics, however, is not impressed. It is already selling a CD-ROM Server which is a fully configured MSDOS tower system — 20MHz 80386, 2Mb of RAM, 40Mb hard drive, monitor, keyboard, and CD-ROM and Ethernet (or other network) interfaces. Into that tower you can stuff up to 10 high-speed CD-ROM drives; if you add extension cabinets, you can have up to 32 drives. That way, up to 100 PC users can share 32 drives, or more than 16Gb.

Attica's workmanlike CD-ROM Server lacks the slick finish and hinged plastic door of Hitachi's mini-tower, not to mention the Music Box software. (That allows you to play music CDs from DOS or Windows 3, and comes complete with headphones.) But Attica claims its server is selling well to libraries and to the higher education market.

Contacts: Hitachi Sales (UK) 081-849 2092; Attica Cybernetics Ltd (0865) 791346.

Jack Schofield



## Fighting DEC to launch RISC superchip for Unix and VAX VMS

The Digital Equipment Corporation is getting aggressive. At the end of last year it launched some new VAX minicomputers that were 250-300% faster than its previous models, then went gunning for Sun with some new Mips-based workstations. And there's more to come. DEC is planning to bring out its own 64-bit RISC (Reduced Instruction Set Computer) processor, codenamed Alpha, to run both Unix and VAX VMS software.

The first Alpha machines should appear in the autumn, probably in a high-priced minicomputer. But the new chip is also said to be scalable — it can be used in anything from a palmtop to a supercomputer, and Cray is reportedly interested in using Alpha chips for the latter. However, rolling out a full range of Alpha-based machines will take at least two years, and possibly 10. It remains to be seen whether that will be too little and/or too late.

Hewlett Packard, with unusual prescience, made the same strategic decision in about 1984. It has already moved all its proprietary MPE and Unix (HP-UX) systems to its own Precision Architecture (HP-PA) RISC system. Nonetheless, it is only just starting to make an impact on the workstation market with the Snake (HP Apollo 9000-720 and so on) models, which are currently the world's fastest single-user machines.

Alpha processors are not going to take over the world, any more than HP-PA chips are; indeed, it's not clear that even the IBM/Apple agreement to push the RS/6000 processor will be able to dent the Intel/Sparc hegemony. But the Alpha design doesn't

have to do that. It only has to stop huge numbers of VAX users from defecting to cheaper, faster Unix boxes... or if that isn't possible, to make sure they move from VAX/Alpha to Ultrix/Alpha.

Since man does not compute by hardware alone, the defence of the VAX user base will also involve making the software compatible. DEC has not revealed its plans for an Alpha-oriented version of VMS, but if it requires more than the straightforward recompilation of current software, there'll be a national outcry.

DEC wasn't exactly a hot, trendy company in the 1980s. It missed out on the PC revolution, flunked the RISC challenge, and was desperately slow to wake up to the potential of Unix, which was, after all, written on DEC machines. Nevertheless it still managed to grow from being a \$2.3 billion company to roughly \$14 billion today, which is more than Apple, Compaq and Sun combined.

Unlike IBM, DEC, in preparation for the NINETIES, has already incorporated OSI standards into its proprietary network, DECnet, and it has a Posix open systems interface almost ready on VMS. It has a wide range of fault-tolerant VAXen, and is already selling a massively parallel machine sourced from Maspar. It is selling Apple Macs in Europe, and making Microsoft Windows a key part of its client/server offerings. And so on.

The conventional PC-market wisdom that all the old mini makers are about to go down the tubes may just turn out to be a slight exaggeration.

Jack Schofield

## Sharing, caring code creates the 'community supercomputer' from networked NeXTs

If Sun's slogan is 'The network is the computer', NeXT Computer's might be 'The network is the supercomputer'. NeXT's chief scientist, Dr Richard Crandall, has just won the 1991 Smithsonian Award for Science for a project which turns a network of NeXTs into the equivalent of a Cray.

'Zilla, the Community Supercomputer', works by distributing parts of a computation across the network. A 'slave' thread on the Zilla workstation goes through a list of permitted machines. If it finds one that's idle, it uses the Unix `rcmd(3)` library to execute processes on that machine. Results are sent back to a specified NFS directory. If there's any input from the keyboard or mouse, Zilla retreats.

A network of 50 NeXT workstations would have 400Mb of memory, at least 1Gb of virtual memory, and run at about 250 mips (million instructions per second). Crandall calls 100

workstations one Zilla unit (zu), which approximates to one supercomputer. Of course, it has nothing like the input/output capability, but it has applications. For example, Zilla has discovered a factor of F13, the 13th Fermat Number (the number is  $2^{2^{13}}$  plus 1, and the factor is 2,663,848,877,152,141,313) and tested exponents up to 8,388,019. It has also been used to generate an animated colour film, with each workstation generating one frame every few hours using a Zillified version of Pixar's RenderMan software.

The idea of turning a network of desktop machines into a supercomputer is not, of course, new. David Gelernter and a group at Yale University have been doing it for years using Linda, a small set of extensions to conventional computer languages. More recently, a number of Macintosh software developers have demonstrated rendering soft-

ware that uses similar processing-sharing techniques. The neat thing about Zilla is its ability to use machines which otherwise wouldn't be doing anything useful. Crandall says: 'Zilla achieves a sort of environmentalist's dream, using the so-called recyclable power of desktop computers. Communities can now create supercomputers in their own schools and offices.' That will be handy for people who want to do their own long-range weather forecasts, simulate black holes or investigate the meaning of life (old sci-fi joke: 'Is there a God, Zilla?' 'There is now!').

Oh yes, Zilla is named after Godzilla. 'I understand that in modern Japanese folklore, Godzilla was not fundamentally aggressive, but only attacked when the situation called for intervention,' adds Crandall.

NeXT Computer UK can be contacted on 081-565 0005.

Jack Schofield



# PC-on-a chip could breed new palmtops

Palmtop DOS PCs have been receiving a lot of attention recently, now the technology exists to make it possible (indeed, easy) to manufacture them.

Expect to see a lot of machines coming out of the Far East. A joint venture, called the 'Companion PC' and led by Phoenix Technologies, aims to provide would-be manufacturers with all the 'bits' for a palmtop system. Lotus provides a set of personal information management tools in ROM (similar to those on the HP palmtop), Microsoft provides MSDOS 5.0 in ROM, Duracell provides the power, Intel provides the PCMCIA standard for RAM cards, and DIP and Phoenix will show manufacturers how to bolt the whole thing together in a 6x10in package.

The heart of the machine will be the new Chips & Technologies PC\Chip — a working PC chipset on a single chip. The PC\Chip looks like an 8086 processor to the operating system, and uses a similar amount of power, but it has the speed of a 16MHz 386SX, according to DIP.

David Frodsham, DIP's managing director, claims that the first computer based on this technology could be ready by the middle of this year and will cost around £1000.

## 2Mb in your hand

If you can't wait that long, take a look at the 8.8x4.4in Sharp PC-3000, which DIP helped to develop. It costs £680 with 1Mb of internal RAM, or £999 with 2Mb, for a full PC-compatible you can pop in your pocket.

The PC-3000 is based around the 10MHz 80C88A processor, weighs less than 1lb, and comes with the usual suite of Personal Information Management applications, plus a spreadsheet in ROM. It takes two PCMCIA-compatible RAM cards for storage (currently available in sizes up to 2Mb) and an optional external floppy disk drive. It draws its



power from three standard AA batteries, which give it an average life of 35 hours.

For a taste of the exotic, though, how about an 286-based palmtop? A Hong Kong company, Palmcom International, showed one off at Comdex which sounded fascinating. It's about the size of the Sharp PC, with similar specifications, but its processor is a 16MHz AMD 80286 and it is dockable. Plug it into the 'Portable Super I/O Expansion Interface' and you can use a standard keyboard and VGA display, plus additional serial and parallel ports. Alternatively, the 'Multi-function System Docking Station' gives access to hard and floppy disks and AT-bus expansion slots.

The suggested retail price for the basic unit is \$995 (around £550), which makes it sound quite appealing. Unfortunately, Palmcom hasn't established UK or European distribution yet, even though it designs the machine in France. Its Hong Kong number is 852 753 0380.

Contacts: DIP (0483) 301555; Sharp 061-832 6003.

David Brake

△ The Sharp PC-3000, designed in Britain by pocket computer specialist DIP

# Microsoft hard on plucky rival DR

It looks like Microsoft may be playing dirty pool in an attempt to wipe out its plucky DOS rival Digital Research. It will not help DR in the States to resolve incompatibilities between Windows 3.1 and DR-DOS 6 and won't even let DR become an official beta tester.

Microsoft UK is echoing the US parent's unsympathetic line. David Smith, Manager of Systems Marketing, said: 'Basically, we are competing with them and therefore we won't help them make their clone compatible. If we were going to help them, we would have to see their source code and they would have to see ours. We are not, however, doing anything to prevent DR DOS 6 from working with Windows 3.1.'

Microsoft has helped a number of similar companies work with Windows 3.1, including Quarter-

deck and Qualitas, makers of memory management utilities. It is even helping Novell, DR's parent company, to ensure that NetWare works, despite the competition between NetWare and LAN Manager. Smith says Microsoft would help DR if it were developing Windows applications or utilities, but not to make its core product compatible.

Duncan Baldwin, DR's European Marketing Manager, complains: 'We cannot understand why Microsoft is not co-operating with us on this.' He said DR still aims to make DR DOS compatible with Windows 3.1, which is in any case not due out until the second quarter of this year, by which time the issue may have been settled.

Digital Research is on (0635) 35304; Microsoft is on (0734) 391123.

David Brake



# UK radio networks get off the ground at last

If you dream like me of linking your computer with your office wherever you are, and you've been reading about the way things are advancing in the US with wireless communications, well, don't hold your breath.

You can use conventional cellular networks to communicate, but they tend to be slow and you get charged for the time you are connected — the data-only networks charge only for data transmitted and received. The good news is that there are three networks in the UK dedicated to data transmission (all incompatible with one another, of course).

One of them belongs to the Cognito, but that is marketed at the moment as being strictly for short text messages (though it can do rather more — see the Hardware Benchtest on page 210 of this issue). The other two, from Hutchison Mobile Data and RAM, are currently being used only on pilot projects. Hutchison and RAM will talk to you if you are a large company (or a manufacturer interested in making your machines compatible with their networks), but their products are not going to be a commodity for a while.

Hutchison demonstrated its network with the IBM PCRadio in November, but only with an external modem — an internal modem won't be ready until mid 1992 at the earliest. Poqet and GRiD are also working on building Hutchison capability into their machines — Poqet is expected to have something around June but GRiD wouldn't give a date. At the moment, the network works only

at 4800 baud, but it's due to be uprated in a month or so to 9600 baud.

Hutchison is claiming 75% coverage in the UK. This sounds fine, but you can't just go to a dealer and buy a few radio modems: the company isn't publishing prices of either hardware or air time (except to say that air time should be cheaper). Instead, it will 'tailor solutions' for customers with large staffs needing to connect to host systems.

## Major coverage

RAM's case is similar. The network has been running since July and presently covers the major cities in Britain. By the end of this year it should cover 80% of the population. The same system has been used throughout Scandinavia for several years and has a speed of 8000 bps. But again, it is not aimed at the man on the street and the only price indication is that it will be 'cheaper than conventional cellular' for short transmissions. Also, unlike the Hutchison system, RAM modems are not Hayes compatible.

Contacts: Hutchison Mobile Data (0992) 553318; Poqet (0895) 430001; RAM 081-990 9090.

David Brake



# Link-ups continue after industry 'all change'

Just when you think you've got all the industry alliances sorted out, the members start jockeying for position again. Here's the state of play at the time we went to press:

- When IBM announced last year that it and Apple would be working with Motorola to produce a new RISC chip, you might have thought this would be the beginning of the end of its relationship with Intel. But no — IBM and Intel will be setting up the Robert Noyce Centre in Boca Raton, Florida, to develop jointly the next generations of Intel CPUs. This, competitors fear, will put IBM three months or more ahead of other manufacturers. Compaq, in response and in a bid to make its machines cheaper, is rumoured to be looking at using AMD Intel-clone processors.

- When DEC became one of the founder members of ACE, you might have thought that DEC would push the MIPS R4000 RISC processor for high-performance work and push Windows or OSF/1 for desktop use. Indeed, DEC and Microsoft have an-

nounced a joint development and distribution agreement — Microsoft will be extending Word and Excel for Windows to support DEC's Network Application Support, and DEC customer-support centres will handle selected Windows products.

But DEC and Apple also have a relationship, and they recently reinforced it — DEC can now supply Macs and connectivity products directly to its customers, and AppleCentres can supply VAX and RISC-based servers and PATHWORKS software.

And DEC is apparently unsatisfied with MIPS' RISC solution, at least at the high end. It recently announced a plan to introduce a new, ultra-powerful 100 MHz RISC chip called the Alpha. It will initially power new top-end VAXes in the middle of the year, but near the end of the year the first Alpha workstations should emerge, running OSF/1-flavoured UNIX and VMS.

This new processor will not be limited to DEC, however — it can be licensed by anyone, just like the MIPS chips. Initially, there should be no conflict between DEC's three processor families — Intel processors at the bottom, MIPS in the middle and Alpha on top. In the future, however, the MIPS chip could be squeezed out as Intel chips get more powerful and the Alpha chip gets cheaper.

David Brake



## New Citizen Inkjet

Citizen Europe has unveiled the Projec, its first entry into the inkjet printer market. The £496 machine offers 300dpi resolution, cut sheet and tractor-feed handling, with claimed print speeds running up to 360cps. It prints in either landscape or portrait format on an A4 sheet in any of three fonts. It should ship this month.

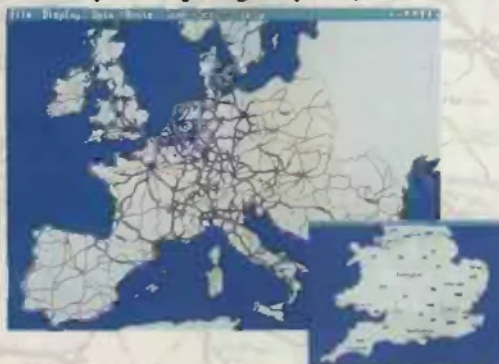
Citizen is on (0895) 72621.

Danny Bradbury



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# The 286 lives on as a trade-in

## New Apple printer

The specifications and timing of Apple's first RISC-based printer are starting to leak. US sources indicate that a PostScript Level 2 LaserWriter based on the AMD 29005 will come out as early as March at under \$2500 (around £1400).

In keeping with Apple's policy of opening up to the outside world, this latest printer is rumoured to include a parallel port and HP IIP emulation.

Apple is on 081-569 1199.

David Brake

The 286 machine has been taking a bashing recently, and rightfully so — the 386SX costs very little more to produce, gives better performance, and is much more suitable for running Windows or Unix. Compaq and Tulip recently discontinued 286 lines, and Dell has vowed to do the same thing very soon.

Compaq UK was told to cut its 286 lines in the middle of December. As a result, the 286N desktop machine was ousted, as was the LTE 286 laptop. The only AT unit left in the range is the SLT 286, which bridges between a laptop and a desktop due to its docking station capability.

Tulip announced the discontinuation of its 286 machines a week before Compaq. Tulip's managing director, Steve McCall, explained that economies of scale would not allow his company to lower 286 prices any more, meaning that Tulip couldn't justify the product. With 286 business diminishing, he dropped the range and introduced three 386SX machines at the same price. You can now pick up a 1Mb 386SX, expandable to 17Mb on board, with a 40Mb hard drive for as little as £1015 from Tulip.

The increasing popularity of graphical user interfaces is largely to blame for the overshadowing of the 286. You need at least a 386SX to run Windows 3 sensibly — and there are 7 million copies of Windows out there already. When the vastly improved Windows 3.1 and OS/2 2.0 finally emerge, the battle will really begin and the 286-based AT will be left behind.

All the market has to offer older PCs in the way of GUIs are ageing GEM, and products like Geoworks Ensemble, a mouse-driven proprietary interface which, while looking very pretty, only has its own applications and cannot be expanded.

## Multimedia

The MPC consortium tried to keep the 286 breathing by including the machine in its multimedia standard. However, people were sceptical about the ability of the 286 to handle multimedia —

arguably the Next Big Thing to hit the industry. Then the consortium found that it couldn't even run its own demo disks on a 286. It looks as if a second standard will have to be compiled — this time with a 20MHz 386SX as the standard machine. That would be yet another nail in the 286 coffin.

At least one company is trying to flog a new 286 model, though. Comcen Technology is promoting a 40Mb 12.5MHz colour VGA 286 for £595. The company claims that there is a lot of life left in the 286 market, because 'people will still want a basic machine for home use'. This may be true, but they may wish to stretch their wallets

just a little further and buy something which is a great deal faster.

'Even the beginner would be foolish to buy anything less than a 386SX,' said Philip Kleinman, marketing manager of London-based HiGrade. Kleinman recently helped formulate a trade-in scheme which enables users to part-exchange older ATs. You can get £585 off HiGrade 386DX or above, by handing over your old AT. Thus, a 386X-40 machine with a 40MHz AMD 386DX chip, 4Mb of RAM, a 52Mb hard drive and a 64K cache, together with the two floppy drives and the mono VGA monitor, will set you back only £895.

Old 8086/88-based XT's can get you a £225 discount. This brings the price of an AMD-based 386SX/25 with 2Mb of RAM, a 52Mb hard drive, two floppies and a mono VGA monitor down from £920 to £695. Alternatively, HiGrade will upgrade your machine to a 386SX/25 for £265, or to a 386X-40 with the 64K cache and 4Mb of RAM for £595.

## IBM gets in on the act

HiGrade claims it was the first company to offer these trade-in deals, but it certainly isn't the only one. Even IBM has got in on the act, though it is keeping quiet about the details. IBM is known to have told its dealers to offer users the chance to trade-in their old IBM kit for new PS/2 models — and until the end of last year, users could even trade-in non-IBM hardware.

You can get £160 for an AT against a low-end PS/2, £205 against a Model 70 or 80, and £235 against a 486. Your old PS/2 model 50Z will get you £300 against a low-end model, £345 against a Model 70 or 80, or £375 against a 486 machine.

The scheme started around last October, and IBM's dealers seem happy. 'It shows people that their old machine is still worth some money,' said one. 'Whether they've got 8088 or 286 machines it gives them the opportunity to trade up to a new technology like OS/2 or Windows.' What IBM will do with the machines it gets is unclear — it is talking to a number of resellers and may have them re-conditioned and re-sold with a different badge.

If HiGrade's upgrade scheme works, Kleinman may well try to ship the machines out to the education market. Underfunded schools and colleges which need cheap machines for lessons and administration could benefit from a 286. They are unlikely to need very powerful software, and a school that has survived for five years on a BBC would see a 286 PC like a gift from the gods.

Kleinman says: 'Our objective is not to make money out of the used machine market.' He would almost prefer users simply to pay to have their machines reconditioned. 'It saves us the hassle of getting rid of used machines.'

Contacts: HiGrade 081-591 9040; Tulip (0293) 562323; Compaq 081-332 3000; Dell (0800) 414535; Comcen (0792) 589988.

Danny Bradbury

## Up and ATM!

Adobe has improved ATM for Windows. The new version is supposed to work twice as fast as before on 386 and 486-based computers, and will work with Windows 3.1. It also has enhanced printer support, can automatically download new fonts to PostScript printers, and can be set up to avoid conflicting with HP LaserJet III scalable fonts with the same name.

Phone Principal Distribution on (0706) 217744.

David Brake



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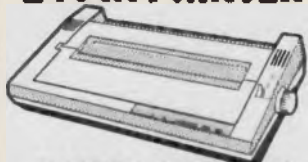
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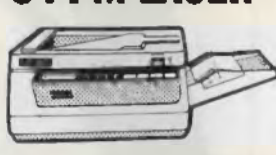
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# CA assaults Windows market on four fronts



Computer Associates is one of the largest software companies in the world, with a turnover of more than \$1.3 billion. Chances are, however, that you will only have heard of it because of its very cheap SuperCalc DOS spreadsheet. The company gets 90% of its revenues from minicomputer and main-frame software, but CA foresees the coming crunch. By 1994, it is hoping to derive 50% of its revenues from PC products.

CA foresees a Windows future and wants to take a big slice of the market — its objective is to offer a bigger selection of Windows products than Microsoft. This stance is interesting: as a company with large amounts of IBM software development under its belt, CA would seem more likely to develop for OS/2 version 2. But UK marketing manager Mike Maunder points out: 'Windows is the platform our customers have told us they are investing in, so it will be our primary market. We have OS/2 products and we will continue to develop for OS/2, but it isn't our primary focus.'

## Assault on the UK

CA chose to start its Windows assault in the UK with a rather motley assortment of software: CA-Textor, an entry-level word processor; dbFast, a dBase III Plus-compatible; CA-UpToDate, a scheduler; and CA-PHIPS, an image processing program.

The two primary programs, Textor and dbFast, don't seem likely to set the world on fire, judging from the little seen of them at the launch. Textor is the only product at the launch that was developed inside CA. Shipping in February, it looks like a fairly straightforward, not-too-fancy Windows word processor. It includes a user-defined toolbar (a feature that looks like it may become standard to most Windows programs) and a table editor. Its big advantage is that it costs £129, so it may gain a niche

as a word processor for Windows users who aren't primarily word processor users.

dbFast should be the first dBase-compatible Windows program on the market, and it will allow users to add check boxes, radio buttons and other graphical features to their existing databases. Unfortunately, from first appearances, it looks as if the way this is done is still pretty primitive — to put a button on-screen, you can't just draw one, you have to put a line of code in saying: 'CREATE BUTTON AT 10,10'. dbFast supports DDE and multi-user data sharing on a LAN with DOS workstations.

At the moment, dbFast has the field to itself, but the big players like Microsoft and Borland/Ashton Tate are investing a lot of money and effort in the Windows database market, and dbFast will have to measure up to whatever they come up with. Still, it costs a relatively modest £339, and it works — it was around as a Mac product and then a DOS product marketed by Genisoft before it came to Windows and CA bought it up.

CA-UpToDate, a network scheduler from a French company called Planisoft, is due out in February. It was also originally a Mac product. Though it is not as broad-based as the other products, it looks like it might be one of the more interesting. It is feature-packed, and groupware is one of the trendiest development areas. The original Macintosh program has been withdrawn for an overhaul — when it re-emerges, it will communicate across networks with its Windows partner.

Finally, CA-PHIPS is a Windows-based 'Professional High-resolution Image Processing System'. It takes existing images from a variety of programs and can scale them, compress them (using a software implementation of JPEG), adjust the colours in them, produce colour separations, and translate them into several different formats. It will cost £279 and should be available sometime this quarter.

## Sony goes soft on the PTC-300

A slightly modified version of the Sony PTC-300 (similar to the Sharp Wizard but using only pen input) is now available. The PTC-300 has a plastic cover and is now called the 'hard' version. The PTC-310 has a leather cover instead of the 300's plastic cover, and is called the 'soft' version. Both share the same specifications: 256x320 LCD screen, 80K of user memory and an 8MHz 68HC000 processor.

Sony has also released two items in the VISCA (Video System Control Architecture) range. The CVD-1000 is a Hi8 8mm video recorder with a computer interface in addition to the normal inputs and outputs. The computer communicates with the recorder via mini-DIN connectors, and equipment conforming to the standard can be daisy-chained.

The computer port runs at 9600bps. For existing equipment, the CI-1000 is an interface unit with two VISCA through ports, a LANC connection to the recorder and Control-S line to the television. Control and image manipulation software is currently for the FM Towns and Apple Macintosh. The CVD-1000 lists for ¥248,000/£1100 and the CI-1000 is a more affordable ¥33,000/£145.

Paul Hardy

## Mystery over Windows spreadsheet

A great deal of mystery hangs over the nature of CA's Windows spreadsheet offering (or possibly offerings). In the US, CA has announced that a Windows version of SuperCalc won't be available until the first quarter of 1993, but it already has a second, powerful and multi-dimensional Windows spreadsheet on the market called Compete. This used to cost \$4995, but the price was reduced to \$995 when it was bought up by CA. It allows you to work with your data in several dimensions and switch between them at the click of a button.

Just to confuse things still further, CA has also bought Access Technology, whose 20/20 spreadsheet is available on a wide variety of platforms, particularly the DEC VAX. The UK office refuses to be drawn on which one (or combination) of these products will be launched in the UK, but it looks like there will be plenty of interesting technology for it to incorporate. Phone CA on (0753) 577733 — by the time this issue has hit the streets, the company may be willing to talk.

David Brake



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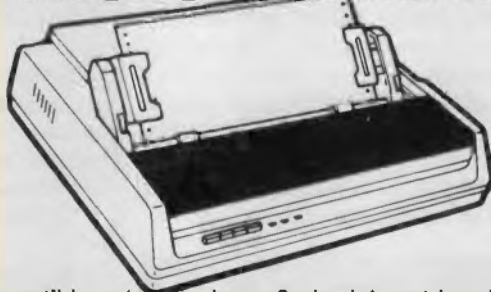
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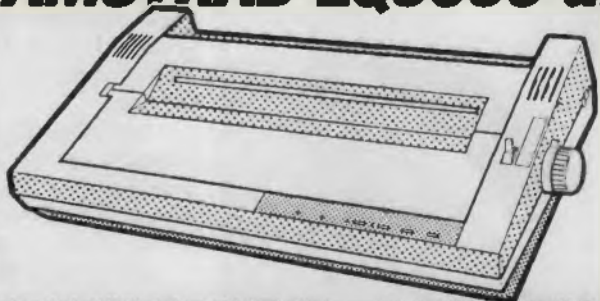
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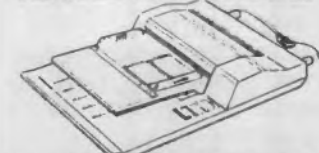
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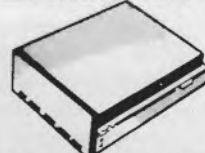
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# Infralink's unregulated range takes computers back to the age of wireless

The big difficulty with most of the cable-less communication devices that are being produced today is that because of the different frequency regulatory authorities, it is currently almost impossible to manufacture a single device that will be usable worldwide.

Infralink, a German company which has recently launched a cable-free printer sharer, gets around this problem because its product range is based on the unregulated infra-red spectrum. Unfortunately, IR acts more like light than radio waves and thus it cannot go through opaque objects, and doesn't travel very far.

By using diffuse IR (bouncing signals off walls and ceilings), Infralink's new products can commu-

nicate with each other even when they have no direct line of sight, but only to a distance of 7 metres (with line of sight, the range goes up to as much as 70 metres). The biggest problem with the product, however, is its expense. You need one £179 box on the parallel port of each computer and one on each printer.

Provided they are in range, as many PCs as you like can be connected to up to eight different printers; no special software is required to make it work, you just switch between printers using buttons on the transmitter. It transmits at 40kbps per second, which is adequate for printing purposes but would be too slow for network use.

Infralink's next product, which will provide both serial and parallel transmission, will transmit at ten times the current speed. While the company intends to stick to perfecting hardware for the foreseeable future, once it has a serial product, cable-free networks will be available using third-party software. Some of the other new products Infralink is looking to provide are infra-red cards to fit into the slots of portables from Toshiba, Dell and others.

Later, Infralink hopes, portables will be built with its technology inside — in fact, a different infra-red technology is already built into the Hewlett Packard 95LX, but the unit has to be placed less than a foot away from the target printer, and in line of sight.

According to the company, error-free data transmission speeds of more than 16Mbps per second are possible. This technology may, in time, help free offices from cables for good, but not until the price drops substantially.

Infralink is distributed by Frontline on (0256) 463344.

David Brake



## New cheap DECstation

DEC's new Personal DECstations 5000/20 and 25, starting at £2896, appear to be the cheapest dedicated Unix workstations yet — certainly they have the lowest prices quoted by a major supplier. It's hard to gauge how much of a bargain this is, however, because as usual the prices quoted by big suppliers are highly variable.

The DECstation 5000/20 contains a 20MHz MIPS R3000 processor (giving a performance of 16.3 SPECmarks), but this is on an upgradable daughterboard so it can be replaced by an R4000 when MIPS releases it. It

also has built-in 8 bit 1024x768 pixel colour graphics, but this can be upgraded and accelerated through one of the two TURBOchannel slots.

For multimedia fans, DEC can also provide a full-motion video card, and the workstations come with audio input and output as standard. Needless to say, since DEC is one of the moving forces behind the ACE consortium, everything about these new machines is ACE-compliant. Unfortunately, nobody really knows much about what that means.

Hewlett Packard and IBM may be planning to rain on DEC's parade as

every workstation manufacturer tools up to attack the entry-level market. All signs point to a new low-cost workstation from HP in January, and another from IBM in March. The IBM machine should have a speed of around 21 SPECmarks and will look something like a NeXTstation.

Details of price and specifications on the HP machine are still sketchy, but the rumours that are circulating suggest a price anywhere between \$5000 (£2750) and \$10,000, and speed as high as 50 SPECmarks (three times faster than DEC's new offering). Unfortunately, HP has been having trouble getting hold of key chips, so supply may be tight for some time after the launch.

DEC is on (0734) 868711.

David Brake



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## Lotus licensing

Lotus seems to have followed WordPerfect's lead on network licensing deals, albeit six months later.

The company has announced new purchasing agreements, allowing users to buy multiple copies of selected Lotus products. 'Multipacks' of 5 and 20 copies are available at discounted prices.


There is a 10% discount on Lotus 1-2-3 or Freelance Graphics in a five-user pack, and a 20% discount on 20-user packs. For Ami Pro, five-user packs get you an 18% discount, and a 20-user pack saves you 28%.

This is all very well, but for two things: WordPerfect did this last year, and offers much more sensible deals. Secondly, a 'node' version of Lotus 1-2-3 used to be discounted at 21%, meaning you are out of pocket if you buy 5 or 10 copies. • Lotus has announced a separate deal aimed at new Windows users. You can buy Ami Pro 2.0 and Lotus 1-2-3 for Windows together for £525, a saving of £395 over the price of both together. But no multiple-use discount is available on top of this deal.

Lotus is on (0784) 455445.

**Danny Bradbury**

# Big Blues as paralysed IBM shapes up for the nasty Nineties

 Last year was a turbulent year for US computer giants. It saw IBM's share of the PC market in the US slip from 23% to under 20%. The company was not alone in this area. Compaq and Apple also saw their US sales go flat and their market shares dip. At the same time, clone makers from Korea and Taiwan got a foothold in a market that all three used to own almost uncontested.

Distribution also went through major changes as direct marketing took off and the superstore concept gained a major foothold even in the corporate market. By mid-year, it became clear that the top three companies would need changes even to maintain their current market share. Consequently, IBM and Apple partnered up, and Compaq directors led a coup against the founding leadership and injected new strategies to halt the decline in their market share.

But IBM needed serious changes in its decision-making process to stay strong in the coming decade. As early as March 1990, it was signalling a major rethink. Managers spoke of changes looming, and insiders predicted that business units inside IBM, with their own profit and loss accounts, would be given autonomy. Even back then there were suggestions that IBM might spin off its PC division and let it run more like an Apple or a Compaq. Insiders also spoke of massive layoffs — or as IBM puts it, retirement incentive programs. But it took 18 months and accelerating market conditions to force IBM into a shake-up.

An elephantine approach to decision making has virtually paralysed the company over the past two years. It stayed competitive doing business as usual in the 1970s, and for the most part even the 1980s — but the 1990s hit it like a ton of bricks. IBM has realized that it can no longer can afford the luxury of decision by committee or consensus. The past two years have seen the computer market change so fast that IBM's normal product development time of 18 to 24 months has left the company way behind competitors. Its traditional 'bigger and better' approach suited some customers, but not always the new markets that were emerging.

A good example is the notebook market. I remember as early as 1985 talking with IBM engineers about the portable computing market. They had on the drawing boards a machine much like the notebook they have out today. But the top management kept pushing them to create a more powerful and substantial system, a decision that came out of various committee meetings. The engineers continued along this route, enhancing the basic system over the years, while nimbler companies were creating lighter and even more powerful portables.

Another example of decision-by-committee problems is IBM's handling of the operating-system development program. As many as 12 different sites are involved in developing OS/2 version 2. More than 2000 programmers are writing code, with IBM spending as much as \$2 billion on the

project. Managers, who can communicate through email, have spent more time flying to committee meetings than at the lab sites. This process alone has kept the project from getting out on time. Add bickering among the programming teams, and you have a formula for what has become a nightmare for Big Blue.

IBM's restructuring plans were finally announced in early December. Chairman John Akers said: 'We are freeing various pieces of IBM to be competitive. We want the pace of execution to be faster.' He admitted that the IBM bureaucracy was 'like a plate of spaghetti' that the company hopes to untangle. But he did not go as far towards decentralisation as many had expected. Moves included:

- Forming a printer division called Pennant System with aim of eventually turning it into a subsidiary with sales of \$2 billion a year.

- Forming a separate organisation called Storage Products for its disk drive, optical disk and computer tape operations. IBM has made major discoveries in the area of optical read-write and high-density drives, but the resulting products were used only by IBM, giving it a technical edge but minimising the profit potential. The new company, based in San Jose, will be free to sell its drives to other vendors over time and is expected to have annual revenues of \$11 billion.

## Blow to Cannavino

Industry reports in November had suggested that IBM would also hive-off its PC division to become a separate subsidiary. But the company stopped short of this: the division will now have direct responsibility for manufacturing PCs and workstations, but will remain a part of IBM.

This is a blow to PC division president Jim Cannavino, who was lobbying for a separate company. Sources say he felt that he needed total control of development, manufacturing and pricing in order to stay competitive. Instead, IBM formed an Entry Systems Technology group within its personal computer business which will have the job of developing future PC subsystems and technology. The National Distribution Division will continue to control pricing.

The changes do make the PC division better equipped to deal with fast market changes, but it is still tied to the overall IBM computing program and will continue to serve the IBM global goal. Time will tell if this is a good decision, because PC developments will dictate how minis and mainframes work together in future.

The delay in making these important changes has cost IBM many missed opportunities. The management hopes the changes will make the company more responsive to the dynamic information markets of the 90s. Otherwise, IBM risks losing its position as the world's most powerful computer and information company.

**Tim Bajarin**



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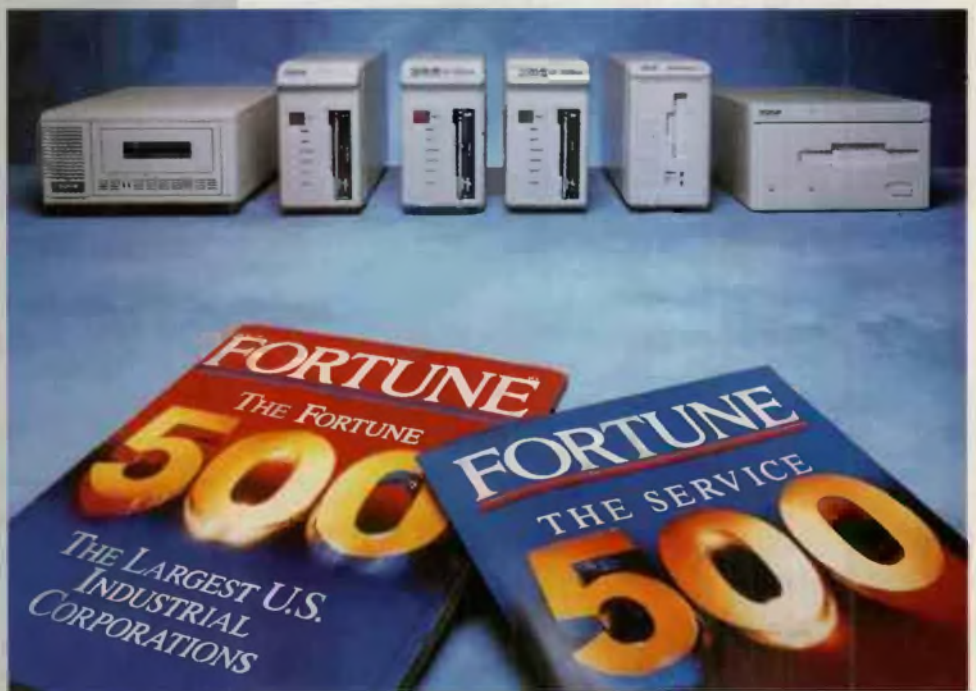
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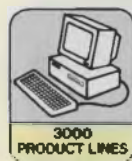
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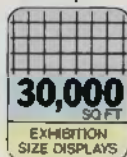


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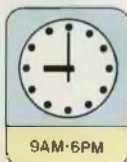
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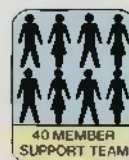


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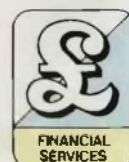


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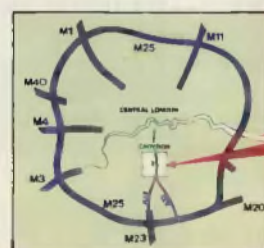
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# Sony adds model number four to its CD 'electronic book' range

● Sony has added a fourth model to its range of CD-ROM readers, the nearest thing yet to an electronic book. The original DD-1 still lists for ¥58,000/£260 but is being heavily discounted to ¥35,000/£155. Two newer models have larger backlit screens yet have become slightly smaller.

The most expensive DD-10 (¥64,000/£285) has a resume function: when it is turned back on it continues from where it left off. All models have sound and video connectors.

The latest model is the DD-DR1 which has no screen but does have a 50,000 bps computer port. Since the standard is open, third parties will be providing interface software for the unit and one such company is HAL Laboratory. The basic software is available for most machines on the Japanese market: the NEC 98 series, Toshiba Dynabooks, Fujitsu Panacoms, IBM PS/55 and AX clones, and Macintosh. The Mac software has a slight downside: although it looks more pleasing, the link runs at a minimal 9600 bps. Prices range from ¥12,000/£53 to ¥18,000/£80 depending on the host compu-

▽ Sony's original DD-1, on which the company's new range of CD-ROM readers is based, is being heavily discounted



ter, plus ¥10,000 for the interface cable.

The Data Discman is a true world machine with a choice of some twelve operating languages built in. This means that not only will CD-ROMs produced anywhere in the world function correctly, the language of the menu options can be selected independently of the language of the ROM.

Some 76 manufacturers are collaborating on providing hardware and software for this standard, so expect more capable machines in the future. One such drive due early in 1992 will have both a screen and a computer interface, and will be a true go-anywhere unit. Look out too for a Toshiba notebook with a built-in drive.

## More titles on disk

What of the CD-ROMs themselves? Hundreds are slated for release in the US to support the recent introduction of the Discman there. In Japan the range is somewhat restricted and more expensive than those available in the US; for the English-speaking user, the US is a more comprehensive and cheaper source of disks.

I tried out one disk relevant to my work, the ¥19,800 Dictionary of Science and Technology which is a tri-lingual Japanese/English/German dictionary. It was riddled with spelling mistakes but the search functions appear to be adequately fast. Other CD-ROMs start from around ¥2,900. Typical titles on the Japanese market include a list of 9000 pills, the words for 3333 songs (useful for those odd moments in karaoke clubs, from Sony/CBS), and phrase books to help the average tourist out of tight spots. The disk, supplied free with the Diskman, contains six books from Sanseido.

Sony imports some of the US releases but the typical \$100 prices translates to ¥29,800/£130. If the format becomes firmly established, I expect the ability to use a reader with or without a computer will be a great selling point and give the 5in disk a run for its money.

Paul Hardy

# Kingston offers 486 'heart transplant'

A 386DX machine designed before upgradability became fashionable can still be upgraded, so long as the processor uses Pin Through Hole mounting. The £650 Kingston 486/Now card will plug into a 386 socket clocked between 16MHz and 33MHz.

For £650 you can buy a card with a 33MHz 486 that plugs into the processor socket of a 386 running at 16-33MHz. For this to work, of course, your processor must be mounted using Pin Through Hole technology, otherwise, prying your old processor loose is rather difficult and completely fatal.

The company claims the 33MHz 486 card should boost performance by around 300 per cent, but this

seems dubious. The processor may be much faster, especially with maths (because of the 486's on-board maths processor) but the rest of your components will be as slow as ever.

If the prospect of messing with your motherboard doesn't fill you with fear, ring Datrontech on (0252) 313155, which distributes this little wonder. The company has a five-year no-quibble money-back guarantee, so if you find that you don't get the power you expected, you can always send it back. Of course, if you've accidentally fried your motherboard removing the processor, you'll be out of luck.

David Brake



## Compaq stakes future on low-end assault

Compaq, like IBM, has made sweeping changes following a year which saw it forced to slash prices to bring itself in line with the rest of the market. The price cuts were not enough to avert a \$70 million loss on a \$709 million turnover in the third quarter 1991.

The company made 1400 people redundant, including co-founder and president Rod Canion. He was replaced by CEO Eckhard Pfeiffer, who set about changing Compaq's marketing approach. The most important change is that while maintaining its high end business, Compaq will also begin to target the education and small business markets.

As a result, Compaq, notorious for high prices, has to produce cheaper machines. Pfeiffer has promised to introduce high-quality machines for the 'price sensitive buyer' next year. The big question is whether Compaq's famous quality control will suffer. Burn-in times may be lowered on cheaper machines, and there have been rumours that the company may abandon the practise of gold-plating selected components for reliability.

UK MD Joe McNully said the Compaq reputation for quality would be maintained, and he denied rumours that the company may begin sourcing Taiwanese clones. All Compaq products will be Compaq designed and built, he said.

### Competition

The company is laying itself wide open to competition from low-end manufacturers who have already saturated the market, but it claims Compaq quality will see it through. But shouldn't a company with its considerable R&D resources focus on a more select market which cut throat low-end competitors cannot touch?

Compaq says some R&D effort will go into its involvement in the ACE consortium, which will

provide the high end of its product base. McNully promised that ACE equipment will be available from his company this year, but would not commit himself to the first quarter. He admits that the consortium is experiencing teething problems, referring to criticisms that the ACE consortium has too many standards from too many people. McNully says he is generally happy with the way that ACE is progressing.

Compaq's dealer channel which has been restructured into two levels. SystemPro and ACE products will be restricted to the top level, known as the system resellers. Everyone will be allowed to sell the rest of Compaq's lines.

In the meantime, Compaq will move closer to customers in terms of support, said McNully. He hinted that as more sophisticated products make their way onto the market, customers may feel more secure dealing with the manufacturer.

The final question mark hanging over Compaq's head is its potential involvement with chip maker AMD. Arch rival IBM recently jumped into bed with Intel, gaining an agreement to produce quantities of its own 486 chips and embarking on a joint plan to produce the next generation of Intel chips. Although McNully refused to comment, this must have put Compaq's nose severely out of joint.

A Compaq partnership with AMD would make sense as AMD, one of Intel's main rivals, may welcome endorsement from an influential company. However, sources close to Compaq say that this could be dangerous, as Intel still seems to hold the most respect.

One thing is for sure: if Compaq can't adjust to the new economic realities, it is headed for deep trouble.

Compaq is on 081-332 3000.

Danny Bradbury

## WordPerfect for Windows is here — at last

WordPerfect's entry onto the Windows scene with WordPerfect for Windows finally happened at the close of last year, nearly six months off schedule.

WordPerfect was first publicly shown last April at the Which Computer? Show, and all looked well until July when shipment was delayed due to internal testing. Finally, the company announced that it would ship the product in the fourth quarter, and meanwhile it announced a trade-in scheme, allowing 5.1 users to upgrade by buying only the diskettes and documentation — the licence was free.

The scheme applied to those users who'd bought 5.1 for DOS after June and within 30 days of the latest release. Although managing director (then marketing director) David Godwin denies it, this seems like a sweetener to keep impatient WordPerfect DOS users loyal.

The product doesn't seem to make as much use of Windows' graphical capabilities as WordStar for Windows, although there is no denying that it has

been written with the platform in mind rather than just ported across. It has been supplied with the obligatory toolbar, meaning that users can access their favourite functions with a mouse click, and has WYSIWYG built in. It also has WYSBYGI (What You See Before You Get It) which enables users to preview all aspects of a font before they use it to change a document.

There is, however, a distinct lack of drawing options — imported graphics must be enhanced using other programs such as DrawPerfect, although this has not yet been adapted for Windows. One of the biggest pluses of the new WordPerfect is that it includes a separate, improved file manager and viewer. Unfortunately for WordPerfect, the file manager in Windows 3.1 will be much improved.

WordPerfect for Windows costs £399. Upgrades from the DOS version, if you don't qualify for a free one, cost £75. Upgrades from MS-Word cost £99. WordPerfect is on (0932) 850505.

Danny Bradbury





## Refill merchants deride green move as HP sauce

Hewlett Packard has launched a scheme to recycle empty toner cartridges, following requests from green-minded users. The company will collect batches of more than 30 for free; users with fewer to get rid of can return them to one of about 30 authorised dealers, who include Northamber, Protek, Westcoast or Holdene.

The recycling process works by disassembly and melting down up to 90% of the cartridge, which is then reassembled at the HP plant. The scheme has apparently been backed by Canon, which makes print engines for HP (among many others).

'We're a green-minded company,' said an HP marketing rep, who did not believe the company would profit from the move. 'But then there is no

rule saying that business can't benefit from being green.

Lazerfill, a London-based firm that 'remanufactures' cartridges by replacing the toner and components like the OCP drum, dismissed the operation as a marketing ploy. Managing director Gordon Davidson says that the printer giant should inspect Lazerfill's operation and recommend that to users. Currently, HP frowns on companies like Lazerfill, saying refilled cartridges could invalidate the HP warranty.

A new cartridge from HP costs £88, whereas a reconditioned one from Lazerfill costs just £55 — minus £10 for your empty cartridge.

▽ Beach Imaging Ltd, of Eltham, offers DIY toner refill kits



### DIY toner refill

Beach Imaging Ltd of Eltham takes the process one step further by offering DIY toner refill kits. Using a specially coated OCP drum and a corona-wire cleaning pad, the kit will reduce running costs by 50 per cent, according to the company. Sounds a bit dodgy? Beach claims that if your kit is damaged by the cartridge, it will repair or replace your printer free of charge. Interestingly, HP's own user group is said to have undermined the manufacturer's no-refills policy by authorising the product.

Intel has also gone green, announcing that it has removed all traces of the ozone-destroying CFC (chlorofluorocarbon) chemicals from its computer manufacturing lines. And Xtree has decided to plant a tree for every registration of its new program as part of its 'Project Green' program.

Contacts: Hewlett Packard (0344) 360000; Beach Imaging 081-850 8344; Lazerfill 071-6371122.

Danny Bradbury

## New WordPerfect deals go soft on home copies

Alongside the hoopla surrounding the launch of WordPerfect for Windows, the company announced a set of very reasonable and foresightful software licensing schemes. The first, and perhaps the most interesting, was a single licence sanctioning the use of the DOS, Windows or OS/2 versions of WordPerfect on the same machine, with the user paying only for disks or documentation when moving from one to another.

WordPerfect used to sell network packs of software at a discount. But under its new scheme, packs of licences will be sold which can apply to any of the three platforms. This will save networked corporates the cost of disk and documentation because they need buy only one set per platform. A single-licence pack costs £245, or £275 with documentation; 5 and 20-licence packs cost £1155 and £4300 respectively, without documentation.

A concurrent use deal means that instead of having to buy as many copies as there are nodes on a network, you need only buy licenses for as many

you wish to run concurrently. Clearly, this can save money if you have a large network with a few WordPerfect users.

Another deal allows you to install a single copy of WordPerfect on both your home and office machines, so long as you run only one machine at a time. Previously you were supposed to deinstall at work and then reinstall at home. Clearly, no-one did this and the new deal merely legalises what happens already.

### Highly desirable move

Bob Hay, chairman of the Federation Against Software Piracy (FAST), applauded the move. 'My view is that it's highly desirable. The situation is that when you bring any one aspect of the law into disrepute, you can degrade the whole thing. I would much rather see people given the chance to stay legal.'

WordPerfect's software does not include any code to police the number of concurrent users on a network, which would ensure the network user's legality. Managing director David Godwin, who is a board member at FAST, says that he bases that particular marketing agreement on trust.

WordPerfect is on (0932) 850505.

Danny Bradbury



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# New Acer SX boasts cheap upgradability

▼ The AcerPower 386SX is the first PC that allows users to upgrade to 486 technology simply by replacing the chip



Several upgradable machines are on the market just now, but nearly all involve the insertion of a card and they tend to be rather expensive. Acer is looking to change all that with a simple, cheap 386SX to 486SX upgrade done by just swapping the main processor.

Acer's new AcerPower 20MHz 386SX will be on sale towards the middle of this month. Prices have not yet been set, but sales director Terry Cooke insists that users will not have to pay a premium for upgradability. More importantly, the cost of the 386SX to 486SX upgrade will not be great—around £200 is Acer's best guess, compared with around £1300 on a comparable AST machine (though you get 4Mb of RAM with that). Upgrades on Compaq's new 'M' series cost at least £600.

Colin Mallon, AST's

European Marketing Manager, was undaunted by the Acer move. 'We are glad our peers are recognising the benefit of upgradability. We feel quite flattered.' Both he and a Compaq representative insisted that a card upgrade is much safer and easier than a processor swap.

Acer hard disks can also be traded for larger ones and the video (which starts at standard VGA) can be enhanced using added RAM to give 1024x768 pixels and 256 colours. Even the co-processor can be upgraded—when you upgrade to a 486SX, you can add a 487SX or (when it comes out) Intel's new clock doubler chip.

The Acer does fall down a bit on its bus, which is standard ISA for expansion and 16-bit on the motherboard. This is sufficient for current applications, but may not be so in two or three years—and future-proofing is, after all, what people buy such machines for in the first place.

Also, Intel will shortly be releasing a surface-mountable version of the 486SX, which should make a 486SX almost as cheap to incorporate as a 386SX. This could make 486SX the new entry level, and there will be little point in buying anything less powerful, even if you could upgrade it later.

Contacts: Acer (0753) 523024; AST 081-568 4350; Compaq 081-332 3000.

David Brake

# Western aims to be your flexible friend



Yet another player has entered the mail order market. Western Systems, a privately owned US firm, is launching a new operation based on a range of four desktop machines—the 386SX-16, 386SX-25, 386-33 and 486-33. Prices are low, but not stunningly so—a 386SX-25 with colour SVGA monitor, 80Mb hard disk and 4Mb of RAM costs £1058.

Where Western plans to offer an advantage is in speed of delivery and flexibility of configuration. It aims, without guarantee, to provide systems within 72 hours of purchase. As for flexibility, you can get each model in a choice of three cases, with a choice of operating systems including Novell and Xenix as well as the standard MSDOS 5.0 and Windows 3.0 bundle. If you want a built-in tape streamer, network card or optical disk, it's yours—and so on. Western will even arrange installation and network the machines together for you through its partner, CalAbco.

Most of the complaints we hear about mail order customers from readers are to do with failing to receive equipment within a reasonable time, so if Western keeps to its promises, it should do well. Western Systems is on 081-845 8383.

David Brake



# Pen-based machine comes out of Eden

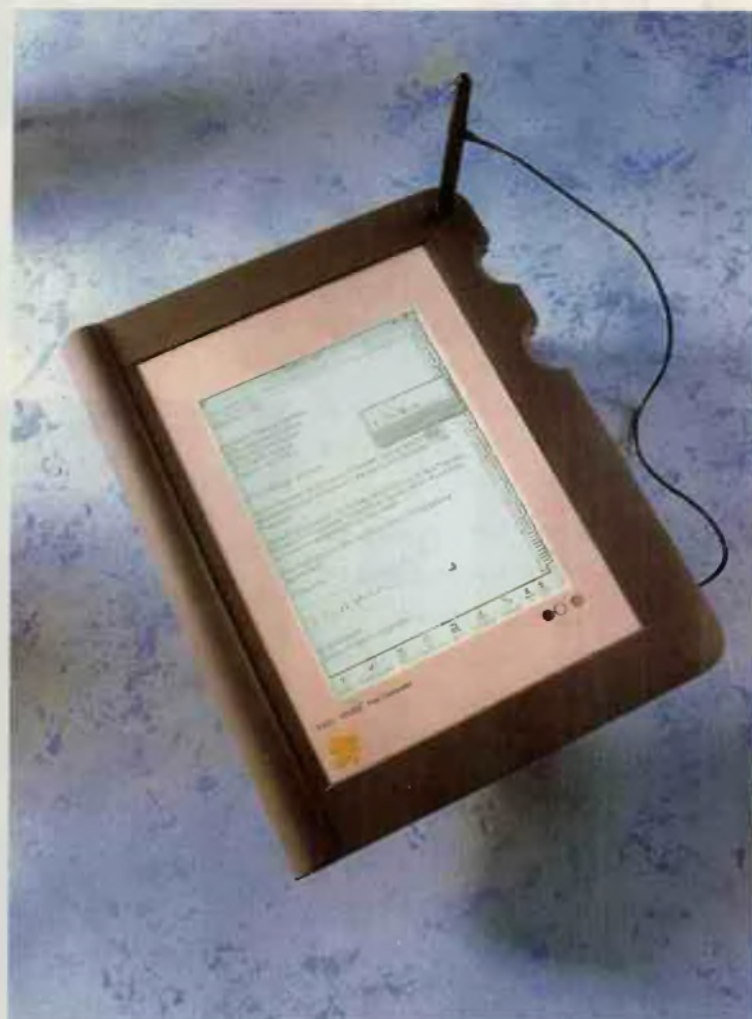
The latest pen-based machine to be launched in this country will be labelled TriGem, but is designed by a British company, Eden. The VPi386 is, according to Eden, the only 386SX-based pen computer with a backlit screen. Eden points out that lighting conditions outside the office are variable, so backlighting is a real plus — GRiD tacitly acknowledged this when it launched a backlit version of its pen computer a few months back. Sadly, this means that the 'typical use' battery life will only be four hours — rather limiting for field work. A spare set of rechargeable batteries weighs 450g.

The price should be very competitive — under £2500. You can choose any pen operating system: PenDOS, Windows for Pen Computing, Go's PenPoint, GRiD's PenWrite... (the more glamorous ones have yet to be released, but by the end of the first quarter you should be able to take your pick).

The VPi386 weighs 2kg with batteries, has a 20MHz AMD 386SX processor, 4Mb RAM and 2Mb of flash memory, VGA screen and two PCMCIA slots for RAM or flash cards.

For more information, ring Eden on (0625) 576050.

David Brake



## Key acquisition of Mac-PC linkers

Key Exchange, a small London firm which specialises in file-translation software, has acquired distribution rights for RunPC and Software Bridge/Mac, two programs to make exchanging data between Macs and PCs easier.

Software Bridge/Mac is quite ingenious. Not only does it allow you to mount PC floppies on a Mac with a SuperDrive automatically, it also launches whatever Mac word processor you normally use automatically and does file format conversion between 24 DOS word processors and three of the main Macintosh ones — MacWrite II, Microsoft Word and WordPerfect 2.

Unlike its nearest competitor, MacLink Plus, it senses the format of the incoming file automatically. It also costs £149, which is £10 cheaper than MacLink Plus. But it is limited to translating word processor formats — MacLink handles a large number of database, graphic and spreadsheet formats as well (though it doesn't handle as many lesser-known WPs).

RunPC is even more interesting. For £50 more, you get all the Software Bridge/Mac features plus the ability to control a PC from a Mac, send files and messages to and fro across a supplied serial cable, or by telephone using two modems, or even (for an extra £200) across an Appletalk network. Unfortunately, there is no mouse support and Windows only works in Real mode.

But because of the speed of serial data transmission, VGA in graphics mode works too slowly for

extended use. RunPC's primary function is to enable users to share vertical market DOS applications, particularly across a network. The £399 network pack gives a licence for up to ten Macs to share a single PC on a network (and to use the disk mounting and file translation software). You need to put an Appletalk card in the PC before you can share it, though.

Key Exchange is on 071-498 9005.

David Brake

## £69 for a nagging

One of the best things about WordPerfect for Windows is that it doesn't follow the recent fashion of bundling a grammar checker. Those who take pleasure in having their computer nag them about split infinitives need not despair, however. For £99, they can buy the latest version of Grammatik for Windows which can be integrated into WordPerfect — it can even be put onto a WordPerfect button bar.

Reference Software International is on 081-518 8640.

David Brake



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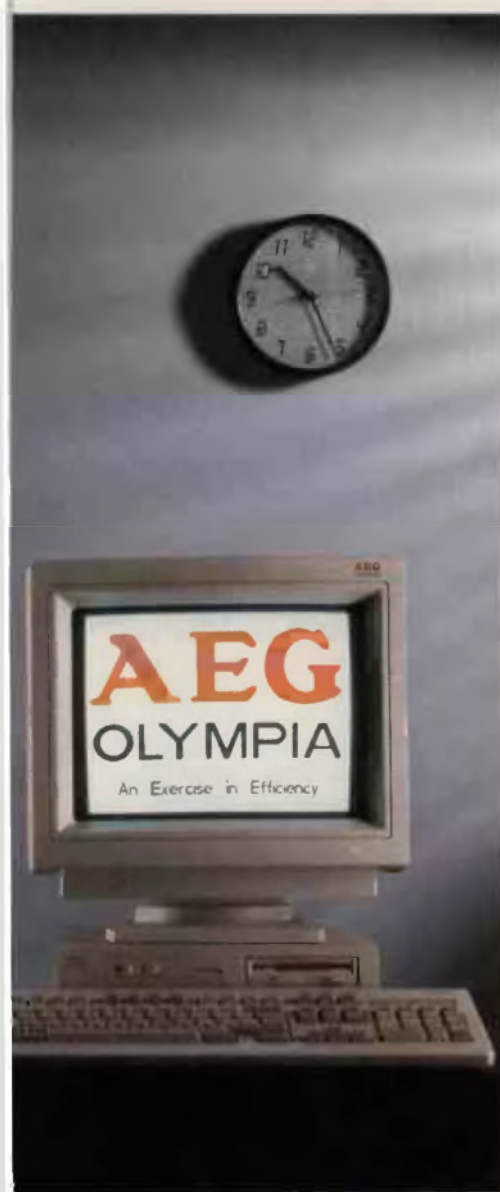
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## Police your own network to stop FAST work

Maxwell's Mirror Group Newspapers and *The European* had enough problems on their plate without being searched by FAST. If the spectre of software auditors rifling through your hard disks frightens you, the oddly-named GreenScreen has just the program for you.

The company's new network management and security program, InControl, has as one of its chief functions the ability to audit software on network and local hard disks and to control the number of copies of applications running concurrently from a server.

GreenScreen says the program means companies won't have to buy more copies than they use simultaneously to cover themselves from accusations of piracy. If we were grumpy, unhelpful sorts we would put it another way: InControl purchasers are spending around £30 per workstation to help software publishers.

But InControl has much else to offer for your money. It gives you a variety of handy security features, including multiple levels of password

protection, boot protection, screen blanking, and a DOS menu system that can restrict access and cannot be circumvented using control-break or other devious means. It even throws in encryption (but only of user-set individual files), and a set of TSR utilities including a phone book with auto-dial, a pop-up calculator, even a calendar and diary with alarms, reminders and filofax output. Quite a bargain — and from a British company.

Two complementary products also each cost £30. InTime is a flexible workgroup scheduler which you can also use on a portable away from the office and update on the network when you return. InTouch is a simple, straightforward MHS-compatible electronic mail package.

All are compatible with Novell, PC LAN and DEC's PATHWORKS networks, among others. Unfortunately, it is also all based on DOS; if you are moving to Windows, you are stuck, for the moment at least.

GreenScreen is on (0705) 268519.

David Brake

## Harvard for Windows goes multimedia

Software Publishing Corporation came up with one of the first multimedia applications aimed at a broad business market when it unveiled Harvard Graphics for Windows, which the company claims is now an 'information presentation package' rather than a simple graphics tool.

SPC bought Precision Software last year to get tools to develop just this kind of system. Harvard Graphics for Windows interfaces with Microsoft's

access and the video functions. Users can place the video sequences within a window and give it attributes such as resizability and a title bar. The quality of the video is impressive, as it was when Intel demonstrated its DVI boards last year, but the sound is like someone talking into a bucket.

### Hypershow function

As interesting as the multimedia capability, if not as pretty, is the hypershow function. Click on a screen button and you get a new screen, with different data and more buttons to take you down to further levels.

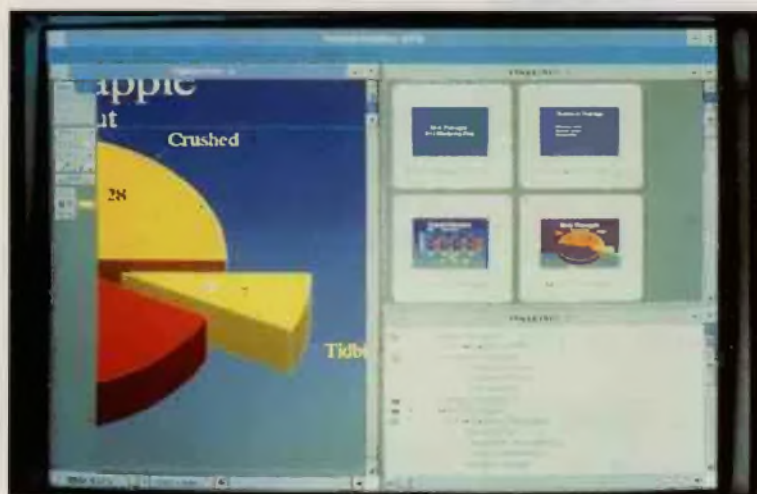
Applications can even be run from within the software: you can access, say, Superbase 4 from within a presentation to examine sales figures.

I'm not sure how much of a gimmick the multimedia is. The picture quality is good enough for a corporate presentation and the compression is such that a minute of data can be stored on about 8Mb to 10Mb of hard drive. You can also plug a camcorder or VCR into the DVI board, although the quality will not be so good. If you want your data squeezed into as little space as possible on a CD-ROM, you must send it back to Intel in the States and pay \$250 per minute of video for the privilege, which hardly seems worth it. In my view, the increased interaction provided by the user interface is what makes the product really worth buying.

Harvard Graphics for Windows is available for £445, or £95 for an upgrade from the DOS version (£30 if it was bought between last May 14 and the end of January).

Software Publishing Corporation is on (0344) 867100.

Danny Bradbury



multimedia extensions for Windows, and with Intel and IBM's DVI Actionmedia products. These are boards which enable audio video data to be captured and replayed on a PC. The video and audio data is stored on a hard disk or a CD ROM.

All the normal Harvard Graphics functions are provided, in addition to waveform audio functions, MIDI, still images, animation, CD-ROM ac-



## Low-cost comms for Windows

Comms software specialist Microcom has moved into the Windows arena with the release of Carbon Copy for Windows, designed to enable remote operation of a machine running Windows, for applications such as training and technical support.

The software, adapted from the DOS version, is said to operate with little or no speed degradation — a bold claim, considering that some comms pundits say real-time remote Windows control is only feasible over an ISDN line. But Microcom says the package works by transmitting screen and window parameters rather than bulky bitmaps.

The £145 package also includes a file transfer facility, in addition to a chat utility, enabling users

to talk via typed messages. There is also the standard telephone book function, and security functions which include a reboot on exit facility.

The company has also shipped the MicroCourier comms package, said to take full advantage of Windows. But certain elements seem to have been ported directly over from DOS to Windows, as it doesn't take advantage of DDE. There is, however, compatibility with all MNP standards, support for a dozen file transfer protocols, and a macro recorder that automatically writes scripts. And at £58 it is one of the cheapest Windows packages around. Microcom is on (0483) 740763.

David Brake

## Browsing through this month's bargains

Singling out companies offering bargain PCs is a dangerous game. We can only judge by what we're told.

Many companies are selling PCs these days, so we are bound to miss some bargains. Also, prices are dropping so fast that by the time you read the magazine, what looked great to us might be over the odds. And of course the big unknown is service. We cannot vet all the companies who send us press releases, so we cannot be sure that they deliver working machines on time and to specification.

Nonetheless, we receive releases offering what appear to be exceptionally reasonable prices, and we pass the offers on to you — just make sure to check around to see the state of the market.

This month's bargain basement Power User machine is from Silicon Valley Computer Systems (based in St Albans, putting together US-made components). It's a 33MHz 486DX for 'just £1199 plus VAT'. Well, not really. For that price you only get a 40Mb hard disk, but even with a 120Mb hard disk, colour SVGA monitor and 4Mb of RAM, it only costs £1349. Only a few months ago, the cheapest machine in the 486 Group Test (November issue) we did was around 25% more expensive.

As for bargain portables, there are a number of entrants this time around. In the Random corner, we have a 20MHz 386SX notebook with 2Mb of RAM (expandable to 5Mb), a 60Mb hard disk, and a single AT slot in a machine weighing just over 3kg for £1350. Goshawk has a cheaper notebook at £999, and a little lighter at 2.875kg,

but it has no expansion slot, a maximum memory of 4Mb and has only a 40Mb drive. It doesn't even come with DOS.

The best deal I've seen so far is from Copam, a Taiwanese company that has recently moved to the UK. It is selling a 20MHz 386SX with 3Mb of RAM (expandable to 5Mb) and a 100Mb internal disk, DOS 5 and Windows 3.0, for just £1150. The company claims that it squeezes all this into a package weighing 1.91kg, and with a three-hour battery life. At press time, the machine had a three-month waiting list but Copam may have had more in since.

Contacts: Copam 081 961 9555; Goshawk (0792) 321392; Random (0223) 322007.

David Brake

▽ Silicon Valley's 33MHz 486DX Power User 'bargain' buy





## Kwik deal with UK distributor

US developer Multisoft has found a sole distributor on this side of the pond for its PC-Kwik, which it claims will speed up the average PC by between 300% and 900%. The package includes documentation designed specifically to help Windows users speed up their operations, something which 3.0 users without a graphics card sorely need.

The software, available from Opensoft in the UK, works by accelerating the peripherals of a PC, including the disk drives, monitor and keyboard.

It includes a flexible RAM cache. Unlike Micro-soft's fixed-size ram cache, PC-Kwik's can lend memory to applications as they are loaded, then return it to the buffer when they have finished. It has a limited memory management function which dynamically allocates extended and expanded memory to applications and to Windows, again retrieving it when it is not needed.

PC-Kwik's disk cache is supposed to be faster than Microsoft's Windows. It uses 'powerwrite', which Multisoft says speeds up disk reads and writes without resorting to delayed write schemes. It works in conjunction with the Power Pak facility, which the company says moves data intelligently from the disk to memory before it is needed, enabling the application to retrieve it at much greater speed.

For non-Windows users, keyboard repeat rates can be speeded up from 9 to 126cps, screen displays can be scrolled back (no more watching vital information scroll off screen), DOS commands can be stored and retrieved from a pop-up menu, and you get a print spooler too.

The software costs £79. Call Opensoft on 081-343 9588.

Danny Bradbury

## Mastersport SL

Zenith released a brace of machines at the end of last year designed to show off a healthy product base, and in particular the extent of its love affair with Intel over the SL chip.

The company is making use of its much-vaunted SL development deal with Intel, which enables it to receive advance copies of the low power processor for its Mastersport 386SL which shipped in volume last summer. The deal was clouded, however, by reported SL bugs which drew criticism from other laptop manufacturers such as Toshiba.

The latest notebook, called the Mastersport 386SLe, was due to ship this month. It includes a fast 85Mb hard drive which takes advantage of the machine's rest mode, and 2Mb RAM. Zenith has added an Enhanced Parallel Port (EPP), which it says increases the performance of network adaptors by up to 3000% under laboratory conditions. The port works

in conjunction with the EPP adaptor from Xircom, which acts like an 8-bit network adaptor and which was jointly designed by the two companies.

According to Zenith, peripherals will be developed in the future to take advantage of the EPP feature, but currently, the Mastersport will not drastically speed up communications with any peripheral except the Xircom adaptor.

This machine is the same price, same size and same weight as its predecessor, and offers the same power management promising up to eight hours of battery life.

### Lanstation product

Other releases include a Lanstation product, the Z-LS/20. It is a 20MHz 386SX-based machine which again makes use of the EPP technology. Running with 2Mb of RAM, expandable to 10Mb on board, it comes preconfigured in either a diskless or 40Mb hard drive version for £1260 or £1530 respectively. The diskless machine has boot-control, a dual-level password mode and a server mode. It can be upgraded to a 120Mb model for £1200.

Zenith Data Systems (0628) 668588.

Danny Bradbury

## Another Oki printer

Oki has fleshed out its LED page printer range still further with the OL830, an 8 page-per-minute model lying near the middle of the Oki pile at £1499.

The OL830, targeted at the entry level PostScript market, includes 2Mb of standard memory upgradable to 4Mb, 17 fully scalable Adobe fonts, and 300x300 resolution. Options are RS232, RS422 and AppleTalk interfaces, plus HP Series II and Diablo 630 emulations.

Oki claims its system collects up stray toner, giving up to 5% more printing and saving 95p per cartridge. Users should appreciate the extra cleanliness.

Oki is on (0753) 531292.

Danny Bradbury

## Auto disk-crammer for the Mac

Salient's DiskDoubl'r, a very popular Mac utility, allows you to compress files which are then decompressed as you use them. But it also requires you to specify which files you want to compress.

AutoDoubl'r, which has been recently launched by the same company, will automatically compress files for you according to whatever criteria you set. You can tell it, for example, to compress all files you haven't

accessed in the last week, or all files older than a week. It apparently uses new technology to compress files twice as fast. Even more remarkably, it is supposed to allow you to use files and applications without having to decompress them first.

Now Apple has a range of portables, compression is likely to interest more users.

AutoDoubl'r costs £65, the same as DiskDoubl'r. Present DiskDoubl'r users will be offered a discount on 'sidegrades'. DiskDoubl'r will remain available because it does a few things AutoDoubl'r can't — like creating self-decompressing files.

Amtech, on (0202) 476977, supplies both.

David Brake





## FOR JUST £1299, TWINHEAD WILL GIVE YOU BACK YOUR DESK.

The Twinhead SuperNote SX packs a lot of computer into a small space, at a very small price: just £1,299 (plus VAT).

So much so, in fact, that it was voted best buy in *The Laptop Buyers Guide & Handbook (USA)*.

Weighing just 3kgs, it boasts a 386SX processor, 40Mb HDD, 2Mb RAM, 1.44Mb FDD, 32 grey shade VGA display with a connection for an external VGA monitor, 2 serial ports and 1 parallel port.

Also included in the price is a full year's warranty, carry case, THlink software and cables and DOS 5.0. Optional extras include Windows 3.0 and mouse.

It also comes with impeccable credentials.

Unlike many notebook PCs where the badge bears little relation to the machine's actual manufacture, the SuperNote was designed and manufactured entirely in Twinhead's own factory in Taiwan, where 10% of the revenue from every PC sold is ploughed back into research and development.

And all Twinhead notebooks, desktops and tower systems are configured and supported by our UK headquarters in Basingstoke.

If you'd like to know where to buy the SuperNote or any Twinhead product, please call us direct and we'll put you in touch with your nearest Twinhead Authorised Re-seller.

**Just contact Julie Grange or Liza Nightingale on  
Tel: 0256-811366 or Fax: 0256-811142.**



# Twinhead

Windows is an acknowledged trademark of Microsoft.



# Windows bolt-on for Lantastic

Artisoft has been fairly busy of late, releasing software and hardware add-ons for its peer-to-peer networking system, Lantastic.

The company has released a Windows bolt-on for the DOS version of Lantastic. Unlike the DOS program itself, which is priced on a node-by-node basis, the Windows product is priced at £240 per network, meaning you get more value if you have

more nodes. The product takes advantage of Dynamic Data Exchange (DDE), allowing users to take clippings from other applications into email.

Artisoft's new £450 Centralstation, targeted directly at the Xircom market, is said to allow users to plug or unplug their portable or peripheral into the network disrupting it. The device will be of particular use to notebook users, says Artisoft, because it won't tie up the printer port. With standard 128K RAM, one parallel port, three serial ports and an optional SCSI port, the station uses 10BaseT or thin coax cabling.

It will be complemented by the introduction of various Stationware applications. The first of these, ArtiCom, has just been released. It costs £280 and allows COM port sharing on any LAN that operates under NetBIOS. It includes built-in terminal emulation software for accessing mainframes and bulletin boards.

Artisoft (0753) 831971.

Danny Bradbury



# New AdLib card will answer your phone

Soon to hit the UK is the Ad Lib Gold sound board — aimed, unlike its predecessor, at the business as well as the leisure market.

The card, available at the end of January, will ship for roughly £250, with add-on products costing about £70. The new board doubles the number of voices available to 22 and is expandable using a series of daughterboards.

Add-on hardware and software available in the US includes a surround sound module, coming in the form of a card snapping onto the back of the Ad Lib Gold. It adds effects such as echo and stereo depth simulation to the Ad Lib Gold. Also available is a CD-ROM interface and a telephone answering

system, which lets the PC play messages and give background music over the phone. Touch-tone access codes can also be assigned, with callers being presented with a series of message options. It's up to Ad Lib whether these goodies appear in the UK.

Ad Lib's UK representative Mindscape is on (0444) 831761.

Danny Bradbury



# Brave offer

Those brave souls at HQ Computers (the people who give the home telephone number of their support manager to every customer) have come up with a Windows-capable PC in a nice portable package and at a pretty reasonable price. The 1Mb RAM, mono VGA price is £649, but a colour SVGA computer with 4Mb of RAM costs just £919.

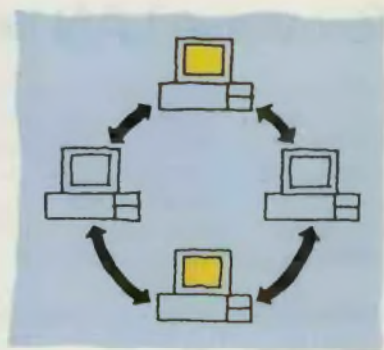
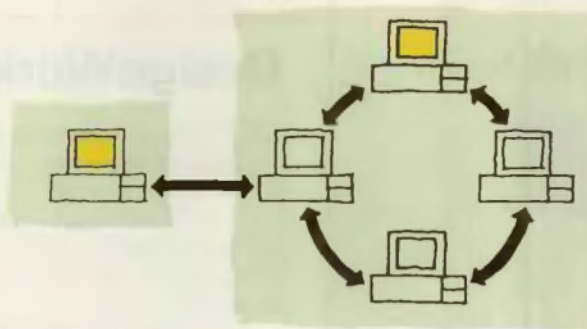
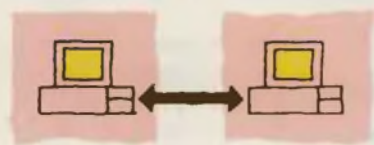
It is a 20MHz 386SX PC with a 44Mb hard drive (sizes up to 125Mb are available), two serial ports, one parallel, a games port and a free three-quarter length slot. All of this fits into a 3.2kg package — that includes the built-in power supply. The only major weakness apparent without actually seeing the machine is in RAM expandability — 4Mb is the maximum.

HQ Computers (0279) 415571.

David Brake



# Our remote control software is now within everyone's reach.



Until recently, if you wanted both PC and LAN remote control, you had to buy two software packages. Not anymore. Now, with Carbon Copy Plus 6.0, you get everything you need in one package.

Carbon Copy Plus 6.0 gives you all the remote control, file transfer and terminal emulation software you need for modem communications between two PCs. Plus, we added support for DESQview 386, QEMM-386, and 386MAX. And now you can enjoy the same remote control capabilities for all the PCs on a LAN. Multiple PCs on your LAN can view or control one PC. Or even control a single PC on a LAN running Windows 3.0, including its mouse.

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All trademarks acknowledged.



## Pixar Showcase for 3D graphics

Graphics specialist Pixar has announced a high-detail 3D composition program for the Mac called Showcase. It's aimed at 'high impact design' for customers such as corporates. According to the blurb, Showcase places you in the role of photographer, taking clip art from a library, placing it in scenes, setting light sources, texturing and shading. A prototype 3D picture is shot and then rendered for photorealism using the company's Mac Renderman software.

The clip art library holds just 40 objects. But third-party companies will be producing more ob-

jects, according to Pixar, which says that in a year's time there could be 100 to 150 objects. Sadly the image *shapes* are not editable — only their textures. Distributor Computers Unlimited seems less than bothered by this. The issue is the actual quality and image detail is very high, a representative said.

Priced at £599 on a CD-ROM or £849 on floppy disk, with a video training course, Showcase is bundled with Mac Renderman, which is priced at £695 on its own. This price will be lowered soon. Computer Unlimited is on (081) 2008282.

David Brake

### Lexmark laser

Lexmark, which has a close relationship with IBM, has released a range of IBM-compatible lasers with its own built-in technology which doubles the resolution when printing in PostScript.

The 4029 series comprises the 6ppm 4029-20 and two 10ppm models, the 4029-30 and the 4029-40. The latter is aimed at LAN environments and has a larger 250-sheet feed tray.

The machines, costing £1449, £1749 and £1999 respectively, include 1Mb of memory expandable to 9Mb. They also incorporate the IBM Proprinter subset PPDS, in addition to HPGL, PCL4 and PCL5 emulation. There is a PostScript option which, when used in conjunction with an extra 4Mb of memory, allows the Lex Res technology to be used. This increases the normal 300x300 resolution to 600x600dpi. The feature also includes what the company calls 'print quality enhance' technology, which is similar to anti-aliasing.

All the printers have 17 type 1 scalable outline fonts as standard.

Lexmark is on 081-578 9343.

Danny Bradbury

Costing £2299, it is bundled with MSDOS 5.0, Q-Basic and Windows 3.0 utilities.

The company claims it is targeting people such as Tandon users with the 386. But Tandon supplies a 386/33 PC, the MCS/Pro, with 64K cache, 4Mb RAM, seven slots and a 110Mb drive, bundled with Windows 3.0 and DOS for just £50 more than the Samsung, which doesn't even have a hard drive — a 40Mb one will cost you an extra £115. Samsung is on 081-391 0168.

Danny Bradbury

## DesignWorks for Windows from GST

GST Software products has followed the likes of Micrografx into the Windows market with the launch of DesignWorks. The £149 graphics package complements GST's TimeWorks DTP product, which is aimed at a similar market.

It includes a library of more than 500

clip art images, text effects, patterns, charts and diagrams. Features include multiple step undo/redo functions, plus bezier curves and autotracing. It also has colour blending features and object scaling and rotating facilities.

GST Software Tools is on (0223) 462212.

Danny Bradbury

## Samsung fields a 486SX

Samsung has added a 386 and a 486SX to its PC range. The Deskmaster 386/33N has 4Mb RAM, expandable to 32Mb on board, four expansion slots, and an SVGA adaptor built on to the motherboard. The machine, bundled with MSDOS 5.0, GW-Basic and Windows 3.0, costs £1999.

The Deskmaster 486S/20 is targeted primarily at the networking and multi-user markets. Running at 20MHz, it has a 4Mb memory, also expandable to 32Mb. It has the SVGA adaptor, two high density floppy drives and four full size 8/16-bit expansion slots.

Costing £2299, it is bundled with MSDOS 5.0, Q-Basic and Windows 3.0 utilities.

The company claims it is targeting people such as Tandon users with the 386. But Tandon supplies a 386/33 PC, the MCS/Pro, with 64K cache, 4Mb RAM, seven slots and a 110Mb drive, bundled with Windows 3.0 and DOS for just £50 more than the Samsung, which doesn't even have a hard drive — a 40Mb one will cost you an extra £115. Samsung is on 081-391 0168.

Danny Bradbury

## Microwave LAN link

To put a pair of buildings on a high-speed LAN, you have until now had two choices: cable them together (difficult if you don't own the land between), or use a laser beam. The latter can be a problem, too, as rain and fog can block the beam — surprisingly, building movement can also cause interruptions. Tall buildings can move a foot or more at the top in wind.

Microwave Modules International will shortly introduce the Digilink 60-10 — a £12,000 microwave link that works at Ethernet speeds given line of sight up to 1000 metres. And it isn't affected by any of the problems above. MMI even had the foresight to use fibre optic cables to connect the dish to your LAN...in case lightning strikes.

Details from Layer One on 0925 220 604.

David Brake

## Hercules prices drop

Prices of Hercules graphics cards have been cut by up to 30% in a move which sees UK distributor Imago finally responding to the growth in the Windows market. The 1Mb Graphics Station drops from £768 to £595, the Graphics Station Plus 2, which has 3Mb of memory, shuffles down from £1115 to £795. These drops bring UK costs nearer to the US pricing, but they still leave scope for the grey marketeers: exchange rates mean that you could pick up a 1Mb Graphics Station for \$478 in the US, while a 3Mb model would cost \$598 — nearly \$200 cheaper than on this side of the pond. Imago is on (0734) 664611.

Danny Bradbury



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## Play School led the way

In his December 'Sounding Off' column Rupert Goodwins refers to the days when only Blue Peter had windows. Tut tut. Everybody knows it was Play School that had the round, square and arched windows.

Actually, that's not a bad idea. Perhaps the Microsoft development team could start working on it?

Kevin Thomas  
Virginia Water  
Surrey

## With fax like this, who needs cards?

Yes, fax is daft (*PCW*, November), but it is with us and we need it. Putting a card into your computer is one way to get fax, but it does have its limitations. An alternative not well marketed in the computer press comes from dear old

Amstrad, which offers standalone faxes (I use the FT9600T) including a parallel printer port for connection to a computer. Prices are a third those of similar rivals, and compare favourably with fax-card prices. They offer the same facilities as cards, or more, plus the advantages of standalone use.

The faxes can work with some comms-type packages, or simply emulate an Epson FX or IBM Proprinter on your parallel port.

Charles Stirling  
Bristol

## Multisoft, where are you?

I was very interested to read Ian Morris' review of DRDOS 6 (*PCW*, October) and in particular that Super PC-Kwik is bundled with the package.

I have intended for some time to buy some disk-cacheing software but I am a hardened MSDOS user, having recently upgraded to version 5. I decided to make inquiries into the availability of

Super PC-Kwik to be used in conjunction with MSDOS 5 on a 386 or 486 IBM compatible.

My first move was to contact Digital Research, who were very pleasant. However, both the sales and the technical departments were unable to furnish me with a supplier or a manufacturer. The mention of Multisoft did not produce even the slightest glimmer of hope.

The long and arduous process of contacting all my suppliers has now been instigated and as yet I am none the wiser. Not even the small ads in your magazine could help.

Therefore, the only course of action left to me was to contact yourselves in the hope that you could furnish me with a name or number that could be approached to allow me to gain access to this most elusive item of software.

Stephen Gunn  
Aberdeen

*Multisoft has only recently taken on a UK distributor. Opensoft, on 081-343 9588, is now handling all Multisoft products.*

Introducing PC Tools Version 7.1, by Central Point Software, makers of the world's best selling utility package.

And, like its acclaimed predecessor Version 6, our newest utility package is designed to release the full potential of your system and your software.

**With over 100 new features and enhancements, Version 7.1 will reveal your own potential too.**

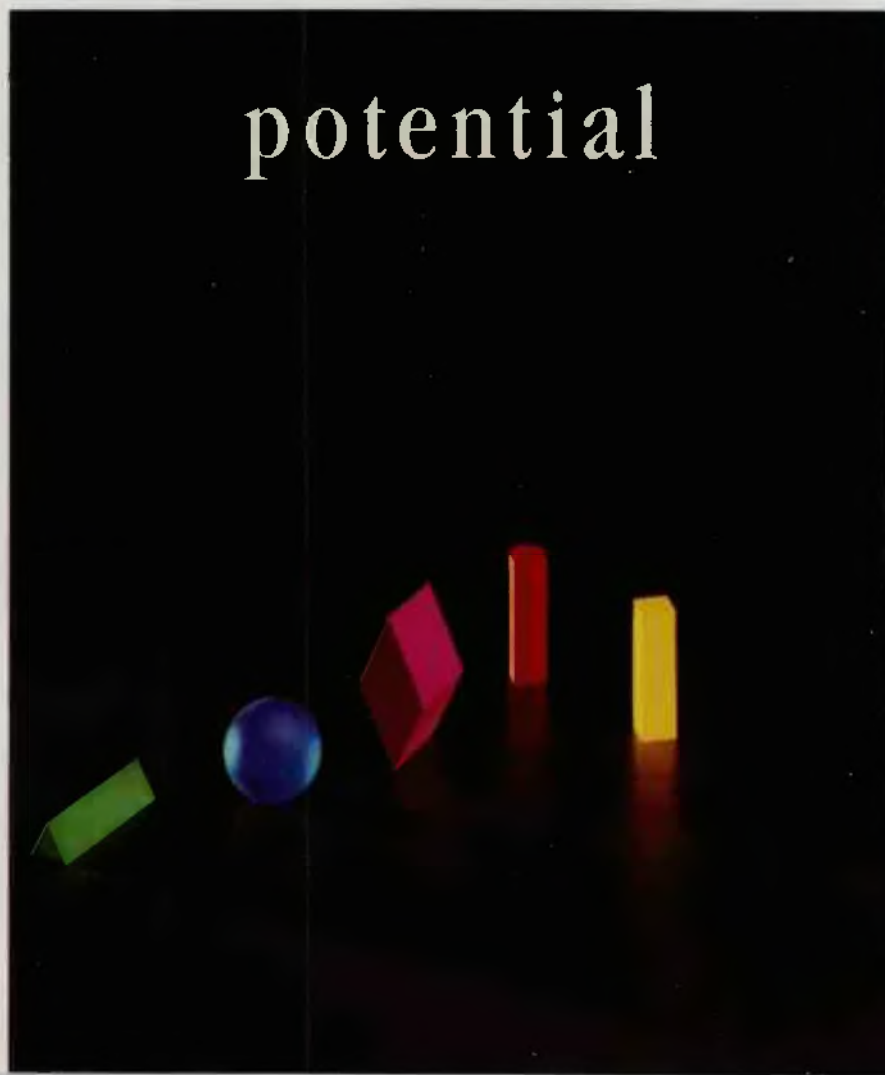
It's the world's first utility package to include fully-featured backup and complete *Windows* emulation in one single box. Protecting your data; making life easier for all PC users; making your working life more productive. With its Anti-Virus feature, remote computing with Commute™ and enhanced *network support*, PC Tools is the most comprehensive utility package by far.

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But perhaps most importantly of all, PC Tools Version 7.1 is uncompromisingly functional, designed to provide every utility that any PC user could require - to enhance your productivity and reveal your full potential.



# potential





## In defence of Works

I wish to take issue with the description '(sort of) word processor' applied to Microsoft Works, in the item on 'IBM word processor challenges Amstrad' ('Newsprint', December). For a budget computer system Works is an ideal integrated package. In addition to the word processor it has a database, spreadsheet, and a communications module. Your review of Works for Windows, in the same issue of PCW, makes this point.

When an item in a magazine is at variance with readers' own experiences, and with statements both in the same magazine and in other respected publications, readers may wonder how many other mistakes go undetected. PCW has a very high reputation, and throwaway comments such as the one in 'Newsprint' can be very damaging to it.

F Weil  
Hatfield

*The review of Works and the news piece were written by two different people. We do not dictate the opinions of our writers, so differences can occur.*

## Guarantees with a poor reception

Your Belgian correspondent Mr Klaas Decannierre (December 'Letters') has got his analogies awry. It is not only the software industry that sells things it explicitly does not guarantee.

You can take a TV back if it fails to tune in to the TV station, but only if it is a failure of the TV itself. No-one is entitled to a refund of a TV that fails to work because you live in a valley where TV signals cannot reach, and you didn't tell the salesman. If I buy a TV there is no guarantee that I will get anything decent to watch.

Many TV shops would make a refund on that basis, and the same goes for software vendors. Companies do not guarantee that their software will do the job you bought it for, merely that it will do the job they wrote it for, which is reasonable. If you find a serious bug that prevents it from doing the job claimed, no company is likely to refuse you a refund. The difficulty is in prov-

ing the bug — which is often nothing more than incompatibility.

However, there is a potentially interesting analogy stuck in his letter, about buying a calculator. If my parents pay good money for my private education, and I come out of school unable to do arithmetic and operate a calculator, it is difficult to argue that they should be refunded. More accurately, it would clearly be the responsibility of the School Inspector, who should be reprimanded.

Would Mr Decannierre argue for a Software Inspector? It's an interesting thought and not necessarily a stupid one.

Andrew Denny  
Croydon  
Surrey

## The discount that wasn't

Just how much in advance of the publication date are your copy deadlines? I read with interest Steve Cassidy's review of WindowBase (PCW, November), and despite his lukewarm assessment I reckoned that it was worth the introductory price of £149. But when a colleague rang SPI for me, the company

# revealed



The full potential of PC Tools Version 7.1 can only be revealed when you return the coupon.

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Please send me more information on Central Point PC Tools Version 7.1 ☐  
Please send me more information on Upgrading to Version 7.1 ☐  
If you're a Version 7.0 user, register to receive your free upgrade to Version 7.1.

NAME: \_\_\_\_\_  
POSITION: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
\_\_\_\_\_  
TEL: \_\_\_\_\_

PCW 1

Post to Central Point Software International Ltd,  
Freepost, P.O. Box 15, Twyford, Berks. RG10 8BR.  
Fax the Brochure Hotline on 081-561 3938.  
Phone the Brochure Hotline on 0734 320562.  
Phone the Upgrade Hotline on 0734 320314.



**Central Point Software**  
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*safer · simpler · faster · computing*



said that the introductory three-month period finished on 30 September! I don't know who to blame. Is it PCW for promulgating misleading or out-of-date information? Is it SPI for having a secret introductory offer?

With the range of database packages available, one with little or no installed base is a risky buy. Is that risk worth taking on WindowBase at more than double the discount price? The answer, I think, is no. So it's back to the xBase shop: at least I know what I'm getting.

Paul Crisp  
Coventry

*The offer was to corporates, but SPC did not make that clear to us at the time. It is not unusual for corporate offers to be left to the discretion of the salesman.*

— Steve Cassidy

## Hold it... I'll just go and pirate a Rolls!

The cost of obtaining a car is becoming impossibly high. May I recommend a measure previously tried in the computing marketplace? What sensible person would, in this day and age, censure the individual who decides that 'car piracy' is the only option? Provided the pirates do not drive dangerously, there seems no reason why they should not take and drive away whatever vehicle is most suited to their needs. After all, those to whom the vehicles are registered surely have adequate insurance to cover replacement.

Another method of acquisition is directly from dealers. You may have noticed the trend among some larger dealers of offering 'extended test drives' of up to a week to potential customers. These companies obviously have plenty of money, and do not miss the cars. What could be more natural than for the customer to keep the car at the end of the test week without paying, if he really finds it indispensable? What reason has the dealer to demand money after the customer has already been using the product for a week? After all, the dealer clearly has no need for the vehicle.

You may claim that if large numbers of the population take up this method of acquiring personal transport there will be a hike in prices, or that manufacturers will go to the wall or give up making cars. I'm afraid I can't agree — it hasn't happened in the computer software and shareware markets, has it?

(Incidentally, you made the throwaway remark in your Panasonic KXP-4455 review that car suspension

dampers are not shock absorbers. This is a mistake. A perfect spring does not absorb energy, but stores it. When a car wheel is forced up by a bump on the road, the energy of the impact is stored by the spring. On the subsequent downstroke, the energy is released by the spring and dissipated into the shock absorber.)

Peter Davey  
Dunbartonshire

*A strange analogy: drive away someone's car, the owner loses the car; copy software, and the owner loses nothing (unless FAST is on the case). That aside, we agree — software piracy is a Bad Thing.*

*But on your last point we beg to differ. Without a damper, the spring will oscillate for longer after the car hits a bump, but the energy will be dissipated. The so-called 'shock absorber', thankfully for those of us with weak stomachs, damps out the oscillations far more rapidly than would naturally be the case. Car suspensions are designed for the real world, not the friction-free one of GCSE physics.*

## Cutting remarks on Micro Surgeons

The computer world is following the Health Service in making its customers undergo painful surgery — or to be more precise, Micro Surgeons is. On 23 October we ordered a computer from Micro Surgeons and our cheque was cleared on 31 October. Three weeks later we still had no computer despite numerous faxes and phone calls. (Is there really anybody there, or is the phone just off the hook?)

We would suggest to any PCW readers who are contemplating taking advantage of Micro Surgeons' apparently attractive low prices to consider carefully whether they want to be parted from their money and left wondering whether their potential supplier will stay in business long enough to deliver their order.

The interest on £1500 for a few weeks makes it worthwhile looking elsewhere. There are other, good deals around from suppliers who actually take an interest in their customers!

R H Tattersall  
Lutterworth  
Leicestershire

*We have had two other letters complaining of late delivery of equipment from Micro Surgeons. Unfortunately, at press time, we couldn't get hold of the company, either.*



## Hindsight

### February 1990

'HM Systems has become the first UK manufacturer to ship the 486, ahead of Mission and Apricot. The full specification Minstrel Workstation costs £7950 and undercuts IBM's PS/2 model 70 486/25 Power Platform (£9112) and Compaq and Apricot machines of similar specifications.'

Guy Kewney, Newsprint

### February 1988

'Paul Bailey, European general manager of Digital Research, entertains not one shred of doubt about the supremacy of GEM. He says that all GEM applications will be able to run under Presentation Manager.'

Guy Kewney, Newsprint

### February 1986

'My favourite inside bulletin, the *California Technology Stock Letter*... helped me catch up with other things I missed on the floor [of Comdex], too. For example, the fact that Hewlett-Packard, Compaq and IBM are thinking of announcing micros based on the 80486 (yes, four, not 80386) next year.'

Guy Kewney, Newsprint

### February 1984

'Portable computers, a novelty two years ago, are now attracting serious research and development money, producing the 16-line, 80-column liquid crystal screen. Everybody at Comdex seemed to have one.'

Guy Kewney, Newsprint

### February 1982

'The IBM Personal Computer has appeared in the UK, much to the surprise of everyone, and, not least, the surprise of International Business Machines itself. It was imported... from Computerland in San Francisco... they sold 20 or so at about £2500 each with only 64K of memory and with only the Adventure game as demonstration software.'

Guy Kewney, Newsprint

### February 1980

'IBM has lost its nerve. It would have to change its nature too radically if it wanted to sell a retail product, and while the writing on the wall says it will have to do so some day, executives would rather put off the evil hour.'

Guy Kewney, Newsprint

Readers' letters are welcome and should be sent to *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG. All letters will be considered for publication unless they specifically state otherwise, and we reserve the right to cut or amend them for editing purposes. The Editor is not bound by the views expressed therein.





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## Rupert Goodwins

The scene was a familiar one. The man from PCW and myself were relaxing over cognac and cigars in the deep leather armchairs that dot the magazine office. In the Adams fireplace, a blazing pile of press releases cast a cheerful light over the antique prints and oak panels of the walls: the slow tick of the clock was challenged in its regularity only by the Editor's snoring. Nobody wanted to disturb him, poor chap; he'd had to initial two memoranda this week alone.

'Can't you rant a bit?' the man from PCW whispered.

'What, now? It'd wake old Swarbrick,' I murmured back.

'No, in Sounding Off. There are lots of things you could do to entertain the readers.'

'Like what?' I asked, puzzled.

'Well, like phoning up Acorn and asking why they bother.'

I considered this for a moment. 'Couldn't do that, dear chap. Aren't they the British Microcomputer Industry, these days? Italian, anyway, and with 1992 it's all the same thing. How about the way the marketing departments pervert the English language?'

Now he looked puzzled. I warmed to my theme: 'Take sophisticated. It used to mean needlessly elaborated, empty complexity for the sake of complexity. According to the salesmen, it now means very clever, lots of smart features, that sort of thing. If you read the press with the old meaning in mind, it makes a lot more sense.'

The man nodded. Taking this as a sign of enthusiasm, I continued.

'If you go back still further, it comes from the Sophists, a group of ancient Greeks who loved complicated argument for its own sake. Before that, though, they were a useful group of people who wandered about, teaching

the fine arts of rhetoric and logic to anyone who'd pay. They were thought of as essential for democracy, since if you don't have an educated electorate the whole idea makes no sense at all. I wish today's politicians would think about that before they blasted away about sovereignty, independence and self-determination.'

My one-man audience was deep in thought, and obviously didn't want to interrupt my flow. On I went.

'It was a clever set-up, since once someone was taught as much as they wanted, they could go out and teach others. Knowledge almost spread itself. We could do with something like that today; most people would love an opportunity to know more, to acquire some academic skills and then use them. Providing it was enjoyable, of course; stick 'em in a classroom and they'd fall asleep. Computers are great entertainers, all those wonderful graphics and noises; link those to education and you've won half the battle.'

He digested my words. Then, as the import hit him, he blinked, looked up, and said: 'Er, multimedia?'

'Up to a point. The trouble with that is you're getting someone else's regurgitated information. It can be made very attractive and interesting, but you're limited to the choices someone else has decided you might make. The best education comes when you find something out for yourself. It's the thrill of discovery that drives people.'

### Virtual reality

'No, what you need is a good interface, something engaging with lots of immediate feedback and an intuitive way of getting input from the users. Virtual reality fits the bill. Shame that all that commercial effort is going into producing games involving people shooting at each other — though cheap, colourful displays were a spin-off from video games. Most important, though, is get-

ting access to lots and lots of data.

'Fortunately, there's tons of the stuff aching to be examined. There's the gigabytes of information NASA pulls out of deep space; lots of that's sitting on decomposing tapes in dank basements. If you could think of something to do with it, they'd love you to death.

'Perhaps you'd prefer history? More than half the discovered documents from antiquity remain untranslated, mouldering away in pigeonholes. Wouldn't take much to digitise those images. And don't forget the more recent stuff; modern statistics and stories are filling acres of disk space daily.

'There's one thing missing — how do you link your goggles and gloves to these pools of data? Telephone lines, or even today's high-speed datalinks, just aren't up to the task of connecting lots of people, in real time, to lots of different places at whim. But — here's the good bit — there's a technology being developed now that has the potential to do just that: shifting gigabytes around the globe in less time than it would take to get them off a hard disk. There are a few problems with the speed of light, but all of the other hard bits are well on the way to being cracked.

'It's called Cell Relay Switching, and there are already a couple of standards for it. Remember the IEEE, those Americans who gave Ethernet the respectable soubriquet of IEEE 802.3? Well, IEEE 802.6 is all about CRS, and it's jolly clever. Take a stream of data and chop it up into much smaller packets than usual, then feed it into a network with lots of parallel paths. If you get it right, your entire data stream can arrive at the destination in the same time it would have taken a few bytes to get there using old technology. Then, a millisecond or two later, someone else's data turns up.

'I can't quite see how the telecomms companies will work out the billing, but that's one problem they've always solved in the past. The effect, once





these links are in place, will be to give the people at home access to the world's data as if it were one, uncommonly large hard disk. Voice and pictures will work just as well. I don't know what will happen when we can all examine the nation's statistics through whatever distant descendent of 1-2-3 happens to be around, but it'll shake up those damn politicians. Furthermore, I find the idea of being able to wander the surface of Mars or to flip through unread manuscripts from Sumeria terribly exciting. Who knows what we'll find? What do you think?

A second set of snores spread through the still, smoke-tinged air of the office. I sighed and signalled to Gould, the butler, for another cognac. Clearly, I needed to work on the ranting. Another day, perhaps.

## Matthew May

**P**ersonal computer manufacturers have a problem — well, they have several actually, but this one is that their designs are lasting little longer than the now infamous Marks and Spencer prawn sandwich. And the price levels of personal computers last an even shorter time, making it a fairly horrendous task to compare the prices of different brands depending on whether their prices have just been cut or are just about to be.

Unlike a prawn sandwich, which can at least be replaced with a model identical to its predecessor, manufacturers have to continually come up with new, faster, and preferably cheaper machines if they are to stand any chance of staying ahead of the game.

But how do you make your brand seem any better than the rest, given that for any particular power level they are now virtually the same? This is referred to in America as Commoditisation, which surely should

win an award as the ugliest word of 1991.

Couple this with the rest of the industry's move towards open systems and it is clear that any attempt to make your product unique by making it non-industry standard is deeply unwise. Unless, of course, you are IBM.

And if you are going to try this risky course then a certain amount of muddying the waters is necessary. 'Sufficiently different, new and better that no other brand will do' is the emphasis required. But your machine must also run anything and work with everything else because your customers aren't so daft any more, and won't buy anything that smacks of future incompatibility.

IBM's attempts to maintain price levels by pushing this line have by and large been a disaster at a time when the move towards downsizing (client-server computing, or whatever you want to call it) is making the personal-computer market crucial even in the corporate sector. What IBM clearly needs are personal computers at prices that can compete with its now wholly credible rivals.

One factor reducing IBM's ability to match competitors' prices is what analysts have described as a stifling top-heavy bureaucracy, which is costly and slows decision-making and creativity.

### Radical restructuring

In December, IBM announced another bout of radical restructuring. It was largely more of the same. More job cuts — a further 20,000 to go this year on top of the same number last year, which means the company will have 20% fewer staff than at its height five years ago.

The other avowed intention is more decentralisation. The IBM battleship is to be broken up into a fleet of fast-moving destroyers. That IBM has only just discovered the principle of run-

ning divisions as separate cost centres, each responsible for making its own profit, is perhaps not as surprising as it might be. For the first time IBM is being forced to behave as less fortunate companies have had to for many years.

That the personal computer division should have to help share the huge overheads behind mainframes and minicomputers is clearly ridiculous, but IBM could get away with that sort of practice when it had monopoly power over much of the industry. But it hasn't been that dominant for several years, which may go some way to explain why most of its PCs look well overpriced.

### Persistent rumours

More intriguing than IBM's public moves are persistent rumours that it is getting ready to build cheap PCs in the Far East for sale only through mail order, computer supermarkets and the high street. Intriguing because the machines will not carry the IBM logo — people wanting reasonably priced computers consider anything with the IBM name on it as far too expensive to be worth a second look.

Anyone who has ever dealt with IBM might guess its response to these rumours: 'IBM does not speculate on future product announcements...'. But surprisingly a statement was to hand.

'There is a vital customer segment only buying on price,' said the IBM press office. 'We are certainly interested in this market potential and various business options are open to us which we are carefully studying.'

That is about as close to confirmation of a rumour about IBM that you will get, so it appears that the company is at least considering the idea.

For all you tiresome people who, heaven forbid, are actually concerned about the price you pay for a personal computer, this year may well be the first in which you can buy a reasonably



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The market for portable computers is experiencing a period of sustained and dynamic growth outstripping all other sectors; and efforts of the industry to deliver products which overcome the limitations of the mid-eighties models are bearing fruit.

New business opportunities and increased competition has resulted from growing confidence in the new generation of portables which offer the power and functionality of the desktop computer.

Technology innovation is producing not only powerful lightweight laptops, but also notebook, palmtop and notepad computers.

Market growth is also being stimulated by the appearance of software tools which provide logical links to desktop systems and value added network data and messaging services.

The Portable Computer Communications (PCC) Show is the first major national event focussing exclusively on portable computing and data communications within the context of the overall mobile IT market.

The PCC Show is answering the need for an applications showcase which offers buyers who are faced with an increasing complexity of choice, a clearly identified event more relevant to their needs than a broadbased general computer exhibition.

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priced IBM PC.

But just to show how reckless you are being, it won't have the letters IBM on it. That would spoil the whole idea. Simple, isn't it?

## David Morton

There can be few nastier words than 'connectivity'. Why on earth people insist on coining new words when there are perfectly usable alternatives in the English language escapes me. Nevertheless connectivity is now an industry buzzword, so I suppose we'll have to put up with it. While I'm not too enamoured with the word, I've become seriously dependent on the practice of connecting machines together so that data can be moved around and resources shared.

Of course, becoming a connectivity fanatic has its problems. You immediately discover that this is another field where there are serious limitations to what is achievable, particularly when you try to connect notebook or laptop machines to a system. There are plenty of ways to connect your laptop to a desktop machine and share data — Traveling Software's LapLink Pro is probably the best known. The latest version even supports modems, in addition to the parallel and serial port transfers, so you can get that vital file from another continent. But all LapLink does is to link two machines. It does not offer network support, though if a LapLinked machine is also on a network, you can transfer files from its network drives.

There are alternatives. Lap2LAN uses a cable between a laptop's parallel port and the same port on a desktop machine. A set of rather clever device drivers redirects network messages so that both the laptop and the desktop machine can be network workstations. It's a little slower than a machine with

an Ethernet card, and at present it's only available for Novell networks, but it's an ingenious low-cost solution. If that is still a little too fiddly — it does require access to the back of the desktop machine — then companies like Xircom and D-Link make 'pocket' Ethernet adaptors that connect to the printer port and with the appropriate drivers installed let the laptop function as a network workstation.

But none of these solutions is as elegant as one would like. All involve messing around with cables and connectors. Portables are expected to face a renewed boom with the arrival of pen-based machines, which it is thought will sell to customers who do not at present use computers. So there's an obvious need for wireless implementations of PC networks. There are already a number of commercial wireless networks on the market, although at present they aren't compatible with the various well known network operating systems.

### Graceful breaks

Implementation is not just a question of transmitting the same data via an RF link or using infra-red LEDs. Conventional network software makes a number of quite reasonable assumptions about the medium on which its signals are being sent. Not least, it assumes that the piece of wire will remain connected for the duration of the networking session — even a badly crimped BNC connector on an Ethernet cable can seriously affect performance with spurious reflections which distort the signal.

With any sort of wireless network, the software has to adopt a different approach: it has to accept that from time to time the connection may disappear, or the signal may become unreadable through fading or distortion. The software has to be able to deal with this in a graceful manner, preferably in a

way that's invisible to the user.

One company that has put a great deal of effort into the development of network software that can function in this way is Go Corporation — better known for the Penpoint operating system that is the principle competitor to Microsoft's Windows for Pen Computing. Go has extended the idea: it allows graceful connection and disconnection as the portable moves in and out of range, but it also allows different networking protocols to coexist on the same client machine. As the portable is carried round a building, it is able to sense any wireless LAN within range. The machine's software will then establish the protocol used, and if the portable owner has the correct privileges it will log in and gain access to the fileserver.

So you can arrive at the office carrying a portable PC, sit down anywhere within range, switch on, and the network card in the machine negotiates the connection and logs on to the local network using the appropriate protocol. Suddenly your little notebook has a couple of extra drive letters, a few hundred megabytes of disk space, and an invisible PostScript laser printer.

Of course you are likely to be able to achieve a cable-scale data rate only over a relatively small area — at least for the foreseeable future. But there's no reason why a whole building couldn't function in this way, with network repeaters at appropriate intervals. The prospect of the idea being extended to wide area coverage — using techniques similar to the pan-European digital cellular network — is exciting, but such a service is unlikely to be priced at a level many of us can afford.

Large corporate customers will be prepared to pay an arm and a leg for that sort of facility, and the service providers will have learned their lesson from cellphones: if you price too low, you get an unhappy customer



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base because you don't have the capacity to meet the demand.

But I live in hope — when I can sit in a field with a picnic hamper and check my email on the files server half a continent away, then maybe I'll let words like 'connectivity' pass without comment. It may not be what we want in many ways — it will be ever more difficult to 'get away from it all'. But connected we will be.

## Jack Schofield

I was going to start this month's Diary with a fancy quotation, but forgot to load OWS before XyWrite. OWS is the Oxford Writer's Shelf, a new program that runs as a TSR (terminate and stay resident) program on PC-compatibles. It provides pop-up access to four reference books: the *Oxford Dictionary for Writers and Editors*, the *Oxford Minidictionary*, the *Oxford Miniguide to English Usage*, and the *Oxford Minidictionary of Quotations*.

I've tried a few 'writer's tools' but most haven't lasted the course. I suppose that, as a professional, I'm the wrong market. I know what I'm doing. When I break the 'rules' I do it deliberately, even if it means starting a sentence with But or missing out the verb. If my typing was perfect I wouldn't even need a spellchecker, because I know which words I often spell incorrectly (supersede, kernel). I use one because it's the easiest way to find 'literals'.

And I don't need a thesaurus either. My vocabulary is already too large for a humble computer writer. I know I could weave in exotic words like lacunae, palimpsest or rodomontade (none of them in *MiniDict*), but like the Rev Samuel Wesley (1662-1735), I prefer to use plain words where possible. The aim is not to impress but to be understood. As Wesley put it in *An Epistle to a Friend concerning Poetry*, 'Style is

the dress of thought; a modest dress, neat, but not gaudy, will true critics please.' Yes, with OWS loaded, you can export a quotation straight into your text!

Grammar and spelling checkers may be more useful to people who aren't writers. They can process text files and pick out possible errors such as confusing there and their, or its and it's. Grammatik IV, StyleWriter and WordStar's useful new Correct Grammar are among the programs competing in this field.

The problem is that English is hard to parse. Grammar checkers often miss errors but throw a wobbly when the usage is a matter of taste or even correct. They gag over mixed capitalisation in words like NeXT. They do find real errors, but you still have to decide which ones these are, and figure out how to correct them. The better you are at this, the less likely you are to need a grammar checker in the first place.

### House style

Where customised grammar, style and spelling checkers help is when checking and correcting other people's texts. Every publisher has, or should have, a 'house style' embodied in a style book. It tells sub editors whether to use '-ise' or '-ize', RAM or Ram or ram, disc or disk, megabytes or Mbytes or simply Mb. There isn't much agreement on such matters in the computer press, and usage is inconsistent. I suppose everyone could follow *The High-Tech-Technology Editorial Guide and Stylebook*, 1991 Edition by Lewis Perdue, just released by Charles Letts & Co. At least it includes a 'spellchecker file' on disk. But it has lacunae — it ignores European computing — and errors. OS/2, for example, is defined as 'the operating system for IBM's PS/2 machines'. Piffle!

Another thing that grammar checkers provide is a 'readability score' for a

text. Examples include the Flesch Reading Ease Index, the Flesch-Kincaid Formula and Gunning's Fog Index. They all show that long, complex sentences full of polysyllabic words are harder to understand than short sentences made up of short words. No surprise there. But it helps explain why *Sun* articles, no matter how loathsome the contents, have a much bigger audience than *Guardian* editorials.

Any mechanical measure of readability is bound to be imperfect, but when it comes to dealing with bulk texts it can save time. It must make sense for government departments, insurance companies and other places where bureaucratese has a home. It could even help in publishing. Articles with poor readability scores might be works of genius or completely incomprehensible, but nearly all are rubbish and can be rejected out of hand. Articles with good readability scores are either worth reading or fatuous; the first two paragraphs will tell you which. I can't be wholly convinced by this argument as I don't do it myself, but it's part of the appeal of Corporate Voice.

Corporate Voice lets you define a new style model just by feeding in a mass of approved text. This can be used to set a corporate standard. You can also, for example, extract style models from Dickens or Doonesbury and compare them. This text is only 83% similar to Ian Fleming but 91% like my own style based on articles published in the *Guardian*. I've thought of sending freelance contributors the JSSTYLE.RE1 file and telling them to match it, but no-one else seems to have the program, and it wouldn't be a Good Thing even if I could make it stick (long sentence). Variety is the spice of life.

Or, to be annoyingly pedantic:

*'Variety's the very spice of life,  
That gives it all its flavour'*

That's from *The Timepiece*, by William Cowper. OWS strikes again.





## Mark

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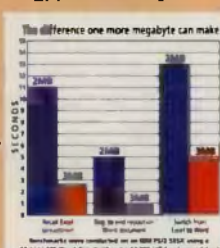
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## Plots Unlimited

Before you settle down in the attic to write that classic, let Plots Unlimited help you with your storyline. Rupert Goodwins' bestseller is coming along nicely, thank you.

**H**ands up all those who want to write a book. Bet you don't, actually. Writing a book is no fun; what most people want to do is be in that wonderful state of having written one. Still, it's a common enough fantasy, and now that word processors and outliners are invading every home in the nation there are plenty of computer-literate folk sitting down and staring at an empty screen called NOVEL.DOC. It's at this point that the rather disheartening revelation occurs: it's no good having the world's finest word processor backed by gigabytes of RAM and micro-second-access hard disks if you can't think of a damned thing to write.

Which is where Plots Unlimited comes in. Written by two fellows from California (where else) with 'extensive credits in network television and motion pictures', it's an MSDOS program that generates plots, sub-plots and all the other good dramatic devices without which your great work will seem like William Burroughs' tryout for Mills and Boon.

### The plot thickens

At heart, the program uses a similar idea to that found in the popular computerised joke, Jargon Generator. You've probably seen or written one of these yourself: it has three lists of high-falutin' words which it strings together in random ways to produce perfectly plausible buzz-phrases for management consultants. In Plots Unlimited, the idea is extended and enhanced almost beyond recognition — it has databases for the various components of a plot, and lots of ways to link them together.

A plot is a simple enough thing, and is almost invariably divided into three

parts. These are sometimes called Acts 1, 2 and 3 — the first bit introduces the characters and defines their situation, the second bit develops the characters and amplifies their problems, and the final part provides a climactic resolution to whatever was causing them all that trouble in the first place. A plot

and match these yourself, or ask MasterPlot to randomly string three together.

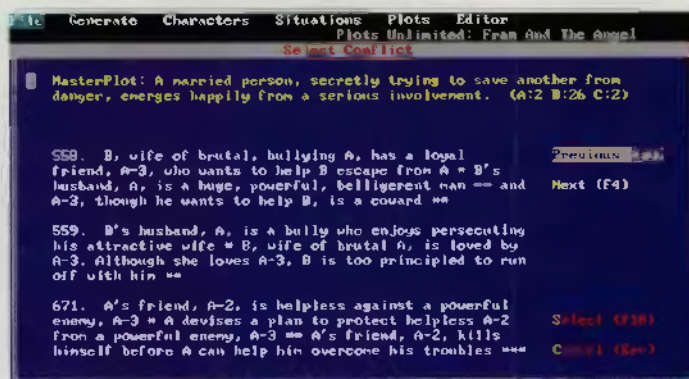
The program then selects which Conflict Situations from its database of around 1800 match the chosen MasterPlot, and displays these. Having picked one ('B, believing the man she loves, A, is dead, obeys the wishes of her parents, F-B and M-B, and agrees to marry A-3'), you can then choose from lists of appropriate Leadins and Leadouts, which are situations leading to and away from the main plot.

### Character count

The characters throughout are called things like A (the main male), B (main female), A-3 (male protagonist of A), and so on, and there are a lot of different sorts of character. To make things easier, you can name as many of the characters as you like and these names are substituted for the shorthand thereafter. You can also design plots by first of all choosing sets of characters (A, B, A-3, X) and letting the software select appropriate conflicts and MasterPlots that match your cast.

This is most useful when designing sub-plots; by the time you've got through your main plot you'll have a good idea of who's involved, and can give the software the list (or a sub-list) of characters. It'll then give you a totally new plot, which you can work into the main one as you see fit.

Note the word 'work'. Plots Unlimited doesn't provide — nor does it claim to provide — complete, perfect, new plots that you can plug into your book or screenplay without further ado. A lot of what it comes up with is hackneyed, sometimes nonsensical and always the



always has characters, and it always has conflict. The good ones have sub-plots, where subsidiary interactions between characters complicate things no end — it's often at this level of development where the would-be writer reaches for the wine-box.

Plots Unlimited takes a more sober approach. First, invent a name for your plot. The software then asks you for your chosen method of generating the plot itself; this can be by Character Combinations, Story Type and Sub-Type, Conflict Situation, MasterPlot or various combinations of the above.

MasterPlot is the easiest and most immediate; it gives you three lists, one with the main character's description ('A Person In Love', or 'A Criminal Person'), one with an action clause ('undertaking a difficult venture when promised a reward for high achievement') and one with a conclusion ('emerges from a difficult ordeal with hard-earned wisdom'). You can mix



barest of bare bones. However, you are encouraged to tinker with every aspect of what it gives you — there's a notepad in the software that lets you say 'B doesn't kill A here, but slips him a Mickey Finn' — and there are several worked examples in the manual that show you how to produce *Casablanca*, or *I Love Lucy*, according to taste.

### Dongle protection

In use, the interface proved idiosyncratic and, initially, frustrating. It's typical of many pre-Windows 3.0 DOS programs, with a combination of pull-down menus, function keys and mouse support tacked on top. It takes some learning, but there isn't that much of it

and those not totally steeped in the Microsoft/CUA way of doing things should pick it up quickly enough. The screens are well laid out and make good use of colour; installation is easy and only makes a small change to your *Autoexec.bat*. The software is protected by a dongle; I don't like this, and I'm not sure that other vertical-market software with mass appeal (such as *AutoRoute*) has shown it to be a good idea.

The documentation is well written (but of course) and covers all the practicalities of using the software well. There is an optional book which goes into the business in a lot more depth; I didn't see this, but can well imagine

that it's a worthwhile investment. A lot of the benefits of *Plots Unlimited* will come with practice and experience.

Brand-new writers will find *Plots Unlimited* frustrating, and puritanical professionals might find it rather insulting. For everyone else, though, it'll provide valuable kick-starts for the imagination and lots to think about: even if you throw away everything it suggests, you'll have a good insight into the mechanisms and twists of plot creation. Me, I'm keeping it on my hard disk: whether I dedicate my bestseller to its creators remains to be seen.

*Plots Unlimited* costs £249 from AshleyWildePublishers on (0638) 500520.

## PagePlus

PagePlus is cheap and cheerful DTP that has nevertheless adopted some of the features of its more glamorous contemporaries. Helen Johnstone planned some pages with it.

Desktop Publishing is one of those areas that has made computing look like fun to the general public. There are a number of budget packages on offer, cheap enough for even the casual user. One of these is *PagePlus*, a popular package for schools.

What makes *PagePlus* even more fun is that it works with just the basics of Windows. No other software is needed, as files can be imported from *Write* and *Paintbrush* to create the document.

*PagePlus*, however, is serious about its desktop publishing. Rather than being a glamorised word processor, it is a program for page layout and design. Text from *Write* or in *Microsoft Word*, *MultiMate*, *WordStar*, *WordPerfect*, *Windows Notepad* or *ASCII* format is arranged on the layouts created by *PagePlus*, with the clip art from *PagePlus* or imported graphics.

### Pasteboard

Like the major desktop publishing packages, *PagePlus* operates with an A4 page view and an area around the page, called the pasteboard, onto which text and graphics can be placed while the page is being designed. Guides and rulers can be drawn on the page to help with positioning and to mark out margins and columns.

Another of the characteristics of the

more expensive DTP programs that it has taken on is the toolbox idea, where functions can be selected from a small, movable box on the screen. *PagePlus* has two, one of which contains eight mouse-driven tools for creating and modifying the graphics and text on the

the character spacing and the font style in this way, and an example of how the text will appear is given in a line along the top of the box. At the same time, those changes are applied to any text on the page or the pasteboard that has been selected.

For anyone familiar with Windows, it is easy to get started with *PagePlus*. Files are handled in typical Windows style, and most of the operations are mouse-driven. With a basic understanding of the way DTP programs work, you can quickly learn most of the *PagePlus* commands.

### Planning

The manual is careful to warn users that planning the document is important — a detailed plan is vital for any complicated documents — because the text manipulation techniques are as primitive and inaccurate as the traditional methods of cutting and pasting.

The way text is formatted bears more resemblance to these methods than to the methods of electronic publishing. Text is imported into the document, either a paragraph at a time or in columns. Once imported into the document, those divisions remain fixed, and each block of text must be selected and formatted separately. This can be a real problem when adding graphics or



page or in the pasteboard area. The other, the Textbar, is for working on text and is an alternative method of performing some of the functions available on the pull-down menus.

By clicking on the icons in the Toolbox, the mouse can be used to draw rectangles, circles and lines, to zoom in on a selected area, to rotate and crop images and to activate text wrapping and flowing.

Using the Textbar, changes are made to the point size, the character width,



changing the text style.

As an example, if text is imported into a document in two columns and then a graphic is added on top of the text in the first column, when the text is wrapped around the graphic, it will spill out over the end of the column. Instead of flowing over into the second column by itself, the text in the second column has to be moved down the page and the overspill text cut, and moved into the space.

The solution is to position and size the graphics first. PagePlus is much better at dealing with graphics than

text: the sizing and cropping operations are intuitive and the colour is easy to control. Colour strength is adjusted on a sliding scale and four-colour separations can be produced.

### DTP training

Once you've learnt how to do all the experimentation first and drawn up a careful plan for the final document, PagePlus can achieve some good results. I can see that it would provide a good means of training DTP in schools, where there is no pressure to produce results quickly. The techniques used

in PagePlus are similar to those used with the professional packages like PageMaker and Quark Xpress, but without the sensitivity.

PagePlus is a good introduction to desktop publishing, and for anyone who needs to produce brochures, flyers or newsletters cheaply, the colour handling will be valuable. However, by the end of the test, I couldn't help feeling that I'd produce better results, more quickly, on a word processor.

PagePlus costs £99 + VAT from Serif (Europe) on (0602) 421502.

## SoundEdit 2.0.5

Taking advantage of the sampling facilities Apple has bestowed on some of the Macs, Chris Cain got an earful of the new version of Farrallon's standard, SoundEdit.

Now that Apple has decided to put sound sampling equipment inside some of the Macs, people are looking to explore the audio side of these machines. Anyone with an LC, Quadra, IIsi or high-end PowerBook can digitise and play back their favourite sounds without expensive add-ons. Sampling time has been rather limited, however, with a maximum of around 30 seconds available using the system software. All this is about to change with the release of SoundEdit 2.0.5, the latest from Mac sound specialist Farrallon.

Already considered to be the standard Mac sampling software, SoundEdit now includes full support for this new hardware. Previously, to sample sounds the software had to be combined with an external digitiser such as Farrallon's own high-quality MacRecorder. The new version also claims to be fully compatible with System 7, although it will run on any Mac using version 6.0.6 or above.

### Quick click

Installation involves dragging the program to your hard disk, after which a quick double click is all that's needed to make things go. This brings up an editing window, a set of five menus at the top of the screen and several interesting icons that make up the program's main control panel. The first of these is

the recording icon, cunningly depicting a microphone, but the package can be used for much more than just recording sounds. The menus house a variety of professional audio editing tools which allow the user to alter and customise every bit of digitised data.

To start sampling you must first

pling at the highest level. The two lowest sampling settings are best reserved for the most simple sounds, such as those used to simulate laser fire in a video game.

To start recording all you do is click on the microphone, which sets the sampling hardware in motion and produces a small time gauge on screen. As the seconds pass, the gauge fills up and when it's full everything that was sampled is displayed as a waveform in the editing window. Recording can be stopped at any point by clicking the microphone again, but most of the time you'll want to go for the maximum time available. Either way, pressing the speaker icon next to the microphone lets you hear how things came out.

### Storing sounds

If everything is fine, the waveform can then be saved as one of four types of file — yes, it appears standards are alive and well in the Mac world too. The default format is SoundEdit's own, but you can store sounds as system resources, instruments or as Audio IFF files. Saving as a resource file seems to make the most sense, but while the package is compatible with System 7, it produces old-style data. New resources can be played simply by doubling clicking on their icons, but SoundEdit's files will need to be converted first using something like SNDConverter.



decide on the recording or capture rate, either 22, 11, 7 or 5kHz. A setting of 22 will sample at 22K per second, giving the maximum possible quality. The drawback is that this uses a large amount of memory, with even a 10-second sound taking up 220K. Recording at a lower level allows for much longer samples, but the overall quality deteriorates the further down the scale you go. A recording at 11kHz is fine for something like synthesised music, but speech or singing really requires sam-



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Should you wish to edit the sound, moving through the menus reveals a bundle of effects including echo, reverb, flanger and reverse. Any clipping or pops can be dealt with using a smooth low-pass filter option and quiet sounds can be amplified to a desired volume level. The Mac's standard editing features can also be used on the waveform:

you can cut and paste things around using the clipboard and the Edit menu. Sound can be downsampled to lower rates or compressed, though again, this reduces sample quality.

SoundEdit is a simple yet detailed software tool that can provide the user with hours of fun as well as being of practical use. It's ideal for anyone want-

ing to incorporate sound in a multimedia presentation or video game, and it can generate some fantastic system sounds. In fact, if you couple it with something like ClickChange you can end up with a whole new Mac.

SoundEdit is available from Gomark on 071-731 7930 and costs £149.

## DAC DataPak 128Mb optical disk

For the same price as a Syquest 45Mb removable cartridge, the DAC optical disk offers three times more storage capacity and a more convenient size, says Mike Collins.

If you are in the market for a removable disk drive, you may be considering the Syquest 45Mb removable format, or the 600Mb or 1Gb erasable optical formats. The larger optical drives are still quite expensive, however, and you often need much more than 45Mb for a large project involving graphics, for instance. Also, the Syquest cartridges are quite large and not totally reliable.

Syquest has recently brought out a new 88Mb removable format, but this is similar in size and reliability to the company's smaller format. To address this issue, DAC, a UK company which produces computer data storage products, has just brought out a new 128Mb Rewritable Optical disk drive.

DAC is the first company in Europe to offer this new format using a conveniently-sized 3.5in disk which offers high reliability and low cost per megabyte, with a useful amount of data storage capacity, particularly for backup purposes or work with large multimedia files.

### ISO compatible

The drive is based around a unit developed by IBM and is covered by extensive worldwide warranties. The format is fully-compatible with the ISO standard which is being adopted by all 3.5in optical drive and disk manufacturers — and Sony, Epson, Hitachi and others all have plans to bring out versions. These will be important factors for many prospective users.

The standard DAC casings are very compact (2in high, 8.5in wide, and 9in deep); are platinum-coloured; have two standard 50-way AMP SCSI connectors; have an ID switch with a small

window which reveals the SCSI ID number, with a push-button above to increment and one below to decrement the ID; and have a front-panel on/off switch. They are part of a range of DAC products in similar packaging, including 400Mb and 1000Mb Winchester-type hard disks, and a high-performance CD-ROM drive. Suitable 3.5in optical

drives (although about 20% slower than the 1Gb Maxoptix rewritable optical drive), and that it is just a little slower than a typical fast hard disk drive — as far as the user is concerned. I have been using one for about a month now, and it actually appears to be just about as fast as any of these other types of drive.



disks are available from several major manufacturers including IBM, Epson, Mitsubishi, and Verbatim.

DAC can provide SCSI interfaces for just about any PC, Compaq, or other compatibles which use the PC/AT bus, and also offers IBM Micro Channel interface adaptors. These are all available with or without high-performance cacheing. A disk BIOS is included with the interface hardware, as well as all necessary diagnostics and system tools that may be required. And DAC will supply suitable CD-Audio drivers for IBM and compatibles, or the standard Toshiba and Apple drivers for the Mac version. All necessary cables are included for no extra charge, and interface prices range from £80 to £200 depending on type.

DAC claims that this optical drive is about the same speed as a Syquest 45Mb removable drive, and a little faster than the Sony 650Mb rewritable opti-

### Optional extra

The drive is also available as a member of DAC's R4000 Professional Series, in a 19in rack-mountable case, with DAC's SCSI Drive Management System (DMS) as an optional extra. The DMS SCSI switching controls are fitted to the front panel of the rack and allow you to connect the drive to each of two different 'host' devices connected to

the two available SCSI ports on the rear of the unit, and switch between them at the touch of a button. You can also change the SCSI ID numbers via these controls, and there is a large, legible display which makes operation of these units quite simple.

An interesting feature is that the disks are just 3.5in square — the same size as floppy disks (although they are nearly twice as thick) — and when you open the shutter, you see an optical disk rather than a magnetic one. You could stick one of these disks in your shirt pocket, or post one via letter, or take it through X-ray machines at airports with confidence.

### Hard to corrupt

For those concerned about data integrity, it is worth noting that it is difficult to corrupt one of these disks: you can throw it around, spill coffee on it, or even stand on it, and it should still be



### PC-320X

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### PC-320X Network Station

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A 128Mb disk costs £82 + VAT.

# World Atlas for Windows

David Brake did his best to find his way around an idiosyncratic world atlas that offers rigid handling of statistical information and seems to have something against cities.

**T**he Nineties promise to be a busy decade for cartographers — these days, maps are out of date as soon as they're released. World Atlas for Windows, however, has only recently been launched, and since it is software it can easily be updated so it should always be reasonably accurate. As well as providing 201 maps, it includes an extensive amount of statistical information on countries and regions of the world, much of which can be compared using user-defined graphs.

The interface to World Atlas is rather idiosyncratic and doesn't conform to any Windows standards. The menu bar, for example, is largely ornamental: the Search item doesn't pull down a menu at all; instead, if you select it, you get the

program's standard search dialog box. Fortunately however, once you get used to the way it works it is fairly straightforward to use, and the large buttons on the side make sense; after all, there aren't that many different operations you can perform on a map.

The political information covers up to around the beginning of last year — Germany is united, the Warsaw Pact countries have liberated themselves and Iraq has invaded Kuwait (but has not yet been driven out). In some cases, information is even more up to date: the US recognition of the Baltic states in September last year is there, for example, though no individual information is available about them. This is about as good as you can expect, though

occasionally they slip up. Revealingly, John Major is correctly identified as Prime Minister of Great Britain, but a few lines later in the text Margaret Thatcher is given as the leader of the Conservative Party.

## The spirit of unity

The maps are rather more disappointing. Presumably because of storage restrictions, there are not enough of them and they are insufficiently detailed. There is, for example, only one map of Britain and Northern Ireland, and it has the location of just 20 cities, and more detailed information on just four, rather strangely selected — London, Manchester, Plymouth and Aberdeen. All right, ours is a small country, but one might reasonably expect more detail on the USA. It, too, only gets one map to cover 3,618,765 square miles of territory, and has 37 cities on it — not even one per state. For that matter, it (and all other maps) omit any borders inside a country. The US, the USSR and Germany all appear to be completely unified (the border between East and West Germany is still marked, because all statistical and political information in the program is still split).

Even if the city you want is in the program's database, finding it is not necessarily easy. Ask to find Seattle, for example, and you will get the map of the US and the city you seek isn't highlighted in any way.

One of the advantages of a software-based map is that it allows you to easily annotate it (without teacher caning you for vandalism), and the Software Atlas does allow quite a bit of this. You can mark locations on the map for future reference with pins, flags and other





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symbols, you can attach notes to maps (but not to individual cities) and you can, using a separate program, add statistical data.

Unfortunately, the program that allows you to add statistical data is somewhat limited. Anything you enter goes into a separate category called 'user topics', so if you type in information about, say, the number of computers per capita, it will not appear if you just ask for economic data.

### Unreliable updates

Neither can you edit any of the data in the original program yourself, so you cannot update it when you get new information; you have to rely on the publisher updating it, using sources you may not necessarily agree with. It is often difficult to determine what the sources are for any given piece of information, although a list of sources for the atlas as a whole is given at the back of the manual.

You can only get or enter statistical data about countries and, rarely, regions, not cities. Nor can you add anything about cities at a later date. And you are stuck with the way the statistics are compared: the figure for number of libraries, for example, is an absolute one, so when you attempt to make European comparisons using a graph, the USSR dominates because having by far the largest population it also has the most population. You can't then ask the computer to go away and calculate the number of libraries per capita or relate it to GNP, even though information on both of those is available separately.

### Executive toy

At £59, World Atlas for Windows is basically an expensive executive toy: frankly, I'd prefer the large and expensively produced paper atlas I'd get for half the price. Where it would chiefly be used is in education. While it in-

cludes a wide variety of statistical information, its handling of it is disappointingly rigid, the information can be US-centric (all tourist entry information is based around restrictions for US citizens), and a number of useful areas of information are missing — anything to do with human rights, for example. You could read the whole of the entry about China without finding a mention of Tiananmen Square.

Putting an atlas with statistical information on a computer should greatly improve its usability and versatility. Unfortunately, World Atlas for Windows does not yet deliver the potential, despite swallowing as much as 6Mb of hard-disk space. Even the CD-ROM version isn't much better — the data and the maps are exactly the same; all that it adds are padding, like national anthems.

World Atlas for Windows is available from Software Toolworks on (0444) 831761.

## allCLEAR

Flowcharts are a staple of business presentations, and there's no quicker or easier way to generate them than with allCLEAR. Nick Beard was in full flow within half an hour.

Most business and computer people regularly use flow charts. In the consulting world that I inhabit, building flow charts is almost a weekly routine. Most graphics packages can help, but the process generally remains slow and cumbersome.

allCLEAR makes building flow diagrams remarkably simple. It is an 'automatic illustrator' which bridges the gap between text and graphics. The basic principle is to create 'scripts' describing a procedure or a decision process, which are then poured into allCLEAR. allCLEAR adds the boxes, lines and arrows which turn your text into a striking flow chart. Here's a simple example:

#### AUTOMATIC TITLE

First statement.

Second statement.

First sentence. Second sentence.

Last statement.

This generates a procedure chart where the automatic title is in large bold letters at the top of the screen, below which are four boxes linked by arrows, each box holding the text of one

of the lines. Font, and the shapes of particular types of box — such as start box, decision box, end box — are user definable. It is remarkably simple.

### Spreading out

Most 'real world' procedures, of course, are not simple linear lists of instructions, they include decision points and iterative loops. allCLEAR accommodates these easily, and allows nesting of complex if-then sequences within a chart. A chart will automatically spread over as many pages as required, placing 'goto A, B or C' labels where required. Scripts can be merged once built, and combined to produce huge flow charts.

allCLEAR comes archived onto a single disk, which is decompressed onto your hard disk. It requires a PC with 512K or more of memory, at least CGA graphics, a graphics printer and DOS 3.0 or above. The decompression routine is built into the installation program, which sets up the directory structure for you.

Under the allCLEAR directory are \FONTS, \SAMPLES, \FILES and \TEMP — all self explanatory. Sam-

ples has a further subdirectory, \TUTORIAL, which contains the example files used in the allCLEAR language tutorial. The installation routine works well, and includes the option to replace calls to the allCLEAR text editor with the name of your existing one. For example, instead of learning yet another editor interface, you can use WordPerfect or whatever.

### Foreign body

Using a 'foreign' text editor requires a 'transfer' TSR program called allCLEAR ASSIST to be loaded alongside allCLEAR. This struggled with the WordPerfect routine, causing WP to hang with the 'please wait' message in the bottom left-hand corner until the Escape key was pressed. This was not disastrous, though doubtless represents a bug.

Once into the word processor, ASSIST continues to assist. For example, typing a question — *does it take batteries?* — prompts the required (yes) and (no) plus indentation to be added to the script as soon as you hit the '?'. ASSIST is unloaded automatically on exiting the program. A similar link



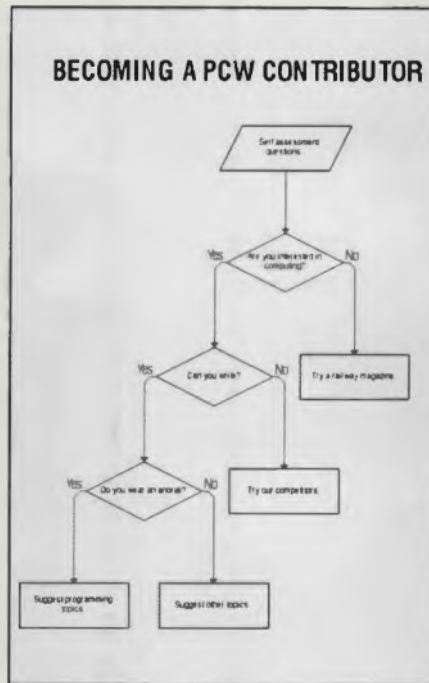
to a publishing/paintbrush program is also available.

The opening screen seems rather complex and untidy, a consequence of the current style sheet which is on display when the program starts. This controls the page layout for the scripts when printed. Summoning a file is a pick-list process, and F2 or 'edit' takes you into the editor.

The View option allows you to scroll through the flow chart, zooming in where necessary to see the detail of the text. The Print menu includes page preview options which are genuinely WYSIWYG. A PostScript printer allows you to have the image scaled to fit on one page. Output can be to a file instead of a printer, and a range of formats is available: PCX, PIC and EPS.

### Consistent syntax

The documentation is good. It is in two volumes, a User's Guide and a Lan-



guage Manual. The 'Getting Started' portion at the front of the User's Guide jumps off to the tutorial in the language manual and back again, in an initially confusing way. This soon makes sense, however, and the process of learning how to create charts is quick and easy. I created the illustration alongside in a mere 10 minutes, only half an hour after opening the box and starting the installation process. More complex charts take a little longer to learn how to do, but the consistent syntax of the script language helps.

Learning all CLEAR should become a required unit on many computing courses, and don't be surprised to see it turning up in MBA courses. A major time saver.

allCLEAR is supplied by Clear Software in the United States on 0101-617 965 6755.

## Mavis Beacon Teaches Typing! v2.0

Mavis is a good tutor: she's observant and considerate — and she lets you play games and squash flies as part of your learning process. Catherine Eade was a model pupil.

The art of proficient typing takes a little time to learn. The advantage of a good software tutorial is that once you've mastered the basics, you can use the program again and again until you reach the level of speed and accuracy you require (and it's a lot less tedious than learning from a book). I've certainly never imagined myself as a wonder-typist. Being self-taught from a textbook, I tend to type like a sloth on amphetamines, with occasional flashes of brilliance.

### Praise indeed

Software Toolworks' Mavis Beacon Teaches Typing! Version 2.0 is the finest typing program in the world, or at least that's what it says on the box. It is actually pretty good. This latest version features 16-colour VGA graphics, a numeric keypad tutorial complete with Grocery Checkout game, graphs and statistical displays. There's also a section on the Dvorak keyboard just in case you possess one of these marvelous inventions.

My first attempt to install Mavis met with a slight problem: it was impossible to set it up on the B: drive, even

when I assigned it as A:. Fortunately the program comes on both 5.25in and 3.5in disks, but it was annoying all the same.

Starting on Intermediate level in an

attempt to improve my speed and accuracy, I wasn't expecting Mavis to be paying that much attention. But I was pleasantly surprised to find that while I'd been copying simple sentences and





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# WESTERN SYSTEMS





more complicated passages of prose, she had been quietly analysing my progress and had noticed my tendency to transpose letters. This diagnosis was followed by specific exercises to strengthen weak fingers and eliminate mistakes.

The program includes an arcade-style section — a racing game, which involves typing to beat an opponent in the car behind you. My speed had by now reached new and amazing heights, but when playing this game it felt quite dramatically due to heckling from colleagues (well, that's my excuse).

The game is fun, you even get to squash a few flies, but it's not the best exercise for achieving accuracy and is probably more suited to children and

arcade buffs.

I was more impressed by the shadow hands effect, where ghostly hands mimic your every move, but I couldn't quite see its usefulness. In other lessons it can be tempting to glance at the clock or speed indicator, or to watch the metronome and subsequently lose concentration altogether. Thankfully it's possible to turn all these effects off.

When you next run the program, Mavis asks you to identify yourself and sets the exercises accordingly. The second time I pretended to be a beginner, and re-lived those terrible first lessons learning the home keys. I moved on to the 500 most-used words in the English language (including 'America', of course) where I surprised myself when my speed leapt to 60wpm and I received the strongest congratulations from Mavis.

### Escape from lessons

This program is good for beginners in that you can spend as long as you want on one particular exercise without feeling that you're annoying the tutor or falling behind. You can repeat lessons as many times as you like, choose exactly which ones you want to practise,

and escape from lessons that are boring you (here Mavis comments 'you'll never learn to type that way').

If you already are a fairly competent typist the program points out your most common faults, which are explained to you and updated on progress graphs — useful if you only need to work on specific areas.

Mavis takes note when you give up, get frustrated or mad, and will suggest playing a game, sitting in a more comfortable position, or even calling it a day. Conversely, if you're typing well she will push you to go faster. There are a variety of lessons: riddles, amazing facts from the Guinness Book of Records, and famous sayings, plus lessons that concentrate on numbers and symbols. The effects are impressive and it's worth persevering.

You are advised in the accompanying manual not to practise for more than an hour a day, but it's kind of addictive. The mentality behind it is similar to that of an arcade game: I kept slipping back to try and beat my last 'score'. No bad thing really: I went from around 35wpm to upwards of 50wpm in three half-hour sessions. Then I went back to the racing game and triumphantly squashed a few flies.

Software Toolworks is on (0444) 831761. Mavis Beacon Teaches Typing! Version 2.0 costs £35.99 (including VAT).

## EndNote

A bibliographic database must satisfy many specialised needs. Looking for one which does it all is like searching for the Holy Grail. Has Paul Begg reached the end of his quest?

**B**ibliographic record keeping is not a specialised requirement limited to academics. The list of people who collect and catalogue press cuttings, articles and books include writers, researchers, government departments, institutions like the police, libraries, marketing and publicity departments and journalists. All have different needs and a bibliographic database which can satisfy such a variety of users is a tall order.

There are quite a few shareware and commercial bibliographic databases around. The shareware packages Biblio and Papers are good, well thought out, reasonably powerful and easy to use, while the commercial freeform database ideaList was originally designed for the storage and management of bib-

liographic data and is good at the job. But as much as I like these packages, none has proved flexible enough to be worth the effort of using.

Jaundiced by what has been a long and futile quest, I approached EndNote without enthusiasm, more in the spirit of 'well, I suppose I ought to try it'. So I copied the single floppy onto my hard disk, opened the manual and prepared to write about all the things it couldn't do.

### Pleasant surprise

Instead I have to write about all the things it does, which is practically everything except type in the data itself — in fact, even this is possible with a sister package called EndLink and ac-

cess to one of the on-line bibliographic databases. Maybe an upgrade will make the coffee.

What makes or breaks a bibliographic database is its ability to cater for three requirements: it must be able to handle a wide variety of source types such as books, newspapers, academic papers, sheet music and so on; it must have sufficient fields to deal with the full range of publishing information; and it must offer flexibility in the way it can lay out the bibliography.

EndNote, which began life on the Mac and has now been issued for the PC and with a promised Windows version in the near future, covers all bases and does even more.

There are 15 source-type categories;





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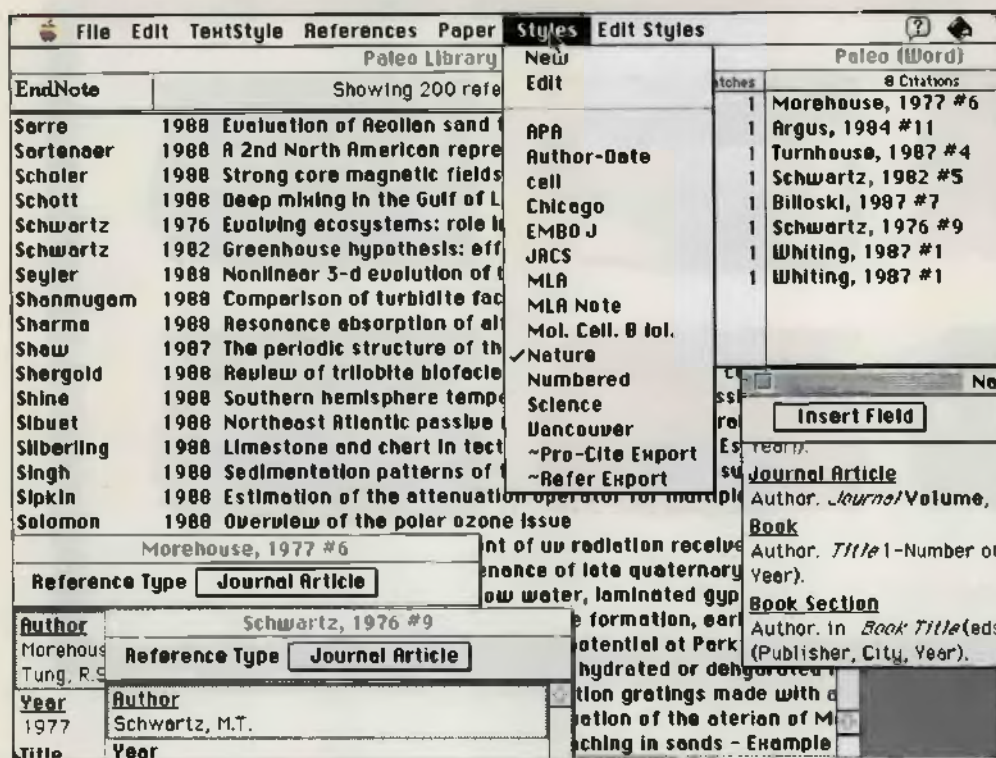
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books, journals, magazines and newspapers of course, but also rarer birds such as maps, audio-visual, computer programs, artwork and personal communications. Some categories are even subdivided. Books, for example, are divided into *book* for a book by one or more authors, *edited book* for edited books and *book section* for listing chapters, single pages or articles within conference proceedings.

### Free fields

Publishing information is amply catered for by 27 specified fields which include ISBN/ISSN numbers, keywords, abstract, and notes. There are also four 'free' fields which can be customised by the user.

EndNote keeps up to 32,000 references. Fields are unrestricted in terms of length and will handle the longest title or a battalion of co-authors, secondary authors and tertiary authors. Each record can be up to about eight pages, so there is room for even the most detailed abstracts and notes.

As it is often necessary to order bibliographic information in ways specified by a journal or according to taste, it is essential that the assembled database can be laid out to whatever style is needed. EndNote provides several predefined layouts, but customising a layout is easy, albeit a little time consuming, and extraordinarily flexible.

Most commands are invoked through menus or pop-up menus which can be used with a mouse or from the keyboard and information is displayed in

windows. Several windows can be open at any one time and can be moved (with mouse only) and sized.

Files, here called libraries, can be opened for different subject categories or even sub-categories and you can create a master file to include every reference source. Entries can be copied and moved and libraries merged.

List View presents a view of all the references in the database. It shows the author's last name, publication date, and as much of the title as will fit in the window. The list can be scrolled through or automatically searched by author, date, or any word in the reference. Once the specified source has been located and highlighted you can either call up a clipboard, which shows the publishing information as it will be printed, or an edit window which displays all the information you have included, including notes which you may have elected not to print.

### Bibliography maker

As if all this functionality was not enough, EndNote is different from other products because it is not simply a bibliographic database. It is a bibliography maker. You can insert bibliographical information directly into your text as you write or use a marker system which works on the same principle as mailmerge in a word processor.

As you write your article, paper or book, instead of typing the publishing information about every cited source you simply insert a marker in the text. A marker is a short note in square

brackets such as [Begg, 1991]. When your article is complete, a few keystrokes and EndNote scans your text, replacing the marker with a number and inserting the full details of the reference in a bibliography created at the end of the text. This can save hours of work.

My most serious criticism of EndNote is that the list can only be displayed alphabetically by author or in the order of entry. Its inability to list bibliographic data by publication date, title or even by publisher is a deficiency which needs to be, and I understand will be, rectified in a future upgrade, EndNote Plus.

EndNote does not possess a print command, but this is not a problem. With a few keystrokes you create a file for export to a word processor. The file can then be printed and you can take advantage of all the features offered by your

word processor, such as adding headers and footers.

### Perfect partner

EndNote works best with WordPerfect, where it can be installed as a TSR at the touch of a hot-key (Alt+Ctrl+E). It will reformat text in RTF in Microsoft Word and Word for Windows and in ASCII in any word processor. Except for ASCII text, it provides for a range of text formatting like italics, underlining and boldening, plus Greek characters, diacritics and an extended character set. If you do not use WordPerfect then double check which features of EndNote will be closed to you.

EndNote 1.0 is available for PC and Mac and a Windows version is expected soon. It needs 512K RAM and DOS 2 or greater (DOS 3 to run TSR with WordPerfect). A sister package called EndLink allows transfer into EndNote of bibliographic databases downloaded from online services such as Dialog, BRS Colleague and MedLine.

Although EndNote has limitations, none are too serious. It needs to be TSR with more word processing software and it is a mite slow popping up. Data entry and exporting need to be a touch easier and speeded up, and fixed fields for publishing history would free the customised fields for other uses. But overall this is an impressive package.

EndNote is available from Cherwell Scientific on (0865) 794884 and costs £115 + VAT. The sister package EndLink costs £85 + VAT.



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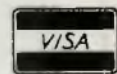
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# Acorn A5000

The A5000 is a move Acorn had to make in order to compete on price/performance with the mainstream PS/2 world. Roger Howorth assesses the new age of the Archimedes.

Since its launch in 1987 the Archimedes has been at the forefront of technology. Acorn pioneered 32-bit RISC processors on the desktop, and the company's multi-tasking operating system is respected for an innovative GUI and font manager. Acorn is also an important supplier in UK education: it counts 91% of UK schools among its customers.

The A3000 accounts for most of these sales; indeed, this is the fourth best-selling computer in the UK, and Acorn the fifth biggest UK supplier. The company is developing sales in Europe, and the A3000 is an officially accepted educational platform in Canada and Australia.

Most of the Archimedes line, including the A3000, is based on the ARM2 (Acorn RISC Machine) CPU which began development in 1983. Since production began in 1987, Acorn has improved the design, resulting in the ARM3, a compatible chip with its own 4K on-chip cache and extra support for co-processor and multi-processor installations.

The ARM3 has been available for some time both as an upgrade to earlier Arcs, and as the CPU in the high-end A540 Archimedes and R260 Unix workstation. ARM3 is also the first fruit from the joint venture set up by Apple, Acorn and VLSI.

## Restructured range

Faced with falling prices and higher specifications from competitors, Acorn restructured its product range and announced a wave of price cuts and the new A5000. This replaces the old A400 series, but is essentially an update of that hardware and a continuation of the line. The restructured range now has the A3000 at entry level, the A5000 in the mid-range and the A540 at the high end. The ARM3 used in both the A5000 and the A540 delivers a staggering 13 MIPS, an improvement of around 100% over the old flagship A440.

However, Acorn regards the A5000 as a significant update with vastly increased price performance, rather than simply a response to competition. RISC OS has been updated to version 3 and is now stored completely in ROM. Other software elements including 12 out-



line fonts, 'modules' and bundled applications are also in ROM, which has grown from 512K to 2Mb in version 3. For the average user, this results in around 150K more free RAM.

The entry-level A5000 is fitted with 2Mb of RAM and a 40Mb hard disk: this may seem small compared with Mac or PC hardware, but the Archimedes is far more economical with its storage. This is achieved by executing the OS from ROM and using a single shared font manager and a large 'Shared C' run-time library.

The floppy disk system been updated with a 1.5Mb high-density drive, and is compatible with various Acorn formats plus DOS and the Atari ST. In typical Acorn style, this has been thoroughly integrated within RISC OS so that directory windows appear and work in the same way regardless of format, much as Dayna's DOS Mounter does on the Mac.

The Archimedes has never been a slouch at graphics, and is even less so now. New screen modes have been added to reflect market demand and show off the A5000's bundled VGA monitor. In fact, most users will get a monitor equivalent to SVGA, but this is not part of the specification so Acorn is not advertising it as such.

## Power on the move

For an example of ARM3's power, look no further than moving a window around the screen. Rather than dragging an outline, as is the case using Windows or System 7, the Arc can redraw windows in real time, as they are moved. This has been a feature of

RISC OS for some time, but the ARM3 makes the movement all but completely smooth, even for large windows.

The mouse now has a 6-foot cable, making it easier to share in the classroom. The keyboard feels much lighter than previous models, whose solid feel I prefer.

The Archimedes has a reputation as a noisy machine. Although the fan has been moved from the front to the back, the new model remains the loudest in my office. With the industry devoting so much attention to Health and Safety, it's about time computers became quieter without users having to resort to a screwdriver being jammed in the fan.

Of course, although Acorn is pleased with its success in the education market, it is keen to develop sales in the business community. Although the Archimedes has consistently outperformed all but a handful of other processors and has pioneered some innovative software, most of this has been at operating system level, and that OS isn't DOS.

## IBM emulator

Acorn has a solution in the shape of its IBM emulator. Its performance varies between applications, but as a rule of thumb it will be OK for most tasks such as simple word processing but too slow for CAD/CAM. Running on an ARM3 it should give performance somewhere between an XT and a 286. The emulator and DOS partition capability certainly offer a degree of comfort to those in need of occasional DOS functionality: it even copes with Windows, albeit slowly. But even the ARM3's sparkling performance can't turn an Archimedes into a PC — and who would want to?

The A5000 begins a new age for the Archimedes in terms of price/performance. While the mainstream world of PS/2 computing marches on, the Archimedes proves itself a capable machine with a healthy spirit of its own. But that may not be enough. What's changed is that, thanks to the low prices of fast PCs, this is a necessary upgrade to make the Archimedes halfway competitive on price/performance, rather than giving it the lead it once held.

Acorn is on (0223) 245200.



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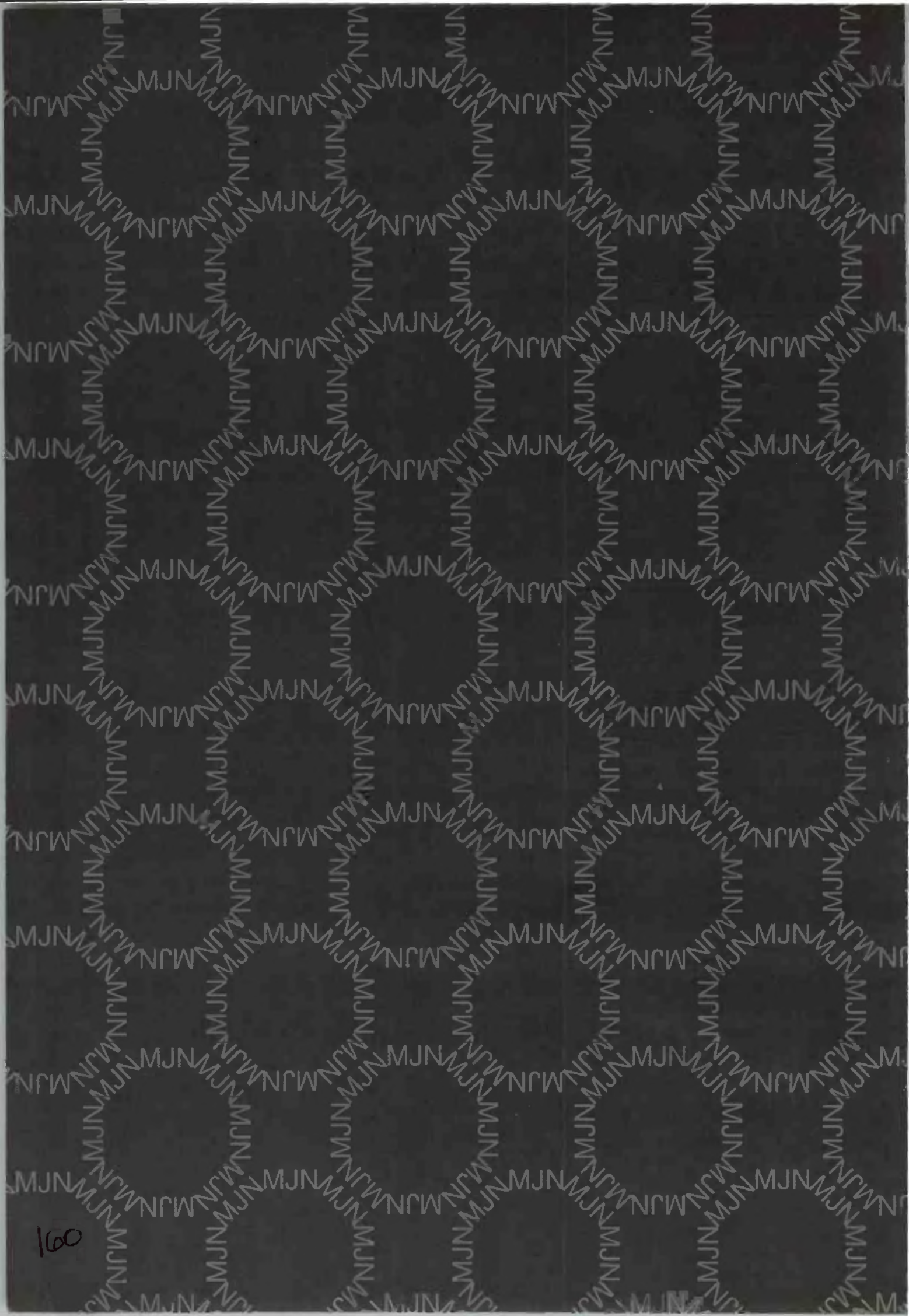
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A large, dark silhouette of a person's head and hand is positioned on the left side of the image. The hand is raised, with the index finger pointing upwards. The background is a vibrant sunset or sunrise, with a bright sun low on the right horizon, casting a warm orange and red glow. The sky transitions from a deep red at the top to a lighter orange near the horizon. The overall mood is dramatic and professional.

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- 80286™ microprocessor
- 2 MB RAM, 70ns DRAM SIMMS expandable to 4 MB on motherboard
- 1.2 MB 5.25" floppy disc drive
- 1.44 MB 3.5" floppy disc drive
- 43 MB IDE hard drive with 32K read-look-ahead cache buffer, 17 ms access time, 10 Mb/second DTR
- 16-Bit VGA graphics card with 1 MB video RAM, giving resolution up to 1024 x 768 in 256 colours
- 14" Super VGA non-interlaced colour monitor, giving resolution up to 1024 x 768
- AMI BIOS
- Support for maths co-processor
- 5 years battery back up for clock/calender
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- Selectable CPU speed between 8/16 MHz
- 8 MHz bus speed
- Landmark speed 21.4 MHz
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- 1 parallel, 2 serial ports and 1 games port
- 102 key enhanced UK click/tactile keyboard
- Easy to read system manuals
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The 386/SX is a hybrid computer designed to give you 386 technology at a 286 price. Although the SX processes data in the same 16-bit chunks as the 286, the SX will run software written for 386 systems with 32-bit data paths. Like all 386 processors, the SX has extended memory capability which allows you to run more than one application at a time.

- 80386/SX™ microprocessor
- 2 MB RAM, 70ns DRAM SIMMS expandable to 16 MB on motherboard
- 1.2 MB 5.25" floppy disc drive
- 1.44 MB 3.5" floppy disc drive
- 43 MB IDE hard drive with 32K read-look-ahead cache buffer, 17 ms access time, 10 Mb/second DTR
- 16-Bit VGA graphics card with 1 MB video RAM, giving resolution up to 1024 x 768 in 256 colours
- 14" Super VGA non-interlaced colour monitor, giving resolution up to 1024 x 768
- AMI BIOS
- Support for maths co-processor
- 5 years battery back up for clock/calender
- 200 watt power supply
- Selectable CPU speed between 8/16 MHz
- 8 MHz bus speed
- Landmark speed 20 MHz
- 4 16-bit and 2 8-bit expansion slots available
- 1 parallel, 2 serial ports and 1 games port
- 102 key enhanced UK click/tactile keyboard
- Easy to read system manuals
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Based on the 16 MHz 386/SX, but with

- 32K SRAM Cache, 25ns
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- Intel 80386™ microprocessor
- 32K SRAM Cache, 25ns
- 4 MB RAM, 70ns DRAM SIMMS expandable to 32MB on motherboard
- 1.2 MB 5.25" floppy disc drive
- 1.44 MB 3.5" floppy disc drive
- 85 MB IDE hard drive with 32K read-look-ahead cache buffer, 17 ms access time, 10 Mb/second DTR
- 16-Bit VGA graphics card with 1 MB video RAM, giving resolution up to 1024 x 768 in 256 colours
- 14" Super VGA non-interlaced colour monitor, giving resolution up to 1024 x 768
- AMI BIOS
- Support for maths co-processor
- 5 years battery back up for clock/calender
- 200 watt power supply
- Selectable CPU speed between 8/25 MHz
- 8 MHz bus speed
- Landmark speed 43.5 MHz
- 5 16-bit and 1 8-bit expansion slot available
- 1 parallel and 2 serial ports
- 102 key enhanced UK click/tactile keyboard
- Easy to read system manuals
- Microsoft mouse
- Microsoft DOS v5.0
- Microsoft Windows v3.0
- Free life-time technical support
- 3 years free on-site service cover
- 3 years free parts & labour warranty
- 30 days money back guarantee

**PRICE £1399**

## 33 MHz 386 Cache

### STANDARD CONFIGURATION

The 33 MHz 386 Cache has all the benefits of the 25 MHz 386 Cache but with the added performance, including a 128K RAM Cache. This machine is an excellent choice for graphics applications.

- Intel 80386™ microprocessor
- 128K SRAM Cache, 25ns
- 4 MB RAM, 70ns DRAM SIMMS expandable to 32 MB on motherboard
- 1.2 MB 5.25" floppy disc drive
- 1.44 MB 3.5" floppy disc drive
- 85 MB IDE hard drive with 32K read-look-ahead cache buffer, 17 ms access time, 10 Mb/second DTR
- 16-Bit VGA graphics card with 1 MB video RAM, giving resolution up to 1024 x 768 in 256 colours
- 14" Super VGA non-interlaced colour monitor, giving resolution up to 1024 x 768
- AMI BIOS
- Support for maths co-processor
- 5 years battery back up for clock/calender
- 200 watt power supply
- Selectable CPU speed between 8/33 MHz
- 8 MHz bus speed
- Landmark speed 58.7 MHz
- 5 16-bit and 1 8-bit expansion slot available
- 1 parallel and 2 serial ports
- 102 key enhanced UK click/tactile keyboard
- Easy to read system manuals
- Microsoft mouse
- Microsoft DOS v5.0
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- Free life-time technical support
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**PRICE £1449**

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## 40 MHz 386 Cache

### STANDARD CONFIGURATION

The 40 MHz 386 is a true power user's dream machine. This system's lightning-quick response makes it an excellent choice for a network file server, CAD applications or engineering or scientific number crunching.

- 80386™ microprocessor
- 128K SRAM Cache, 25ns
- 4 MB RAM, 70ns DRAM SIMMS expandable to 32 MB on motherboard
- 1.2 MB 5.25" floppy disc drive
- 1.44 MB 3.5" floppy disc drive
- 125 MB IDE hard drive with 32K read-look-ahead cache buffer, 17 ms access time, 10 Mb/second DTR
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- AMI BIOS
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- 200 watt power supply
- Selectable CPU speed between 8/40 MHz
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### STANDARD CONFIGURATION

The 25 MHz 486 Cache, 33 MHz 486 Cache and the new 33 MHz 486 EISA are more powerful than the 386 range primarily due to external support chips built into the processor. These chips include a maths co-processor and an 8K internal cache - both contributing to powerful performance. A 25MHz 486 system is the best choice for intensive graphics and large networks file serving.

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- 14" Super VGA non-interlaced colour monitor, giving resolution up to 1024 x 768
- AMI BIOS
- Support for maths co-processor
- 5 years battery back up for clock/calender
- 200 watt power supply
- 8 MHz bus speed
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The 33 MHz 486 is a pure number crunching PC. The RAM is expandable to 32 MB, it offers the ultimate PC performance at a terrific price. It is highly recommended for the most intensive graphics, multimedia and scientific applications.

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- Landmark speed 152.0 MHz

**PRICE £2399**

## 33 MHz 486E Cache

### STANDARD CONFIGURATION

The 33 MHz 486 EISA offers all the features of the 33 MHz 486 plus additional RAM expansion up to 64 MB and 32-bit EISA technology. This machine offers maximum performance and is recommended for the largest of networks.

Based on the 25 MHz 486 Cache with:-

- Intel 80486™ microprocessor
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- 210 MB SCSI hard drive with 64K multi-segmented cache, 14 ms access time, High performance SCSI controller with on-board processor giving 32 MB/second DTR
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M12









# On the dot

We've been taking an interest in dots recently, the sort produced by printers costing less than £500. There are many good buys, but your best choice depends much on what you want a printer for. Helen Johnstone, Chris Cain and our team put 26 through their paces to help you.

Choosing a computer to suit your needs may be a nightmare, but it can be simplicity itself compared with acquiring good peripherals. There are even more companies after your cash, all claiming that their modem, monitor, printer or whatever is the best on the market. This holds particularly true when you're choosing a low-cost (under £500) printer. You have to know what you're looking for.

Impact and the cheaper inkjet printers appear at first sight to be much the same, but closer examination shows that comparisons aren't so clear cut. Units of a similar price can have widely

different specifications and give different end results, even if they're technically similar. A few key aspects need to be checked and tested before you consider laying out any loot.

## Defining your needs

The first is to define your needs. Some impact printers are good but they're no match for a laser when it comes to text and image quality. If you plan to produce your own magazine, or lots of printed artwork, you may be best advised to save until you can afford a more expensive device. If, however, you plan to print listings and produce

mailshots, a quality impact printer is by far the best system. Getting decent address labels on a laser is a real task.

Listings really need a machine with a good tractor feed, for example, because continuous paper is the best medium for producing them. Business letters, on the other hand, will more than likely require standard A4 sheets, so a friction or sheet feeder will get best results. Artwork is also almost always printed on single sheets.

Which brings us to graphic capabilities and fonts. Most low-cost printers can produce reasonable graphics dumps, but finding a machine with a

## The makings of a good printer

There is a rumour that printers, especially sub-£500 printers, are boringly identical. They are not. Cheap matrix printers have been subtly evolving since they first appeared in the 1970's. However, some have evolved further than others.

The simplest **9-pin printers** strike a ribbon with any of nine vertically aligned pins to form each row of the character **dot matrix**. Similarly, **inkjet** printheads eject a matrix of blobs. **24-pin printers** give high definition with their extra pins but are not generally faster. Print quality depends on accurate dot positioning. The printer must advance the paper precisely and have accurate control over the print position. Some systems are better built for accuracy.

### Pins prone to bending

Pins should be well aligned. Some heads have wonky pins and others are prone to bending. Most pins are

round. Square ones give more solid uprights albeit with rather jagged diagonals. Bigger stepper motors and more powerful magnets in the print head allow higher printer speeds. Fast printers using less than heavy-duty hardware tend to produce poorly aligned print. the same printer with a **slow mode** can get good results when you need them, yet offer fast printing when quality is not important.

Paper-handling facilities are important in office work. Single sheets are generally friction-fed typewriter-style, wrapping the paper around a **platen** (a large rubber roller) and keeping it in place by small rollers, or **bails**.

Friction feed cannot handle a roll or box of continuous **fanfold** paper because the slightest misalignment will increment down the pages until the paper goes completely askew. Sprocket holes down both sides of fanfold paper allow precise winding. **Pin feed** systems have a ring of pins at each end of the platen to

engage these sprocket holes. This allows winding in either direction but is difficult to load and does not allow for different widths.

## Pushing and pulling

A **tractor feed** has adjustable sprocket rings to cope with different widths. A **pull tractor**, believe it or not, pulls paper through the mechanism. The geometry of this arrangement can mean that you waste a lot of paper getting clean tear-offs.

Recent **push tractor** systems force the paper through from behind, without obstructing tear-offs, and tend to be easier to load. Paper buckling gives push tractors slightly uneven feed characteristics, more noticeable with graphics than text. Some push systems stop paper buckling using the platen and bails to pull from the front as well. A few models in this Group Test had both push and pull tractors fitted as standard. A **park** facility can tuck fanfold out of the way to allow single sheets to be printed.



really good black is the key to getting the best output. If you're looking for colour pictures, you'll obviously need a unit that can produce all the shades you're going to need.

As for fonts, you want as many as you can get; a good Near Letter Quality (NLQ) typeface is also a must if you're going to be printing letters. Quality of type varies greatly from unit to unit and is affected by the number of pins the printer has to play with. A top-class 9-pin can produce good-looking documents, but a 24-pin will always give a better result. Other features to look for are speed, interfaces and ease of use.

We put 32 printers through their paces and the results range from predictable to downright unbelievable. Which did we consider to be the best performer? Read on...

## Canon BJ-10ex



The last dot matrix printer I used, before Chris Cain dumped four on my desk at the beginning of this Group Test, was the Canon BJ-10e BubbleJet. There are a couple of things that dot matrix printers can do that lasers can't, be it printing on continuous stationery, printing multiple part forms, or in the case of printers like the BubbleJet, fitting into a brief case. Fortunately, I don't need to do any of these things.

The first thing that surprised me was just how difficult it is to get a printer to work with a given piece of software. DIP switches are not something I enjoyed seeing again.

There are several odd things about the way you set up the BJ-10ex (the latest version of the ground-breaking BubbleJet). The most notable is nothing more complex than plugging in the printer cable. On most printers the lead carrying data from the computer goes in at the back; on the BubbleJet it goes into the right-hand side, at the front. There's nothing wrong with being left-handed, but designing a printer that is inconvenient for most of its potential market is a little odd.

The reason the printer cable, and indeed the power lead, go in at the side is that the back houses a stand to allow the BubbleJet to be used in an upright position. This takes up a lot more office real estate but arguably makes the paper feed more reliable. Better still, it allows the excellent optional sheet feeder to be clipped on.

Which brings us rather neatly to optional extras. The sheet feeder really

isn't optional. To do anything sensible you need to add one to your order right from the start. The battery is rather more problematic. At 40 minutes of use per charge, you probably need two to use the BubbleJet on the move.

### Good technical quality

And the printout? It really is surprisingly good. Use the printer's native fonts and, while you won't exactly be overcome by the aesthetic qualities of either Courier or Prestige, the technical quality is never in doubt. With a font rasteriser like Adobe's Type Manager or Microsoft's True Type, you might not be quite so impressed. Such fonts are printed by putting the printer into graphics mode — and that, unfortunately, isn't the BJ-10ex's strong point.

The quality of black areas, a traditional gripe with dot-matrix printers, is great. In fact, take any one row of dots on the page and it looks fine. The problem is the alignment of dots from row to row, both horizontally and vertically. Compared to some dot matrix printers, it's quite good. If you're used to laser printers, it isn't good enough.

The BJ-10ex really is a nice piece of kit. It's slow, sure, but not *that* slow, and it's very, very quiet. The quality of printing, in graphics mode, is erratic, but used as a text printer, with decent quality paper, you'll have few complaints. The battery life means printing on the road is severely limited, but that isn't necessarily what you want a portable printer for.

Guy Swarbrick

## Canon BubbleJet BJ-10ex

### Supplier

Canon (UK) Ltd (0800) 252223

### Type

Inkjet

### Price

£345

### Fonts

Roman, San Serif, Courier, Prestige, Elite

### Print speed

Quoted cps: 83 draft, 83 NLQ.

Benchmark cps: 54 draft, 54 NLQ

### Interfaces

Parallel

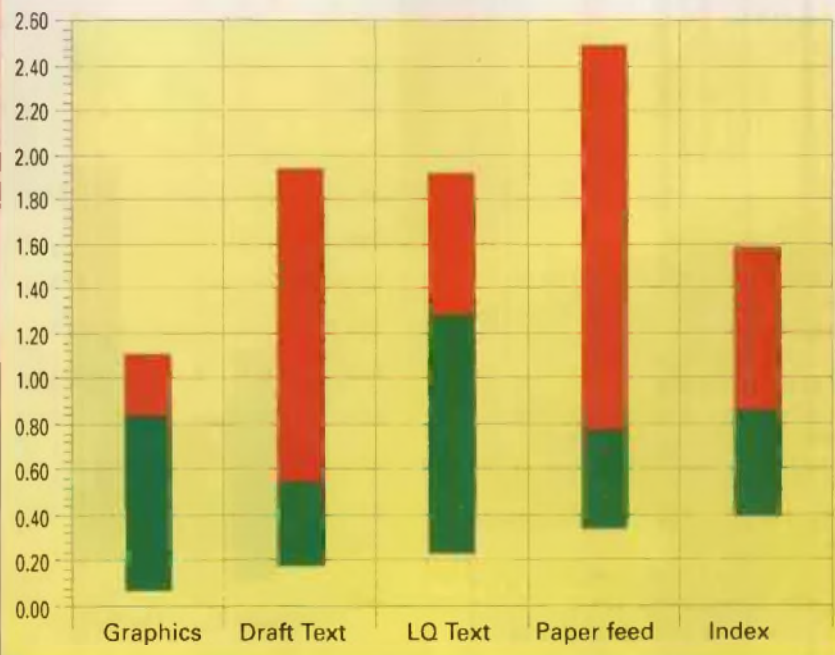
### Paper handling

Friction feed, optional automatic sheet feeder

**Good Points** Small, neat, quiet.

**Bad Points** Needs good-quality paper.

**Conclusion** Superb portable printer.





## Citizen 224



Citizen's 224 was certainly among the best looking of the traditional 24-pin dot matrix printers in this test. Strange, then, that it should also be the printer most likely to appeal to the market's enthusiasts. Lots and lots of DIP switches and control codes lie just under the surface.

Not that the 224 isn't easy to set up. From a software point of view, it's simply an Epson LQ. No problems finding a printer driver. From a hardware point of view, Citizen has made a lot of the more common setup items accessible from a rather clever front panel.

There are only four switches on the panel which are labelled Online, Park/Load, LL/FF and Quiet (and amazingly, the latter works, at the expense of quite a lot of speed and multiple-layer form penetration). A slider switch below these allows you to switch be-

tween four menus.

In the second position the switch allows you to choose between four fonts, the third between 10, 12 and 15 characters per inch and proportional spacing, and the last lets you select the colour option (which also needs a DIP switch setting), clear the data from the 8K buffer, lock the currently chosen font, or select condensed printing.

However you set it up, the Citizen is a pretty good performer, both in terms of speed and quality of printout. In graphics mode, printing rasterised outline fonts from Microsoft's True Type, the printer was, of course, slower than using the resident fonts. There was none of the twitching print head which characterised the frenetic IBM 2380, but there was none of the raw speed either.

### Paper handling

Using native fonts was a different story altogether. In draft mode, the printer fairly zipped through the page and even using the excellent NLQ fonts you could have little cause for complaint.

Paper handling isn't the best in the world, but it isn't bad. A single-sheet feeder is included which works quite well, and the tractor drive always resists the tendency to eat fanfold paper. The one problem, and it is a major problem, is that the single-sheet feed doesn't grip the paper tightly enough and slippage can cause some words to look italicised.

If you want to feel intimidated, take the lid off the DIP switches on the right-

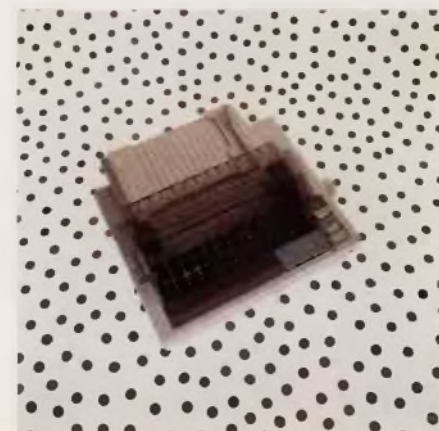
hand side of the printer. The fact that the settings are described on the inside of the removable lid is a good thing; the fact that there are so many of them is not.

If you want to feel really intimidated, have a look at the manual. There's a quarter of a page on how to get the printer working with applications, and about 150 on how to control the 24 pins directly from BASIC.

The Citizen 224 is a disappointment in a lot of areas. The paper feeding isn't good enough and the documentation is unnecessarily techie. If you want a good, solid printer for intra-office work, the 224 isn't a bad bet. If you want to use it for correspondence, think carefully about how good your letters have to look.

Guy Swarbrick

## Epson LQ-200



## Citizen 224

### Supplier

Citizen Europe (0895) 272621

### Type

24-pin dot matrix

### Price

£269

### Fonts

CTZ Courier, CTZ Sanserif, CTZ Roman

### Print speed

Quoted cps: 160 draft, 53 NLQ

Benchmark cps: 113 draft, 44 NLQ

### Interfaces

Parallel, RS232 optional

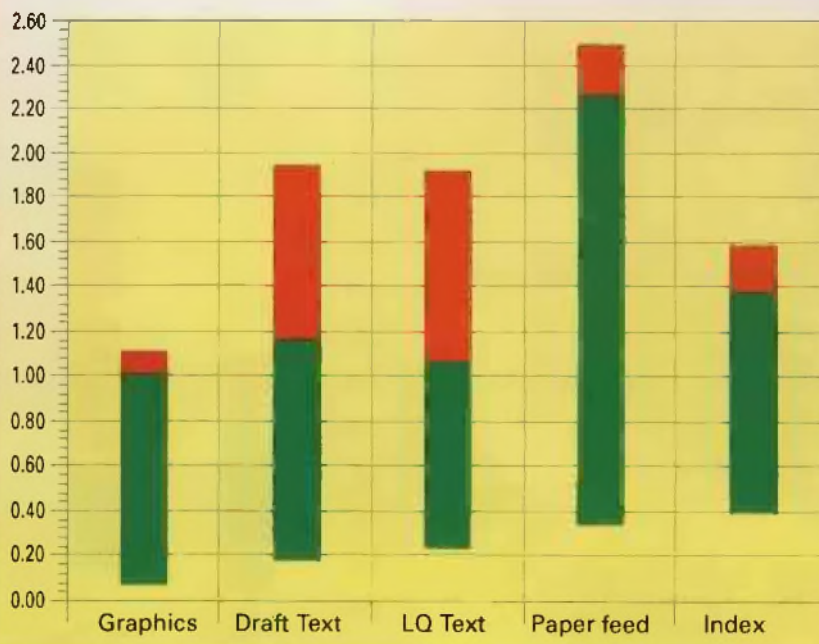
### Paper handling

Friction feed, push tractor, paper parking. Optional ASF, semi-automatic sheet feeder, colour kit.

**Good Points** Looks, speed in text mode, build quality.

**Bad Points** Noise, speed in graphics mode, documentation

**Conclusion** Better than average.





Epson is the most famous name in personal printers, but this doesn't necessarily mean its products are the best. Most PC clones are far better than IBM PCs, and there are plenty of Epson-compatible printers which offer more for a good deal less. The 24-pin LQ-200 certainly seems to have stiff competition, but does it offer something that the others simply cannot match?

The unit measures 320x390x150mm and weighs in at 6.9kg, complete with tractor-feed attachment. Its overall appearance is much the same as most common terminal printers, with the traditional cream case, although the LQ-200's smoked plastic cover looks quite posh. The top of the front houses standard On Line, Form Feed and Line Feed controls, and each has its own status LED. Instantly accessible are the platen knob, on the right-hand side, the power switch, and a Centronics parallel interface at the rear.

### Simple switching

As standard, the unit can work with continuous paper and cut sheets, though a separate paper guide must be fitted in order to use the latter. Switching between these is simple, as the tractor feed detaches quickly. Installing the plastic guide is even easier. The unit also supports rear and bottom paper feeding.

Of course, its printing abilities are of most concern. The LQ-200 comes complete with eight fonts, including Script and Roman. Shadow characters are offered, as are other general effects such

as underlining, strike-through and italics. There are 15 international character sets, five graphic ones, and user-definable character facilities. The user can switch between these using a row of DIP switches concealed in a compartment at the right of the rear.

### Clear manuals

Setting up is a piece of cake, but then this is an Epson product—the manuals are so clearly written that you can't really go wrong. Diagrams are provided in every chapter, along with simple explanations. A detailed set of technical specifications is also included.

In use, the LQ-200 gave a reasonable performance in both text and graphic modes — its NLQ isn't the best, but there are definitely worse examples in this test. Under the PCW benchmarks, the unit managed an average of 41cps in this mode and 96cps in draft.

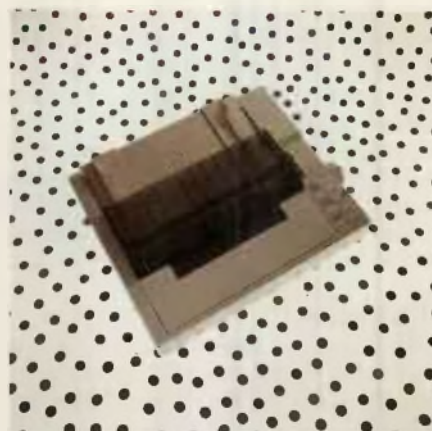
The unit gave no technical problems in use and only two of its features annoyed me — quite an achievement when it comes to printers. Firstly, the tractor feed is positioned on top rather than at the back, so you can never print at the top of the first sheet of continuous paper.

Secondly, this printer is far from quiet and could easily disturb people working nearby. To be fair, though, this is a problem with most impact printers.

All in all, the LQ-200 is an ideal printer for producing listings and quick printouts. It would also suit home use if your needs aren't too demanding.

Chris Cain

## Epson FX-850



Epson is the world leader in printers, so you expect a certain expertise to show even in its cheapest and most basic models.

That's certainly the case with the FX-850, which does not look like a budget 9-pin dot matrix. It has the aura of a serious office printer, with a sturdy professional look and a smart smoked plastic cover to the paper guide that makes it look more expensive than it actually is.

The FX-850 is about two feet wide and the control panel, with an impressive array of six buttons and eleven LEDs, is no less complicated than the average laser printer. On the back is space for a second parallel or serial port, and a paper guide is supplied as standard. Both features are normally only included on larger, more expensive models.

## Epson LQ-200

### Supplier

Epson (UK) Ltd (0442) 61144

### Type

9-pin dot matrix

### Price

£239

### Fonts

Roman, Sans Serif, Courier, Script, Orator, Prestige, OCR B

### Print speed

Quoted cps: 160 draft, 53 NLQ

Benchmark cps: 97 draft, 42

NLQ

### Interfaces

Parallel

### Paper handling

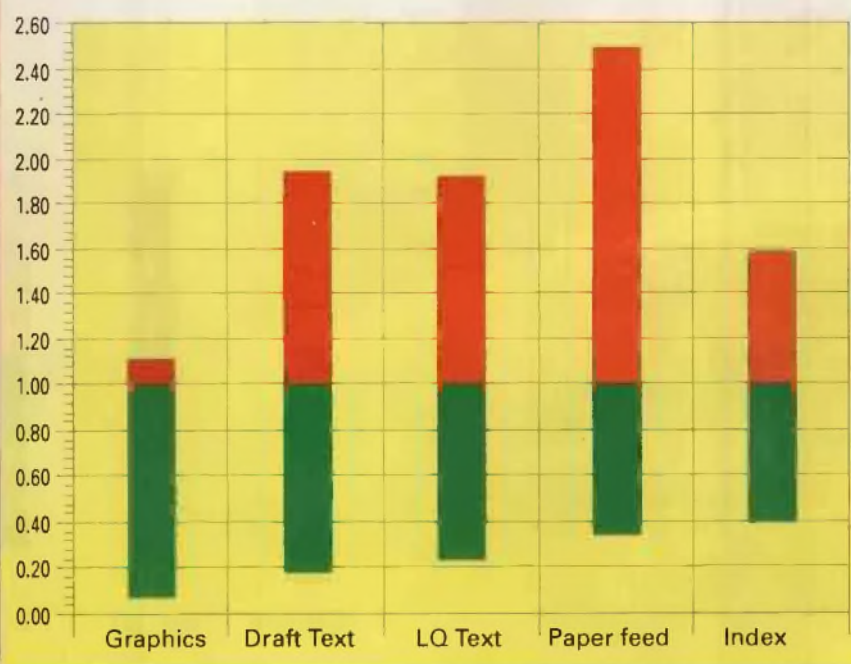
Friction feed, pull tractor feed.

Optional single-bin ASF.

**Good Points** Well built, good manuals, multiple feeding facilities.

**Bad Points** Annoying tractor feed, a bit noisy.

**Conclusion** Cheap and cheerful.





sive machines.

The buttons on the control panel were labelled in full, not with abbreviations, and were straightforward to operate. One row of buttons sets the type style, with a choice of draft, Roman or Sans Serif type, three settings for characters per inch, and a condensed type setting. The others are to set the printer online, and cater for Line Feed and Form Feed (not LF and FF) and for Load/Eject.

### Auto-eject

The Load/Eject, which automatically ejects the paper or sets it in position for printing, is a feature I would like to see copied by other manufacturers. One touch on the button flings the bail arm back to avoid jams, pulls the paper through and aligns it automatically. When the FX-850 starts printing, the bail arm snaps back into position to hold the paper straight.

The FX-850 takes continuous form and cut-sheet paper, holding both at the same time and switching between the different paper-feeding mechanisms with a lever on the right of the printer. It accepts labels, envelopes and multi-part forms.

Printing on labels was an awkward process, but everything else was remarkably easy. Apart from the automatic paper loading, the print modes were easy to set. It was also quiet, for a dot-matrix printer. It makes a racket, but any drop in noise was welcome after listening to some of the printers in this test.

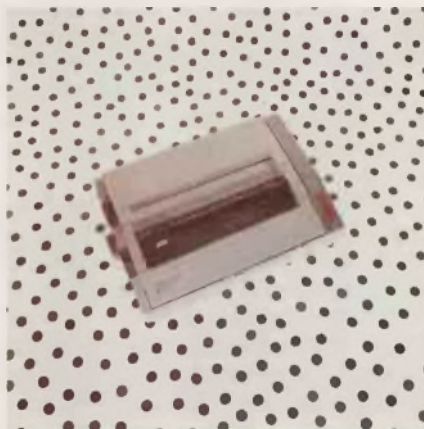
For a 9-pin printer, the FX-850 gave exceptionally clear print. The bold was slightly smudgy, but the effect was no doubt due to the ribbon being new and would have worn off. The FX-850 also performed exceptionally on speed, achieving nearly 190 cps in draft mode. In NLQ mode it recorded a speed of 44 cps, but still didn't seem slow.

This was a printer I enjoyed using, and I felt confident that with Epson engineering it could go on working well for years. Although it is one of the more expensive printers looked at here, it is probably worth the money.

Helen Johnstone

## Facit E420

Facit Computer Peripherals is a division of Facit Limited, part of the Norwegian Entrenor group. The company is a leading supplier of paper-tape punches for the numerical control in-



dustry, and now produces a range of mini and microcomputer systems and various peripherals.

The Facit E420 is the first 'designer' printer I've ever seen. It doesn't have a unique shape, nor even an especially attractive shape; but the colours are great. The case is built up of three shades of grey plastic: dark grey at the bottom, light grey around the sides and a somewhere-in-the-middle-grey lid. That in itself would look cool, but add the purple/pink trimmings and you've got a very flash-looking machine (if your taste runs that way).

The purple/pink platen knob is on the left of the machine, so it seems that Facit has tried to find a new market niche: left-handed fashion freaks. I suppose it's fair enough to produce a printer that's wrong-handed for 90% of the population, but it isn't sold as a left-handed printer.

The lid is rather badly designed. It comes in one piece that is hinged at the back, so getting access to the ribbon or rollers while paper is loaded is awkward. It doesn't lift up very easily either, because two clips at the front require a lot of persuasion to let go of the case.

The control panel consists of three purple/pink touch pads that control the usual things: online, paper feed and the like. These are mounted on a dark grey stripe along the right-hand side of the case. At the left are two pink slider switches that raise and lower the bail, and switch from tractor to friction feed.

Setting the machine up proved to be

## Epson FX-850

### Supplier

Epson (UK) Ltd (0442) 61144

### Type

9-pin dot matrix

### Price

£429

### Fonts

Roman, Sans Serif

### Print speed

Quoted cps: 220 draft, 45 NLQ

Benchmark cps: 188 draft, 45 NLQ

### Interfaces

Parallel

### Paper handling

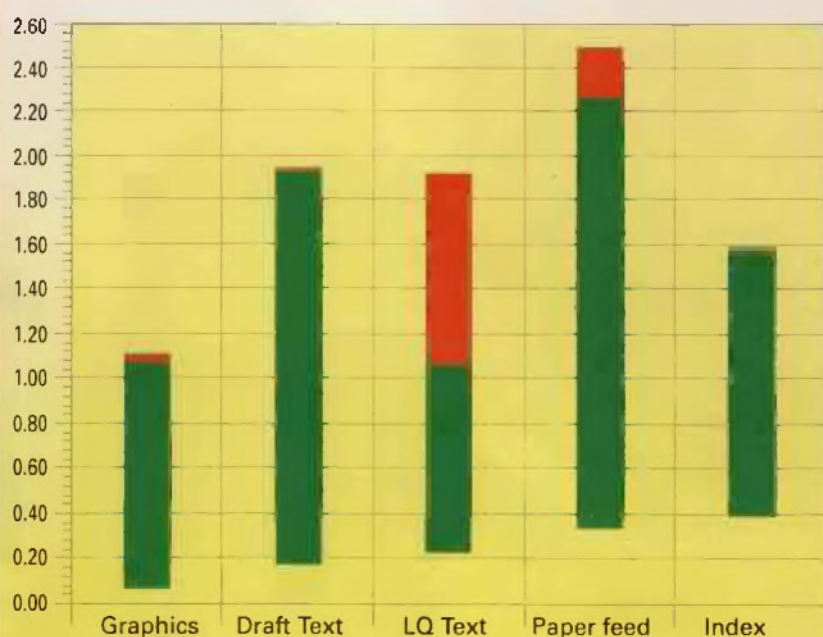
Friction feed, push tractor feed.

Optional pull tractor feed, single/double ASF.

**Good Points** Automatic paper loading. Fast, good-quality print.

**Bad Points** Price.

**Conclusion** More than you would expect from a dot-matrix printer.







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72-25-60	Toshiba T1000LE 20MB Notebook PC	—	—	779.00
71-50-72	Toshiba T2000 40MB HDD Notebook PC	—	—	1179.00
72-56-84	Toshiba T2000SX 40MB HDD Notebook PC	—	—	1459.00
71-51-51	Toshiba T2000SKE 60MB Notebook PC	—	—	1879.00
94-03-97	Toshiba T2200SX 60MB Notebook PC	—	—	2229.00
71-84-40	Toshiba T3100SX 40MB HDD Laptop PC	—	—	1399.00
72-37-27	Toshiba T3100SX 80MB HDD Laptop PC	—	—	1499.00
72-43-17	Toshiba T3200SX 120MB HDD Laptop PC	—	—	1599.00
71-01-56	Toshiba T3200SX 40MB HDD Laptop PC	—	—	1399.00

<b>DESKTOP PROCESSORS</b>				
71-92-36	Compaq Deskpro 386S 40MB Desktop PC	—	—	1218.00
71-71-28	Compaq Deskpro 386/25E 120MB Desktop PC	—	—	2397.00
72-66-14	IBM SL386SX-16MHz 40MB HDD colour screen	—	—	1025.00
71-82-75	IBM PS/1 40MB HDD colour screen	—	—	809.00
71-84-19	IBM PS/2 model 35-043 40MB HDD 12" colour screen+keyboard+DOS 3.3	—	—	1389.00
71-84-88	IBM PS/2 model 55-081 80MB 12" colour screen+keyboard+DOS 3.3	—	—	1564.00
71-85-36	IBM PS/2 model 55-081 80MB HDD 14" colour screen+keyboard+DOS 3.3	—	—	1665.00
71-87-87	IBM PS/2 model 57-A49 160MB HDD 12" colour screen+keyboard+DOS 3.3	—	—	2578.00
94-05-24	Olivetti PCS286S with 40MB HDD colour screen	—	—	839.00
72-45-82	Olivetti PCS386SX with 40MB HDD colour screen	—	—	1099.00

<b>SPREADSHEETS</b>				
32-62-27	Borland Quattro Pro v3.0 (DM)	199.00	199.00	184.00
32-63-99	Lotus 1-2-3 r2.3 (3.5")	278.00	278.00	268.00
32-63-82	Lotus 1-2-3 r2.3 (5.25")	278.00	278.00	268.00
32-79-41	Lotus 1-2-3 r3.1 (3.5")	339.00	339.00	324.00
32-79-34	Lotus 1-2-3 r3.1 (5.25")	339.00	339.00	324.00
32-07-35	MS Excel server v3.0 (5 users) (DM)	1029.00	1029.00	1029.00
30-54-06	MS Excel v3.0 (DM)	259.00	259.00	249.00
32-81-08	SuperCalc 5.1 (3.5")	79.00	78.00	77.00
32-78-17	SuperCalc 5.1 (5.25")	79.00	78.00	77.00

<b>WORDPROCESSING</b>				
32-68-56	Correct Grammar for DOS (DM)	79.00	74.00	69.00
32-68-63	Correct Grammar for WIN (DM)	79.00	74.00	69.00
32-46-34	Grammatik IV (DM)	79.00	72.50	69.00
32-56-68	MS Word for Windows v1.1 Network pack (5 users)	1149.00	1149.00	1149.00
32-92-24	MS Word for Windows v1.1 (DM)	249.00	249.00	249.00
32-54-31	MS Word v5.0 (3.5")	269.00	269.00	259.00
32-54-24	MS Word v5.0 (5.25")	269.00	269.00	259.00
32-54-93	MultiMate v5.0 (LAN ready) (3.5")	294.00	294.00	269.00
32-41-88	WordPerfect v5.1 (3.5")	209.00	209.00	209.00
32-41-71	WordPerfect v5.1 (5.25")	209.00	209.00	209.00
32-78-36	WordPerfect for Windows (5.25")	209.00	209.00	209.00

Cat. No.	Description	Prices Each		
		1 or more	£100+ Order	£500+ Order
32-78-48	WordPerfect for Windows (3.5")	209.00	209.00	209.00
30-28-01	WordStar Express for DOS (DM)	59.00	54.00	49.00
32-16-79	WordStar 6.0 (3.5")	239.00	239.00	229.50
32-16-62	WordStar 6.0 (5.25")	239.00	239.00	229.50
32-91-69	WordStar for Windows (DM)	249.00	249.00	239.00

<b>DESKTOP PUBLISHING</b>				
32-53-83	Aldus Pagemaker v4.0 (3.5")	474.00	474.00	449.00
32-53-76	Aldus Pagemaker v4.0 (5.25")	474.00	474.00	449.00
32-93-72	Deskpress (5.25")	189.00	189.00	179.00
32-93-89	Deskpress (3.5")	189.00	189.00	179.00
32-67-08	Timeworks Publisher 2 (3.5")	99.00	94.00	89.00
32-66-98	Timeworks Publisher 2 (5.25")	99.00	94.00	89.00
32-08-69	Typographical Standard Collection (DM)	74.00	69.00	64.00
32-45-11	Ventura Gold for GEM/DOSS (LAN ready) (DM)	524.00	524.00	524.00
32-45-04	Ventura Gold for Windows (LAN ready) (DM)	524.00	524.00	524.00
30-79-61	Ventura Publisher v2 (DM)	—	—	429.00

<b>INTEGRATED</b>				
32-19-16	Lotus Symphony r2.2 (3.5")	429.00	429.00	329.00
32-17-89	Lotus Symphony r2.2 (5.25")	429.00	429.00	329.00
32-55-72	Lotus Works (DM)	104.00	104.00	99.00
32-14-59	MS Works v2.0 (3.5")	99.00	99.00	94.00
32-06-94	MS Works v2.0 (5.25")	99.00	99.00	94.00

<b>UTILITIES</b>				
32-68-01	BatteryWatch Pro v3.0 (3.5" only)	33.00	31.00	28.00
30-82-83	Fastback Plus v2.1 (DM)	94.00	89.00	84.00
30-23-20	Norton Commander v3.0 (DM)	84.00	79.00	73.00
30-79-78	Norton Editor (DM)	49.00	46.00	43.00
32-75-25	Norton Utilities v6.0 (DM)	99.00	97.00	94.00
32-75-87	Norton Desktop for Windows (DM)	84.00	74.00	69.00
32-61-53	PC Tools v7.1 (3.5")	89.00	84.00	79.00
32-61-46	PC Tools v7.1 (5.25")	89.00	84.00	79.00
32-81-84	Central Point Anti-Virus (DM)	79.00	74.00	69.00
32-67-22	Sidekick v2.0 (DM)	59.95	54.95	51.00
32-91-90	Xtree Pro Gold v2.5 (DM)	88.00	78.00	69.00

<b>OTHER SOFTWARE</b>				
32-36-08	ABC Flowchart (DM)	199.00	189.00	189.00
32-52-80	Autoroute Plus v4.0 (3.5")	249.00	249.00	239.00
32-78-62	DR DOS v6.0 (3.5")	74.00	69.00	64.00
32-79-72	DR DOS v6.0 (5.25")	74.00	69.00	64.00
32-92-93	DesqView 386 v2.4 (3.5")	134.00	134.00	124.00
32-36-15	MS Project for Windows v1.0 (DM)	334.00	334.00	319.00
32-25-99	MS Windows 3.0 (3.5")	75.00	70.00	66.00
32-25-82	MS Windows 3.0 (5.25")	75.00	70.00	66.00
32-59-43	MS Windows (5 user LAN pack) (DM)	299.00	299.00	279.00
32-67-77	MS-DOS 5.0 upgrade (3.5")	59.00	54.00	49.00
32-75-01	MS Visual Basic (DM)	114.00	114.00	104.00
32-48-89	Norton Anti-Virus (DM)	117.00	117.00	109.00
32-82-70	Gemm 386 v6.0 (3.5")	59.00	54.00	51.00
32-82-87	Gemm 386 (3.5")	59.00	54.00	51.00

<b>9-PIN PRINTERS</b>				
71-61-12	Brother 1709 Printer - 132 col dual intfl.	—	339.00	332.00
71-16-50	Epson FX1050 Printer - 132 col parallel	—	384.00	374.00
71-16-43	Epson FX850 Printer - 80 col parallel	—	303.00	295.00

Cat. No.	Description	Prices Each		
		1 or more	£100+ Order	£500+ Order
71-84-02	Epson LX400 Printer - 80 col parallel	—	123.00	118.00
71-16-36	Epson LX850 Printer - 80 col parallel	—	169.00	161.00
71-31-39	OKI ML320 Printer - 80 col parallel	—	325.00	313.00
71-31-77	OKI ML320 Printer - 132 col parallel	—	392.00	379.00
94-37-27	Panasonic KXXP1170 Printer - 80 col parallel	—	—	—
71-94-94	Panasonic KX-P1695 Printer - 132 col parallel	—	349.00	339.00
72-17-12	Star LC20 Printer - 80 col parallel	—	127.00	119.00

<b>24-PIN PRINTERS</b>				
94-02-01	Epson LQ1170 Printer - 132 col parallel	—	—	509.00
71-30-74	Epson LQ2550 Printer - 132 col dual interface	—	—	749.00
94-01-84	Epson LQ1070 Printer - 132 col parallel	—	364.00	357.00
94-01-91	Epson LQ870 Printer - 80 col parallel	—	419.00	412.00
71-01-49	NEC P20 Printer - 80 col parallel	—	195.00	190.00
72-49-46	NEC P30 Printer - 132 col parallel	—	269.00	262.00
71-26-42	OKI 391 Printer - 132 col parallel	—	—	509.00
71-28-17	Panasonic KX-P11241 Printer - 80 col parallel	—	225.00	215.00
71-34-21	Star LC24-10 Printer - 80 col parallel	—	169.00	159.00
72-47-95	Star LC24-200 Colour Printer - 80 col parallel	—	256.00	244.00

<b>LASER PRINTERS</b>				
71-49-63	Brother HL-BV Laser Printer - 8ppm dual intfl.	—	—	1099.00
94-19-49	Epson EPL-4100 Laser Printer - 6ppm dual intfl.	—	—	592.00
71-92-50	HP LaserJet Laser Printer - 8ppm dual intfl.	—	—	1099.00
72-44-89	HP LaserJet IID Laser Printer - 8ppm dual intfl. duplex	—	—	1839.00
71-12-65	HP LaserJet IIP Laser Printer - 6ppm dual intfl.	—	—	746.00
71-11-62	HP LaserJet IIISI Laser Printer - 16ppm dual intfl.	—	—	2699.00
72-62-67	Kyocera F1200S Laser Printer - 10ppm dual intfl.	—	—	1548.00
71-96-07	Kyocera F3300 Laser Printer - 18ppm dual intfl.	—	—	2592.00
72-22-16	OKI Laser 400 Laser Printer - 4ppm parallel	—	—	515.00
71-65-45	Panasonic KXP44501 Laser Printer - 10ppm dual intfl.	—	—	1082.00

<b>INKJET PRINTERS</b>				
94-19-32	Canon BJ-10ex Bubblejet Printer - 80 col parallel	—	219.00	211.00
71-39-33	Canon BJ-300 Bubblejet Printer - 80 col parallel	—	374.00	366.00
71-39-40	Canon BJ-330 Bubblejet Printer - 132 col parallel	—	439.00	429.00
71-26-04	HP PaintJet Colour Printer - 80 col serial intfl.	—	484.00	477.00
71-26-11	HP PaintJet Colour Printer - 80 col parallel intfl.	—	484.00	477.00
72-44-41	HP DeskJet 500 Inkjet Printer - 80 col dual intfl.	—	312.00	299.00
94-08-09	HP DeskJet 500C Colour Inkjet Printer - 80 col dual intfl.	—	—	515.00
71-81-10	HP PaintJet XL Colour Printer - up to A3 size media dual intfl.	—	—	1149.00
71-77-33	Mannesmann Tally MT92C Colour Inkjet Printer - 114 col dual intfl.	—	—	1295.00
71-80-93	Toshiba Expresswriter 201 Inkjet Printer - 80 col parallel	—	235.00	227.00

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		1 or more	£100+ Order	£500+ Order
MICE				
71-33-73	Logitech Serial Mouseman XT/AT	53.95	49.95	46.25
94-00-29	Logitech PS/2 Mouseman	53.95	49.95	46.25
71-33-97	Logitech Bus Mouseman	53.95	49.95	46.25
94-09-33	Logitech Pilot Serial Mouse	22.50	20.45	19.95
71-15-40	Microsoft Serial Mouse+Windows	111.00	111.00	105.00
71-74-58	Microsoft Bus Mouse+ Windows (5.25")	111.00	111.00	105.00
71-74-65	Microsoft Bus Mouse+ Windows (3.5")	111.00	111.00	105.00

<b>LCD PROJECTION PANELS</b>				
72-67-48	3M Model 4080 64 True Colour Panel VGA,EGA,CGA,MAC	3099.00	3099.00	3099.00
91-58-41	3M Model 2080 16 Shade Magenta Panel VGA,EGA,CGA,MAC	1499.00	1499.00	1499.00

<b>MONITORS</b>				
94-05-93	NEC Multisync 3FG 15" VGA,SVGA,XGA	415.00	415.00	399.00
94-06-03	NEC Multisync 4FG 15" VGA,SVGA,XGA	525.00	525.00	525.00
72-12-62	Philips 3CM9709 VGA	251.00	251.00	239.00

<b>MODEMS</b>				
94-24-05	Datalflex Pocket Comfax Fax Send/Receive V22bis,V22,V23,V21	299.00	299.00	285.00
94-24-12	Datalflex Pocket Biscam V22bis,V22,V21	159.00	159.00	149.00
94-24-29	Datalflex Pocket Quadcom V22bis,V22,V23,V21	299.00	299.00	285.00
71-41-45	Dowdy Qualtro External V22bis,V22,V23,V21	459.00	459.00	439.00
71-55-84	Hayes Ultra 95 External V32,V22bis,V23,V21, Hayes 9600	649.00	649.00	649.00
71-55-91	Hayes Smartmodem 9600+Quad External V22bis,V22,V23,V21, Hayes 9600	534.00	534.00	534.00
71-56-32	Hayes Smartmodem 2400+Quad External V22bis,V22,V23,V21	399.00	399.00	399.00
72-42-14	Miracom Courier HST External V22bis,V22,V23,V21,HST 14,400bps	429.00	429.00	409.00
71-46-19	Miracom Courier Dual Standard External V32bis,V32,V22bis,V22,V21,HST 14,400bps	669.00	669.00	669.00
71-66-24	Miracom WS3000 External V22bis,V22,V23,V21	282.00	282.00	269.00
71-07-16	Pace Ultralink Quad External V22bis,V22,V23,V21	354.00	354.00	339.00
71-07-23	Pace Ultralink Thirty Two External V32,V22bis,V22,V23,V21	629.00	629.00	629.00
94-23-88	Pace Linnet Quad External V22bis,V22,V23,V21	235.00	235.00	225.00
94-23-95	Pace Linnet Thirty Two External V32,V22bis,V22	399.00	399.00	385.00

<b>NETWORKS</b>				
72-37-58	Novell NE1000 8-bit XT/AT (ISA)	115.00	115.00	109.00
72-36-24	Novell NE2000 16-bit AT (ISA)	155.00	155.00	145.00
71-46-33	Novell NE2 16-bit PS/2 (MCA)	199.00	199.00	185.00
94-26-01	Novell Network Lite 5.25" 1 Node	65.00	63.00	59.00
94-26-18	Novell Network Lite 3.5" 1 Node	65.00	63.00	59.00
94-34-11	Kircom Parallel Port Thin Ethernet Adaptor	299.00	299.00	274.00

Cat. No.	Description	Prices Each		
		1 or more	£100+ Order	£500+ Order
FAX MACHINES				
71-53-57	Canon Fax 80	345.00	345.00	329.00
94-29-62	Canon Fax 170 Fax/Answerphone	499.00	499.00	499.00
72-25-08	Panasonic F3550BE Fax/Answerphone	539.00	539.00	539.00
72-36-86	Panasonic Panafax UF-121	389.00	389.00	369.00
72-69-13	Panasonic Panafax UF-270M Memory	799.00	799.00	799.00
71-42-93	Panasonic Panafax UF-300 Inkjet Plain paper Fax	999.00	999.00	999.00
72-25-15	Panasonic Panafax UF-750 Laser Plain paper Fax	1999.00	1999.00	1999.00
71-42-62	Toshiba TF-172 Fax/Answerphone	525.00	525.00	525.00
71-42-55	Toshiba TF-232	499.00	499.00	499.00

<b>ORIGINAL RIBBONS</b>				
20-74-63	Epson DFX5000 Cartridge Ribbon	21.95	18.70	17.25
20-74-70	Epson LQ2550 Black Fabric Longlife	11.55	10.15	9.95
20-30-58	Epson LQ1000 Original Ribbon	6.40	5.80	5.50
20-30-65	Epson LQ800 Ribbon	5.00	4.50	4.15
20-28-77	Epson MX/FX 100/105/1000 Original	3.70	3.35	3.15
20-52-90	IBM Quietwriter 111 Ribbons	9.90	8.95	8.50
20-56-47	MT330 Black Ribbon	11.30	9.95	9.45
20-63-61	OKI Microline 393 Black Original	13.70	12.50	11.70
20-26-02	OKI 182/192/193	4.20	3.75	3.50
20-89-81	Panasonic Black Ribbon for KX-P1180	5.90	5.30	5.00

<b>LASER SUPPLIES</b>				
20-59-67	Epson G3500 Drum Cartridge	97.50	89.40	84.10
20-59-50	Epson G03500 Toner Cartridge	14.85	13.45	12.80
20-55-82	HP/Canon Series 2 EPS Cartridge	57.95	52.95	48.95
20-45-38	HP/Canon Series 1 EP Toner Cart	60.95	54.95	52.20
20-99-04	HP LaserJet IIP Toner Cartridge	49.95	44.95	42.95
21-12-84	IBM 401/9E Laser Cart (new version)	129.00	129.00	119.00
20-63-92	Kyocera OPC Drum Kit for F1000/F2000	109.00	109.00	103.00
20-45-83	Mannesmann Tally 910 OPC Drum	99.95	99.95	91.95
20-79-44	Panasonic KX-P4450 Drum Unit	84.45	76.25	72.45
20-79-13	Panasonic KX-P4450 Toner	18.35	16.55	15.75

<b>INKJET SUPPLIES</b>				
21-11-05	Canon BJ-10e/Starwriter 80 replacement cart.	13.85	12.45	11.75
20-52-52	Epson S02500 sealed ink cartridge	19.60	17.80	16.95
20-92-27	Epson S02550/S0850 Ink Cartridge	24.95	22.50	21.45
20-76-14	HP DeskJet Cartridge Black	12.75	11.45	10.35
20-76-38	HP PaintJet Cartridge Colour	22.95	20.70	19.50
20-76-21	HP PaintJetXL Cartridge Black	19.65	17.65	16.75
21-04-74	HP PaintJetXL Colour Cartridge (Magenta/Blue/Yel)	57.75	54.50	51.50
20-72-05	HP ThinkJet Cartridge Black Plain paper	7.95	7.45	6.95
20-84-31	HP ThinkJet/QuickJet Cartridge Black	7.95	7.45	6.95
20-84-24	Mannesmann Tally 91 Black Ink Cart	9.95	8.95	8.45

<b>5 1/4" DISKETTES</b>				
All prices are for Boxes of 10				
10-28-67	3M 5 1/4" DS/HD 96TPI (for IBM AT)	7.50	6.90	6.40
10-07-66	3M 5 1/4" DS/DD 48TPI 745-0 Diskettes	4.45	4.00	3.70
10-50-53	3M 5 1/4" DS/DD (360K) P Formatted	4.75	4.25	3.95
10-50-60	3M 5 1/4" DS/HD (1.2MB) P Formatted	7.90	7.30	6.80
10-31-03	Datallife 5 1/4" DS/HD 1.6MB IBM PC AT	7.45	6.75	6.40
10-50-39	Datallife Plus 5 1/4" DS/HD (1.2/1.6MB)	7.90	7.20	6.80
10-21-59	Dysan 5 1/4" DS/HD UHR (IBM PC AT)	7.50	6.70	6.15
10-38-66	Maxell 5 1/4" DS/HD for IBM PC AT	7.10	6.55	6.20
10-22-90	Sony 5 1/4" FD 96TPI DS/HD (1.6MB)	7.40	6.675	6.30
10-48-27	TDK 5 1/4" DS/HD 96TPI	6.40	5.90	5.40

Cat. No.	Description	Prices Each		
		1 or more	£100+ Order	£500+ Order
<b>3 1/2" DISKETTES</b>				
All prices are for Boxes of 10				
10-28-50	3M 3 1/2" DS/DD (Box 10)	6.10	5.55	5.25
10-50-84	3M 3 1/2" DS/HD (1.44MB) P Formatted	12.20	10.95	10.25
10-43-08	3M 3 1/2" DS/HD (2MB)	11.60	10.60	9.45
10-41-88	Datallife 3 1/2" DS/DD (1.44/2MB)	12.65	11.05	10.40
10-46-38	Dysan 3 1/2" DS/HD (1.44/2MB)	11.20	10.20	9.50
10-54-24	IS Bulk 3 1/2" DS/HD (1.44/2MB) (50 pack)	46.90	39.50	34.60
10-46-45	Maxell 3 1/2" DS/HD (1.44/2MB)	11.50	9.50	9.00
10-18-99	Sony 3 1/2" DS/DD	6.10	5.50	5.10
10-39-90	Sony 3 1/2" DS/HD (1.44/2MB)	11.25	10.20	9.50
10-48-58	TDK 3 1/2" DS/HD (1.44/2MB)	11.40	10.00	8.90

<b>DATA CARTRIDGES</b>				
80-16-18	3M DC2080 80MB Preform Rhomat Data Cartridge	17.80	16.25	15.40
80-08-84	3M DC2000 40MB Data Cartridge	11.85	10.65	9.95
80-17-11	3M DC2120 120MB Data Cartridge	17.95	15.99	14.99
80-04-82	3M DC3000LP 45MB Data Cartridge	13.25	11.95	11.35
80-00-73	3M DC800A 60MB Data Cartridge	13.80	12.45	11.80
80-10-96	3M DC6150 150MB Data Cartridge	15.49	13.99	12.99
80-17-04	3M DC8250 250MB Data Cartridge	22.49	20.49	18.99
80-18-07	Carlisle DC6150 150MB Data Cart	15.70	14.20	13.35
80-12-23	Datallife DL6150 150MB Data Cart	15.95	14.60	13.50
80-15-46	Sony QD 6150 150MB Data Cartridge	14.80	13.45	12.80

<b>OTHER MEDIA</b>				
80-16-49	3M 1/2" Compactape for DEC TK50/TZ30	19.75	17.80	16.80
80-17-59	3M 1/2" Compactape for TK70 Drive	26.25	26.25	23.65
10-40-23	20MB Bernoulli 8" cartridge	82.60	74.85	70.85
10-47-62	Beta 20MB 5 1/4" Bernoulli Cartridge	51.15	46.35	43.90
10-51-63	Beta 44MB 5 1/4" Bernoulli Cartridge	77.20	69.95	66.25
80-11-75	Datallife HD 60MB Data Cassette (ST600)	12.20	11.10	9.75
80-18-90	Maxell CS600HD Data Cassette	12.75	11.55	10.80
10-61-24	Maxell HS-460 4mm Cassette	11.50	10.30	9.50
10-55-03	Sony QG-112M 8mm Tape for Exabyte Drives	16.40	14.70	13.95
10-54-86	Syquest SD400 Removable Cartridge for S0555 drive	83.50	76.15	69.45

<b>FURNITURE</b>				
93-50-03	Small VDU Desk	59.90	55.90	51.90
93-50-34	Large VDU Desk	71.90	65.90	59.90
93-50-41	Pedestal Unit	61.90	57.90	53.90
93-50-58	Newstar Office Chair	71.90	63.90	59.90
93-50-10	Newstar Office Chair with Arms	86.95	82.90	76.90
93-36-03	Son-of-Thru-door	189.00	189.00	179.00
93-41-83	Workstation plus side extension	—	134.00	119.00
93-03-21	Dot matrix stand 132 column	54.90	49.90	46.70
93-39-64	SteelForm Terminal Arm 104	169.00	169.00	159.00
93-50-72	Data Chair	21.25	21.25	21.25

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DESCRIPTION	CAT NO	PRICE FACILITY		
		1 OR MORE	£100+ ORDER	£500+ ORDER
Brother 1924 Printer Ribbon	20-92-72	9.95	8.90	8.00
Brother 1924 Printer	26-92-43	—	481	475

For example: the Brother ribbons price drops to £8.00 when you purchase £100 or more of Action's products. If ordering ribbons along with the printer then 4 ribbons could be bought at only £7.60 and the printer at £475.00



a bit of a pain. The first problem was plugging it in: it was shipped with a two-pin European plug. PCW has loads of computers (and at the moment, loads of printers) but not an abundance of spare plugs. The next problem was getting it to acknowledge the existence of a PC. The model we received was fitted with an optional serial interface, which disabled the parallel port, and the vast 83-page manual (of which seven pages are in English) doesn't explain too clearly how to rectify this. It says that you have to change a few DIP switches inside the case, but gives no clue as to opening the cover. We stuck a screwdriver in every hole and wiggled it until the top fell off.

### Slow

Once up and running, the machine didn't really seem worth the wait. Print quality from its single font was poor and extremely slow. In NLQ mode (which wasn't very near to letter quality) it took almost six minutes to print a single page, averaging just under 10cps.

An optional sheet feeder is available, and two of the seven pages in the manual are devoted to setting it up. Inserting single sheets is a matter of placing one in the slot in the lid and shifting the bail lever; the paper is then automatically positioned. Fanfold paper is handled by a push tractor, and there is a paper-parking facility for quick switching between fanfold and sheets.

The E420 is currently priced at £199, so unless you are very fashion-conscious and want a good looker rather

than a good performer, you should definitely look elsewhere. There are much better printers available for the same money, or even less.

Mat Beard

## Fujitsu DL1200



Fujitsu is Japan's largest mainframe manufacture and as such has been doing its own thing for years. For this reason, the idea of a Fujitsu matrix printer was worrying: would the company bother to consider industry standards? Would it incorporate any 'good ideas' which the rest of the industry had long since rejected because they didn't work in practice?

The DL1200 turned out to look pretty weird. A fair proportion of the depth is taken up by plugs at the back and a front ledge for the control buttons. The Centronics connector is sensibly positioned

on the side of the unit, well away from the paper path. Opening a flap at the front reveals the reason for this strange upright design — the print head points skywards and runs along underneath the platen. The only disadvantage I can see to this arrangement is that you cannot see what is being printed as it happens, but this is minor and the reduced depth might leave room for a box of fanfold paper on the table behind the printer — a positive advantage.

The DL1200 has a push tractor feed, which may be why vertical registration was quite poor (though perfectly acceptable for text). Otherwise, the 24-pin impact head produced a very reasonable text in both draft and NLQ modes at an acceptable rate.

The paper was easy to load and unload by pressing buttons on the front panel. Friction-feed sheets were also easy to use: you just drop them in the slot and press the load button. A paper-saving feature winds fanfold forward to align perforations with a tear bar, and then back again ready for printing, so that you don't waste a sheet getting a clean tear. The non-standard Fujitsu ribbon cartridge is also quick to change without getting ink over your fingers.

### Printed menu system

Many features of the printer can be set up using a printed menu system. Buttons on the front panel are used to position the print head under the desired option, which is then selected using a third button. All a bit strange, but it works.

## Facit E420

### Supplier

Facit Ltd (0634) 868000

### Type

9-pin dot matrix

### Price

£199

### Fonts

One

### Print speed

Quoted cps: 130 draft, 24 NLQ

Benchmark cps: 32 draft, 10 NLQ

### Interfaces

Parallel

### Paper handling

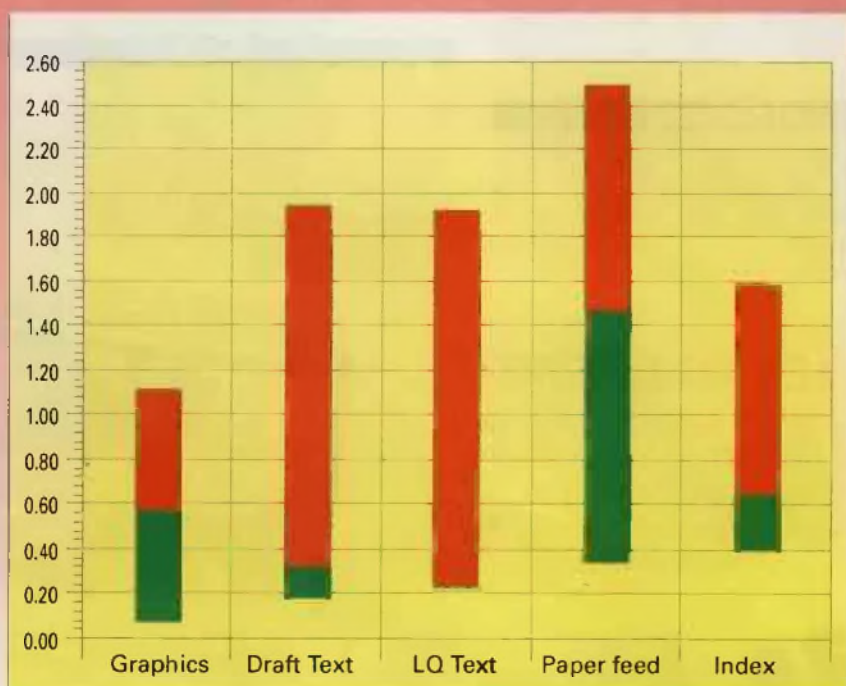
Friction feed, push tractor.

Optional single ASF

**Good Points** Looks good.

**Bad Points** Too many to list.

**Conclusion** Over-priced, under-powered.





The printer is capable of emulating Fujitsu's own DPL24C Plus model, but most people will find the Epson LQ2500 mode more useful. Optional emulation modes are available, including a Diablo 630 and DEC LA50/75/120/210. This reflects Fujitsu's main presence in the mini and mainframe markets.

Eight fonts, selectable from the front panel, are built into the DL1200. Additional font cartridges can be purchased if needed, but none were supplied for review.

The DL1200 feels like a printer that was designed for hard work. It has a wide carriage, good quality (though not excellent) output, and is reasonably quick. It certainly gives no trouble in operation and I suspect it will go on printing for years. It could be faster.

Frank Leonhardt

## Genicom GP10



Genicom was formed by a management buyout of the Data Communications Products Division of General Electric in 1983, and bought its way into the printer business in 1987 with the acquisition of Centronics Data Computer Corporation.

The GP10, the cheapest of its dot matrix printers, is large and looks strong but otherwise, there is nothing unusual about the safe, bland design. A single-line display on the front panel includes six buttons for controlling the menu settings and printer status, with LED indicators for all the usual functions: online, power, paper out, font and pitch. Two different fonts are included and the printer can be set to draft or Near Letter Quality. The most notable feature of the control panel is the pitch control, which has seven settings between 6.5 and 20 characters per inch.

### Standard ports

Unlike most of the printers in this review, the Genicom is fitted with both parallel and RS232 serial ports as standard, with space for a third interface socket. This will make it a useful printer for the office environment, where being able to link two or more computers to the printer could prove invaluable.

The paper handling capacity is another hint that it has probably been aimed at the office rather than for home use. There is an option for automatic sheet feeding and paper parking. A lever at the side lifts the bail arm so that cut-sheet paper can be aligned without opening the case.

The speed will also appeal to office users, particularly if it is a shared printer. In the PCW benchtests, it reached 154 cps in draft mode and 38 cps in NLQ. The print quality was quite good. Draft text looked a little weak but was readable, and NLQ was consistent and adequate for most letters. Unfortunately, on some graphics, the ink looked faded and washed out towards the end of the page.

The usual dot-matrix screech was compounded in the GP10 by an annoying whine that made it unpleasant to have at your side. It was undeniably fast, but even that proved to be a nuisance at times. Since paper could be wound around the roller without opening the case, it was easy to forget whether the bail arm had been lifted. If the arm wasn't out of the way of the paper, it would shred a page and jam the machinery in seconds, before I could reach it.

The GP10 would best suit an office environment, where its speed and strength would be most appreciated and paper jams are expected.

Helen Johnstone

## Hewlett Packard DeskJet 500



Walter Hewlett and David Packard (sons of founding fathers Bill and Dave) found they had a smash hit on their hands when the

## Fujitsu DL 1200

### Supplier

Fujitsu Europe 081-573 4444

### Type

24-pin dot matrix

### Price

£499

### Fonts

Courier 10, Prestige Elite 12, Bold Face, Pica 10.  
Draft compressed.

### Print speed

Quoted cps: 200 draft, 60 NLQ  
Benchmark: 109 draft, 45 NLQ

### Interfaces

Parallel

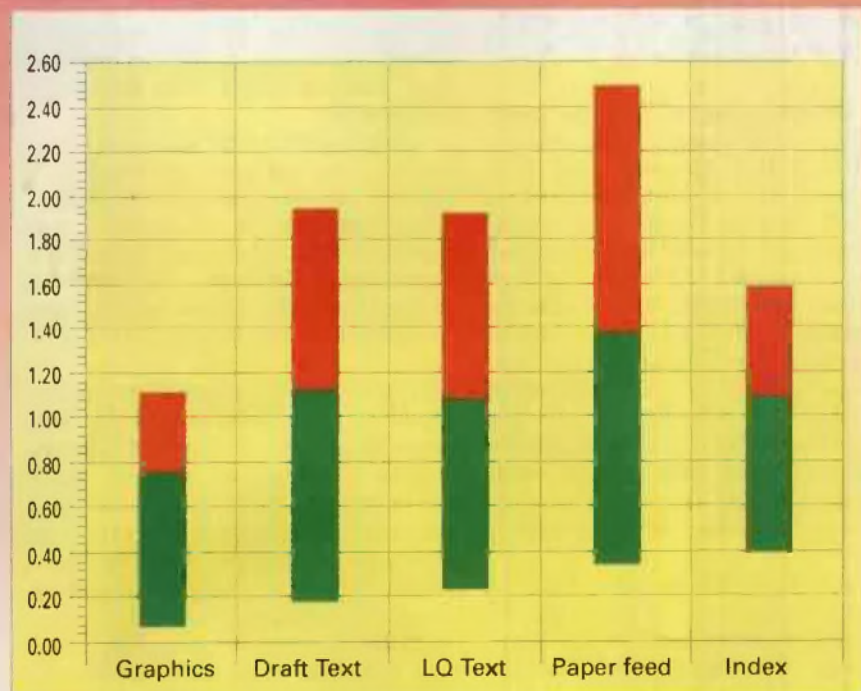
### Paper handling

Tractor, friction feed, tractor feed.  
Optional single/double ASF.

**Good Points** Solid, wide carriage, neat output.

**Bad Points** Poor at graphics, not fast for price.

**Conclusion** Good workhorse.





## Genicom GP10

### Supplier

Genicom Ltd (0252) 522500

### Type

9-pin dot matrix

### Price

£365

### Fonts

Courier, Gothic

### Print speed

Quoted cps: 250 draft, 55 NLQ

Benchmark cps: 154 draft, 38 NLQ

### Interfaces

Parallel

### Paper handling

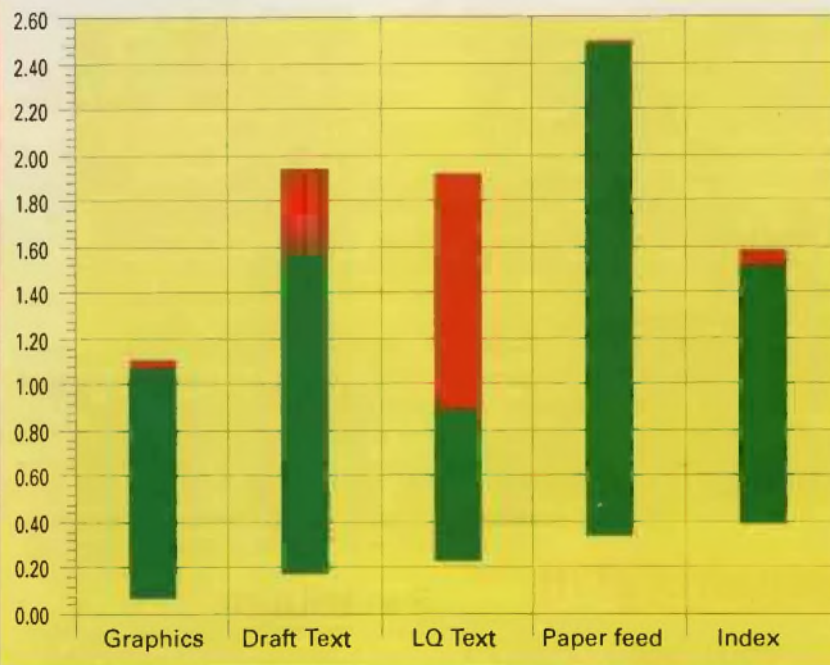
Standard: friction feed, tractor feed.

Optional: single/double ASF.

**Good Points** Speed, connectivity.

**Bad Points** Jams

**Conclusion** The office bore.



first DeskJet appeared in 1988. Laser-quality at dot matrix price was the claim, and the punters went for it in a big way. The \$13billion-turnover Hewlett Packard Corporation doesn't disclose detailed sales figures by product but it will admit to shipping more than two million inkjets (including the DeskJet) since its first printer using this technology, the ThinkJet, was introduced in 1984. Let's just say thousands of DeskJets are sold every month. The DeskJet was updated in 1990 with higher speed and more built-in fonts while gaining the '500' label, and was followed by the colour '500C' version in 1991.

The DeskJet 500 wouldn't look out of place on London's South Bank, fitting unobtrusively between the Festival Hall and the Hayward Gallery. Angular and concrete-coloured, 8in high and 16in wide, it dominates your

desk. The HP's substantial volume is actually cleverly utilised and the designers have packed a lot of features into its bulk. Using only A4 (and close relations) cut-sheet paper, the printer includes a 100-page sheet feeder which saves real estate by placing input and output trays one above the other.

### Control panel

Underneath the machine is the usual Centronics parallel interface, in addition to a 25-pin serial port and a socket for the external power lead. The six-button panel on the front top surface controls the usual on/off line, draft and font features, along with fine paper adjustment.

Opening up the HP's various covers reveals an unlikely assortment of wheels, cams and plastic levers all there to encourage sheets of paper to contort past the printhead and into the out tray. Amazingly, it all works. The printhead is combined with the ink cartridge and is replaced when empty as one (£14) unit.

Under Windows, installing the HP DeskJet Family drivers took all of 30 seconds and we were up and, silently, running. This printer is no screaming dot matrix, and gently whirrs and clicks in operation, sliding out freshly printed sheets to dry before dropping them carefully in turn. The paper handling, despite its complex mechanism, proved with the test machine and many previous examples to be bullet proof, if a little slow.

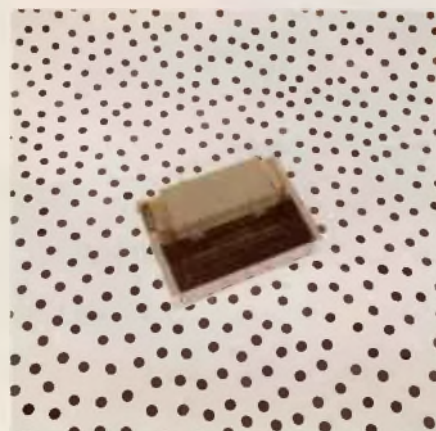
The print quality is excellent. It is

not laser quality as HP claims, and is affected significantly by paper type, but it's as close as you're going to get without moving up considerably in price. The DeskJet can print in both portrait and landscape and by installing the HP Windows 3.0 scalable drivers and fonts from the included disk, superb clear scalable typefaces become available. Further fonts can be purchased in plug-in cartridge form.

The documentation is first rate, being both informative and easy to follow. Widely discounted to £300 (from the £500 RRP) the HP DeskJet 500 represents excellent value, producing very high quality output in a quiet, proven package.

Nick Edmunds

## Hewlett Packard ThinkJet





The Hewlett Packard ThinkJet burst onto the scene as one of the first practical personal inkjet printers in 1984. By 1992, unfortunately, it is showing its age. Hewlett Packard has a reputation for producing reliable products and then supporting them for the duration of their useful life. This explains why the ThinkJet is still available, even though other HP printers have since appeared with higher specifications and lower prices.

The ThinkJet is a neat 290x270x110mm unit with a built-in battery, charged by a small external black box. It is not portable by today's standards but you can just about carry it with one hand. A smoked plastic lid folds down from the front to allow access for changing paper and print cartridges, and a fold-up paper divider can be removed to allow single sheets to be inserted.

Paper is normally fed through the ThinkJet using a pin feed, which is a fiddle to load. Once loaded, however, it gave no problems. Friction feed sheets can be used, the paper being held in place between textured wheels which look like they have been removed from a model-maker's grindstone. Curious though this arrangement is, it seems to work and has dispensed with the need for a platen.

### No platen

Unfortunately the platen knob has also been dispensed with, so there is no way to wind the paper backwards or forwards manually. Line-feed and form-

feed buttons are provided but the mechanism appears to have no means of reversing, so paper has to be carefully jiggled out backwards when it is being changed.

The ThinkJet is available with a number of different interfaces, but the review unit had a Centronics parallel. The physical connection was made using a non-standard 15-way sub-miniature D, but a special cable is available to connect it to the back of a PC.

The software interface is Hewlett Packard's own and is definitely not Epson compatible. The commands are logical and easy for programmers to write drivers for, but unless you are a programmer this may be of little help. The command set was used to derive the LaserJet set, but this is not backwards compatible.

Print quality, using an old-design combined ink/head cartridge (£8.50), was pretty poor, lacking both contrast and definition with no letter quality mode. It was, however, quite readable. Using special 'inkjet' paper and a suitable cartridge should greatly improve on this, at extra cost and inconvenience. The machine was not particularly slow compared with other portable inkjets, and it was quiet. But by today's standards, it was not at all impressive.

A new ThinkJet costs £449. If you shop around you can get a DeskJet for less. This (see above review) has a vastly superior print quality and is well supported by drivers. If you want a pin feed, practically any other matrix printer will give better results. If you want a

portable, the Kodak/Diconix is smaller, cheaper, industry standard compatible and has NLQ output using the same sort of print technology. On the other hand, if you want a battery powered printer which is nothing special and you are offered one of these cheap, it is, at least, well constructed.

Frank Leonhardt

## Hyundai Pinovia 930



Have you noticed, over the last few years, the slow emergence of South Korean names in daily British life? Samsung, Lucky Goldstar, Daewoo and, in the case of the Pinovia 930 printer, Hyundai. Who are these tin-pot Far Eastern interlopers?

Well, Hyundai is hardly tin-pot. It's the second largest company in South Korea (after Samsung) with 175,000

## HP DeskJet 500

### Supplier

Hewlett Packard (0344) 360000

### Type

Inkjet

### Price

£499

### Fonts

Courier, Courier italic, CG Times, CG Times italic, Letter Gothic, Letter Gothic italic

### Print speed

Quoted cps: 240 draft, 120 NLQ  
Benchmark cps: 125 draft, 75 NLQ

### Interfaces

Parallel, serial

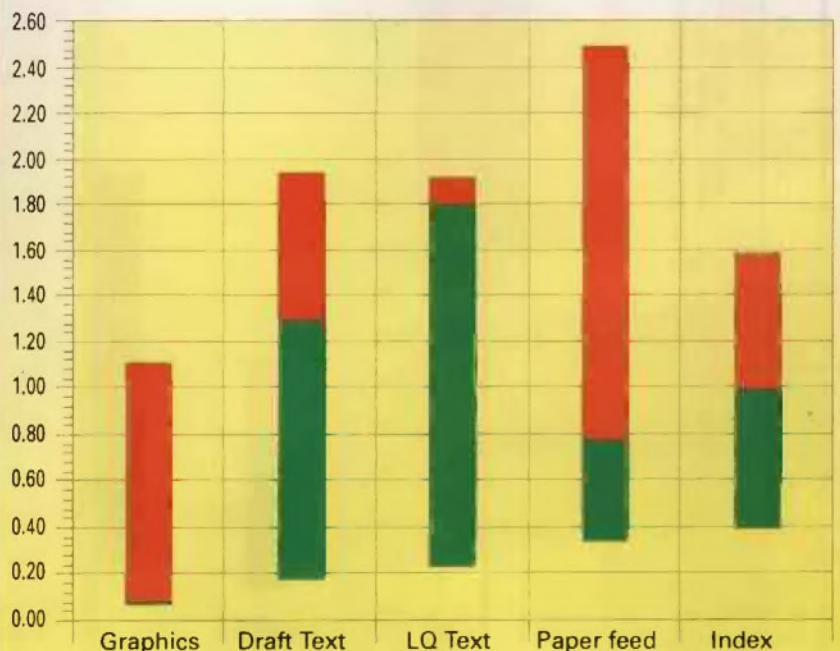
### Paper handling

Standard: 100-sheet ASF, envelope feed.

**Good Points** Silent with high-quality output

**Bad Points** Print cartridges aren't cheap.

**Conclusion** Got £300? Buy one.





## HP ThinkJet

### Supplier

Hewlett Packard (0344) 360000

### Type

Inkjet

### Price

£449

### Fonts

One

### Print speed

Quoted cps: 150 draft, 150 NLQ

Benchmark cps: 80 draft, 80 NLQ

### Interfaces

Parallel, serial, HPIB, battery-powered Centronics

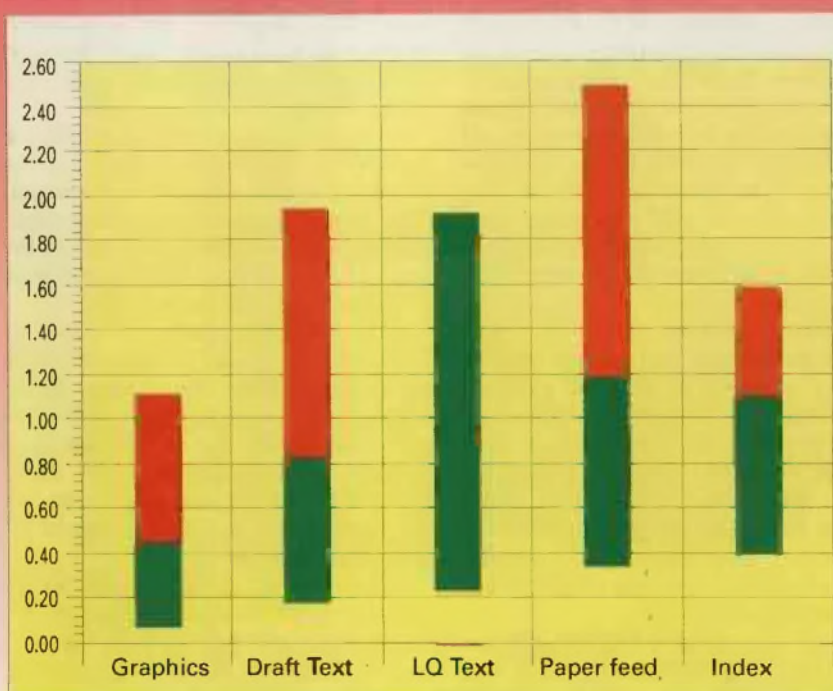
### Paper handling

Standard: friction feed, pin feed

**Good Points** HP name.

**Bad Points** Incompatible with modern printers, poor-quality print, expensive, inconvenient.

**Conclusion** Very outdated, avoid unless really cheap.



employees and a US\$40 billion turnover. Its exports represent 10% of the entire country's. We've seen its cars in this country for some time and now Hyundai has started to market a full range of PCs and peripherals from a 486/33 tower system down to the 9-pin dot matrix reviewed here.

Sturdily built from office-standard grey plastic, with a metal chassis, its general appearance is very similar to that of its competitors. Microswitch font, pitch and on/off-line controls are

gathered on the front top surface, alongside no less than 11 LEDs. The tractor feed is a 'pusher' type and continuous stationery can be parked when using the clip-on single sheet guide — a good time-saving feature. For a 9-pin A4 printer, the machine is surprisingly space consuming — roughly 16.5x15in allowing for cables — and the side-mounted power switch is not recessed and so is liable to be switched off accidentally — at least it is in the chaotic PCW office environment. Beside the

Centronics parallel port, there's also a DIN 6-pin serial connector at the rear of the machine.

### Ribbon jam

The Hyundai, like most printers tested here, plugged in, switched on, and worked without fuss. Unlike most printers tested here, the ribbon cartridge jammed after one page of test printing, resulting in phone calls to a very apologetic Hyundai person. The new ribbon (by courier from Germany) ran happily.

## Hyundai Pinovia 930

### Supplier

Hyundai Electronics Europe

081-741 8634

### Type

9-pin dot matrix

### Price

£169

### Fonts

Courier, Roman, Sans Serif, Script, Helvetica, and two others

### Print speed

Quoted cps: 180 draft, 43 NLQ

Benchmark cps: 89 draft, 23 NLQ

### Interfaces

Parallel, serial

### Paper handling

Friction feed, pin feed, autoloading/parking

**Good Points** Good print quality for a 9-pin.

**Bad Points** Beware of jamming ribbon cartridges.

**Conclusion** Not bad.





# VIGLEN PERSONAL COMPUTERS POWER AND PERFORMANCE AT THE RIGHT PRICE

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The new Viglen Dossier packs unrivalled power into an A4, notebook sized computer. Designed using the latest state-of-the-art technology, the Dossier boasts a 32 bit 386SX processor running at 20MHz, with 2MB RAM (expandable to 8MB) and 60MB hard disk as standard (expandable to even higher capacity in future). A super fast paper white LCD screen with 32 grey levels and VGA resolution gives superb display quality with the ability to connect to an external VGA colour monitor if required. With an average battery life of 3 hours and over, the Viglen Dossier is the ideal portable office for those people on the move. Truly A1 performance from an A4 sized computer!

<p><b>DOSSIER</b></p> <ul style="list-style-type: none"> <li>Fully IBM PC/AT compatible, will also run 32 bit software written for the 80386/80486 processors.</li> <li>80386SX processor with 80387SX co-processor socket</li> <li>Speed of 6/20MHz</li> <li>2MB RAM (384K shadow RAM) expandable to 8MB.</li> <li>Fast 60MB hard disk, option for higher in future.</li> <li>1.44MB 3.5" floppy drive.</li> <li>Super fast paper white LCD screen with CCFT side light. VGA display with 32 shades of grey and EGA/CGA/MDA emulation.</li> <li>Low profile 81 key keyboard with click feeling contact switch.</li> <li>MS-DOS 5.0 with Shell.</li> </ul>	<p><b>386SX20</b></p> <p><b>£1599 + VAT</b></p> <ul style="list-style-type: none"> <li>1 parallel/external floppy port, 1 serial port, 1 external keyboard socket (PS/2 or AT), external colour VGA monitor socket, AT expansion bus socket.</li> <li>Size 297mm(W) x 216mm(D) x 51mm(H).</li> <li>Weight 2.97kg (6.6lb) with battery.</li> <li>Fully removable and rechargeable ni cad battery.</li> <li>Battery life average 3 hours.</li> <li>Universal AC adaptor.</li> <li>Carrying pouch for Dossier and accessories.</li> <li>Landmark speed (ver 2.0) = 22.68MHz.</li> <li>SI (ver 4.5) = 21.1, powermeter MIPS = 3.52</li> </ul>
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## Options

A host of options are available for the Dossier including external monitor, keyboard, external floppy drive etc. Some of the more popular ones are listed below.

- 2MB extra RAM factory fitted on motherboard £159 + VAT
- 2MB RAM module £159 + VAT
- 4MB RAM module £316 + VAT
- Worldport 2496 fax/data modem £479 + VAT
- Worldport 2400/MNP5 external modem £379 + VAT
- Acoustic coupler to either modem above £49.95 + VAT
- External ethernet module £249 + VAT

**TELEPHONE**  
**081 997 30000**



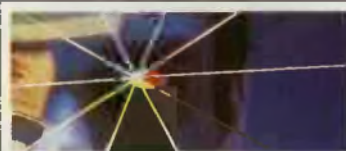
### MS-DOS 5.0

MS-DOS 5.0 is supplied as standard with all Viglen computers.

### MS-DOS 5.0 upgrade

Existing Viglen computer users can upgrade to MS-DOS 5.0 from previous versions of MS-DOS by purchasing either the MS-DOS 5.0 STANDARD package (as supplied with new systems) or the MS-DOS 5.0 UPGRADE package (which provides for easy upgrade). The price for the MS-DOS 5.0

STANDARD package is £49 + £5 carriage + VAT and the price of the MS-DOS 5.0 UPGRADE package is £69 + £5 carriage + VAT. Please state the serial no. of your computer and disk format required when ordering.



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Microsoft Windows 3.0

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## What to Buy for business

In the 1991 "What to buy for business" consumer report, Viglen once again achieved the highest number of recommendations. Look out for the stamps on the following pages.

**Genie and Vig ranges ...**



## Vig RANGE



The standard Vig range case

The Vig range can also be ordered in a lower case option as shown above. Refer to the options section below.

The Vig is a range of IBM compatible systems featuring outstanding performance and specification. Its innovative design using state-of-the-art technology and British manufacture have made this range one of the most popular computer systems in the UK. All models in the range share a common elegant look providing both a 1.25" and a 3.5" floppy drive as standard along with a very high specification and plenty of room for future expansion. The special case design also allows the case to be stood on its side as a mini tower system. The Vig range can also be ordered in a much larger lower case as an option (refer to the options section

### General Specification The Vig models all have the following common specification:

- Fully IBM AT, MS OS/2, Xenix and Unix compatible. The Vig SX, Vig III and Vig IV also run 32 bit software written for the 80386 and 80486 processors
- 1 x 1.2MB and 1 x 1.44MB floppy drive.
- Enhanced 102 key keyboard.
- 2 serial, one parallel printer and one game port.
- 16 bit 1024 x 768 resolution super VGA card using the very fast industry standard WD paradise chip set
- Standard Vig range small footprint case dimensions (170H)x(370W)x(410D)mm with 200 watt power supply.
- Microsoft compatible mouse.
- MS-DOS 5.0 with Shell and Microsoft Windows 3 all installed, pre configured and ready to use (just type WIN to get started in Windows).
- Industry standard BIOS.
- EMS LIM 4 support.

### Vig SX

#### Vig SX-20 HD40VM VGA Mono

- As general Vig specification and with
- 32 bit 80386SX processor running at 8/20MHz with socket for 80387SX co-processor
- New ultra high speed 40MB hard disk (<18ms, 1:1 interleave, 32K cache), option for up to 1.2GB

### 80386SX

£949 + VAT

#### Vig SX-20 HD40VC Super VGA Colour

- As Vig SX-20 HD40VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1099 + VAT

### Vig III

#### Vig III/L HD80VM VGA Mono

- As general Vig specification and with
- 32 bit 80386DX processor running at 8/25 MHz with socket for 80387DX co-processor
- VGA monochrome monitor with resolution of 640 x 480
- 4MB RAM upgradeable to 32MB on motherboard

- New ultra high speed 80MB hard disk (<18ms, 1:1 interleave, 32K cache), option for up to 1.2GB
- Landmark speed (ver 2.0) = 27.7MHz, SI (ver 4.5) = 26.3, powermeter MIPS = 4.53

### 80386DX

£1149 + VAT

#### Vig III/L HD80VC Super VGA Colour

- As Vig III/L HD80VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1299 + VAT

#### Vig III/33 HD80VM VGA Mono

- As Vig III/L HD80VM but with
- 33MHz with 64K of cache RAM upgradeable to 256K

- Landmark speed (ver 2.0) = 55MHz, SI (ver 4.5) = 39.7, powermeter MIPS = 7.70

£1249 + VAT

#### Vig III/33 HD80VC Super VGA Colour

- As Vig III/33 HD80VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1399 + VAT

### Vig IV/SX

#### Vig IV/SX HD80VM VGA Mono

- As general Vig specification and with
- 32 bit 80486SX processor running at 8/20MHz with socket for 80487SX co-processor and Weitek 4167.
- Upgradeable to full 80486DX running at 33MHz.
- 8K cache internal to processor and 64K secondary cache upgradeable to 256K

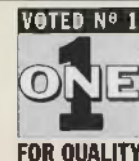
- 2MB RAM upgradeable to 32MB on motherboard
- New ultra high speed 80MB hard disk (<18ms, 1:1 interleave, 32K cache), option for up to 1.2GB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 66.8MHz, SI (ver 4.5) = 31.3 powermeter MIPS = 8.93

£1449 + VAT

#### Vig IV/SX HD80VC Super VGA Colour

- As Vig IV/SX HD80VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1599 + VAT



## COMPUTER WEEKLY

The 1991 independent survey, the 'Quality of IT Suppliers' by Computer Weekly, ranked Viglen No.1 overall for its quality as a PC supplier, for its technical staff, general capabilities, for its products and for competitive pricing.

### Vig IV/25 & 33

#### Vig IV/25 HD100VM VGA Mono

- As general Vig specification and with
- 32 bit 80486DX processor running at 8/25MHz with in built Maths co-processor and socket for Weitek 4167.
- 8K cache internal to processor and 64K secondary cache upgradeable to 256K
- 4MB RAM upgradeable to 32MB on motherboard

### 80486DX

£1699 + VAT

#### Vig IV/25 HD100VC Super VGA Colour

- As Vig IV/25 HD100VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1849 + VAT

#### Vig IV/33 HD100VM VGA Mono

- As Vig IV/25 HD100VM but with
- 32 bit 80486DX processor running at 8/33MHz

£1799 + VAT

- Landmark speed (ver 2.0) = 110MHz, SI (ver 4.5) = 50.7 powermeter MIPS = 14.70

#### Vig IV/33 HD100VC Super VGA Colour

- As Vig IV/33 HD100VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1949 + VAT

### Vig IV/33 EISA

#### Vig IV/33 EISA HD200VM VGA Mono

- As general Vig specification but with
- 32 bit 80486DX processor running at 8/33 MHz with in built Maths co-processor and socket for Weitek 4167.
- 8K cache internal to processor and 128K of secondary WRITEBACK cache
- VGA monochrome monitor with resolution of 640 x 480
- 4MB RAM upgradeable to 32MB on motherboard.

### 80486DX

£2949 + VAT

- New ultra high speed 200MB hard disk (<15ms), option for up to 1.2GB
- 8 32 bit EISA slots (fully ISA compatible). 6 free slots
- 6 bus master slots
- Landmark speed (ver 2.0) = 111.52MHz, SI (ver 4.5) = 51.6 powermeter MIPS = 14.76

#### Vig IV/33 EISA HD200VC Super VGA Colour

- As Vig IV/33 EISA HD200VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£3099 + VAT

#### Vig IV/33 EISA SCSI200VM VGA Mono

- As Vig IV/33 EISA HD200VM but with
- 32 bit EISA SCSI caching hard disk controller (fitted with 1MB of cache RAM upgradeable to 4MB)

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- 200MB SCSI hard disk

#### Vig IV/33 EISA SCSI200VC Super VGA Colour

- As Vig IV/33 EISA SCSI200VM but with
- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£3699 + VAT

## Options

- For each extra MB RAM please add £44.00 + VAT. The total RAM configuration of the Vig ranges shown must be one of the following: 4MB, 8MB, 16MB, 20MB and 32MB. Note that RAM prices are valid when ordered with a system. Due to the nature of RAMs and the many combinations and types of DRAMs available, the cost of upgrading at a later stage may differ
- For the full system to be incorporated in a lower case add £159.00 + VAT.
- A full range of other options including co-processors, higher capacity hard disks, network cards, CD ROM systems, tape backup systems, modems, OS/2, Xenix, Unix, Novell etc are available. Please call us as there are too many options to list.
- To upgrade the Super VGA memory from 512K to 1MB, please add £22.00 + VAT



Viglen colour VGA systems are now supplied with the latest very high resolution 28 dot pitch 14" super VGA plus colour monitor with full FCC, TUV, UL, CSA and DHSS safety approvals. This monitor displays 1024x768 resolution and is IBM high resolution 8514/A and XGA compatible. The results speak for themselves: none of the screens displayed in this advertisement were simulated - all were photographed directly off-screen



genie®



The Viglen Genie range incorporates ingenious British design and the latest state of the art technology to provide the smallest footprint IBM compatible computer currently available with so much power and so much expansion capability. Despite its small size, the Genie manages to make available 5 free expansion slots (3 of which can take full size and full AT height add on cards) and to provide hard disk expansion capacity of up to 500MB. There are three main models in the current range starting from the 80386SX based Genie 3SX, and extending to the Genie 4DX which is one of the most powerful personal computer systems currently available and is based on the 32 bit Intel 80486 processor running at 33 MHz. The Genie is ideal for most applications, from the basic high performance single user system to the most demanding multi user applications.

### General Specification

The Genie models all have the following common specification:

- Fully IBM AT, MS DOS/2, Novell, Xenix and Unix compatible. The Genie 3 and 4 also run 32 bit software written for the 80386 and 80486 processors.
- Industry standard BIOS
- EMS LIM 4 support
- 1 x 1.44MB floppy drive with option for external 1.2MB floppy drive or streamer.
- Enhanced 102 key keyboard
- 5 free expansion slots (4 x 16 bit 3 of which are full length and full AT height and 1 x 8 bit)
- 2 serial and one parallel printer port
- 16 bit 1024 x 768 resolution super VGA card using the very last industry standard WD paradise chip set with 512K of RAM as standard
- Very small footprint case size 100 (H) x 315(W) x 380(D)mm
- Microsoft compatible mouse
- MS-DOS 5.0 with Shell and Microsoft Windows 3 all installed, pre configured and ready to use (just type WIN to get started in Windows).

### genie® 3SX

NOW

80386SX

#### Genie 3SX HD40VM VGA Mono

As general Genie specification and with

- 32 bit 80386SX processor running at 8/20 MHz with socket for 80387SX co-processor
- 1MB RAM expandable to 32MB on motherboard and more with expansion card

- New ultra high speed 40MB hard disk (<18ms, 1:1 interleave, 32K cache), option for up to 500MB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 20MHz, SI (ver 4.5) = 18

£849 + VAT

#### Genie 3SX HD40VC Super VGA Colour

As Genie 3SX HD40VM but with

- Super high resolution 14" super VGA plus .28 pitch colour monitor.

£999 + VAT

### genie® 4SX

NEW

80486SX

#### Genie 4SX HD100VM VGA Mono

As general Genie specification and with

- 32 bit 80486SX processor running at 8/20MHz with socket for 80487SX co-processor and Weitek 4167. Also upgradeable to full 80486 DX running up to 33MHz.
- 8K cache internal to processor and 64K secondary cache upgradeable to 256K

- 4MB RAM expandable to 32MB on motherboard.
- New ultra high speed 100MB hard disk (<18ms, 1:1 interleave, 32K cache), option for up to 500MB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 66.8MHz, SI (ver 4.5) = 31.3, powermeter MIPS = 8.93

£1449 + VAT

#### Genie 4SX HD100VC Super VGA Colour

As Genie 4SX HD100VM but with

- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1599 + VAT

### genie® 4DX

NEW

80486DX

#### Genie 4DX HD100VM VGA Mono

As general Genie specification but with

- 32 bit 80486DX processor running at 8/33 MHz with built Maths co-processor and socket for Weitek 4167.
- 8K cache internal to processor and 64K secondary cache upgradeable to 256K
- 4MB RAM expandable to 32MB on motherboard.

- New ultra high speed 100MB hard disk (<18ms, 1:1 interleave, 32K cache), option for up to 500MB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 110MHz, SI (ver 4.5) = 50.70, powermeter MIPS = 14.70

£1649 + VAT

#### Genie 4DX HD100VC Super VGA Colour

As Genie 4DX HD100VM but with

- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1799 + VAT

## Options

- For each extra MB of RAM please add £44.00 + VAT. The total RAM configuration of the Genie 3SX can be one of the following: 1MB, 2MB, 3MB, 4MB, 5MB. The total RAM configuration of the Genie 4 range must be one of the following: 4MB, 5MB, 8MB, 16MB, 20MB and 32MB. Note that RAM prices are valid when ordered with a system. Due to the nature of RAMS and

- the many combinations and types of DRAMs available, the cost of upgrading at a later stage may differ
- Price for higher capacity hard disk drives instead of the 40MB are as follows: 80MB £129 + VAT, 100MB £199 + VAT, 200MB £429 + VAT, 300MB £769 + VAT, 400MB £949 + VAT, 500MB £1099 + VAT.
- Please call for many other options.

# Why Choose Viglen?

## BEST VALUE FOR MONEY

Spec for spec Viglen offers the best price performance systems available.

## BUY WITH CONFIDENCE

From a company with experience, Viglen are a British company who have been in the manufacturing business for 18 years; a lot longer than many personal computer companies.

## QUALITY AND SERVICE

The quality systems and service from Viglen is second to none. All Vig and Genie systems are designed and built in the UK under one of the most stringent quality control and test procedures.

## RELIABILITY

Viglen incorporate the highest quality industry standard components, and combined with stringent quality control measures during manufacture this makes the Viglen personal computer system one of the most reliable systems available.

## AFTER SALES SERVICE

Viglen after sales service is second to none. With lifetime hotline technical support and a service department that can offer repairs and upgrades at competitive rates with rapid turnaround.

## COMPLETE SYSTEMS

All systems are complete with Windows and DOS pre installed. NO extras required.

## FULL 12 MONTHS WARRANTY

All Viglen systems come with a full 12 months parts and labour warranty. On-site maintenance can be offered at very competitive rates for up to 4 years.

## COMPATIBILITY GUARANTEED

We guarantee that all Viglen PCs are fully compatible and will run ALL the software programs that operate on the equivalent IBM PC/XT/AT system.

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Viglen as a major licensee of the Microsoft Corp., will be able to offer future upgrades of MS-DOS or Windows to its customers.

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We offer a comprehensive before and after sales network consultancy and installation.

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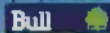
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## ALWAYS AHEAD

Viglen are always in the forefront of technology and you can rely on Viglen to be leading the field in the latest developments.

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**Warranty and On-Site Maintenance** All Viglen systems come with a full 12 months return to base parts and labour warranty. Full on-site maintenance with Bull HN is available for £69.00 for the first year (£39.00 for the Dossier) and 7% of the invoice value (if obtained within 14 days of purchase) or 9% of the invoice value (if purchased any other time) for each subsequent year up to 4 years.



**Service and Upgrades** The Viglen service department provides a comprehensive after sales repair and upgrades service. Most Viglen systems can be upgraded with higher RAM, hard disk capacity or even higher performance main board. Simply call and ask for our service department.

**Networks** Viglen offer a comprehensive range of network consultancy services for all types and sizes of networks from the basic 2 user system to the more sophisticated 250+ user systems. The services include specification, quotation, installation and maintenance. Hence whatever the size of your requirement, just call us and ask for our network department.

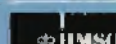


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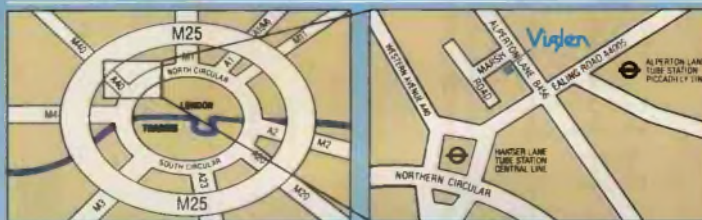
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If you want silent printing, you don't buy a dot matrix printer. But given the nature of the beast, the Hyundai was better than most — though still irritating colleagues. Print quality was good for a 9-pin, approaching some 24-pin models in clarity, but 'letter quality' is never really achievable on any machine with only nine pins.

The Hyundai has five built-in fonts, and as with all matrix printers supports both Epson FX80 and IBM Proprinter emulations.

The manual, despite its rather strange use of English ('Occasional cleaning of the printer is a good action you can take') and unexplained lapses into German, is quite comprehensive and well laid out.

At £169 the Hyundai Pinovia 930 is at the bottom end of our price range and is aimed at the 9-pin value-for-money market. Given the limitations of these budget machines, the Hyundai does its job with reasonable output quality.

Nick Edmunds

## IBM 2380

IBM's printer products are suffering something of an identity crisis at the moment, but none has the problems of the 2380. Try to find a 2380 in the list of Windows drivers and you'll be out of luck. Still, that's what the documentation and the badges insist that it's called.

Make the counter-intuitive leap from 2380 to Proprinter II, though, and you should be able to get things working fairly quickly. This is an IBM machine,

with IBM written all over it, so how come it's got a Lexmark badge on too? Simple really. IBM printers are dross, so IBM spawns off a company, Lexmark, and gives it the unenviable task of getting rid of them all. Cynical? Moi?

Unless your company already uses a 2380, you'll almost certainly be surprised by its appearance. It doesn't look like any dot matrix printer you've ever seen. In fact, it looks more like an industrial toaster than anything else.

### Toblerone-shaped

Open the printer up and you realise why it's the shape it is. The printer mechanism is mounted at 45 degrees to the desktop. This is an old automotive engineering trick: by sitting the engine at an angle you can reduce the height of the bonnet. Quite how or why IBM managed to make the truncated Toblerone-shaped 2380 the tallest dot matrix printer I've ever seen, will I



suspect remain a mystery.

It works, though. It's well built, packed with (not altogether effective) sound-deadening foam and (this is a plus point in an impact printer) the mechanicals are very simple; cleanly and elegantly designed, then shoved in at 45 degrees for no apparent reason.

The acid test, of course, is not what it looks like, but how it performs when you run fanfold through it. The answer is very well indeed. In graphics mode it is if anything a shade too black. With Microsoft's slightly misformed True Type characters, even at sizes as large as 14 point, holes became blobs.

Pure graphics is pretty good too. Blacks are black and consistent and alignment is superb. If you think, however, that the printer is noisy printing text, just wait until you print large areas of dithered grey. That, unfortunately, is the price you pay for speed.

Text printing with the four built-in fonts (Draft, Fast Draft, Gothic and Courier) is fast and the results crisp and neat. Fanfold paper is handled well (a function, it has to be said, of the odd design) and the adjustment for paper thickness is placed prominently on the outside. This is a multi-part invoice printer's printer.

That, from International Business Machines, is hardly a surprise. The two surprises are that it's so good at invoice printing and that it's so good at everything else. If you want a printer that is also an attractive piece of furniture, the 2380 is definitely not for you. If, however, you have more sane criteria, the

## IBM 2380

### Supplier

IBM

### Type

9-pin dot matrix

### Price

£439

### Fonts

Courier, Gothic

### Print speed

Quoted cps: 270 draft, 65 NLQ

Benchmark cps: 178 draft, 55 NLQ

### Interfaces

Parallel

### Paper handling

Friction feed, push-pull tractor feed, bottom feed. Optional 150-sheet ASF

**Good Points** Fast, well built.

**Bad Points** Quirky design, noisy.

**Conclusion** A surprisingly good printer.

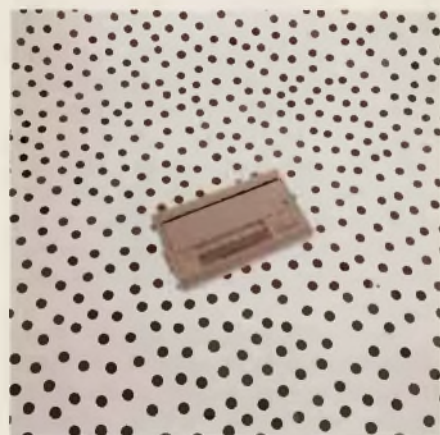




2380 is a fast, flexible and reliable piece of kit.

Guy Swarbrick

## Kodak Diconix 150 Plus



Kodak's expertise in photographic technology made it a household name, which may be why most of its printers are expensive high-resolution machines. The Diconix is one of Kodak's first for the budget market, and is obviously another product aimed at cashing in on the portable computing boom.

The Diconix is bound to appeal to the design-conscious executive for its size and friendly, almost cute, appearance. It is smaller than its close rival, the Canon BubbleJet, and lighter at just 3.75lbs. There are just three buttons on the control panel and a single parallel

or serial connector.

Nevertheless, the Kodak prints in draft, NLQ, quality and condensed modes, and takes plain paper, continuous form, inkjet paper, and a special type of transparency for inkjet printing. But being a non-impact printer, it won't take multi-part forms. It supports both Epson and IBM Proprinter emulations and there is a version for use with Macintosh computers.

Inside, the design is equally simple. The ink cartridge is removed and replaced by releasing a single lever, and loading paper is easy. Single sheets are pushed through from the back of the machine and pulled up and aligned by hand. Continuous form paper is fed through in the same way and placed onto the tractor pins. The paper is out of reach only for a few centimetres, so any paper jams would be a cinch to fix — though I had no trouble with jams.

### Silent

The Diconix was as simple to operate as it looked and was nearly silent when printing. In speed, it was comparable to the other portable printers at 77cps in draft mode and 28cps in NLQ. I expected the inkjet technology to give fairly good quality print and it did. The letters were clear, but the print in draft mode was sometimes too faint to read easily. Graphics came out well, with even tones and well-defined lines.

The Diconix worked reliably through the test: the ink cartridge lasted throughout, and it printed on recycled paper as well as better-quality plain paper. The

print quality is adequate for most purposes 'on the road', when speed and paper handling won't matter.

What will appeal most to the serious traveller is the built-in battery. It will recharge while the printer is connected to a computer and will automatically switch to printing when necessary. There is an estimated 50 minutes of printing time, or 12 hours on standby, on a fully-charged battery. Recharging takes approximately 10 hours. It is also worth noting that the AC adaptor is smaller than most.

Buying the Diconix as a portable printer, or for low usage, would not be a mistake. It compares well with the other portable machines. As an incentive to Mac users, the price of the Mac version has been dropped to £320 plus VAT to coincide with the release of the PowerBook.

Helen Johnstone

## Mannesmann Tally MT81

When Mannesmann Tally announced the merger with Siemens last year, it also announced its objective to have a printer in every sector of the market. For Mannesmann Tally that meant improving its laser and inkjet printer ranges for the top end of the market. Its PostScript printer gave an impressive performance in our Hardware Group Test in the December 1991 issue. Would its dot matrix printers, on which the MT success was built, fare as well?

## Kodak Diconix 150 Plus

### Supplier

Kodak (UK) (0442) 61122

### Type

Inkjet

### Price

£345

### Fonts

Generic

### Print speed

Quoted cps: 145 draft, 44 NLQ

Benchmark cps: 77 draft, 28 NLQ

### Interfaces

Parallel, serial or Appletalk

### Paper handling

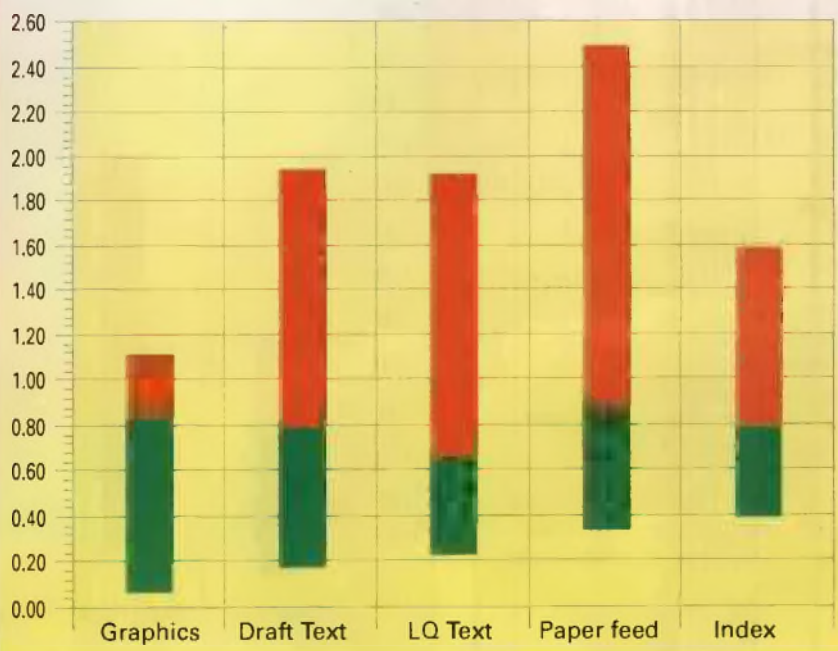
Friction feed, tractor feed

**Good Points** Small, light.

Rechargeable battery.

**Bad Points** Draft print is a little faint.

**Conclusion** Fine portable printer.







The MT81, smallest and cheapest of the 13 dot matrix printers in the current range, has nothing elaborate about its appearance. There are three buttons to set the printer online and to select the printing mode, and four status LEDs. There's a single parallel or serial connector at the back, and that's it.

Well, actually there's much more to it. The MT81 operates in three print modes, which Mannesmann Tally has chosen to call Elite, Correspondence Quality and NLQ. Elite at 12cpi prints the fastest, with a claimed speed of 155 cps. Correspondence Quality, at 10cpi, is given as 130 cps and NLQ is rated at 26 cps.

The MT81 takes both continuous form and cut sheet paper, and unexpectedly for such an unostentatious printer, it is capable of paper parking, where one type of paper can be used without removing the other.

The big advantage of the plain de-

sign is that it is easy to understand and use. It has to be, because the manual instructions are so short they verge on the surreal. For such a basic printer, the test results were also surprisingly good. Even in the draft modes, Elite and Correspondence, the print was clear and the letters well defined. In NLQ mode, the quality was comparable to that of a laser printer.

### Noise

The MT81 was also faster than it looks. For draft print it recorded a poor speed of 77 cps, and for NLQ it worked out at 20 cps. The only problem was the noise. I suspect it was just our model, as the screech it made was more typical of the jungle than the office. It's unlikely that every MT81 sounds like an over-excited monkey.

This is a printer I would be happy to recommend, but check the noise level before buying. There are few printers that would give the same print quality for such a low price, and it is small enough to be useful at home as well as in the office.

Helen Johnstone

## NEC Pinwriter P30



The Pinwriter P30 is one in a line of 24-pin dot matrix machines that have been around for some time, starting at the P20 and going up to the P90.

The P30 is a 136-column version of the 80-column P20 (now available for as little as £195). This makes it rather a large beast, and it must be a strong contender for the heavyweight championship. However it's a lot more attractive than Mike Tyson, with a two-tone grey casing and a tinted acrylic lid (not so tinted that you can't see through it).

The control panel is a flat touchpad affair which is used to change the on-line status, load and unload paper, change the type style, and so on. An array of green and orange LEDs displays the current settings. To the right of the machine are the platen knob and the on/off switch, and at the rear are the power socket and the parallel interface connector.

The P30 has excellent paper-handling facilities, with a push/pull tractor feed and paper parking, so single sheets can be used together with continuous



## Mannesmann Tally MT81

### Supplier

Mannesmann Tally (0734) 771688

### Type

9-pin dot matrix

### Price

£159

### Fonts

Roman, Courier, Sans Serif

### Print speed

Quoted cps: 130 draft, 24 NLQ

Benchmark cps: 77 draft, 21 NLQ

### Interfaces

Parallel

### Paper handling

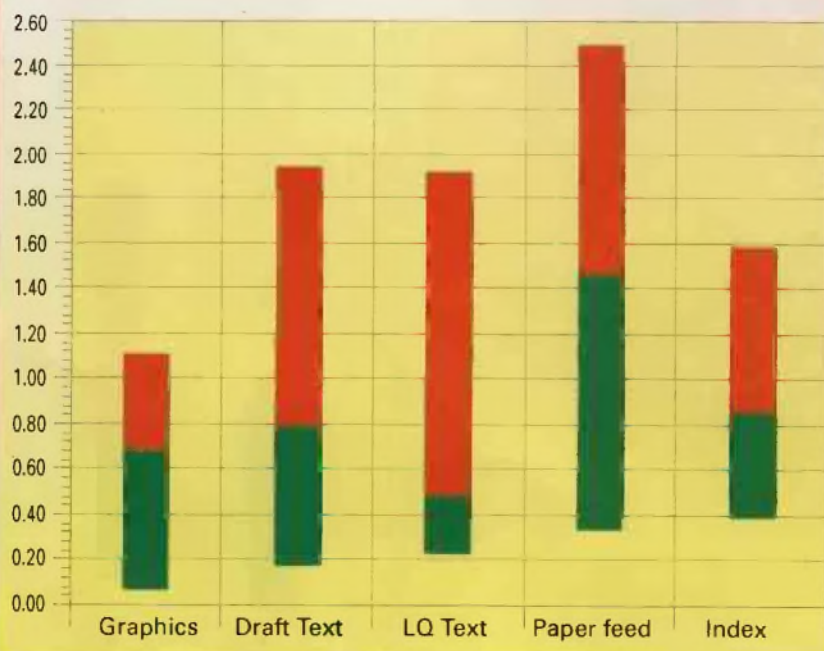
Friction feed, push tractor feed.

Optional single-bin ASF

**Good Points** Print quality, price.

**Bad Points** Appearance, noise.

**Conclusion** Appearances can be deceptive.





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286 16MHz	386SX 20/25 MHz	386 25MHz	386 33MHz	386 40MHz	486 33MHz														
(SY 228) Expandable to 4MB on board. 0 wait state. Landmark speed 21MHz. Expansion slots: 6x16 bit, 1x8 bit.	(SY 366) Expandable to 8MB on board. 0 wait state. Landmark speed 26MHz. Expansion slots: 6x16 bit. Call for Slim Case option.	(SY 334) Expandable to 8MB on board. 0 wait state. Landmark speed 33MHz. Expansion slots: 6x16 bit, 2x8 bit.	(SY 374) 64K CACHE MEMORY Expandable to 32MB on board + EMS. Landmark speed 58.7MHz. Expansion slots: 7x16 bit, 1x8 bit.	(SY 380) 64K CACHE MEMORY Expandable to 32MB on board. 0 wait state. Landmark speed 70MHz. Expansion slots: 6x16 bit, 2x8 bit.	(SY 433) 64K CACHE MEMORY Expandable to 32MB on board. 0 wait state. Landmark speed 156MHz. Expansion slots 6x16 bit, 2x8 bit.														
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forms. As usual there is an optional auto-sheetfeeder, but manual sheet feeding is automatic and easy. Our print speed test produced an average speed of 46 cps using Courier at 10 cpi, 14 cps slower than NEC's cited speed.

### Print quality

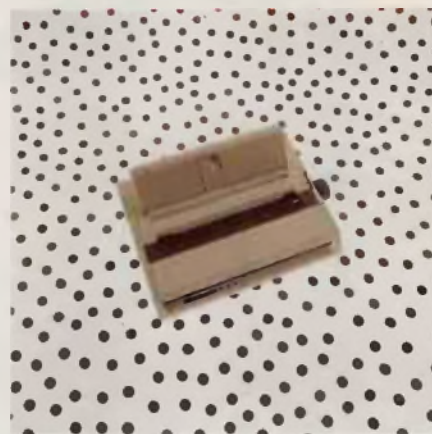
NEC claims the printer is capable of 90 cps using its 'high-speed letter-quality quick gothic' font, and 216 cps using the high-speed draft font. The print quality was very good, and I had to look closely at the LQ text to distinguish it from laser text, the main difference being that the P30 text is not as black.

There are nine resident fonts, including true super/subscript, and 96 or 128-character fonts can be downloaded. The P30 is supplied with an 8K buffer on the parallel model, and 16K if the optional serial kit is fitted. The Epson LQ-850/1050 is emulated, and according to the manual, so is the NEC 24-pin (there's a novelty).

The P30 is one of the best dot matrix printers I have used, and at £299 it offers excellent value. For people who don't require a wide-carriage printer, the P20 is even better value at £195, as the print speed and quality is exactly the same. The optional sheet feeder is cheaper on the P20 (£85 rather than £115) but all other accessories are the same. The ribbon costs just under £7 and prints approximately three million characters. This works out less than a penny per sheet, so the running costs are less than an inkjet and the quality is comparable.

Mat Beard

## Oki Microline 182



Back in the days when men were real men, women were real women and dot matrix printers were real dot matrix printers, the Oki Microline 182 wouldn't have looked at all out of place. You know where you stand with a printer like this: big, rubber-coated platen, tractor-feed sprockets, hand-sized paper advance handle... the works. This isn't one of those wimpy inkjet printers.

After a while, I began to remember all the things I hated about the days when dot matrix printers were the *only* printers. Some printer manufacturers have taken to lining the inside of the case with sound-deadening material. Not Oki. If you can get a pair of ear defenders thrown in for the price, you'll have done well.

The other thing I never got on with was tractor feed, and reassuringly the

Oki's tractor feed is as odd as any I've come across. The great thing about it is that despite being manufactured in Germany, it won't take European paper sizes. The platen is so wide that the tractor sprockets can't be moved close enough together. US paper, fortunately, is quite easy to get hold of. That isn't an excuse, but it's the best you'll get.

### Standards

Oki is a great lover of standards. It has hundreds of them, all its own. None of this messing around borrowing other people's, or even re-using your own. The latest version of Windows has 25 Oki printer drivers. Funny thing is, none of them seem to work with the Microline 182.

The manual says what you really need is a Microline 182 or 183 driver, but that a Microline 82 or 83 driver will do fine. Windows has everything else, as far as I can tell, and incredibly none of them work.

The manual does provide an alternative—BASIC. Remember that? LPRINT. Ah, the memories come flooding back. Sad, isn't it?

WordPerfect Corporation has claimed in the past that its software supports more printers than any other. That may well be true. It certainly supports this one — sort of. The only Microline 182 driver for WordPerfect for Windows makes some interesting patterns, none of which bear any relation to the text you were trying to print, but the driver which claims to be for a 182+ works fine, if you call printing in Prestige, non-proportional, fully justi-

## NEC Pinwriter P30

### Supplier

NEC (UK) 081-993 8111

### Type

24-pin dot matrix

### Price

£399

### Fonts

Gothic, Courier, Prestige Elite, Bold PS, Helvetica, Times

### Print speed

Quoted cps: 180 draft, 90 NLQ

Benchmark cps: 109 draft, 46 NLQ

### Interfaces

Parallel

### Paper handling

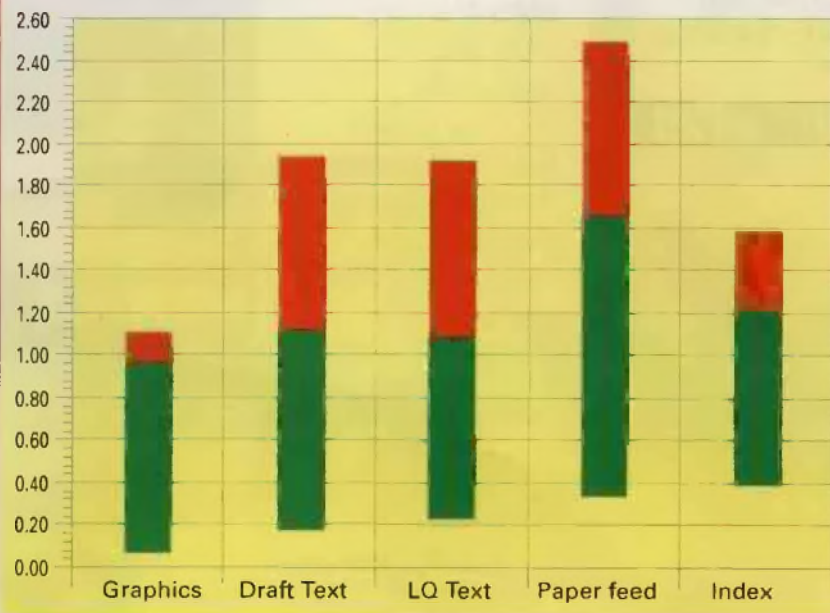
Friction feed, tractor feed.

Optional ASF

**Good Points** Excellent quality text, solid build.

**Bad Points** Poor graphics printing.

**Conclusion** Excellent.





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fied and nothing else 'fine'. Graphics works too, but by the time I'd got it working I'd lost what little interest I'd had.

There might be a good reason for buying an Oki Microline 182, but I'm damned if I can think what it is. I wonder if there will ever be a market for slow, crude, noisy 'classic' computer peripherals? People buy American cars...

Guy Swarbrick

## Olivetti DM 124C



The DM 124C is a 24-pin colour printer, as the perceptive among you will have deduced from the name. It's pleasingly rounded, although at 10x38x30cm it's a large machine and the styling doesn't hide its block-like appearance. Another point in its favour is the bottom-covering foam-rubber foot which reduces

noise no end. These things combine with the pastry-cutter shaped platen knob, and the rather ramshackle paper loading tray, to give the impression of a printer that's been designed to some curious rules.

The user interface consists of three LEDs and four buttons. Normally, three of these perform standard printer functions — on and off-line, form and line feed — with the fourth button loading and unloading paper. Of the three lights, one indicates that the printer is on, one shows whether the printer is online or not (confusingly, it lights up when the printer is offline — this caused me an initial frisson of frustration) and the other is labelled Quality. It performs various functions, most commonly to show whether the printer is in double-pass mode or not.

The printer can emulate an IBM Proprinter or an Epson LQ 2550, but as only the latter knows about colour I decided to make it an Epson. It's an interesting exercise, trying to work out what mode your printer's in when the only output is a couple of flashing LEDs, and even more so when the manual has no index, no logical layout and is written in not-quite English. Eventually I found that to set the emulation you had to load a sheet of paper, turn the printer off and hold down a button while turning it back on again. This turned the printer into a sort of terminal — it printed out a set of menu options, you moved the printhead with one button and selected an option with another. The printer then underlined

the option, and produced another menu.

Once I'd got the hang of this, it was simple to set things up. Or it would have been had I been using fanfold paper: with cut sheets, I kept running out of room halfway through a menu option. All this to avoid the cost of a little alphanumeric LCD.

### Majorite grey

Once I'd set the emulation, and told the printer that it was using a colour ribbon (this involved holding down the Local button for two seconds until the LEDs started to flash, and then stepping through a binary sequence with them until the combination matched the combination that the manual told me represented having colour enabled), and confirmed that it was set up properly by resetting it and printing out a test page (if there was an easier way, I couldn't find it), I was ready to go. Unfortunately, despite an afternoon of messing about with Windows, the only pictures it would print were in various shades of Majorite grey. Ho hum.

The quality of the output is fine, if unexciting; the characters are well formed and there's little striping on large areas of black.

This printer has a reasonable performance compromised by an unfriendly user interface, which is further compromised by a depressingly unpleasant manual. Compared to the great efforts made by the Far Eastern companies in this area, it looks particularly bad — I really don't think Olivetti is trying. Worth considering as part of a

## Oki Microline 182

### Supplier

Oki Systems Ltd (0753) 531292

### Type

9-pin dot matrix

### Price

£269

### Fonts

Courier

### Print speed

Quoted cps: 155 draft, 40 NLQ

Benchmark cps: 82 draft, 30 NLQ

### Interfaces

Parallel or serial

### Paper handling

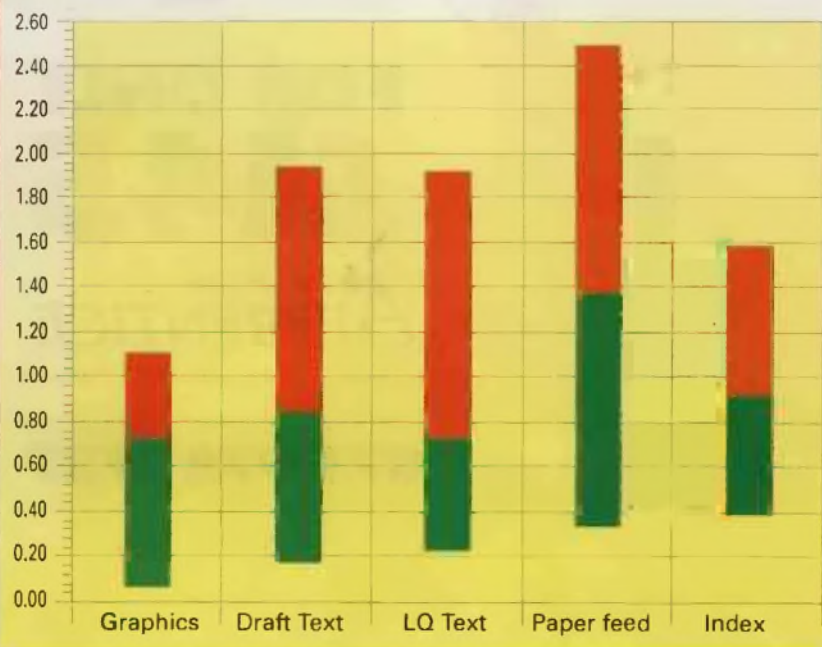
Friction feed, tractor feed.

Optional roll stand

**Good Points** Er... traditional.

**Bad Points** It doesn't work.

**Conclusion** Why?







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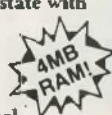
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Rupert Goodwins

## Olivetti JP 350



As PG Wodehouse never said: one instinctively knows when something is right. You don't have to use instinct to spot correctness in the printer world — a good design is copied by all and sundry. It happened with the Epson FX-80, the role model for dot matrix printers the world over, and now it seems to be happening with the HP Deskjet.

The Olivetti JP 350 inkjet printer, while retaining the Italian flair for stylish peculiarity, is clearly influenced by the classic HP design. Both printers have the electronics and paper handling mechanism in a large box above a flat paper tray; the Olivetti differs in paper handling by having the sheet

feeder on the top, rather than underneath the output tray. Power and parallel connections are at the back, well away from any paper paths.

### Dimpled buttons

The main control panel has no fewer than 12 LEDs and five buttons. These are soft and blue and dimpled, and thus rather reminiscent of baboon buttocks. They control the normal day-by-day settings such as font size and style; if you want to change the permanent defaults you have to go into a special mode by hinging up the head cover, holding down the Line Feed key, and switching the printer off and on again.

This then prints out the first of many setup menus. The printer head has a small arrow on it which points at whichever option on the menu is active. By selecting and confirming different options, you can set up graphics resolution, interface type (although only parallel comes as standard), character sets and all the other paraphernalia.

The printer, as it comes, can only emulate a HP Deskjet Plus. Other emulations (most notably Epson FX-850) are available on ROM cards, as are different fonts — these slot into receptacles in the top of the printer, next to the paper feed tray.

There are only two internal fonts, Courier and Draft. Given the high quality of the output, this is rather a shame — it's very close to laser quality and the graphics can be equally splendid. With large dark areas, the printer puts down so much ink that the paper begins to get saturated — this highlights (or rather

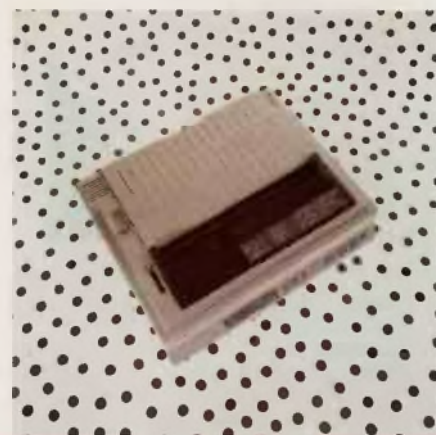
lowlights) the role paper quality plays with this sort of printer. It's important, if you want the best quality possible, to experiment with various types of paper until you find one that's consistently good.

In use, the printer is reasonably fast. Its real beauty, though, is in its silence — the print head whispers across the paper, and the loudest noise is the chug of the paper feed motor. After a week testing impact printers, I felt like applauding. Quietly. The paper handling is impeccable: it copies the HP Deskjet's mechanism for keeping sheets apart while the ink dries, which is important for big black pictures.

Rupert Goodwins

## Panasonic KX-P1124i

Panasonic is part of Matsushita, one of the bigger industrial conglomerates on



## Olivetti DM 124C

### Supplier

Olivetti Office (0908) 690790

### Type

24-pin dot matrix colour

### Price

£339

### Fonts

San Serif, Roman, Courier, Prestige

### Print speed

Quoted cps: 200 draft, 50 NLQ

Benchmark cps: 121 draft, 42 NLQ

### Interfaces

Parallel

### Paper handling

Friction feed, tractor feed.

Optional ASF

**Good Points** Colour.

**Bad Points** User interface and documentation poor.

**Conclusion** For the patient.





the planet. The KX-P1124i is its contribution to the can't-afford-a-laser market and demonstrates both attention to detail and a corporate inability to think of a reasonable name.

The styling is functional and unimaginative, and at 43x36x14cm this printer isn't one of the smallest on trial. The parallel port input is hidden at the back where you can also find the captive mains lead. The power switch is next to the platen knob on the right-hand side; everything else happens on the front panel.

The user interface consists of seven buttons, three LEDs and a 16-character macro. These are selectable (after a little button pushing) from the front panel, although apparently not from control codes. They remember everything about the printer's setup, so you can have plush, slow, high-quality printing for the letters to your mother, and zippy, dotted, cramped output for your database dumps, without having to remember anything more than the macro number.

### Flexible

The KX-P1124i is a flexible beast when it comes to paper manipulation. The normal set of back and top loading slots is provided, but there's an extra intake on the front of the printer, behind a flap that extends across the width of the machine and another on the bottom. The tractor feed pushes from the rear or pulls from the bottom or the top; friction only works from the top or the front of the machine. There's a rather nifty function whereby the printer will

roll up fanfold so that you can tear it off easily, and then roll the paper back down so that the top of the page is in the right place for the next bout of printing; you can also move the paper up or down in very small steps from buttons on the front panel.

There are 11 fonts available, with nine basic sizes ranging from 5 to 20 characters per inch. The fonts are a useful selection of Courier, Prestige, Bold Proportionally Spaced (exactly what isn't made clear), Script, Sans Serif, Orator, Roman and Super LQ — this last is a double-pass set with a resolution of 30x48 dots per character.

Print quality was at least acceptable, and sometimes more than that. The characters were well formed, but at certain settings there was a slightly uneven quality to the density of the ink. In graphics mode, though, dark areas were surprisingly solid. There was a little banding, but with a fresh ribbon the major problem was that the printer put so down much ink that the paper became saturated and wrinkled. Moving the printhead back solved this but increased the banding — you have to experiment with each different type of paper to find out the optimum level. At that level, the quality can be very good.

Rupert Goodwins

## Philips NMS1433 Plus

If manufacturer stability determines your choice of printer, look no further: Philips enjoyed its 100th birthday in

1991. This 250,000-staff Dutch electronics giant markets the usual 286-to-486 PC range plus printers from dot matrix to laser.

The printer reviewed here is at the bottom of the Philips range, with the standard low-end 9-pin matrix A4 specification. Given the much superior quality of 24-pin machines I'm always surprised that 9-pins still sell, but they are cheap to buy and run. At only £140, and using economical ribbon cartridges, the Philips is looking for customers on just such a tight budget.

The German-made NMS1433 Plus comes in exciting plastic-grey with a tinted perspex cover. Microswitch controls for pitch, speed, font and on/off-line are on the front panel just above the recessed power switch along with the usual warning LEDs. Though not huge, the Philips isn't exactly tiny and considering its limited capabilities took up a surprising amount of valuable desk space (even with its neatly hidden Cen-



## Olivetti JP 350

### Supplier

Olivetti Office (0908) 690790

### Type

Inkjet

### Price

£499

### Fonts

Letter Gothic, Courier, Times

Roman

### Print speed

Quoted cps: 360 draft, 120 NLQ

Benchmark cps: 74 draft, 55 NLQ

### Interfaces

Parallel

### Paper handling

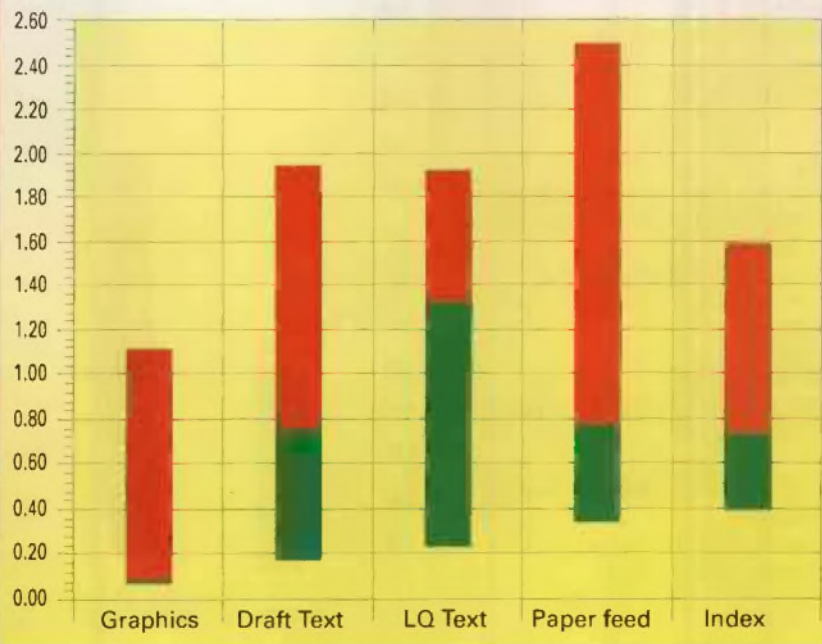
150-sheet A4 paper tray. Optional

70-sheet feed and sprocket feed

**Good Points** Sheet feeder reliable, very quiet, very high quality.

**Bad Points** Few fonts, few drivers exist for Deskjet Plus, odd buttons.

**Conclusion** Good printer that could be excellent with extra fonts and emulations.





tronics port) at 16in wide. It has a built-in tractor feed rather than the cheaper clip-on variety. It's a push feed, and though pull feeds are generally better the design does avoid wasting continuous stationery when printing individual pages, as happens in some of the cheaper pulling tractors.

### Tinted cover

The NMS1443 came with the usual removable, single-sheet paper guide which worked as well as these cheap compromise-for-a-real-sheet-feeder devices ever do. The Philips got no marks for the daft heavily tinted cover. Why make something out of clear plastic, to look through at the printed page, and then make it so dark you can't read your output? The answer probably has something to do with corporate image and the charts of what colour goes with what in Eindhoven. But it is still daft. Apart from this niggle, the machine was generally well constructed and all the controls worked well.

In use, and like all similar machines, the printer emulates the Epson FX80 or IBM Proprinter II. Unlike similar machines with the more usual two or three fonts the Philips has five on-board fonts as standard and can produce quite a variety of character sizes and styles. As the graphs show, the printer is reasonably speedy (against the other machines in this test) and indeed has a special 'super speed draft' mode at a claimed 300cps. Printed output quality compared with other budget machines was really nothing special; adequate for

personal correspondence but only when presentation is not important. All dot matrix printers are noisy and the Philips is probably below the average decibel level — a definite bonus.

The documentation was not very impressive, consisting of two thin manuals, one being the 'multi-lingual instructions with international diagrams' type, but in use it proved to be adequate. Philips has produced a printer which works, is inexpensive and has some good features, but you could do better with your hard-earned dosh.

Nick Edmunds

## Seikosha SP1900



Seikosha is part of the giant electronics group which owns Epson, but in the interests of competition the rival parts fight for market share. The company, which also produces laser printers, is

pushing this machine as a £179 printer although distributor SDL is selling it at under £100. This undercuts not only the 24-pin machines (increasingly becoming a commodity) but even many of the machine's 9-pin brothers.

Pricing of this sort always brings quality into question, but the SP1900 looks the part if nothing else. Measuring 380x110x80mm and weighing about 3.3kg, it's relatively small and light. It is cream coloured, with a touch-sensitive control panel on the front right-hand side. It also has a removable smoked perspex printer hood, with different typeface options printed in white across the top, and with a sharp edge for tearing off paper. A slot-in paper guide is also included, as is a parallel interface set into an alcove at the rear of the machine.

Seikosha claims that the device can print at 192 cps in fast draft mode. It has the ability to print using either single sheet or continuous stationery, and a paper-parking feature saves you having to unload continuous paper to print a single sheet. A printhead adjuster enables you to print multiple forms of up to three parts.

Presumably to cut down on control buttons and lights, Seikosha has rather clumsily made the printhead an integral part of the margin and typeface selection process. You move the head along to one of the seven typeface definitions (Pica, Elite, Condensed 17, Condensed 20, Proportional, Fast Elite or Software Defined) by pressing the form or line feed buttons, located along with

## Panasonic KX-P1124i

### Supplier

Panasonic (0344) 853915

### Type

24-pin dot matrix

### Price

£365

### Fonts

Courier, Prestige, Bold PS, Script, Sans Serif, Orator, Roman, Super LQ

### Print speed

Quoted cps: 240 draft, 80 NLQ

Benchmark cps: 113 draft, 50 NLQ

### Interfaces

Parallel

### Paper handling

Friction feed, push and pull tractor feed. Optional ASF

**Good Points** User interface, feature list, print quality.

**Bad Points** Not the fastest of printers.

**Conclusion** Good value.





the NLQ and online buttons on the front panel. The NLQ button is also used to set draft, NLQ serif or NLQ sans serif modes. There are indicator lamps for the power, paper empty and NLQ modes.

The paper management works well. Continuous stationery can be moved back a maximum of 18 inches, to allow single-sheet printing with unloading.

### Louder than most

The machine is louder than most, and the print hood doesn't do much to damp out the noise. This could be annoying in the office, but in a home study you could probably live with it. Print quality is adequate, although certain unidirectional modes were just a little too fuzzy to be usable, making the quality difference between draft and NLQ modes perhaps more apparent than usual. It prints at 96 cps in Epson fast mode.

For £100, there really are no justifiably bad points about this printer. It is an obvious choice for the budget home user, students being a prime example. The even better news is that by the time you read this, Seikosha will have superseded the SP1900 with the SP1900+, an identical machine that will also sell for £99 — but complete with an automatic cut sheet feeder said to be able to hold 250 sheets.

Danny Bradbury

## Star LC-20

Star started life in Japan in 1947, mak-

ing bits for clocks. In 1989, it had the UK's bestselling matrix printer, the LC-10, and is currently shifting something like two million printers a year. That's a lot of dots.

Somewhere in Star's industrial design department sits a sports-car designer *manqué*. Although the LC-20 isn't as streamlined as, say, the LC-24, it's still one of the more attractive printers we tested. The lines are spoiled somewhat by four rather ugly buttons on the front panel which look more like the rubber feet you find on telephones than ergonomically optimised components of the user interface. They are complemented by a host of LEDs which show the chosen font and its selected size, plus online status and power.

The parallel interface connector itself — there's no serial option other than a converter lead — is situated on the right-hand side of the case where it's far easier to get to than if it resided

in its more normal place at the back of the box. The power lead is there, but since it's captive and can't be dislodged anyway this hardly matters. The mains switch is back on the front panel — everything you'll need frequent access to falls easily to hand.

The LC-20 can cope with fanfold or single-sheet paper, from 4in to 10in in width. It's got a rather clever feature whereby you can 'park' fanfold without having to unspool it, and use the printer for cut sheets. This takes quite a bit of fiddling: you have to wind back the fanfold until it's just peeking over the top of the paper-out slot, hold the font and paper-feed buttons down until it has spooled back out of the way, and then move two levers and fiddle with the paper tray. It doesn't work well. I suppose most people will just ignore it. A sheet feeder is available as an optional extra but wasn't tested.

### Printing with care

The LC-20 will cope with up to three sets of paper at once if you're doing multi-part forms, and although the manual makes no mention of them you can also print thinner envelopes, with care. There are four fonts — Courier, San Serif and Orator (all NLQ and somewhat slow), and Draft, which is plain, fast and 9-pin dotty. Orator comes in two varieties: normal, with lower-case letters in lower case, or in a mode where the lower case comes out as small capitals. This isn't selectable from the front panel: you have to set a DIP switch. This is easy to get at when you



## Philips NMS1433 Plus

### Supplier

Philips 081-689 2166

### Type

9-pin dot matrix

### Price

£139.99

### Fonts

Roman, Sans Serif

### Print speed

Quoted cps: 160 draft, 40 NLQ

Benchmark cps: 113 draft, 29 NLQ

### Interfaces

Parallel

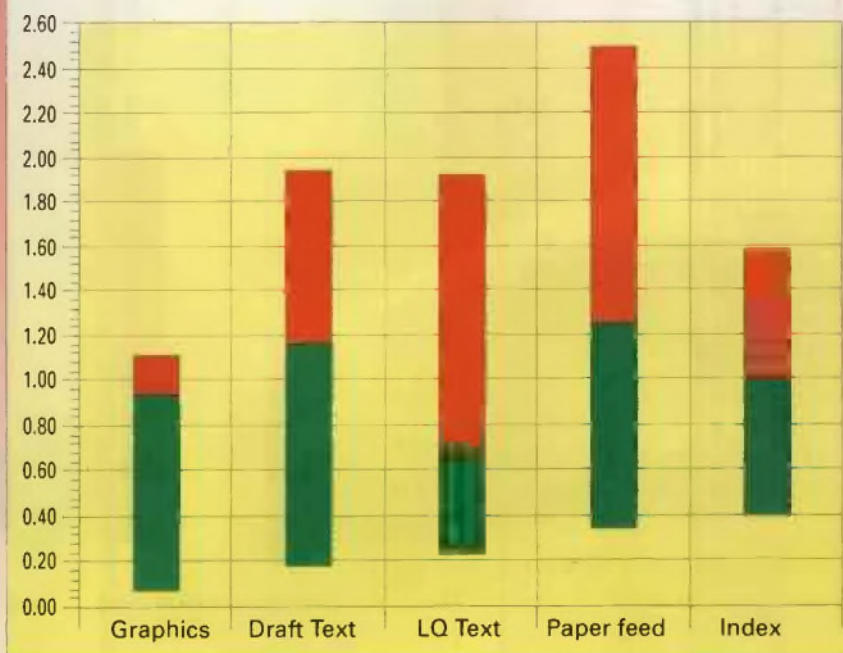
### Paper handling

Friction feed, push tractor feed, paper parking

**Good Points** Cheap.

**Bad Points** Poor print quality.

**Conclusion** Nothing special.





lift the smoked perspex front cover: you don't have to unscrew or lever anything.

You can set, from the front panel, 10 or 12 characters per inch, proportional spacing or condensed print. There are more options for enlarging characters or printing various special effects, which you can either get at through normal control codes or by including special sequences of characters in the document you're printing. ((F))1, for example, chooses the San Serif font.

The printer managed 99.6 and 23.5 cps in draft and NLQ mode respectively, which compares with the quoted 150 and 37.5 figures in the manual. The graphics were rather uneven; nobody could mistake areas of 'solid black' as originating anywhere except on a cheap 9-pin dot matrix printer. Even large areas of text had a somewhat speckled appearance. The quality was not of the highest. It's not very fast, either.

But for the price, you're getting what promises to be a reliable buy. In NLQ, it's acceptable and for churning out program listings or database dumps it's an economical choice.

Rupert Goodwins

## Star Micronics LC24-200 Colour

The 200 series was introduced in September 1990 and comprises three models, the top one being the LC24-200 Colour. All the models have the same paper-handling capabilities, but the 24-

200 offers a larger print buffer, more fonts, a colour option and, as the name suggests, is a 24-pin printer.

The LC24-200 is large but attractive. It has a 'windscreen' tinted lid and an aerodynamically designed casing. The Centronics parallel port has been put in a strange place: it's on the right-hand side towards the front, so once a cable is plugged in, the machine's attractiveness is significantly reduced. The control panel has five buttons for selecting font, pitch, paper feed, paper park and online status and there a variety of green and orange LEDs show the current settings.

### Fuzzy edges

The speed-test results were fairly good; the draft speed was measured at 112 cps and the letter quality at 41 cps, but the quality left a lot to be desired — the edges were very fuzzy. The manual states that a maximum speed of 222 cps



is achievable using the high-speed draft font, and 67 cps letter quality is possible using the Elite speed font. There are ten resident fonts and optional panel-selectable font cartridges.

The Epson LQ-860 and IBM Proprinter X24E are emulated. Star is working on some drivers for Windows. The beta copy of the drivers that we were sent need a lot of work: when used with Word for Windows, a long list of fonts can be called up but approximately half result in Times Roman, and there is no way of using all the other fonts supported. The drivers, however, do give access to the colour option, but when tested with a simple scribble from Windows Paintbrush it didn't cope too well. Only six colours (and black) are available, and the printer makes no attempt to blend them to give accurate colour representation.

There are various accessories available including a 32K RAM card to expand the printer buffer from the standard 30K to 62K. There are also auto-sheetfeed and roll-holder options. Manual feed is relatively easy: you just drop a sheet into the paper guide and press the feed button; the paper is then positioned in *almost* the right place for printing.

### From the top

I say almost because the printer took no notice of any top margin I had set and started printing at the very top of the sheet, though this could be another problem with the beta-Windows drivers. Love it or hate it, Windows is the

## Seikosha SP1900

### Supplier

Seikosha (0753) 685873

### Type

9-pin

### Price

£155

### Fonts

Serif, Sans Serif

### Print speed

Quoted cps: 160 draft, 40 NLQ

Benchmark cps: 97 draft, 25 NLQ

### Interfaces

Parallel

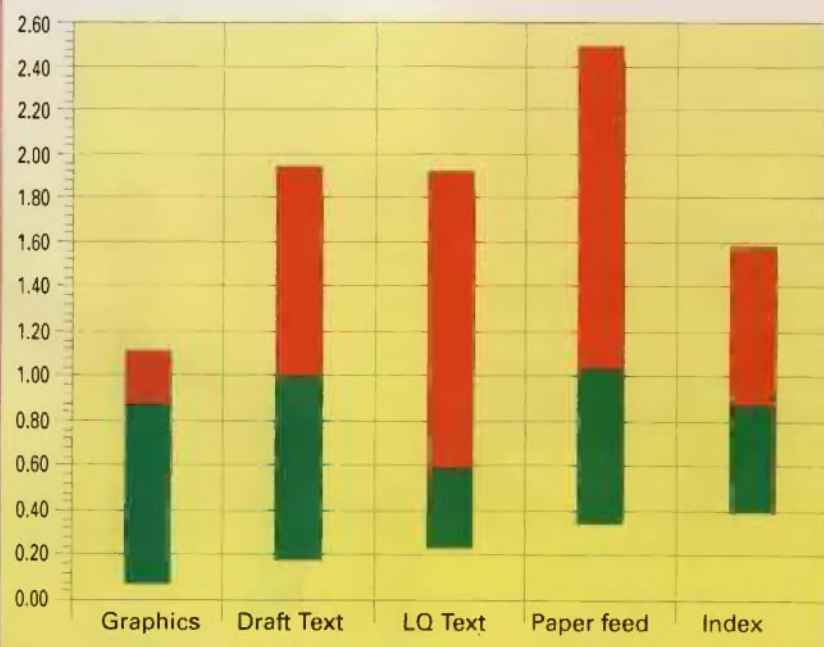
### Paper handling

Friction feed, push tractor, semi-automatic cut sheet

**Good Points** Cheap, reasonable print quality and paper management.

**Bad Points** Manual controls clumsy. Loud.

**Conclusion** A good buy for the home user.





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MCS 485-33 CPU module	£868

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	£954
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Includes 3.5" floppy 4Mb RAM

MCS PRO 385-33c CPU module	£434
MCS PRO 485-33 CPU module	£868
40Mb hard disk module	£130
110Mb hard disk module	£261
200Mb hard disk module	£434
400Mb hard disk module	£868
5.25" floppy drive module	£65

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Complete with Windows 3, mouse &amp; DOS

PAC II 385x-20c 2Mb	£1041
PAC II 485x-20 2Mb	£1258
PAC II 485-33 2Mb	£1519
PAC II 3.5" floppy drive	£87
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## Large Desktops &amp; Towers

385-25 100Mb 2Mb	£1215
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385-33 200Mb 4Mb	£1997
385-33 300Mb 4Mb	£2344
385-33 Tower 100Mb 4Mb	£1997
385-33 Tower 200Mb 4Mb	£2257
385-33 Tower 300Mb 4Mb	£2604
385-33 Tower 600Mb 4Mb	£3039
485-33 EISA 100Mb 4Mb	£3039
485-33 EISA 200Mb 4Mb	£3299
485-33 EISA 300Mb 4Mb	£3647
485-33 EISA Tower 100Mb 8Mb	£3343
485-33 EISA Tower 200Mb 8Mb	£3603
485-33 EISA Tower 300Mb 8Mb	£3950
485-33 EISA Tower 600Mb 8Mb	£4385
485-33 EISA Tower 1000Mb 8Mb	£4819

Towers have both floppy drives fitted

## Screen options

VGA Colour option (extra)	£130
Panasync Multifrequency Colour (extra)	£150

(recommended for all MCS models)

## OLIVETTI

VGA MONO

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*PCS 285 40Mb 1Mb	£694
*PCS 285 80Mb 1Mb	£846
*PCS 385x 40Mb 1Mb	£921
*PCS 385x 100Mb 1Mb	£1135
VGA colour option for PCS	£77

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385x-20MT 200Mb 3Mb	£POA
385-33c 80Mb 4Mb	£POA
385-33c 120Mb 4Mb	£POA
385-33MT 120Mb 4Mb	£POA
385-33MT 200Mb 4Mb	£POA
485x-20 80Mb 4Mb	£POA
485x-20 120Mb 4Mb	£POA
485x-20MT 120Mb 4Mb	£POA
485x-20MT 200Mb 4Mb	£POA
485-33 80Mb 4Mb	£POA
485-33 120Mb 4Mb	£POA
485-33MT 120Mb 4Mb	£POA
485-33MT 200Mb 4Mb	£POA

## Screen Options

Olivetti VGA Colour	£POA
Olivetti High Res. VGA Colour	£POA
Panasync Super VGA Colour	£POA

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PC 3086 HD30 3.5" 640K	£499
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PC 3386sx HD80 3.5" 4Mb	£1079
PC 4386sx HD80 3.5" 4Mb	£1099
PC 5286 HD40 3.5" 1Mb	£599
PC 5286 HD40 3.5" 1Mb	£699

## Screen Options

VGA Colour	(extra) £75
HR VGA Colour	(extra) £150
Sony VGA Colour for 4386 (extra)	£150

## PORTABLES

## AMSTRAD

ALT 285 20	£812
ALT 285 40	£1034
ALT 385 40	£1107
ALT 385 80 4Mb	£1328
ACL 385 120 4Mb	£POA
ANB 385x-16 20	£POA
ANB 385x-20 40	£POA

## SANYO

285 20	£POA
285 60	£POA
385x-20 20	£POA
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## TANDON

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Novell 3.11 20 user	£1489
100 user	£2989
250 user	£5289
NE 1000 8 bit ethernet card	£113
NE 1000 compatible card	£80
NE 1000 remote boot PROM	£39
NE 2000 16 bit ethernet card	£158
NE 2000 compatible card	£90
NE 2000 remote boot PROM	£39
NE 3200 EISA fileserver card	£749
NE/2 16 MCA card	£148
NE/2 32 MCA card	£378
16' Thin ethernet cable & connectors	£39
T Piece alone	£12
50 Ohm Terminator	£12

(all cards include T-piece)

## PRINTERS

## Panasonic

KXP 1170 9 pin	£POA
KXP 1123 24 pin	£POA
KXP 1124i 24 pin	£POA
KXP 1695 9 pin wide	£POA
KXP 1624 24 pin wide	£POA
KXP 1654 24 pin wide	£POA
KXP 2624 24 pin wide	£POA

## Olivetti

*JP350 Inkjet	£293
*P150 Inkjet	£219
*DM109	£149
*DM309E	£309
*DM309LE	£379
*DM124	£189
*DM124C	£208
*DM324E	£439
*DM324LE	£539
*DM634E	£869
*TH760S	£599

## Canon

BJ10e	£POA
BJ10ex	£195
*BJ300	£345
*BJ330	£393
BJC 800	£1239

## OKI

ML182 elite	£POA
ML 320	£POA
ML 321	£POA
ML 380	£POA
ML 390	£POA
ML 391	£POA
ML 393 Colour	£POA

## Epson

LX-850	£145
FX-850	£270
FX-1050	£343
DFX-5000	£1080
DFX 8000	£1976
LQ 200	£153
LQ 450	£173
LQ 570	£212
LQ 870	£370
LQ 860 Colour	£445
LQ 1010	£273
LQ 1070	£325
LQ 1170	£435
LQ 1060 Colour	£610
LQ 2550 Colour	£680
SQ 850 Inkjet	£430
SQ 2550 Inkjet	£629

## Kodak

Diconix 150 +	£209
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## Citizen

120 D plus 9 pin	£103
224 D 24 pin	£159
Swift 9	£149
Swift 9X	£204
Swift 24e	£219
Swift 24	£209
Project	£299
PN-48	£211

## Hewlett Packard

*Thinkjet	£267
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*Quietjet+	£365
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Deskjet 500c Colour	£POA
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*Paintjet XL	£1049
*Ruggedwriter	£925

## NEC

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P30	£215
P60	£325
P70	£400
P90	£630

## STAR

LC20	£105
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LC15	£177
LC24-10	£140
LC24-200	£171
LC24-200 Colour	£210
LC25-15	£295
ZA200 Colour	£239
ZA 250 Colour	£300
XB24-200 Colour	£301
XB24-250 Colour	£362

## LASER PRINTERS

## Hewlett Packard

*HP III	£689
*HP III	£1020
*HP III	£1739
*HP III	£2515

## Panasonic

*KXP 4420	£POA
*KXP 4450i	£POA
*KXP 4455 2Mb	£POA

## Olivetti

*PG306	£739
*PG306 Postscript	£1139

## Canon

*LBP 4	£609
*LBP III	£980
*LBP III T	£1352
*LBP III R	£1455

## Epson

*EPL 4100	£638
*EPL 7500 Postscript	£1175

## NEC

*Silentwriter2 266	£688
*Silentwriter2 S60P PS	£1107
*Silentwriter2 290P PS	£1414

## OKI

*Okilaser 400	£POA
*Okilaser 800	£POA
*Okilaser Postscript	£POA
*Okilaser 800D	£POA
*Okilaser 840P	£POA

## Star

*LP-4	£584
*LP-4 PS	£789
*LP6 III	£929
*LP6 III PS	£1165

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## Star LC-20

### Supplier

Star Micronics (0494) 471111

### Type

9-pin dot matrix

### Price

£199

### Fonts

Courier, San Serif, Orator 1 and 2

### Print speed

Quoted cps: 180 draft, 45 NLQ

Benchmark cps: 100 draft, 24 NLQ

### Interfaces

Parallel

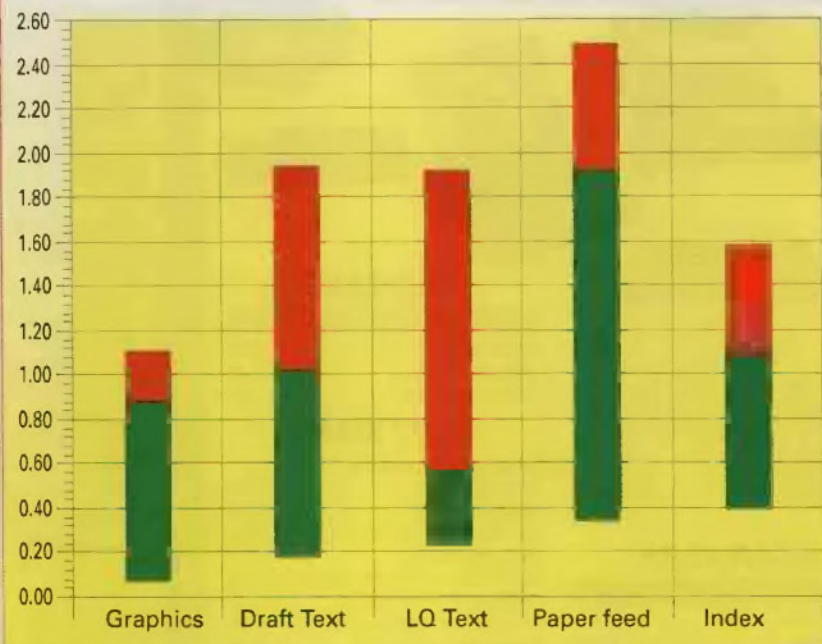
### Paper handling

Friction feed, push feed tractor, paper parking

**Good Points** Cheap, looks good.

**Bad Points** Nine pins mean slower, less gorgeous output

**Conclusion** A good second printer.



way everything is going, so I would wait until the problems with the Windows drivers are sorted out before even considering buying one of these.

For reasonable-quality documents with the odd splash of colour, the LC24-200 fits the bill. But for £349 I would expect better-quality printing and better colour handling.

Mat Beard

## Star SJ-48

The sense of déjà vu when I opened the box and removed the Starjet SJ-48 was incredible. In fact, the feeling started before I'd removed the printer from the carton. The packaging, right down to the pieces of expanded polystyrene inside, is identical to the Canon BJ-10ex.

So, at first glance, is the printer itself. The same silly physical arrangement

with the printer cable and power cord going in to the front and rear ends respectively of the left side of the case. Star's excuse is the same as Canon's, too. The vertical orientation stand takes up most of the rear of the case. To be fair, there are differences between the two machines. You just have to look hard to find them.

The immediate difference is the colour, and on closer inspection the qual-

### The proof is in the printing

For less than £500, there is an interesting selection of printers available. Our list of 32 is by no means definitive but it covers many of the new portable printers, as well as a number of colour models and the many permutations of the dot matrix. Much to our surprise, considering the matrix printer's reputation as the cheap and nasty end of the market, some dot matrix printers enlisted recommendations from our reviewers.

Today's 9-pin dot matrix has improved so much on the early models, in terms of quality and speed, that they are now capable of producing documents to the standard of business letters and in-house reports. They still have the edge on the other technologies for speed, but the gap is steadily narrowing. The inkjet printers, although they are still inclined to be slow, have proved themselves on the quality of graphics. And the portables have not been a disappointment.

### Recommendations

Picking a winner out of such a mixed bag was not easy. With so many shapes and sizes, all would have a place somewhere. After selecting what we considered to be the overall best, we then gave a number of other recommendations to printers that we felt served their purpose particularly well.

One of these was the Canon BubbleJet 10ex. As a portable, it is small and light enough to fit into a briefcase, yet strong enough to cope with travel. Unlike other portables in the review, it hasn't compromised on print

quality. It was the high standard of print that ultimately earned the BJ-10ex a PCW Recommendation for the best portable tested.

Speed is another important factor. For multiple copies of a memo or a report, some of the printers in the review would take 20-30 minutes. The Epson FX-850, the NEC Pinwriter 30 and the Star ZA-250, however, could zip through the same report in under three minutes. All three are impressively fast, so we compared them on quality: all gave clear print and good graphics. On value for money, they were hardly distinguishable. Eventually, we decided all three were good enough for a PCW Recommendation.

### Astounding speed

For the overall winner, we wanted a printer that would look exceptional on whatever criteria we chose. The one that emerged is not the fastest, but for an inkjet printer, the speed is astounding. It also gave a quality of reproduction that would be fine for business correspondence, reports, memos and even flyers and promotional material.

It scored well on usability too. It printed quietly, which was a great relief after some of the machines we looked at. It was also a solid and rugged, and with an established manufacturer behind it and a good track record to date, we felt there would be no problems with reliability. On all counts, Hewlett-Packard's DeskJet 500 proved itself to be the worthy winner of the PCW Seal of Approval.



ity of the plastic casing. It feels cheaper and more flexible on the Star than on the Canon and is a couple of shades of grey lighter.

Badging aside, the only other obvious external difference is the control panel. The functions are the same, though oddly not in the same order (there isn't much you can do from the front panel of a printer, after all). But the positive, firm switches on the Canon are replaced with cheaper touch-sensitive devices.

### Familiar

Open the SJ-48 and again apart from the badging, everything is familiar. Same BubbleJet cartridge, same simple but effective head transport mechanism and the same row of Mitsumi DIP switches. Again there are minor electrical differences, the switches performing subtly different functions, but the hardware is identical.



It isn't really surprising to find the BubbleJet print engine licensed to other manufacturers. The Canon laser printer engines revolutionised the office, but not in Canon-badged products. Even the Bubble Jet has been seen in alternative casings, most notably Apple's superb StyleWriter. It isn't even surprising that the ironmongery is so similar: that's the way Canon works.

Given the company's history, you'd expect the licensed product not to behave like the original. You'd be right. This is Epson, not Bubble Jet, compatible. That might be a Bad Thing: the world has moved a long way since Epson introduced the FX-80. Fortunately, the Starjet is compatible with the 24-pin LQ-510 rather than the lesser FX-80.

The big surprise is the quality of the printout. The internal Epson compatible fonts are great. The blacks are weaker and the print alignment is worse (thanks largely I think to the drivers, rather than the hardware). The graphics and hence True Type and ATM quality is as unreliable as it is with the BubbleJet.

Fortunately, this is a damn good Epson-compatible printer. It has, surprise surprise, almost all the attributes of the BubbleJet. It's light, easily portable, battery powered (but only just — 40 minutes per charge) and the optional sheet feeder really isn't an option, it's an essential. The big difference is quality. Build quality and print quality.

Guy Swarbrick

## Star ZA-250



This wide-carriage model falls just within our price range for this Group Test (£499 RRP, usually well discounted), and is robust and fast enough to justify the cost if you have a heavy workload. It can be fun, too, with four fonts (you can also design your own) and colour to play with.

You can't expect too much of coloured ribbon, but when used judiciously the results can be good. Colours can be mixed, and though they will never match your screen colours, you can get some striking effects. The ability to highlight debts in red might get an invoice paid that bit quicker.

Print quality in NLQ mode is acceptable for workaday letters. Thick blacks in graphics mode showed a certain streakiness, but not so bad as to be serious. Benchtests put it among the

## Star LC24-200

### Supplier

Star Micronics (0494) 471111

### Type

24-pin dot matrix or colour

### Price

£299, £349 for colour

### Fonts

Times Roman, Courier, Sans Serif, Prestige, Script

### Print speed

Quoted cps: 200 draft, 67 NLQ

Benchmarks cps: 113 draft, 41 NLQ

### Interfaces

Parallel

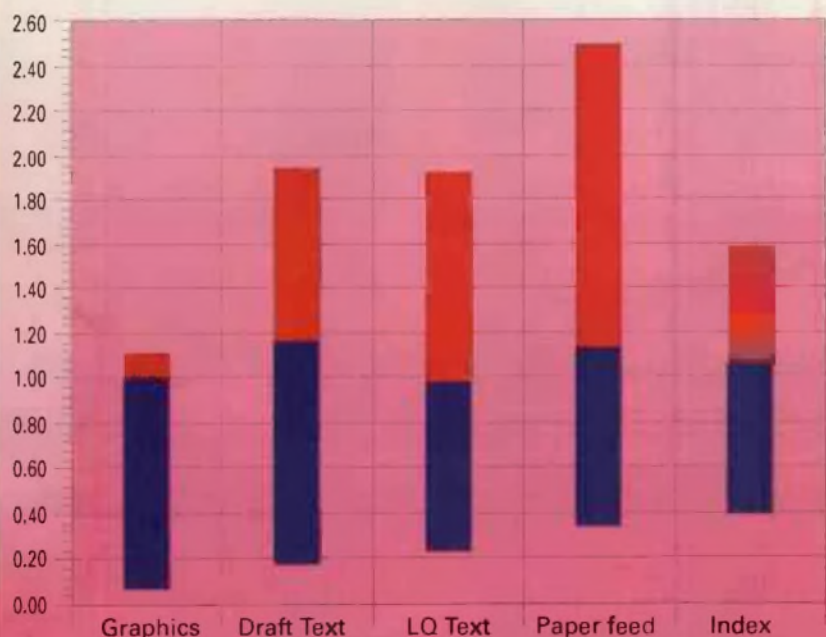
### Paper handling

Friction feed, push or pull tractor feed, paper parking. Optional single-bin ASF, paper-roll holder

**Good Points** Ten resident fonts.

**Bad Points** Poor colour handling, no Windows support.

**Conclusion** Overpriced.





## SUB-£500 PRINTERS

	Canon BubbleJet 10ex	Citizen 224	Epson FX 850	Epson LQ 200	Facit E420	Fujitsu DL1200	Genicom GP10	HP DeskJet 500	HP Thinkjet	Hyundai 930	IBM 2380	Kodak Diconix 150 Plus	Mannes- mann Tally MT82
Printing method	Inkjet	24-pin dot matrix	9-pin dot matrix	9-pin dot matrix	9-pin dot matrix	24-pin dot matrix	9-pin dot matrix	Inkjet	Inkjet	9-pin dot matrix	9-pin dot matrix	Inkjet	24-pin dot matrix
Epson Emulation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Optional	Yes		Yes	Yes	Yes
IBM Proprinter Emulation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Optional	No		Yes	Yes	Yes
Other Emulation	Canon 130	NEC P6 Plus	No	No	No	Optional Diablo	No	PCL level 3	PCL level 1		No	Diconix	No
Tractor Feed	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Pin feed	Yes	Yes	Yes	Yes
Friction Feed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quoted Draft Speed (cps)	83	160	220	160	130	200	250	240	150	180	270	145	160
Quoted NLQ/LQ Speed (cps)	83	53	45	53	24	60	55	120	150	43	65	44	53
Benchmark Draft Speed (cps)	54	113	188	97	32	109	154	125	80	89	178	77	85
Benchmark NLQ/LQ Speed (cps)	54	44	45	42	10	45	38	75	80	23	55	28	382
Fonts	Roman San Serif Courier Prestige Elite	CTZ Courier CTZ San Serif CTZ Roman	Roman San Serif	Roman Sans Serif Courier Script Orator Prestige OCR B	Generic	Courier Prestige Elite Bold Face Pica 10	Courier Gothic	Courier CG Times Letter Gothic	Generic	Courier Roman Sans Serif Script Helvetica	Courier Gothic	Generic	Sans Serif Roman
Colour	No	Optional	No	No	No	Optional	No	No	Optional		No	No	No
Interfaces	Centronics Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel, Serial	Parallel, Serial, HPiB	Parallel, Serial	Parallel	Parallel/ Serial/ Appletalk	Parallel
Paper Parking	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes
Battery Powered	Option	No	No	No	No	No	No	No	No	No	No	Yes	No
Cost of replacement ribbon/ cartridge	£17.99	£4	£5	£6	£4.60	£5, £11 colour	£5.50	£14.10	£8.50	£7	£6.84	£12.50	£3.50
Average life of above (characters)	700000	2 million	3 million	2 million	1 million	3.5 million	1 million	5000 (pages)	60,000	2 million	3.5 million	500 (pages)	2 million
Automatic Sheetfeed	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Yes	No	No	Optional	No	Yes
Dimensions (mm)	310x216x48	412x320x 130	150x455x 360	131x390x 320	380x270x 111	195x526x 250	130x450x 350	440x377x 202	88x293x206	410x312x93	495x286x200	50x165x274	162x415x310
Weight	1.8kg	5.4kg	9.5kg	6.4kg	5kg	7 kg	8 kg	6.5kg	3.36kg	5.2kg	6.5kg	1.7 kg	5.8kg
Contact	Canon UK	Citizen Europe	Epson (UK)	Epson (UK)	Facit	Fujitsu Europe	Genicom	Hewlett- Packard	Hewlett- Packard	Hyundai Electronics	Lexmark	Kodak	Mannes- mann Tally
RRP	£345	£269	£429	£239	£199	£499	£365	£499	£449	£169	£439	£345	£359
Phone No.	0800 252223	0895 272621	0442 61144	0442 61144	0634 868000	081 573 4444	0252 522500	0344 360000	0344 360000	081 741 8634	081 578 9343	0442 61122	0734 771688



## SUB-£500 PRINTERS

NEC Pinwriter P30	OKI Microline 320	Olivetti DM124C	Olivetti JP350	Panasonic P1124L	Philips NMS1433 Plus	Seikosha 1900	Star LC-20	Star LC24-200 Colour	Star ZA-250	StarJet SJ-48	Toshiba Express- Writer 201	
9-pin dot matrix	9-pin dot matrix	24-pin dot matrix (colour)	Inkjet	24-pin dot matrix	9-pin dot matrix	9-pin dot matrix	9-pin dot matrix	24-pin dot matrix	9-pin dot matrix (colour)	Inkjet	Thermal transfer	Printing method
Yes	Optional	Yes	Optional	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Epson Emulation
No	Optional	Yes	Optional	Yes		Yes	Yes	Yes	Yes	Yes	Yes	IBM Proprinter Emulation
No	OKI	No	HP DeskJet Plus	No		No	No	No	No	No	No	Other Emulation
Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Tractor Feed
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Friction Feed
180	360	200	360	240	160	160	180	200	420	100	53	Quoted Draft Speed (cps)
90	62	50	120	80	40	40	45	67	84	100	53	Quoted NLQ/LQ Speed (cps)
109	178	121	74	113	113	97	100	113	147	51	17	Benchmark Draft Speed (cps)
46	55	42	55	50	29	25	24	41	53	51	17	Benchmark NLQ/LQ Speed (cps)
Gothic Courier Prestige Elite Bold PS Helvetica Times	Courier Sans Serif	Courier Sans Serif Roman Prestige	Letter Gothic Courier Times Roman	Courier Prestige Bold PS Script Sans Serif Orator Roman Super LQ	Roman Sans Serif	Serif Sans Serif	Courier Sans Serif Orator 1 Orator 2	Courier Sans Serif Prestige Script	Courier Sans Serif Orator Script	Roman Gothic	Courier Prestige Elite	Fonts
No	No	Yes	No	No	No	No	No	No	Yes	No	No	Colour
Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel	Interfaces
Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Paper Parking
No	No	No	No	No	No	No	No	No	No	Optional	Yes	Battery Powered
£6.95	£5.95	£6.50, £12.80 colour	£13.70	£6.50	£5	£5.50	£4	£5	£5.50, £12.50 colour	£17.95	£14 for 5 ribbons	Cost of replacement ribbon/ cartridge
3 million	3 million	2 million	500000	3 million	2 million	2.5 million	2 million	2 million	2 million	700000	70000	Average life of above (characters)
Optional	Optional	Optional	Optional	Optional	No	No	No	Optional	Optional	Optional	No	Automatic Sheetfeed
582x342x160	116x398x345	99x384x299	147x425x450	429x358x142	380x280x110	380x110x280	396x301x120	463x356x156	608x400x157	310x216x47	44x303x80	Dimensions (mm)
11.5kg	6.4kg	5.5kg	9kg	8.5kg	3.3kg	3.3kg	5kg	7.1kg	11.9kg	1.6kg	0.85kg	Weight
NEC (UK)	OKI Systems	Olivetti Office	Olivetti Office	Panasonic Office	Philips	Seikosha	Star Micronics	Star Micronics	Star Micronics	Star Micronics	Toshiba	Contact
£399	£449	£339	£499	£365	£139	£155	£199	£299/£349	£499	£345	£265	RRP
081 993 8111	0753 531292	0908 690790	0908 690790	0344 853915	081 669 2166	0753 685873	0494 471111	0494 471111	0494 471111	0494 471111	0932 825084	Phone No.



## Star SJ-48

### Supplier

Star Micronics (0494) 471111

### Type

Inkjet

### Price

£345

### Fonts

Roman, Gothic

### Print speed

Quoted cps: 100 draft, 100 NLQ

Benchmark cps: 51 draft, 51 NLQ

### Interfaces

Parallel

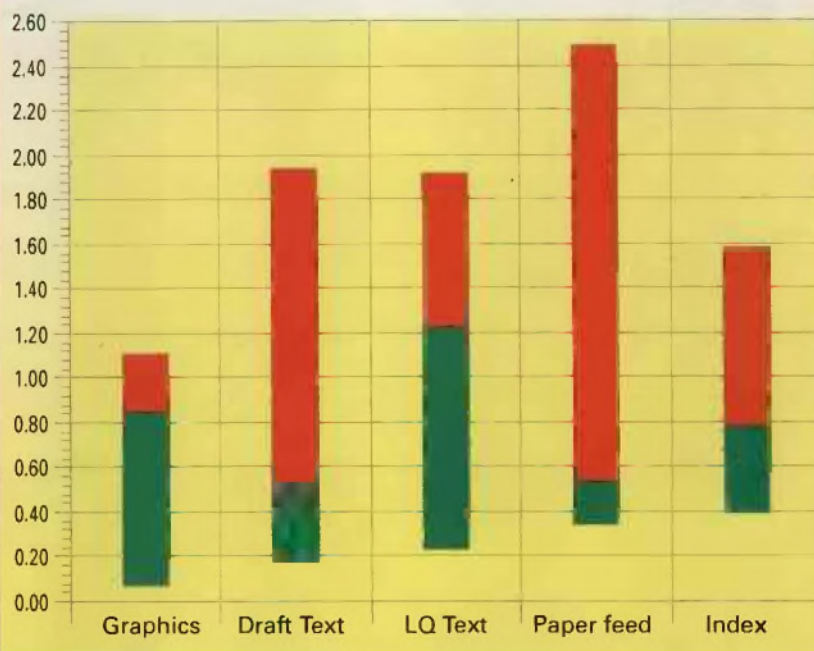
### Paper handling

Friction feed. Optional 30-sheet feeder

**Good Points** Looks like a BubbleJet.

**Bad Points** Isn't, quite.

**Conclusion** Almost a BubbleJet



leaders for speed, and noise levels are perhaps below average.

### Elegant

The ZA-250 looks elegant, considering its size: roughly 2ft by 18 inches, including plugs. You'll need a slotted or frame stand if you use the optional pull-tractor (£39), which feeds fanfold through a slot under the machine. Star recommends this for printing multi-

part forms (up to five layers).

A rear-feed push-tractor, and a single sheet feeder with auto-positioning, come as standard. The push-tractor will park fanfold to allow you to print single sheets without unloading. There's an auto-sheetfeed option (£149 single bin, £399 double).

The power lead is at the rear, safely to the left of trailing paper. At the right back edge is the parallel port in the

form of a pull-out cartridge. A serial cartridge and a parallel one containing a 128K buffer (the machine itself has 32K) are options for £69 and £49 respectively.

On the front of the machine is a recessed power switch and a daunting control panel. This has no less than 12 LEDs indicating the fonts, power, paper-out, and various print characteristics. Six buttons underneath are marked

## Star ZA-250

### Supplier

Star Micronics (0494) 471111

### Type

9-pin colour/mono dot matrix

### Price

£499

### Fonts

Sans Serif, Courier, Orator, Script

### Print speed

Quoted cps: 420 draft, 84 NLQ.

Benchmark cps: 147 draft, 53 NLQ

### Interfaces

Parallel

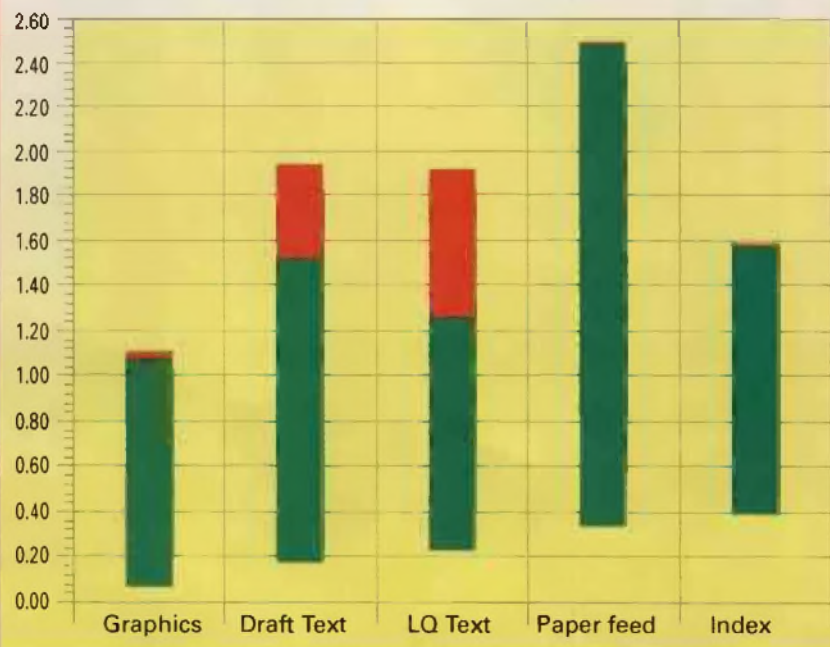
### Paper handling

Friction feed, tractor feed, paper parking. Optional single/ double ASF

**Good Points** Sturdy, versatile.

**Bad Points** Controls too complicated.

**Conclusion** Workhorse with flair.





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Average HDD speed: 0.3ms (Core test: on a 28ms hard disk)

"The addition of the hard disk caching controller gives the balance that you'd otherwise need an EISA-based system for, but at a considerably lower cost. You could opt not to buy the caching hard disk controller, and save £285. But that'd be a false economy. You'd be the first to kick yourself if you experienced what the machine is capable of with it."

Computer Buyer, AUG 91

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SVGA Card Memory Upgrade (1024x768x256 colours)	£ 30.00
1GB/15ms SCSI HDD Upgrade from 420 IDE	£ 766.00
80/120MB Tape Streamer (DC600 tape type)	£ 369.00
150/250/500MB Tape Streamer (DC6150/DC6250 tape type)	£ 475.00
MS-WINDOWS Version 3.0	£ 57.00
MS-DOS Version 5.0	£ 50.00
Workstation Case (333w/315x110x105mm) Upgrade	£ 40.00
Mini Tower Case Upgrade	£ 19.00
Full Tower Case Upgrade	£ 69.00
Maths co-processors for all systems	P.C.A.
All 14" VGA systems come with 256KB of memory on the VGA card (640x480/16 colours).	

DAN TECHNOLOGY Systems prices and specifications are subject to change without notice.

Dan-486c/33  
64K CACHE SYSTEM

£776

• 33MHz Main board with 80486-33 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (32MB max).

MONITOR	14" mono VGA	14" colour SVGA non-interlaced	17" colour SVGA non-interlaced
NO HDD	£ 890	1044	1519
40MB/28ms IDE	£ 1061	1215	1690
88MB/19ms IDE	£ 1145	1298	1773
125MB/19ms IDE	£ 1227	1380	1855
210MB/15ms IDE	£ 1388	1541	2016
420MB/14ms IDE	£ 1742	1895	2370
660MB/15ms SCSI	£ 2026	2180	2655

Add £42.00 for every additional 1MB RAM.

Subtract £40.00 from mono VGA price for mono Hercules.

Dan-486SX/20  
64K CACHE SYSTEM

£594

• 20MHz Main board with 80486SX-20 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (32MB max).

MONITOR	14" mono VGA	14" colour SVGA non-interlaced	17" colour SVGA non-interlaced
NO HDD	£ 708	862	1337
40MB/28ms IDE	£ 879	1033	1508
88MB/19ms IDE	£ 963	1116	1591
125MB/19ms IDE	£ 1045	1198	1673
210MB/15ms IDE	£ 1206	1359	1834
420MB/14ms IDE	£ 1560	1713	2188
660MB/15ms SCSI	£ 1844	1998	2473

Add £42.00 for every additional 1MB RAM.

Subtract £40.00 from mono VGA price for mono Hercules.

Dan-386c/40  
64K CACHE SYSTEM

£527

• 40MHz Main board with 80386-40 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (32MB max).

MONITOR	14" mono VGA	14" colour SVGA non-interlaced	17" colour SVGA non-interlaced
NO HDD	£ 641	795	1270
40MB/28ms IDE	£ 812	966	1441
88MB/19ms IDE	£ 896	1049	1524
125MB/19ms IDE	£ 978	1131	1606
210MB/15ms IDE	£ 1139	1292	1767
420MB/14ms IDE	£ 1493	1646	2121
660MB/15ms SCSI	£ 1777	1931	2406

Add £42.00 for every additional 1MB RAM.

Subtract £40.00 from mono VGA price for mono Hercules.

Dan-386c/33  
64K CACHE SYSTEM

£516

• 33MHz Main board with 80386-33 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (32MB max).

MONITOR	14" mono VGA	14" colour SVGA non-interlaced	17" colour SVGA non-interlaced
NO HDD	£ 630	784	1259
40MB/28ms IDE	£ 801	955	1430
88MB/19ms IDE	£ 885	1038	1513
125MB/19ms IDE	£ 967	1120	1595
210MB/15ms IDE	£ 1128	1281	1756
420MB/14ms IDE	£ 1482	1635	2110
660MB/15ms SCSI	£ 1766	1920	2395

Add £42.00 for every additional 1MB RAM.

Subtract £40.00 from mono VGA price for mono Hercules.

Dan-386/25  
SYSTEM

£431

• 25MHz Zero wait state main board with 80386-25 Microprocessor, AMI BIOS, Shadow RAM for System & Video BIOS • 1MB RAM (8MB max).

MONITOR	14" mono VGA	14" colour SVGA non-interlaced	17" colour SVGA non-interlaced
NO HDD	£ 545	699	1174
40MB/28ms IDE	£ 716	870	1345
88MB/19ms IDE	£ 800	953	1428
125MB/19ms IDE	£ 882	1035	1510
210MB/15ms IDE	£ 1043	1196	1671
420MB/14ms IDE	£ 1397	1550	2025
660MB/15ms SCSI	£ 1681	1835	2310

Add £42.00 for every additional 1MB RAM.

Subtract £40.00 from mono VGA price for mono Hercules.

All systems include the following as standard: • Small footprint case • 200W Power supply • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

dan TECHNOLOGY plc

CROWN HOUSE, NORTH CIRCULAR RD (cnr Abbeydale rd), LONDON NW10 7PN FAX: 081-963 0034 TEL: 081-961 6959



Font, Mode, Pitch, Set/Eject/Park, Paper Feed, and On-Line. By prodding these in a dizzying array of combinations you can access virtually all the printer functions.

This kind of arrangement, increasingly common, seems to me to be more trouble than it's worth. If you have the nous to figure it all out, you have the nous to set the machine up more easily via your computer.

### Confusion

Also, the confusion doesn't stop at the button prodding. You can set the control panel to override contradictory software instructions, but then your program print functions won't work fully, nor will those of any colleagues sharing the printer. If you don't set the override, as often as not the control panel simply won't work.

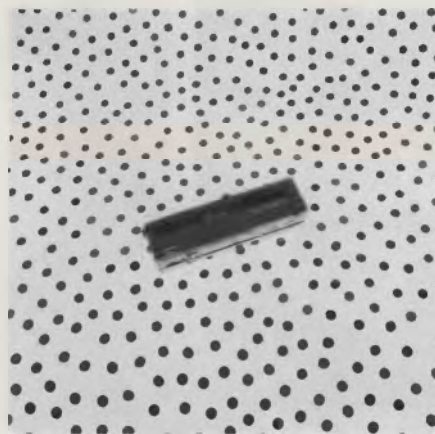
You can generally ignore the panel and let your software take control, though you do have to prod buttons to set defaults like paper size. This involves the printer acting like a VDU, printing out options and prompting for responses. Absurd, when 100% of users will have a real screen.

The manual is as good as most printer manuals, which is to say that it is fine if you know about printers. Otherwise, get your dealer to set the printer up with your software (hint: for colour, you may need to cite Epson EX-800/1000 emulation, a fact buried on page 117).

These are irritations rather than limitations. This is a good heavy-duty machine. If you don't use big spreadsheets, you might consider the 80-column Star ZA-200, which gives you the same facilities for £100 less.

Clive Akass

## Toshiba ExpressWriter 201



Laptop pioneer Toshiba has added the mini ExpressWriter 201 to its catalogue to cash in further on the portability boom. It's the smallest printer in this Group Test. With the battery pack attached, it is about the size of a large pencil box (303x80x65mm); without it, you could almost call it a pocket printer.

The design is unconventional, with the casing built to enclose the printing mechanism and little else. Paper is fed either into a guide that opens out on the side or through a slot on the bottom, depending on whether plain or thermal paper is being used. This means that the printer is sometimes placed on its base and sometimes on its side. Presumably for this reason, the control panel has been designed so that the LED indicators can be seen from two

sides of the printer, although the buttons for controlling the printer are only on one side.

The power switch and a density control are set back in the casing on the front, and the power lead and the printer connector are both attached to one end. It's an easy design to work with.

The ExpressWriter uses a thermal print head, so thermal paper gives best results. You can also fit a ribbon cassette to print on plain paper. There are two resident fonts, Courier and Prestige Elite, and according to the manual there are two print speeds. The ExpressWriter claims a speed of 63 cps at 12 characters per inch and 53 cps at 10 cpi, although in the PCW benchmarks, both were calculated to be 17.2 cps.

The ExpressWriter was a little slow in operation, but the reproduction on both plain and thermal paper was good. Blacks in graphics mode were never more than dark grey, but otherwise, the graphics were acceptable.

### Travelling companion

This has to be one of the easiest of the tested printers to travel with. But although the printer itself would slip into an overnight bag, the AC adaptor takes up almost as much room again. For longer trips, you'd be advised to pack some spare ribbons or the special thermal paper, as the ribbons only last for around 20-25 pages. They cost £3.40, which works out at about 15p per page, and thermal paper is just as expensive at around 14p per page.

However, weighed against the other portable printers, the ExpressWriter comes out lighter and gives better quality print than most.

Helen Johnstone

## Toshiba ExpressWriter 201

### Supplier

Toshiba

### Type

thermal transfer

### Price

£265

### Fonts

Courier, Prestige Elite

### Print speed

Quoted cps: 53 draft, 53 NLQ.

Benchmark cps: 17 draft, 17 NLQ.

### Interfaces

Parallel

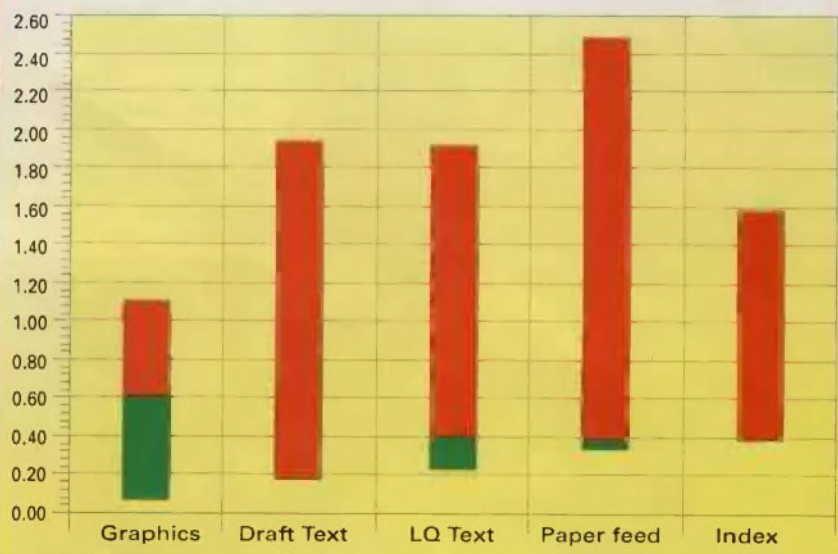
### Paper handling

Friction feed.

**Good points** Small, easy to use

**Bad points** Costly consumables.

**Conclusion** A fun printer





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- ◆ 1.44 M byte 3.5" Citizen Floppy
- ◆ High performance IDE controller
- ◆ 80386dx CPU with switchable speed mode
- ◆ 80387dx Co-processor ready
- ◆ Sizzling 32K write back cache
- ◆ Superlative 1MB 16 bit SVGA Graphic Card 1024x768 256 colours. ET4000 chips
- ◆ 14" SVGA Colour Monitor .28mm dot pitch. with tilt and swivel base
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# Borland C++ 3.0

Version 3.0 of Borland's magnum opus in the development world is good, but not that good. Code generation and optimisation are plus points, but the mismatched IDEs and lack of a proper Windows-based debugger disappoint, says David Morton.



I must start this review with a confession: I wasn't able to adopt my usual approach when reviewing this new release of Borland's C++ compiler, with the 'Applications Frameworks' class libraries. Normally I would install the new version alongside the old, to make comparisons between the two rather easier. I was thwarted in this by the most mundane of limitations: I didn't have a big enough hard disk.

Now, I hear you say, that's not good enough; a reviewer should have a decent machine on which to do his job. Fair enough, except that the 105Mb hard disk on my ALR has been sufficient so far; it's the sheer scale of Borland's new release that's the problem. While C++ 2.0 with Applications Frameworks was alarming enough — taking up 22Mb for a full install — 3.0 needs a little over 40Mb of disk space, with another 7Mb of workspace for the install program.

Thankfully, when I installed DOS 5 I took the opportunity to set my hard disk up as one large partition. Had I kept my old configuration, I wouldn't have had a partition big enough to hold the full install. I can't complain at the size of the software really — it's not as if it's padded out with useless extras, but I wonder how much bigger software can get before manufacturers will have to reconsider their distribution methods. I could see a lot of merit in selling this product pre-loaded on a hard-card.

## Installation

The install program is DOS based and is pretty tedious. The files are all compressed onto ten 3.5in floppies or twelve 5.25in — both sizes of media are included. All these have to be unzipped, so the install takes quite a few minutes to complete. Once the files are installed on the hard disk, the next time you start Windows a dialog box asks if you wish to install the program group for C++.

There are a couple of tricky bits in the install that took me a little while to spot. If a SuperVGA card is installed, then a windows.DLL file may need to be renamed. Also, to enable the compiler's DPMI

support, a separate and quite remarkably unfriendly install program must be run. In my case the install also made a mistake: the PIF file for the DOS version of the IDE was wrong and had to be edited so that Windows could find the executable.

The full installation includes the compiler — with both command line and Integrated Development Environment (IDE) versions — Turbo Assembler, Debugger and Profiler, Turbo Vision class libraries for DOS, Object Windows class libraries for Windows, and Borland's Resource Workshop. The latter is Borland's replacement for the much criticised Whitewater Resource Toolkit shipped with the earlier version. Unlike Borland's Turbo Pascal compilers, which come as separate DOS and Windows products (Turbo Pascal for Windows and Turbo Pascal 6.0) the C++ compiler can produce both DOS and Windows code executables (and Windows .DLL files, of course).

## Overview

Once everything is installed, first impressions are a little disappointing: a great deal of the C++ environment is still DOS based. There is now a Windows version of the IDE, but that, in effect, is borrowed from Borland's cheaper Turbo C++ product; in fact, the icon under Windows is identical, only this time it's talking to the cleverer compiler.

Clicking on the icon for Borland C++, the Turbo Debugger or the Turbo Profiler takes us into a full-screen DOS box. The two IDEs were a little confusing at first, since in one or two areas — notably the 'compiler optimisations' dialog — the DOS IDE offers rather more detailed options than the Windows version. If you're going to have two different interfaces for the same compiler, I would have thought there was merit in making them as close as possible, rather than having irritating little differences. One particularly thoughtful touch is that the two IDEs share the same desktop, configuration and project files, so should you need to switch between the two environments, then at least they keep track of each other.

Differences apart, the IDEs are up to Borland's usual standard, and the Windows one is provided with what the company has chosen to call a





'SpeedBar', a row of icons for regularly-used operations like cut and paste a block of text, or build the current application. Personally, although I use these icon bars in a number of applications, I do wish the manufacturers would make some effort to regularise them. Moving between Windows applications with different conventions for SpeedBar, ButtonBar or SmartIcons does rather negate one of the principle advantages of Windows: the consistent user interface.

Also in the Windows IDE, but without an equivalent in the DOS IDE, is an Object Browser. This shows the class relationships within the program in graphical form. You can trace the line of inheritance from a base class, through the derived classes and into the user-defined class. The Object Browser will display classes, member functions and variables, and is a quick way of locating the source code for a particular class or class member.

Both the Turbo Debugger and the Turbo Profiler now support SuperVGA modes when working with Windows programs. This is a significant improvement, since the previous versions would play merry hell with the Windows screen when swapping between the text-mode debugger or profiler screen, and the graphical Windows display, if the VGA card was set to a resolution other than the standard VGA mode of 640 by 480 pixels. This SuperVGA support is automatic for most modes, but if the card is being used in 256-colour mode, then the appropriate driver file must be renamed and copied to the same directory as the debugger and profiler executables.

While the debugger makes a valiant attempt at swapping the screen between the two modes, it really is very wearing to use. This is particularly true with a SuperVGA card, since the monitor may well need to re-synchronise between the different scan rates used by the two screens. My venerable NEC Multisync 3D really didn't relish this operation at all.

My preferred method for debugging, and the one I will probably continue to use until Borland provides a fully integrated Windows debugger, has always been to use the Turbo Debugger's support for a second monitor — either a MDA or a Hercules — for the debugging screen. This is a fairly cheap option, since such screens can be bought complete with adaptors for about £60. However, Borland has extended the remote debugging facilities to include networked PCs as well as the facility to use two machines connected via a serial cable, which was provided in the previous version. NetBIOS-compatible networks are supported, and any other machine on the network can be used to display the debugging information.

### Gilding the lily

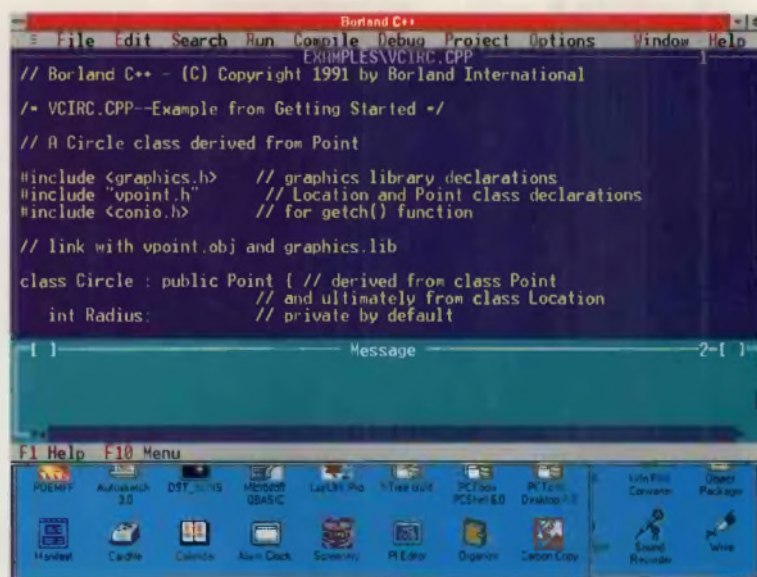
While these remote facilities may seem like gilding the lily a little, they do provide a much better debugging environment. Of course what Borland really ought to do, is to provide a proper Windows-based debugger so that the application, the Windows IDE, and the debugger can all share the same

Windows screen — and without any nasty jumping in and out of a second text mode.

One of the traps that is easy to fall into when reviewing a compiler is to review the development environment, debugger and assorted tools without actually discussing the compiler at all. In many ways, despite Borland's excellent efforts in improving these elements of the package, they're of much less importance than the internal changes to the C++ compiler itself. The new compiler addresses what was a very valid criticism of Borland's earlier efforts, going all the way back to Turbo C 2.0, that while they provided an excellent programming environment which was much easier to use than most of their competitors, the code generated by their compilers was poor — significantly worse than that from their major competitors.

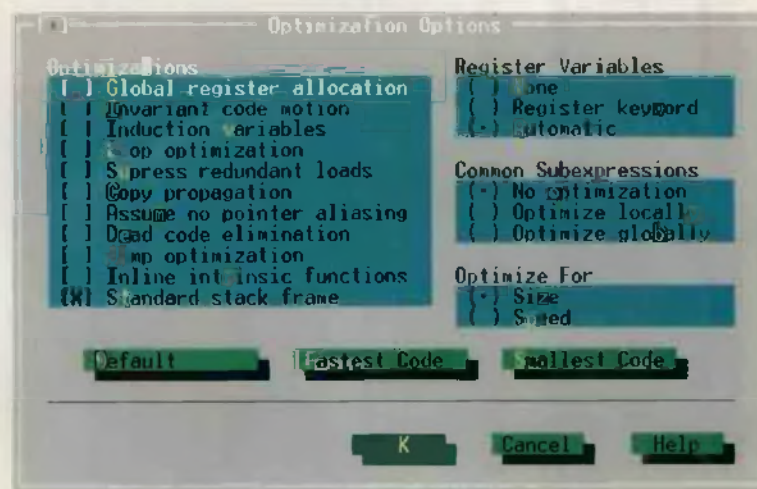
△ Frequently-used menu options are displayed in the form of a toolbar in the Windows IDE

▽ To fully utilise the compiler options, the traditional DOS-based IDE must be used



Borland says that the compiler's code generator has been completely rewritten, and that the code is now significantly better than that produced by Microsoft's current compiler. That's not a claim I was able to verify, since I didn't have a copy of Microsoft's C 6.0 to hand, but the evidence indicates that Borland's code generation has been con-

▽ Borland is, at last, serious about C++ optimisation

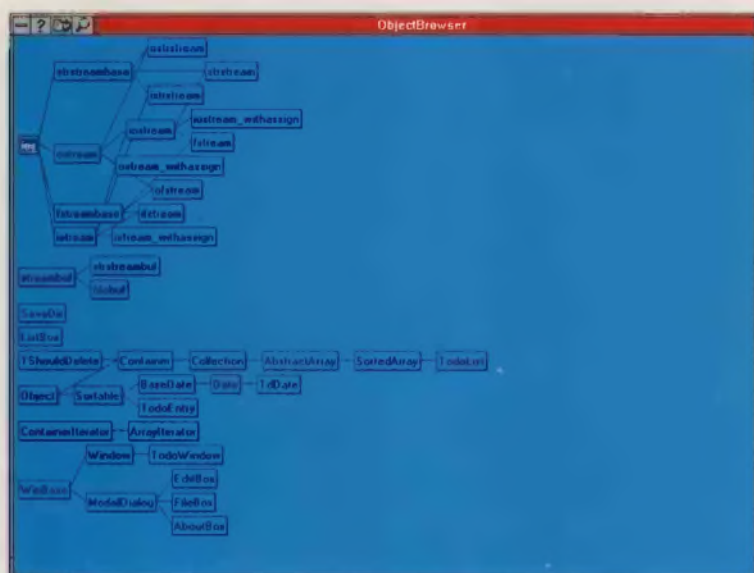






siderably improved. The compile times have also been significantly reduced compared to the previous version, and compiling Windows code using the Windows IDE is a lot faster than Microsoft's Quick C for Windows. Borland's use of pre-compiled headers offers significant speed advantages too, although it seems a little odd that the default settings for 'use pre-compiled headers' are different in the two IDEs.

The rewritten version of the compiler also supports C++ 'templates' — generic class definitions which can then be used to create a set of real classes for different data types. The class definition is written first, without specifying the data type, and then the class definitions can be created for the different data types, using the template. Thankfully, Borland has made sure that the debugger understands templates too, and breakpoints set within templates are replicated within all the classes derived from that template.



Keeping track of objects and class hierarchies can give conventional programmers nightmares. The Object Browser in Turbo C++ helps

### Optimiser

For many users the most significant change from 2.0 to 3.0 will be the provision of a very efficient optimiser in the compiler, which is also supported by the debugger and profiler. The problem with optimising compilers can be that the optimisation process takes a significant amount of time: it can multiply compile times by as much as three-fold in some cases. The programmer has to develop the program with the optimiser off, and only optimise

the code for the 'production' compile.

The problem with this approach is that it's rather vulnerable to bugs being revealed by the optimiser late in the development cycle. With a quick enough optimiser, the code can be developed with optimisation on, so that the code that ships is the code that has been debugged. Crucial to this latter approach is a debugger which, like Borland's, is aware of the optimisation process, and can aid in debugging optimised code without confusing the issue. The Turbo Debugger is able to display a variable that has been placed in a CPU register by the optimiser, in exactly the same way as a conventional (non-register) variable. Borland claims the debugger adds 50% to the compile time when optimising for maximum speed, and 20% when optimising for minimum code size.

From the user's point of view, driving the optimiser is fairly straightforward, with both IDEs offering options to optimise for speed or code size. More sophisticated use of the optimiser requires the use of the DOS IDE, since the Windows one doesn't offer the same number of options. From the Windows IDE the choices are to optimise for code size or speed, to select whether to use register variables or not, and if they're to be used whether the selection is manual — through the use of the 'register' keyword — or if the variables to be placed in registers are selected automatically by the compiler. There are also selections for register and jump optimisation.

The DOS IDE provides all of these, but also offers a greater degree of control: when selecting optimisation for size or speed, a further set of check-boxes are displayed, and individual elements of the optimisation can be turned on or off, allowing the user to fine-tune the optimisation. In use the effect of adding optimisation to the compile operation did slow the compiles down quite noticeably, particularly when optimising for speed, but no more than the figures Borland suggests.

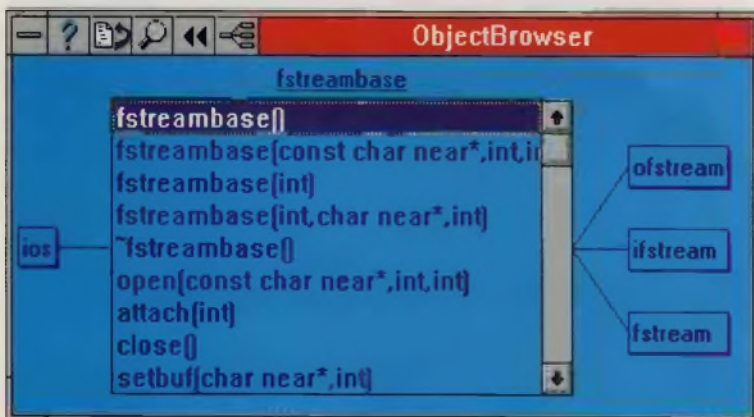
### Turbo Profiler

If the facilities provided by the optimiser aren't enough for your application, then the Turbo Profiler will probably be your next port of call. Using the profiler you can establish where your program is spending most of its time, and where some judicious assembler may well provide the maximum benefit.

The new release of the Turbo Profiler now supports profiling of Windows applications in all modes: local, remote serial and remote network (the profiler has the same options for its output display as the debugger). Also new in this version is so-called 'coverage analysis', which detects sections of code that are not executed when the program is run, allowing the programmer to remove redundant code with rather more confidence.

The bundled Turbo Assembler hasn't escaped a little tweaking either, and it now has C header file conversion so that the assembler can share type and data structure definitions with modules written in C and C++.

The most difficult aspect of Windows programming, or indeed programming for any GUI, is actually getting started and producing the first piece of code. The difference in complexity between the





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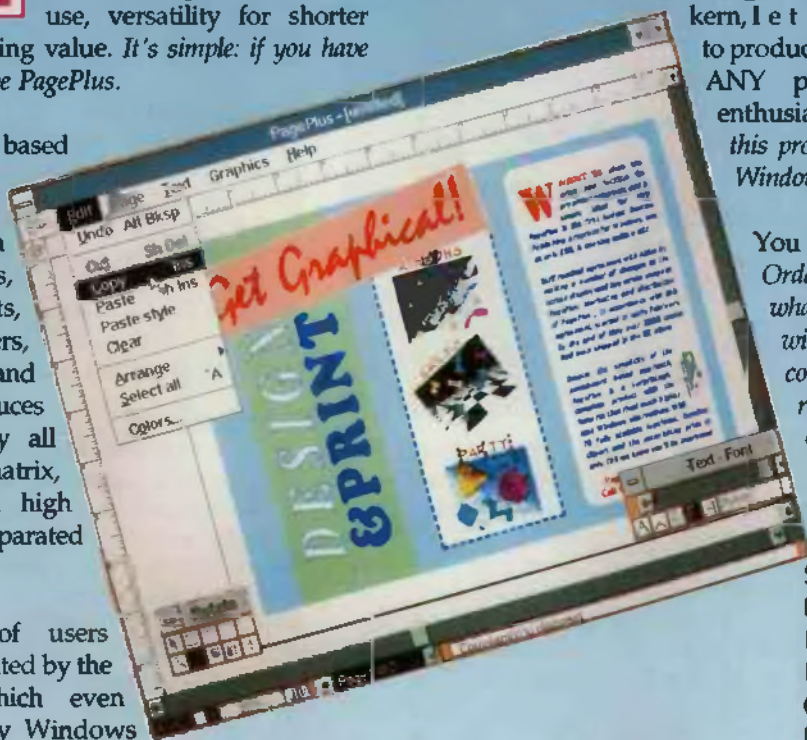
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▽ As well as its more sophisticated attributes, the IDE contains the sort of functions you would expect from a programmer's editor

traditional 'Hello World' program under DOS and under Windows is enough to put off all but the most enthusiastic beginner. The ObjectWindows part of Applications Frameworks attempts to make this process less painful and was in the previous version, but it is still not for the faint hearted.

In this release, Borland has included a library called EasyWin, which is just that: an easy way into Windows. A conventional DOS program, using the standard I/O operations like printf — can be recompiled and run under Windows. The end result looks rather as you'd expect: the code hasn't magically sprouted all the trappings of a GUI application, but it is a quick and effective way of getting a DOS program onto Windows.

A new utility called WinSight is also provided which lets you look at Windows messages, rather

the nastiest I've seen in a long time — I had to REM out rather a lot of lines in CONFIG.SYS before it would run at all. Once running it tells you that while it's installing it will ask you to press a key on the keyboard from time to time to make sure the keyboard is still working, and that if the keyboard locks you should re-boot and start again. Thankfully the program works rather better than appearances would suggest, and I was able to use the extra memory in my machine to good effect with the DOS version of the compiler from then on.

Of course, you can still use C++ to produce DOS applications — something that tends to get forgotten in the headlong rush towards Windows for everything. The Turbo Vision class libraries are still provided, and the new release also includes the source code for all the Applications Frameworks as standard; indeed, this would seem to be responsible for a good deal of the bulk of the complete installation. Many programmers are, quite rightly, wary of using library code unless they are provided with the sources, since only then do they have complete control of their application.

## Documentation

Although the documentation is up to Borland's usual standard — ten manuals are provided — the definitive Windows programming book by Petzold is no longer bundled with the company's compilers. It would be a brave — or foolish — programmer who attempted to develop Windows code without a copy of Petzold at the very least, and preferably Microsoft's SDK references: the *Guide to Programming* and *Programmer's Reference*.

## Conclusion

This product could still benefit in some ways. If we're going to have two IDEs, I'd prefer them to be more similar, and a proper Windows-based debugger would save the eyesight of those with just the one monitor. The EasyWin libraries are a good way of making a quick port of a DOS program, and quite a bit better than the competition; and the ObjectWindows Application Frameworks provide all that would be needed to turn that quick port into a proper Windows application, but something equivalent to the Windows Maker Pro interface building tool bundled with Zortech C++ would be an excellent addition.

But first things first, and Borland has at least demonstrated that it has its priorities right by addressing the weaker parts of the product, the code generation and lack of optimisation, first. C++ 3.0, for all its new features and fixes, is really just another step on the way to the perfect Windows and DOS development environment in that language.

While there are one or two things that I'd still like improved, 3.0 is a significant improvement on its predecessor, and Borland can expect to gain a lot more of the C++ compiler market as a result. If the company keeps on at this rate, version 4.0 should be perfect: I only hope I've been able to save up for a new hard disk by then, and that my drive's big enough to park the low loader.

Borland C++ 3.0 costs £299.95 (£439.95 with Application Frameworks).  
Borland is on (0734) 320022.



▽ Borland's Resource Workshop allows you to design a complete Windows interface without writing a single line of code

like Microsoft's 'spy' program provided with the company's SDK. WinSight is rather more clever though, displaying the Windows messages rather like an outliner or folding editor.

Although I've tended to treat it as the poor relation, the DOS version of the compiler is now DPML compatible, so when it's running under Windows in either standard or 386 Enhanced mode Windows can act as a 'DPML server', making more memory available for compilations. The install program for the compiler's DPML facilities is quite





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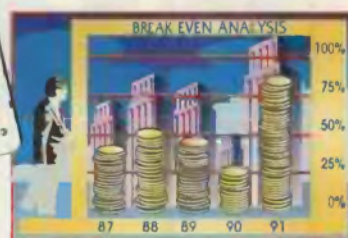
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# Cognito Messenger

Cognito, 'ere go some interesting ways of moving data, as Descartes almost said. A new service slotting into the BBC TV's old 425-line band promises far more than your average pager. It can make your network walk. Rupert Goodwins tries one of its messaging units.

Television and the telephone are two of the technologies that have shaped the 20th century: powerful, all pervasive and fundamentally wrong. Most people watch TV at home; the set never moves from one year to the next and little viewing takes place on the move. So it's odd that so much radio bandwidth is devoted to TV transmissions — a cable would work just as well, without using up valuable megahertz. Pressure on the radio spectrum is increasing, mostly because of the demand for mobile

the coverage map looks much as the early Cellphone one: London and the Thames Valley; motorway coverage up to Liverpool, Manchester and Leeds; and islands of service for Glasgow, Edinburgh and up along the eastern Scottish coast to Aberdeen. Most of the rest of the motorway network is covered too: Perth and Swansea are OK, but Plymouth and Inverness will have to wait.

The mainstay of the network is the Messenger, a hand-portable data terminal. It looks like a personal organiser with its 4x40 LCD and tiny Qwerty keyboard and black plastic case, though a little deeper in at 19x9x4cm. But a black rubberised antenna, hinging up from a niche at the back, shows this is something different. A clip-on battery pack lasts for about six hours without a recharge, which means up to three days of sensible use.

In addition to the Qwerty keys (which really are tiny — I can press four at once with one fingertip) there is a set of command keys. Other controls are available from the main keyboard through a CMND shift key. A dinky cursor cluster next to the display suggests some form of editor lurks within.

The Messenger weighs more than half a kilo, and when the back comes off it's clear why. Inside are two main modules, one each for the computer and radio sides. Both are shrouded in multiple layers of metal screening, because of the high potential for mutual interference. (The transmitter is powerful for such a small device: 5 Watts might not sound much, but it's enough to crash an unshielded computer at a distance of 10cm. And computers generate more than enough noise to mask even strong radio signals. Other electronic devices always noticed when the Messenger started up nearby — my screen flickered, and my phone burped.)

Engineering quality is very high, easily the equal of the latest Oriental cellphone, as far as I can see (I don't mind unscrewing modules, but unsoldering



tasks where wires are inappropriate.

Like telephones, in fact. Most are tied to the home by cable, yet they are far more useful if you can take them with you.

## Increased diversity

So the launch of Cognito, a wireless messaging and data service, is doubly pleasant. Firstly because it increases the diversity of public datacoms; secondly because it uses the old 405-line TV frequencies. It's a perfect example of what promises to be a major trend — the move towards wireless as the primary mode of personal communications.

Cognito the company, a division of Dowty, has for four years been planning and implementing a radio network across the country. At the moment,



the shielding is probably further than Cognito would like to see me go). The radio board is already at revision 7, not bad for a 'brand new' product; the box contains 128K flash EPROM, 32K RAM, and a Motorola 68HC11 processor, roughly the power packed by electronic organisers. The supertwist display, backlit on demand, is very clear even without the extra light; it's a nice piece of work.

There are three connections to the outside world; a tiny socket for the mains charger, a miniature 6-pin serial printer connector, and a metal stud for an external antenna — you can get vehicle-mounting kits which considerably increase the range.

### Base stations

The base stations, which receive the messages and pass them on, are interesting in their own right. The computer side is made from off-the-shelf equipment such as Sun workstations and statistical multiplexers (devices for sharing multiple digital channels down a line). Cognito says this cuts the cost of implementing the network and makes it easier to add nodes. Also, networks sold abroad can use local products, with little time needed to get the system up and running.

The communications speed between the terminal and the base station is 6.144 kbit/s, which seems a healthy lick. However, multiple terminals will have to share one 6.144 kbit/s link — the X.25-based protocol will allow hundreds — so the throughput for each will drop proportionally.

The base station relays messages along landlines to the base station nearest the recipient. If that recipient is not online at the time, the network stores the message and passes it on when contact is resumed. However, the message is discarded after 24 hours, which strikes me as a bit short.

### Signal blob

CMND-W wakes the machine up to start listening to the network. If it picks up a base station it sends an identification signal. A signal meter option, as on many cellphones, displays the strength of reception as a row of blobs. This is useful because at the frequencies used, a small change in position can make a big difference in the signal strength. Once connection is established, a Signal blob on the display is turned on. There are other annunciators for Low Battery, Message and Mute — the latter meaning you have silenced the device's loud 'message received' bleep.

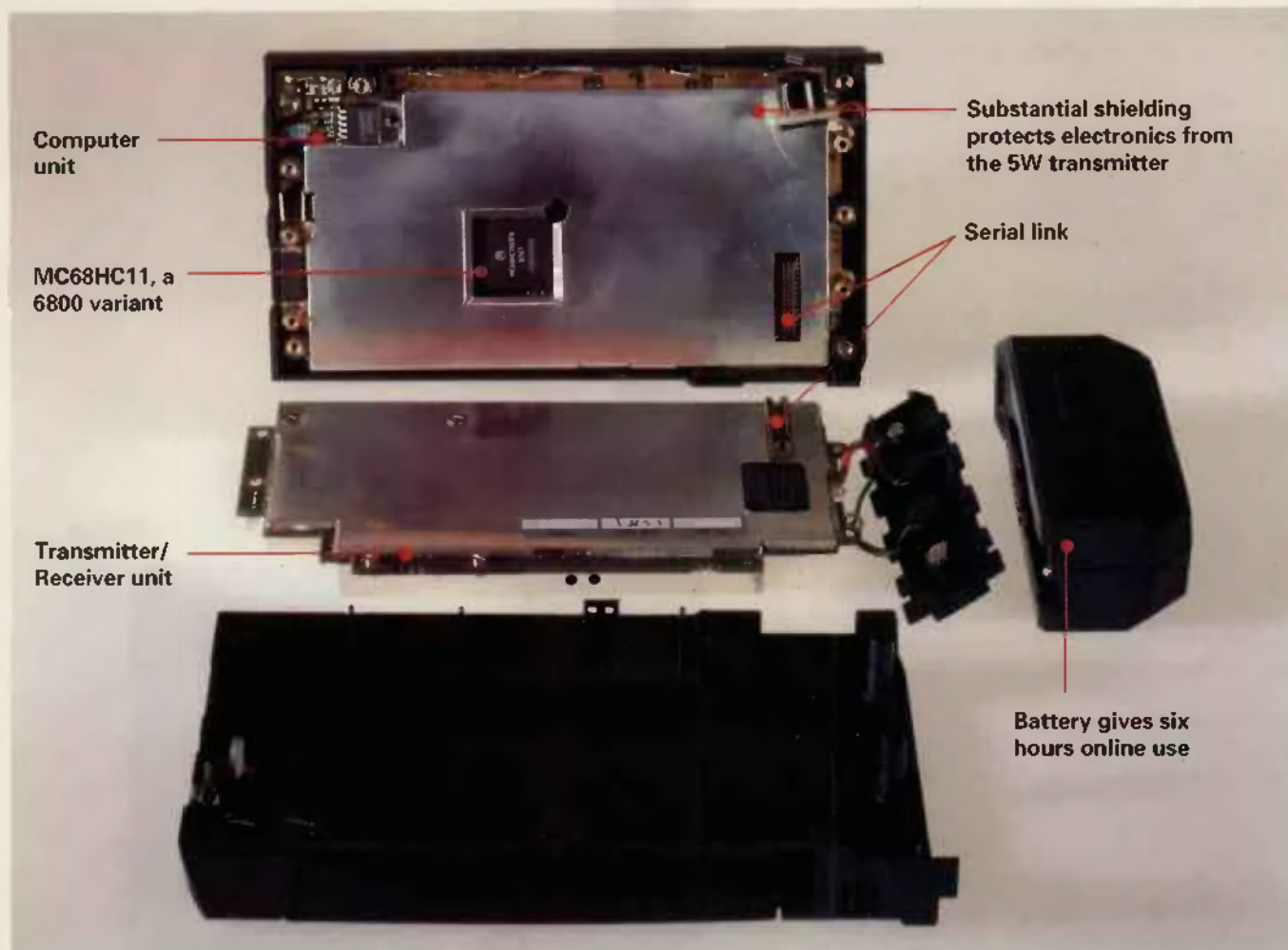
The main screen shows the time and date and how many messages are in each of four lists — In, Seen, Out and Kept. *In* is for unread messages; *Seen* stores them after they've been read; *Out* is for messages that you've sent; and *Kept* stores messages you particularly want to keep.

All the lists work in the same way: you place the cursor over the one you want and press either the Read or the List keys. List shows one-line entries for each of the messages, and Read displays the first (and subsequent, each time you press it) entry.

One of the major advantages of the Cognito system over others such as paging is that you can check on the status of your message after you've sent it; there's a single-character code by each entry in the Out list which says whether the message has been received, or is still being stored. You can even







set an option which lets the sender know when you've actually viewed the message.

The process of sending is quite simple. A Write key dumps you in the editor and you first have to address the message. Network addresses are six

digits long; if you're typing in someone's number you have to add all the leading zeros and a # symbol (#000426, for example). However, the Messenger can also maintain an internal directory, so you need only type in enough of a name to identify it uniquely

### The walking network port

Cognito can also link up with your desktop PC or office network via a unit called an RTU (Radio Terminating Unit). This is one of the most interesting aspects of Cognito, and one which we really wanted to look at. Unfortunately, although we were shown one working, we didn't have time to test it.

It looks very much like a Messenger without a screen or keyboard. It has a general-purpose serial port instead of a printer port, because the RTU acts very much as an intelligent modem.

Two RTUs can be used very like a serial link. You can have one hooked into the office network and the other connected to your roving salesman's laptop, for example. All of your office services — electronic mail, product database, or whatever — would be available on the laptop, as if it were wired in.

Well, almost. The same restrictions

apply about the reduction in data rate if multiple stations are operating on the same link, so the nominal 4.8kbit/s might drop quite significantly in use. If the software you're running 'times out' after a certain delay, this might cause problems. Nevertheless, this is a potent service.

It is made far more so by the availability of an Application Support Package. This is a software development toolkit with all the links to the RTU and all the protocols required hidden away underneath standard C library calls. It's available for MSDOS and SCO Unix, although any other common platform should be easy to accommodate. It gives developers the means to easily integrate Cognito capability into just about anything.

Software is under development to provide Cognito network access to any programs written to the 3MHS (Message Handling System) adopted by Novell, cc:Mail and others. In many

cases, only a couple of days a week would be needed to add some form of service to an existing system, and I'd like to think that conferencing systems and email providers such as CIX and Telecom Gold will show an interest. If this happens, Cognito will become a lot more interesting to lots of people.

Incidentally, there are no pressing technical reasons why the RTU's functions couldn't be put into the Messenger itself. Marketing more than electronics dictated their separate existence. Cognito is also making available, on a cost-only basis, the radio module and the custom chip that does most of the tricky packetisation and protocol handling for a terminal. The company is also talking to a number of famous but unmentionable names about new products: it is keen to get the service into as many niches as possible.



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### New use for an old band

The Cognito system uses an area of the radio spectrum called Band III, a name which dates from the early days of FM and TV. Band I held the original black-and-white BBC VHF 405-line TV transmissions, Band II is what most people call the FM or VHF radio broadcast band where all the stereo stations live. Band III held the ITV VHF 405-line service. Bands IV and above are the current UHF TV frequencies.

The old 405-line service on bands I and III was closed down in the mid-Eighties — it had been calculated that for years it would have been cheaper to buy the remaining 405-line viewers brand-new colour sets than to carry on transmitting the old service. Band III was most attractive to new users — it's on a higher frequency, which means that antennae can be smaller and more efficient — and a number of two-way radio services moved in. Not all have been successful, and Cognito is anxious that its network is not thought of as just another Band III service.

The choice of frequency for a service is important and difficult. The allocation of bands is dependent to a large and increasing extent on international agreements rather than technical considerations. In general, the higher the frequency the less the range, and

the more expensive the technology — and the less demand for the waveband. As more services are developed, however, more of them move up in frequency, bringing prices down.

Cellular telephones use a band above UHF TV that until the 1980s would have been too expensive to use for mass-market products. Where old frequencies are re-used, there are often limitations which affect the usability of the service — the slice of Band III allocated to Cognito, for example, will never be able to handle more than a fraction of the traffic which takes place on the cellular telephone frequencies. That's OK: Cognito isn't that sort of service.

You'll hear about DECT and HIPERLAN in the near future. These are European radio network standards with a much higher capacity for traffic. But they are more replacements for wired in-office LANs than true mobile systems: they use microwave frequencies instead of VHF, and are based around the traditional client-server general-purpose network ideas.

The European Telecommunications Standard Institute (ETSI), which decides how such things work, is considering how public-access radio data networks should be standardised, but little action is expected before the mid-Nineties. In the absence of a European standard, other proprietary public-access digital radio networks are on the books — there are four licensees in the UK. But it's unlikely that they'll offer anything much different from Cognito. We'll probably benefit most from competition and smaller technology, rather than radically different ways of use.

and the unit will fill in the rest for you.

The final option, not implemented in the network at the time of writing, is \*. This selects a special service, such as Fax. The fax-sending software was in the Messenger; if you address a message to \*FAX, a special screen comes up with a field for a telephone number. You can then enter your text as before. This is a truly useful feature that I'd loved to have seen working. I can think of no technical reasons why it should take long to get running.

There is a limit on each message size to 240 characters, including the Subject line. This is clearly one packet in length (the remainder of the 256 bytes are used for error correction and address information, packet type and so on) and is less restrictive than you might think — especially given the fiddly nature of the keys, which makes it difficult to type in anything of substance.

Although there's no count of characters left on-screen while you enter text, the Messenger does bleep when you get within 40 characters of the end. A prod at the red Send key entrusts your prose to the mercy of the ether.

The interface is simple and intuitive; I didn't open the manual until I came to write this review, despite having used the Cognito system for a couple of weeks. There are plenty of other features besides the

basic messaging; you can get the machine to turn itself on at certain times in order to grab any messages while preserving the battery. You can also save power by getting the unit to talk to the network less often when turned on. There are options to password-protect the Messenger as well.

Unfortunately I used the system only in the London area. It works well, with messages bouncing across the system in under a minute, and I found it a useful adjunct to my usual regime of phone calls and faxes. My major gripes are that the small keyboard makes error-free typing impossible, and that the Shift key is hard to operate while holding the unit in one hand. There are a couple of other rough edges. You can't find out when a received message was sent, for example, and a message that's been deleted under the 24-hour rule still appears as pending in the local Sent list.

### Creditable effort

Otherwise I like the Cognito system and the Messenger terminals. Both are well designed and effective. The price — £600 for the terminal, and around £60 a month all-in costs — is painful and clearly not pitched for the private user. But there are features on offer which you can't replicate with paging and cellular modems. Also, Cognito is willing to talk to people considering the system for a specific purpose. This is a creditable effort for a first-generation system, and I'm looking forward to seeing what happens next.

Cognito is on (0635) 508200.



# "The Minstrel hits the spot for looks, design, price and performance."

What Micro?

what's more it's British designed and built.



## WHAT MICRO? BEST BUY

The standard machine has to be the HM Systems Minstrel. From a company that consistently leads manufacturers with far greater resources into new territory, the 25Mhz Minstrel hits the spot for looks, design, price and performance. Given £2,000 to spend on a 386SX, buy this one and hide the other £600 and it will still look like a bargain.

### HM Systems Minstrel 25Mhz

Just as the first 20 Mhz systems tiptoe to market, innovative British manufacturer HM Systems has already put out what it claims is the first 25Mhz system. The review

model was pre-production and a little rough at the edges, but no-one can deny that HM Systems keeps its engineering promises. There are Minstrel workstations from 286 to 486, and as each new model has been released over the last two and a half years each system has been tightly packaged in the same case.

In 1988 it was half the size of the opposition and even now it is small at 290x390x100mm. Because of the similarity between models, and because most of the features are mounted on the one board, the systems can be upgraded by replacing the motherboard.

After buying this model, though, it might be quite some time before it needs an upgrade. Fast video and a cached hard disk make for some scorching benchmarks, even allowing for a faster clock speed. The system unit has four free slots, with two serial ports and one parallel port. This is exceptional in a system of its size and is a result of a complete redesign internally since the last new Minstrel, which has made space for an extra slot.

The exact configuration was not settled in the review machine (with the result that there was nowhere to plug in the mouse supplied; no doubt this will not happen in a commercially available version).

There is ventilation on both sides, with some slight fan noise. At the front there is the 3½ in drive plus

LEDs for the hard disk and floppy disk drive. All HM Systems PCs have SuperVGA as standard. The review machine used a SuperVGA monitor, although of course a standard VGA monitor will still be compatible. When using intensive graphics-based software, SuperVGA is a real benefit, and most Windows users will notice the difference as well. Put simply, if you can get twice the information on screen, Windows multitasking is twice as easy.

The keyboard is sound, with quite a lot of travel. The general construction is very solid, and the Minstrel has the power and special features to act as a specialist graphics workstation, while retaining the price performance which makes it attractive to most users. The clincher is that HM Systems has realised that fast data access and fast video will be worth more in performance terms than their cost.

**VERDICT:** Top turn for its build quality, looks and speed. A class act.

HM SYSTEMS MINSTREL £1,380  
HM Systems (081) 209 0911

PERFORMANCE	5
Build quality	5
Extra features	4
VALUE FOR MONEY	5

### SXs COMPARED

Model	Tower/desktop	Price £	Processor speed	Standard/max ram (Mb)	Software and hardware included	Disk options (Mb)	Landmark Index	What Micro? test Index	Data Transfer rate (K/sec)	Track to track seek time (ms)	Average seek time (ms)	Disk size (formatted)	VGA rating (frames per second)
Amstrad 4386SX	D	1,000	20	4,16	Dos 3.3/Windows/ Apps manager	80	14.0	7.8	3,780	3.0	17.3	83.9	6.9
HM Systems Minstrel	D	1,380	25	2,16	Dos 4.01	50,100,240	13.0	9.7	1,340	0.2	0.2	82.2	7.8
Data Dynamics 386SX-20	T	1,440	20	4,0	DR Dos 5.0	40,80,135, 180	12.5	7.8	223	5.5	31.1	42.5	4.8
Tully Vision Line etc.386SX	D	1,825	20	2,18	Dos 4.01/Windows	40,100	10.2	7.8	790	1.5	24.5	104.8	6.2
Compaq 320ec	D	1,898	20	1,4	Dos 4.01/Windows	40,80,110	7.8	5.1	3,320	13.7	14.3	42.5	4.2
Acer 1120GX	D	2,100	20	2,0	Dos 4.01/Windows	40,100	10.3	7.7	5,880	5.8	28.9	42.5	5.7
Obvati PC Pro SX20	D	2,299	20	1,17	Dos 4.01	40,100	15.8	8.8	4,080	0.6	18.0	104.8	7.7
Falco Infinity	D	1,395	20	1,8	Dos 4.01	40,100,200	12.6	7.3	687	3.8	15.9	104.8	6.1
Packbotum 386-206SX	D	1,195	20	1,8	DR Dos 5.0/Lucid 3D	40,80 & others	9.0	7.8	545	10.4	23.7	45.0	5.9
Centerprise Leo 386SX-20	D	1,530	20	1,4	Dos 4.01	40,80,320	11.5	7.9	564	10.5	23.8	45.0	6.7

Prices quoted for colour VGA plus smallest hard disk greater than 40Mb and basic RAM. Landmark speed and What Micro? speed calibrated against IBM XT = 1.0  
What Micro? June 1991

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# Dell 486P/33



486 models were long seen as too exotic for personal use, but with falling prices they are gaining the cachet of executive toys (oops... we mean workhorses). Simon Rockman looks at Dell's bid to score in this new market, the traditional realm of IBM and Compaq.

**T**he old saw 'If it isn't broken don't fix it' doesn't hold up too well in computing. Companies that rest on their market-leading laurels soon find themselves in trouble. Big names like Compaq, IBM and Ashton-Tate have all seen the markets they 'owned' slip from under them. Against this background, the launch of the Dell 486P/33 seems a sensible move,

even though it replaces the very similar 433P, which was launched only recently.

Dell has recognised that in the past few months, the 486 market has been transformed. Prices have fallen to the point where the term '386 server' sounds faintly ludicrous, and the 486 is being adopted as the 'standard' desktop machine of the image-conscious executive. This latter market, traditionally the realm of Compaq and IBM, is huge and I expect Dell, with its reputation for customer support, to take an increasing slice of it.

The 486P/33, essentially a second release of the 433P, has been thoroughly cost-engineered to compete. Doing something a second time usually means doing it a little better and a little differently — especially if you can save a few cents.

You have to look hard to spot the differences in

PHOTOGRAPHY BY DAVID WHITE



the 486P/33. The case is the same sleek 380x400x105mm, with just enough room for one of each flavour of floppy, with the power switch tessellated into the gap where the 5.25in drive overhangs the 3.5in drive.

The 486P/33, unlike the bigger D range, has no reset button or LED SmartVu display, but there is a lock. Features at the rear are pretty much as expected: power sockets in and out (to power the monitor); a fan; two 9-pin serial ports, a Centronics parallel, PS/2 style connectors for keyboard and mouse, and a 15-pin VGA connector for the on-board video. A switch dictates the nationality of the power.

### Subtle improvements

Improvements on the old 433 are subtle. There's a better method of upgrading the processor, and Dell claims that the upgrade path on the new machine is secure. The video specification has been beefed-up, with more RAM, a 45% improvement in speed, and a faster refresh rate. A flash EPROM replaces the standard ROM so that the BIOS can be easily upgraded, and the power-on password can now dictate control over the disks and printer ports so data cannot be removed.

To open the machine up is simple, undo two screws on either side of the case and the top slides forward. With no room for extra drives and only three slots, this is not a box that will be opened up regularly and the use of Philips screws in place of the thumbscrews used on the D range is sensible.

The need for change to keep up with the computer market is at odds with the need to mass-produce models to keep prices down. One solution is to take a modular approach to design, which means that only certain parts of a new model are different from its predecessors. This also benefits the customer by making the machine upgradeable. The 486P/33 is top of a range which runs from the 486P/20 (with a 486SX at 20MHz), and the 486P/25 (a 486SX at 25MHz), to the oddly named 486P/25-487, with a 487 occupying the co-processor slot — though, thanks to the mysterious ways of Intel, the 487 has a built-in CPU and is essentially a full 486.

### Upgrading

Previous upgradeable Dells, which had to cope with 386 as well as 486 processors, took the upgrade on a custom expansion card. But by sticking to the 486 range, this need has been obviated and all four types can be shoved into the same socket. Setting the clock speed for the new silicon is a matter of changing jumpers. Dell sells an upgrade kit which includes the necessary chip-removal tool and a sticker which replaces the model number on the case.

A trade-in system credits the customer with between £200 and £550 for the returned chips. This sets the prices of the upgrades. To move from a P/20 to a P/25 costs £249, from a P/20 to a P/33 £499, and from a P/25 to P/33 £299. The system has a 16MHz option but none for 50MHz — presumably the top-of-the-range Intel chip is destined to stay a bit special for a while yet. It won't be long before we see the new P/24 chips, which run a double clock internally: these should plug straight in to make a 486P/66. I want one.

The lack of a processor board should make the machine more reliable but at the cost of some flexibility. Dell showed a stunning use for the processor bus at last year's Comdex in Las Vegas. By having the VGA on the same card as the CPU, the video performance was improved by more than an order of magnitude. The exhibit was a technology demonstration, a co-operative effort between Dell, Intel and Microsoft, but nothing in the design would seem to prevent the idea from making it to production. The current system of processing bits at 33MHz (or in the case of the Comdex machine, 50MHz) and then pushing them down an 8MHz bus to a video card is just plain daft.

Sitting on the printed circuit board next to the speed jumpers is the video RAM. An interesting approach has been taken to conserve board space and modularity. The standard quota of RAM is 512K and there are no sockets for more. Conventional wisdom would have an empty (but expensive) SIMM socket. The Dell solution is to have an IDC connector and a set of pins which hold a second 512K of RAM on a PCB with the chips facing down. The resulting sandwich is sturdy, even if it does look like the kind of kludge you'd expect inside a BBC Model B. Amstrad uses a similar arrangement for the processor in the 3000 range and whatever Amstrad's image, the 3000 seems pretty well put together. The Dell speaker fits neatly into the specification for all PC speakers: pathetic.

### Video RAM

The system RAM is supplied in SIMMs. The slower models have 1Mb but the 33MHz machines are supplied with a single (double sided) 4Mb SIMM. All 486P systems are expandable to 64Mb; this would require four 16Mb SIMMs. If you choose to fully populate the RAM, you will have to restrict card expansion in order to have a half-length card in the bottom ISA slot. There is no socket for a Weitek co-processor, nor is there an option for an external CPU cache, although a section of the PCB looks designed to accommodate that option later. The 486 has an 8K cache but increasing the size improves the hit rate.

The IBM-like bits are the standard VLSI chipset with Western Digital taking care of the disk and video bits. The Phoenix BIOS is very new: it was dated November 21, 1991 — just a couple of weeks before this review was written.

With 1Mb of on-board video RAM, only the user requiring accelerated graphics will want a video card so three slots seems plenty — today. With the imminent arrival of Windows 3.1 and its multimedia bits included as standard, a lot of people are going to want to add SoundBlaster cards. Add a SCSI interface for a CD-ROM and your executive has only one slot left for his network card.

The slots are full-length ISA and sit on a riser board which plugs into the main PCB. One board slotting into another, and then into a third, sounds like a recipe for loose connections but the build quality is good and the card guides line up properly to hold the end of the board. The use of a riser adds to the flexibility of manufacture. A four-slot machine could be built on the same PCB just by making the case taller.

The cards all fit horizontally, which in the bad





Video RAM is expanded by using an upside-down PCB

old days might have indicated cooling problems; but with a move to lower power components (for speed rather than power reasons) most boards don't get too hot. A fan in the power supply might drag some hot air out of the system, but there are no vents in the case so most of the incoming air will be dragged through cracks in the case and the slots in the drives. A fan with a thermostatic switch would have been nice. The PSU itself is pretty meaty at 224Watts and should cope with anything reasonable. Even hard drives don't draw much juice these days and the 100Mb IDE unit supplied with the machine is rated at 6.5Watts.

The 101-key UK keyboard has a good feel, slightly clicky but very fast.

### Specifications

#### Dell 486P/33

#### Manufacturer

Dell (0800) 414585

#### Processor

Intel 486 at 33MHz

#### RAM

4Mb (expandable to 64Mb)

#### ROM

Phoenix

#### Mass storage

100Mb

#### Keyboard

101-key UK

#### Display

VGA with 512K video cache, expandable to 1Mb

#### Interfaces

Two serial, one parallel, PS/2 mouse

#### Expansion

Three full-length 16-bit ISA slots

#### Size

380x400x105mm

#### Bundled software

Drivers and utilities, DOS 5

#### Price

£2364

### Software

The 486P/33 was supplied with DOS 5 and Dell's own support software. My only problems involved trying to use the screen drivers with a late beta copy of Windows 3.1, but that was hardly Dell's fault. Windows ran perfectly, which comes as no surprise but is worth noting given that I had some problems running the same release on an Apricot. The 3.1 screen drivers are a little different to those employed by 3.0 although many will work, and the ones with problems will have to be sorted out before 3.1 ships.

One disconcerting aspect of powering up is that Dell checks you are prepared to abide by licence agreements imposed by the bundled software. A screen prompt asks you to confirm that you have read the legal bumf. It's difficult to complain about being asked to do something you should agree to, but I couldn't help being reminded of the Leather Goddesses of Phobos, a game that begins with general knowledge questions to ensure that you are old enough to play in Lewd mode (it demands a greater knowledge of American presidents than many English users will possess). The

Dell system believes you when you say you have read the copyright message.

The software the company is so keen to protect is neatly catered for by a program called the Diskette Librarian, which will make backup copies to floppies. Before you can use the machine in anger you need to indulge in a little editing of the AUTOEXEC.BAT file, which came configured to run an introductory demo that explains the system. As an example of an interactive tutorial it is stunning: the graphics look like pencil sketches and the software explains in a non-computer way what the various bits of the machine are. The style ties in with the excellent documentation.

Further software comes in the form of two software support utility disks. These include an Expanded memory manager, an international keyboard utility, a keyboard password utility, a program to check the printer port mode, and one to redirect the printer port. Similar utilities are available from other sources but it's good to have them supplied. The Windows drivers are fine with Windows 3.0, but whatever Microsoft would like us to believe, there are lots of non-Windows applications which we all still have to use. Dell caters for a wide range of these and includes video drivers for AutoCAD, AutoShade, Cadvance, Framework, GEM, Generic CADD, various versions of Lotus 1-2-3, Ventura Publisher, VersaCAD, PCad, WordPerfect 5.1 and WordStar Pro.

### Documentation & troubleshooting

Maintaining a customer support line as good as Dell's is expensive, so good documentation can pay for itself. Raw beginners will turn to Dell's paper version of the on-screen tutorial, called Getting Started. It has lots of pictures, some words, and few numbers. There are pamphlets on the Dell-installed software and the hard drive.

There's also a troubleshooting guide, which looks good: this is difficult to judge without something going wrong. It has clear instructions on how to run the diagnostic tests. The main User's Guide is a solid document which appears to have all the information you'd want on taking bits out, putting other bits in and setting jumpers and clock speeds.

### Conclusion

So this is it: the 486 is no longer special. True, the 386SX will remain the most popular processor for a while yet — a survey by AMD claims that the 386 has at least three years left. But only the 50MHz 386 can now be viewed as exotic. The 486P/33 is an example of an 'ordinary' machine with a fast CPU.

In making the 486 a mass-market item Dell may be spearheading the change, but today's leading customers are the mainstream of the future. If you can get the leaders to buy your machine, you stand a better chance in the more competitive (and lucrative) mass market later on.

I see this machine being favoured by senior managers with enough technical knowledge to know what a 486 is and who are awake enough to know that IBM and Compaq are not the only choices. I also see it as an option for small software developers whose livelihoods depend on a machine working and who can justify the cost by the time saved compiling their code.



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# Letraset Painter

Want to paint like Van Gogh? You can, for the price of a Mac and Fractal Design's paint package. There are snags, of course, but this pioneering 'natural media' package is the first to look like it was designed by painters for the use of painters, says Brian Larkman.





It is ironic that the discipline least prepared for high technology, and least interested in computer jargon and flashy gizmos, is also turning out to be the greatest power-user — the visual arts. Although computers have gained a high profile as 'aids to design', most artists and designers can see little to attract them from traditional media. They see the standard computer setup of screen and keyboard, plus an electronic soap-on-a-rope to draw with, as too crude for serious use — except perhaps typography and linework. Artists want to emulate the soft edges, blends, bleeds and textures of the familiar natural media, but to do that you need a huge range of colours and high resolution. Only now are desktop computers both cheap enough and powerful enough to coax a significant number of artists into electronic image-making.

Established computer illustrators, on the other hand, demand ever more special software features to set their work apart. 3D modelling and animation packages all now have texture mapping, bump mapping, and other techniques to dirty the smooth 'plastic toy' surfaces that we all associate with computer graphics.

Similarly, professional bitmapped systems include a range of fantastic and obscure image processing options — and the list is growing month by month. The next item on the shopping list was inevitably the painterly tricks and specialist techniques of traditional artists and designers, so both groups could take advantage of software that pretends to be a real artist's studio.

### Painterly emulation

Quantel's Paintbox systems have for some time had the power to emulate soft-edged and colourful effects like pastel or watercolour applied to heavily textured paper, but few could afford such equipment. Gradually though, some less wad-breaking systems — Macintosh, Amiga, PC — have begun to acquire as standard hardware powerful enough to drive drawing and painting software capable of fulfilling the real needs of artists. But most still have software interfaces and toolboxes designed by programmers rather than designers.

TimeArts' Lumena, running with the Hercules Graphics Station on a PC, and Oasis from the same source running on a Mac, both provide a range of customisable tools.

PixelPaint Professional from SuperMac — currently the 24-bit favourite on the Mac — offers a simpler, less overwhelming interface but it still has some superb tools, including textured paper, charcoal, watercolour and airbrush.

In contrast to these nominal 'nods' toward the creative artist, Fractal Design's Mac package Painter makes very few concessions to the 'traditional' computer art package, offering less than half of the accepted 'essential' tools listed by Chris Cain in his software Group Test (PCW October). Instead, it provides the full range of artists materials that work almost exactly as the natural materials do, even to the extent of dirtying felt pens and texturing a wide range of surfaces to paint on. Used with a pressure sensitive tablet like the Wacom, the result is an almost total suspension of disbelief: within minutes you feel as if you are using real watercolour or chalk, charcoal or marker pen. Astonishing!

Immediately I can hear artists saying what's the point? £300 would buy every possible natural medium I might need to last for years — and what about feedback from the surface? But, as I shall explain, there are advantages in using an electronic rather than a natural medium.

### First impressions

Anyone used to conventional computer paint programs will feel a little disoriented when they first see Painter. For a start the packaging is a 2.5 litre paint can and the manual (rather good) looks just like an A5 drawing pad. On launching, the only standard-looking Mac window is a toolbox similar to PageMaker's — floating in the top-right corner of the screen, and quite vestigial — with basic icons like Zoom, Move and Block Define.

Below this at startup are the Brush and Colour palettes, two of Painter's other eight palettes (as the package calls all its function windows). An Expand button in the top-right corner of each palette win-

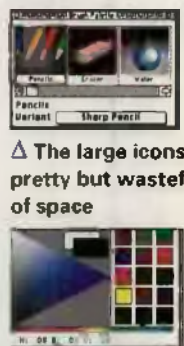
▽ Fig 1 The Tool, Brush and Colour palettes on startup



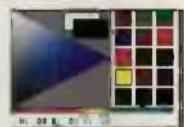
dow accesses extra functions. But on the whole the palettes are colourful, and easy to understand and use. In fact, the Brush palette is so simple and bold, with just three large coloured icons visible, that your first impression is that the program is for kids. But the icons scroll horizontally and a quick run-through soon dispels doubts. Tools include Pencil, Chalk, Charcoal, Felt Pens, Airbrush, Oil Crayons, Pen and Ink, Hairy and Graduated brushes, Van Gogh and Seurat painting styles, Eraser, Water Droplet and a powerful Cloning Tool.

Most of these also have variants available from a drop-down menu on the Brush palette. For example, Pencils can be Sharp, Thick and Thin, 500lb (very large and soft), 2B or Standard Colour. Felt Pens can be Fine Tip, Medium Tip, Felt Marker and Dirty Felt Marker. (This last picks up or 'bleeds' some of the colour from the marks it passes over, staining the pen.)

The eraser has soft, anti-aliased edges and can therefore be used like a 'putty-rubber', as a drawing tool in its own right. It also has several Bleach variants that will fade the areas they pass over — even the dye in coloured paper. The Water Droplet can be plain water, blurring edges smoothly, or



△ The large icons are pretty but wasteful of space



△ The Colour Palette works like the way an artist would mix colours

◁ Fig 2 The digitised bowl in Fig 1, after cloning and Van Gogh brushing with relief



with a hard edge as in some watercolour techniques. It can also be Frosty, blending the colours it passes over but leaving an internal grain.

The instant-artist Seurat and Van Gogh brushes seem like a bit of a joke at first, but you find that the terms describe useful pointillist and multiple oil-brush techniques, and you wish more were available. The days of a Michelangelo or Lucian Freud emulator are far off, though Jackson Pollock and Roy Lichtenstein are still up for grabs!

### Powerful cloning feature

The most powerful feature of Painter, especially for the less artistically gifted, is the Cloning function. A clone is an exact copy opened over an image already present in the system, usually either a painting, or a scanned photograph. The clone is directly linked to its original, so that original colours can be 'rubbed through'. If the clone surface is erased, the clear area left is still linked, so that areas of colour can be pulled through from the original in a chosen brush style.

To help guide the individual brush strokes, electronic 'tracing paper' can be added so that a faint image of the original can be seen. AutoCloning automates this process, placing brush strokes of the current 'paint' at random within a selected area. In conjunction with a mask it is possible to paint an irregular area in this way, but as the marks are dabs or dots rather than strokes you cannot reproduce a true painterly style. The old manual methods still have their uses.

The Colour palette is unlike any other used

▽ Fig 4 Pencil 'cloning' of the puppet photograph



△ Fig 3 Digitised photograph of puppet in 24-bit colour

on a Mac. Fifteen squares show the default colours for the current tool and variant (for example, pastel shades for chalk, bright colours for felt pens).

Primary and secondary colours (used for several special brushes and effects) are displayed in separate overlapping rectangles, and across the bottom is a spectrum slider for selecting hue. Once a hue is chosen a large colour triangle shows every possible variation, with the predominant spectral colour at the apex blending to black and white at the other

two corners. For an artist this is a very natural way to select colours, and far easier to understand than the usual RGB sliders.

Surface texture is selected from another horizontally scrolling palette. A range of paper and canvas surfaces is available and more can be added from a library, or created in ColorStudio. Once a texture is chosen, every brush stroke is given a 'grain' to emphasise the 3D feel. The texture is attached to the brush, so that changing paper surface during a drawing allows 'frottage' or 'rubbing' effects.

Surface textures can also be applied to a complete painting via the edit menu, and if a clone is in operation the brush strokes themselves are pushed into relief. This is especially effective with oil painting styles, and convincing palette-knife effects in 3D relief can be obtained (see Figs 1 and 2).

Masking is handled by the unnecessarily large Frisket palette, and by an extra set of tools which you can add to the basic toolbox by pressing an 'expand' button. A Knife tool defines the mask as a freehand line and it can be moved, rotated and saved to a library. The Frisket palette gives control over the type of display and reversal of the defined mask. Only one mask can be in use at a time and the outline cannot be modified without redrawing the whole mask. Standard masks are provided in the library and more complex shapes can be constructed in ColorStudio if you have it. Overall, Painter's frisket system is its weakest aspect — a pity because the airbrush is rather effective.

### Tweaking

Most artists and designers start using a particular medium straight from the tube or box. As they get more familiar with the material they will start to experiment, cutting crayons to points, mixing extenders with paint, trimming brushes, wetting paper, and so on. Painter is ideally suited to this type of use.

The large range of tools and surfaces is obvious and easy to use on large simple palettes, and many users will just stick with the ones on offer. Others will want to tweak a particular tool. This can be done via the Brush palette's Opacity Slider and Method menu, as well as via the separate Brush Size, Brush Behaviour and Expression palettes.

All these techniques are hidden to some extent on palette extensions, available using the expand button, or on extra palettes remain unused. As you get more familiar with the system, you can begin to modify the variants on-the-fly, changing their characteristics to suit the task and exploring the finer points of Brush%/Size, Jitter, ClojitAmt and Dye Concentration!

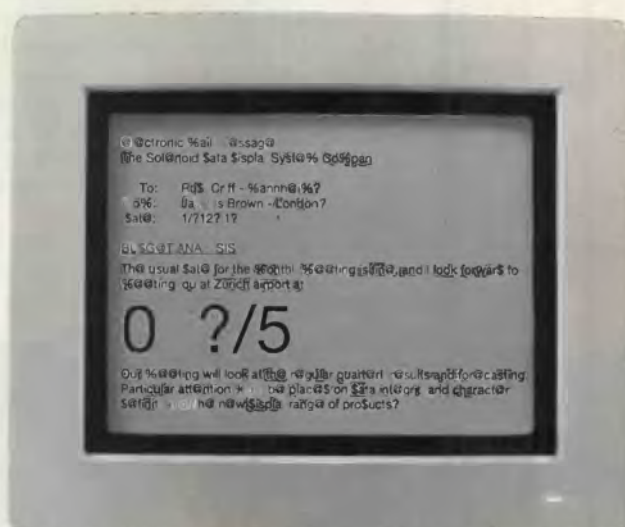
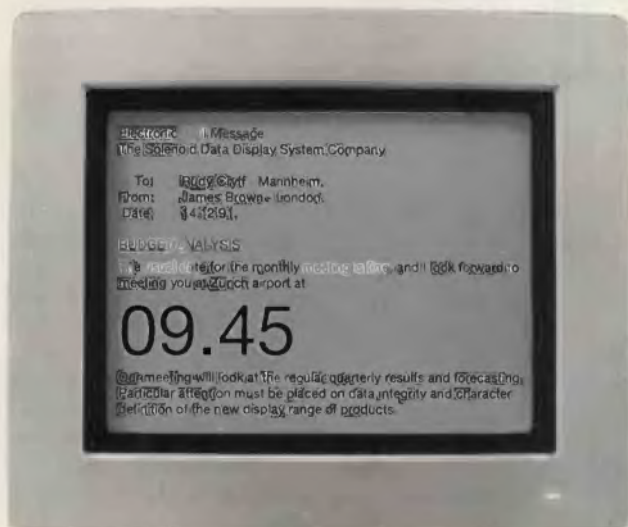
Useful combinations can be added to the list of Variants with a simple Menu selection. If necessary, a new category of brush, complete with its own icon, can be added to the palette. But beware of charging in with loads of bizarre brushes, for there is no apparent way to remove them short of re-installation. I know!

### Pressure sensitivity

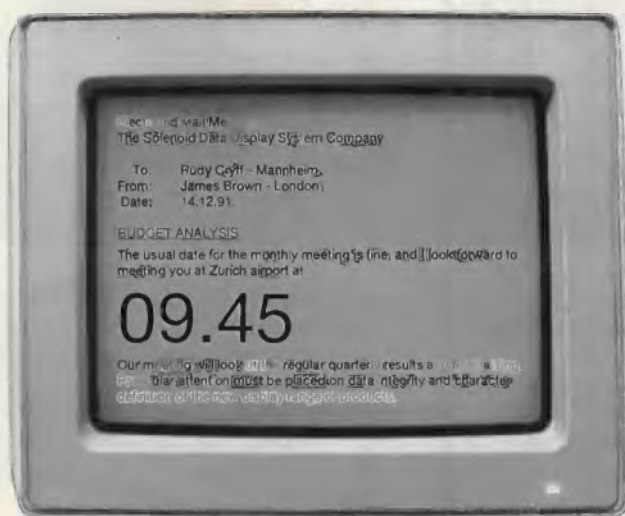
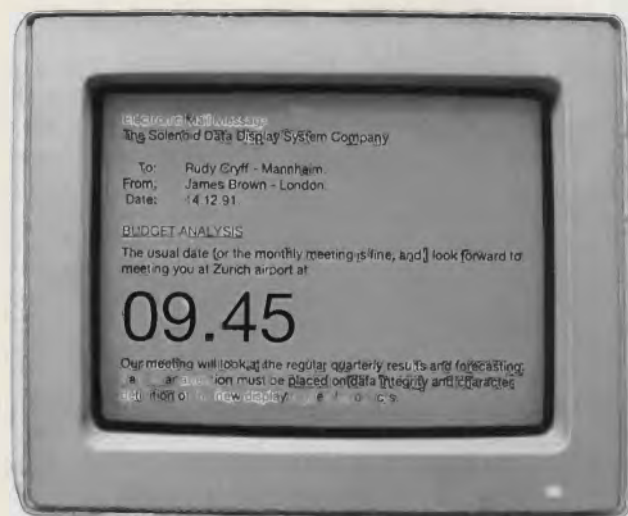
Painter could never replace natural materials as a medium of expression for most fine artists, illustrators and designers. But it certainly goes a lot further than any other program currently available. What



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gives it an edge is the way that pressure sensitivity is used. Many programs now offer support for the Wacom pressure-sensitive digitising tablet, but Painter provides a brush Expression palette allowing the stylus pressure to vary size, amount of jitter, opacity or colour for each brush. This gives flexibility and control to every type of mark. At last you can produce drawings on a computer that have a true hierarchy of line, varying thickness and opacity along their length to model the subject.

This degree of sensitivity is still not enough to convince everyone. A straw poll of the fine artists and designers at a local art college was divided



△ Fig 5  
Seurat-style  
clone of  
puppet with  
colour  
distortion

fairly evenly between those who wanted nothing to do with Painter and those who couldn't wait to try. However, everyone who tried agreed that there was too little feedback from the surface to get any real feel from the system. It was a bit like eating synthetic food that copied the flavour perfectly, but had no texture. Looking good isn't everything, even in the visual arts.

### Implications

The reaction of artists and designers to this program has a number of implications for all of us. At the moment, although Painter can by no means copy the style of any painter, it does allow anyone with a minimum of skill to produce a reasonable pastiche of almost any style. In a sense, it is as much a simulator as Flight Sim II — a Virtual Artist's Studio. The history of computer graphics (such as it is) shows that in time Painter and programs like it will become more sophisticated and feature-laden. This may or may not be intimidating for true artists and designers. At first it seemed that DTP would put a lot of typographers and designers out of business. In fact, only the typesetters suffered; a trained designer is still needed to get a good-looking bit of artwork out of a DTP system, so the same thing should be true of any Natural Artistic Materials Simulator.

The question remains as to whether computer painting is worth the money and effort. Painter's

£295 asking price — not to mention £1500 for an LC, the minimum Mac configuration — would buy a lot of conventional materials. It is undoubtedly fun to use, and it can force jaded computer-aided designers to dredge the memory of some little used skills back up to the surface. It also encourages non-artists to take a more painterly approach to the visual component of their presentations.

Computer painting is quick and clean and it makes multiple iterations (versions) easy to produce. All of these are great advantages but they also have their downside. Speed is important in a busy design studio with a deadline, but sometimes the act of mixing paint, or waiting for one layer to dry, gives you time to contemplate the next step in imagemaking. If art is at least partly a process of personal development, then it has to be taken at walking pace. Similarly, the chance to try out ideas and undo them if they don't look right is sometimes a godsend, but it can remove some of the tension essential to fine-art illustration.

The final question is what you do with your on-screen creation. Designers and desktop publishers will undoubtedly send their final images to print. Painter has no colour separation facilities and only rudimentary image processing tools, though any PhotoShop Plug-in can be used. Nevertheless, images can be saved in one of four popular formats (TIFF, RIFF, PICT and PhotoShop), so separation and processing can be done elsewhere.

For fine artists and illustrators in particular, size is also a real problem because they often work with a much higher upper limit than A3 (the current maximum practical all-at-once WYSIWYG screen-size). A1 or A0 are common. Really large prints from Xerox/Colossal Graphics are now possible, as are large scrolling screen documents, but the cost of the former and the memory and speed constraints of the latter put them just out of reach for the average LC user — but not for long.

### Conclusion

Who is this package aimed at? The combination of Painter, a reasonably well equipped Mac LC, and a Wacom tablet, seems at first sight to be the answer to an artist's prayer for an electronic medium worth using. But there are limitations. An LC with extra video RAM using a standard 12in monitor can display many thousands of colours, giving almost True Colour, but the display area is tiny. This is not helped by Painter's huge icon palettes, beautiful as they are. Learning the key equivalents is essential. Speed of mark making is also a bit of a problem — periodic coffee breaks to let your brush catch up are essential — but the system is usable and the final image is usually worth the wait.

If you have a large-screen, 24-bit system then Painter is great, especially for those rough visualising sketches that you would normally do on a layout pad, even if a decent colour Mac was up and running on your desk. Those of you who are not the design elite — or David Hockney — shouldn't be put off though. Sooner than you think, 24-bit displays, notepad computers and pressure-sensitive tablets will become integrated — and affordable. They might even be made by Apple.

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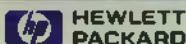


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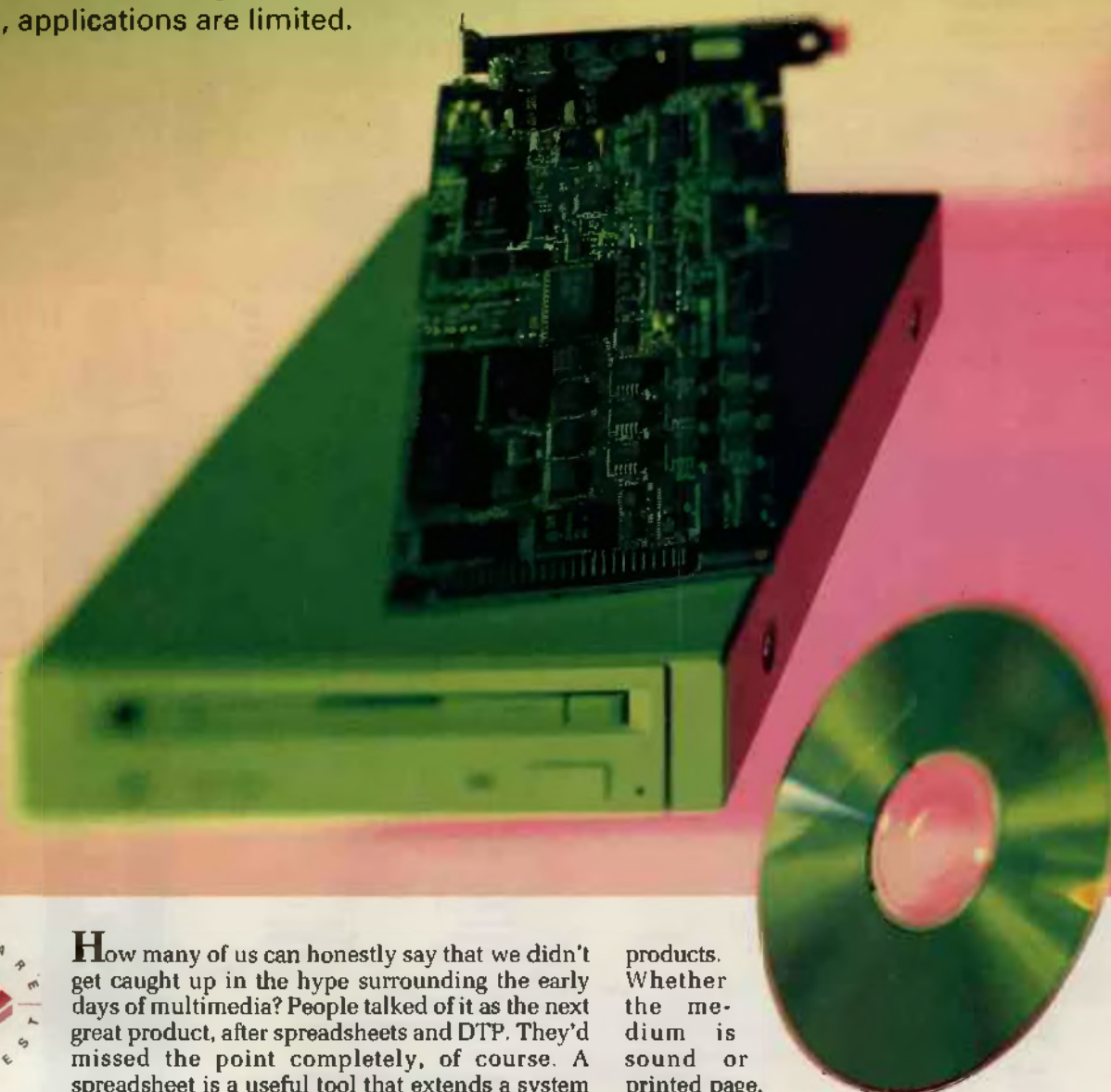
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# Multimedia PC Upgrade Kit

In the software MediaVision has provided with the Multimedia PC Upgrade Kit, the company has gone some way to defining just what 'multimedia' is. But Guy Swarbrick found that generally, while the underlying hardware platform is quite strong, applications are limited.



How many of us can honestly say that we didn't get caught up in the hype surrounding the early days of multimedia? People talked of it as the next great product, after spreadsheets and DTP. They'd missed the point completely, of course. A spreadsheet is a useful tool that extends a system accountants already knew into areas previously undreamed of. DTP effectively gave 'the man in the street' the ability to publish in a form others would find attractive while retaining complete control, both over the publication and the deeds to his house.

Multimedia offered... what, exactly? What is multimedia? A silly question it may be, but most multimedia products are nothing of the sort. They are single-medium products, or at best dual-media

products.

Whether the medium is sound or printed page, still or full-motion video, few products really offer multimedia facilities.

Let's suppose you've gathered together a collection of sound cards and digitisers, scanners and printers, video cards and compression boards. What do you have? Multimedia, that man at the back? Yes, sort of, but what are you going to do with it?

In practice, what you have is a PC that will blink, bleep and burp (that's what most people seem to do

PHOTOGRAPHY BY BRUCE MACKIE



as soon as they get an audio digitiser...). What, exactly, are you going to do with it?

That's where multimedia differs from spreadsheets and DTP. It isn't a tool that provides a solution to a problem. It's a lower-level set of tools that acts as a platform on which you can build tools to solve problems.

If you think that's a rather cynical view, take a look at the *European Multimedia Yearbook 1992*, where the first 96 pages, nearly a third of the book, are devoted to the technical issues. Almost exclusively hardware issues. There's a breather in the middle, then the second half of the book is devoted to a directory of, almost exclusively, hardware suppliers. It isn't the book's fault. It's reflecting the market brilliantly.

## MediaVision

When we reviewed the Pro AudioSpectrum sound card a few months ago, MediaVision reckoned we'd missed the point completely. We'd reviewed the product as a sound card when in fact it was a multimedia product. (The company also accused us of getting the name wrong. Just because the box said ProAudio Spectrum, we shouldn't have assumed that was the product's name.)

Our initial reaction was to recite a speech similar to the introduction to this article. Then a rather large box arrived. In it was another Pro AudioSpectrum card, the adaptor to activate the on-board SCSI port, a Sony CDU-6211-10 external CD-ROM drive and (and this is the clincher) some software. Well, rather more than 'some software'. The first thing out of the box was a CD-ROM containing the Multimedia Extensions to Windows, now renamed Windows with Multimedia. The first card had drivers for Windows/M, but that wasn't really a big deal. Windows/M is just another part of the platform, not a solution in its own right.

The other two CD-ROMs in the box contained Jones in the Fast Lane, a multimedia game from Sierra Online, and Compton's Multimedia Encyclopedia from Britannica Software (the people who ruined the Guinness Disc of Records).

That changed the situation a little. This was multimedia. Better still, not included with the package but sent along to whet the appetite, was a CD-ROM from MPC (the Multimedia PC), a consortium headed by Microsoft to promote Windows/M and the idea of the MPC, a minimum machine for multimedia (see page 234).

## Hardware

For a detailed description of the Pro AudioSpectrum board your best bet is a quick flick back to the Short Reviews section of our November 1991 issue. Suffice it to say that the board has sound capabilities way above those of the AdLib and SoundBlaster boards, with which it is compatible, though some way short of Roland's line of musical accessories.

To those of us without Windows with Multimedia, that's rather academic. Nobody has yet released software that uses the board directly, so all you have is a very expensive SoundBlaster (for those who don't want Windows with Multimedia, MediaVision sells a low-cost sound card, the Thunderboard). But even that's not fair. The bare, unexpanded card offers the ability to record audio

to the hard disk and, with an external box, a MIDI controller. For multimedia, though, a CD-ROM drive is essential.

My first reaction on seeing the add-on that converts the simple sound card into a SCSI controller (or, rather, liberates the card's inherent SCSI controlling abilities) was that I'd be losing another slot. When my brain finally clicked into gear again, I realised that I'd gain one when I took the Hitachi CD-ROM controller out. If I had a PC with a built-in SCSI port, though, I would have been a little upset because I would either have had to disable the original port to be able to use the integrated audio functions the Pro AudioSpectrum card provides, or keep the original controller and lose the audio wizardry.

Setting the card up takes a couple of minutes and you can get it wrong. The cable that joins the full-length card to the SCSI add-on (which is really little more than the bracket and a few connectors) is a familiar grey ribbon. What's missing is the familiar pin numbering which, with the aid of the red edge on the cable, enables you to put the cable on right first time. In addition to the SCSI connector, there's a PC speaker connector which routes either PC beeps through the CD-ROM drive or CD audio through the PC speaker. Both seem a little pointless but the manual doesn't say which is attempted, and to help preserve the sense of mystery, neither work.

Externally, a twin-cable, phono plug terminated lead connects the left and right audio channels of the CD-ROM drive to the card. A Centronics parallel-like cable (D connector to conventional SCSI) allows the drive and the PC to communicate.

There really isn't much more hardware involved. Three 3.5mm mini jacks take audio to mini-speakers and an amplifier and provide microphone input. The joystick port, with the aid of an adaptor, provides MIDI communications for controlling similarly equipped electronic musical instruments.

That's a little odd. The MPC Multimedia PC specification provides for both joysticks and MIDI control. The Pro AudioSpectrum provides both, but they are, apparently, mutually exclusive. Equally strange is that only one, rather than the usual two joystick ports is provided. The first problem disappears when you see the adaptor — the joystick connector is passed through. Microsoft Flight Simulator fans with yokes and rudder pedals are out of luck: we're stuck with a single joystick port.

You may have noticed that there's an important element of multimedia missing — video. It's there already, of course. You need a VGA card to run Windows with Multimedia at all. VGA is no big deal, and in fact, many of the applications require a 640 x 480, 256-colour SuperVGA card. Not as a minimum; that's what you need. Try to run them on something better, like Opta's MonaLisa in 1024 x 768, 24-bit and they simply refuse. Bizarre. No, on a device-independent platform like Windows, it's more than bizarre. It's unacceptable.

## System software

Although the (poor) documentation provided with the Multimedia PC Upgrade Kit doesn't say so, there are a number of DOS drivers you need to get the card to work properly with Windows with Multimedia. The most obvious are those for the CD-



ROM drive. TSLCDR.SYS is the driver for the Sony drive and is installed automatically into CONFIG.SYS.

The program MSCDEX.EXE provides the necessary extensions to DOS to allow the drive to work. If you have an old version on your hard disk, don't assume that you can skip the installation routine. In order to run some of the sample applications you need the latest version (2.20) and the command line parameters aren't exactly intuitive.

You'll also need MVSOUND.SYS, the driver for the sound card. Everything will appear to work without it; you'll get no error messages to hint that there's a problem. Nor will you get any sound.

There are a couple of bundled DOS applications (the same as those supplied with the bare card). A simple MIDI sequencer and a synthesiser/sampler/CD audio mixing application complete the picture. I couldn't get the sampling to work properly, or the CD recording to work at all, but the promise of doing these things under Windows meant that I wasn't too bothered.

### Windows with Multimedia

Installing Windows with Multimedia will be familiar to anyone who's installed the bare bones version of the Microsoft GUI, since the installation program's the same (actually it's a unique version, halfway between the Windows 3.0 and 3.1 programs, but who's counting).

If you have a vanilla 3.0 already installed, the Multimedia upgrade will also upgrade your GUI to the bug-fixing 3.0a. Unless you have network problems you probably won't notice the difference, but what the hell. It's free.

There really isn't much to the upgrade, so you could argue that pressing a CD-ROM to do it is something of a waste. If you're prepared to enter

former was installed on top of Windows 3.0, the latter on to beta release 2 of Windows 3.1. Again, both worked fine.

What did cause a few problems was when beta release 3 of Windows 3.1 arrived. This is the version after Microsoft decided to add the audio portions of the multimedia extensions into the retail version of Windows. Nothing I did could get the rest of the multimedia gadgets running with this version of the GUI. I suspect there is either some work to be done papering over the cracks, or that there will be a new release of Windows with Multimedia around the time Windows 3.1 comes out.

### Spot the difference

So what's different, once the extensions are installed on top of 3.0? Surprisingly little. The Control Panel has changed and much more closely resembles the version incorporated into 3.1, with a series of modules within a window rather than the fixed format under 3.1. The additions are titled Display, Drivers, Joystick, MIDI Mapper, Sound and Screen Savers, although the last isn't, strictly speaking, a Multimedia Control Panel. Apple must be doing something right: each release of Windows gets more and more like Finder.

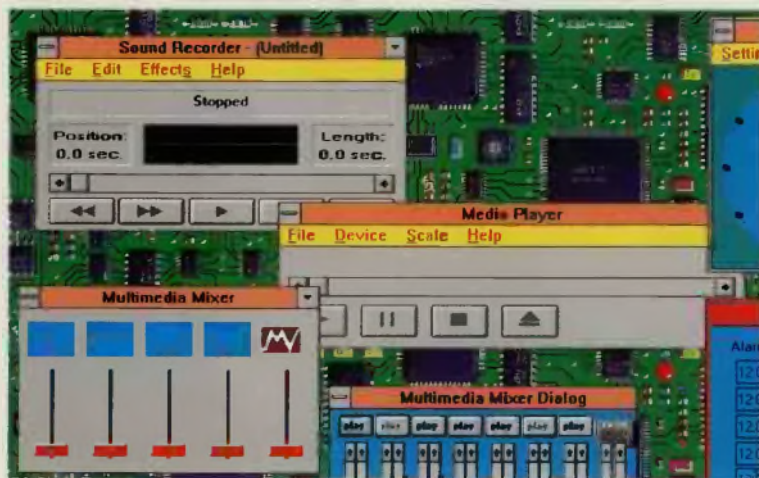
The function of most of the new Control Panels is fairly obvious. Sound is the only interesting one, the others are merely functional. Like SoundMaster on the Mac, it allows you to assign sounds to different system functions, like the system beep, or on startup, or every quarter of an hour or whatever. Sample sounds include a rather good gong and some short speech samples.

More interesting, if less useful, are the seven utilities that come with the MediaVision bundle, some from Microsoft, some from MediaVision itself. The Alarm Clock is a useful extension of the standard Windows clock, the Media Player replays sound samples, and the Sound Recorder... well, records sound, funnily enough. Mixer and Pro Mixer control input and output through all the available audio channels, the former rather crudely, the latter with rather more control than most people would need. Music Box is a simple system for playing audio tracks on the CD-ROM drive. The final application, Hyper Guide, is simply a Multimedia help program which provides a concise version of the already sparse manual, but in a slightly more attractive format.

The good thing about the applications is that they show you what the hardware is capable of. The bad thing is that they show you what the hardware isn't capable of.

Recording is crude, even with a high-quality microphone, and I never did get the CD-ROM drive to play audio. The setup is simple, once you figure it out (the manuals don't help much) but the performance is inconsistent. You can have everything working fine and reboot for some reason and recording stops working, or playback stops working.

There's a lot of kit in the Dell 433P that the tests were carried out on: TSRs, memory managers, caches, video cards. I suspect there was more than one combination of hardware and software that caused problems. And that's where the concept of Multimedia under Windows (pre-NT, at least) starts to fall down. Literally.



△ The number of true multimedia applications may be small, but Windows with Multimedia does at least have some useful utilities and demos

into such an argument, you obviously haven't been keeping up with CD pressing economics. Even without the demos that MediaVision has put on the disc, it's far cheaper to distribute software on CD-ROM. Unfortunately nobody does, because you can't usually rely on your customers having the drives. MediaVision, of course, can.

I actually installed the extensions twice, once with my old card and the Hitachi drive and once with the Sony drive running through the new adaptor. Both, unsurprisingly, worked fine. The





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## The Multimedia PC

Perhaps the most interesting thing about MPC and the long-term impact of Windows itself is the liberalisation of the PC market. Compatibility is ceasing to be an issue. Provided you have the core operating environment, you can add whatever hardware you like. All you need are the drivers.

### Core environment

But what is the core environment? MPC, Microsoft's Multimedia PC marketing organisation, defines the minimum specification for the PC itself (see below). It is a little unadventurous, but like sound on the Mac and Digital Signal Processing on the NeXT, the important thing is that developers know this is the least they can expect to find in any machine.

The nature of Windows, and NT when it arrives, means that the nebulous definition of things like audio synthesisers is unimportant. If you can send the correct instructions to the driver and the driver operates the synthesiser correctly, there shouldn't be a problem.

What might be a problem are the software standards. MPC has defined a lot more than the hardware. A family of file formats collectively known as RIFF, the Resource Interchange File Format, covers audio, video (still and animation) and text.

As you might expect, Microsoft didn't look too hard for the formats. Text is its own RTF (Rich Text Format). The important thing is not whose standards they are,

but that they are standards and RTF is up to the job.

There are two types of audio files. MIDI, sensibly enough, follows the accepted 1.0 version of the MIDI file format, while digitised sound is stored in .WAV or WAVE files. Currently the standard only allows for Pulse Code Modulation (PCM) data, but is designed to be extensible. Mono or stereo, 8 or 16-bit, 11MHz, 22MHz and 'CD-quality' 44kHz are catered for, although the latter suffers from an insatiable appetite for hard-disk space, particularly in 16-bit stereo mode.

### Microsoft graphics standards

One thing Microsoft is good at is defining graphics standards. Well, arguably the company is very bad at it, since it has defined a lot of them and doesn't seem entirely happy with any of them. In the context of RIFF, there are three options. Windows Metafiles are the old object-oriented files that you may or may not remember from the file conversion menus of Windows applications, the only place they ever seem to appear.

The others are variations on the DIB (Device Independent Bitmap) specification. The first is the vanilla BMP file of Windows 3.0 fame. The second, RIFF DIB (or, to abbreviate the abbreviation, RDIB) allows for up to 32 bits per pixel.

Still video is relatively easy. Animation is a little more tricky. Windows with Multimedia may be with us, but the animation portion of RIFF isn't quite ready

(fortunately, the hardware isn't here yet either). The specification is based on MacroMind Director's file format but, as yet, the only aspect of it that has been published is the name, the Multimedia Movie Format.

To hang the whole thing together there's a protocol for communications between hardware, device drivers and software. The Multimedia Control Interface (MCI) is an ASCII string protocol allowing applications like Guide, through its LOGIX communications program, to control complex hardware without any modifications.

At the moment, you need to be quite intimate with all this to achieve anything. Even application development environments like Guide or Toolbook, which are well suited to the actual production of multimedia applications, need a lot of additional work to access the multimedia extensions.

### Dedicated to ASCII control codes

Hiding RIFF and the MCI from multimedia authors is not difficult, but it will take a little time. We may see great multimedia applications before that happens (there are some dedicated multimedia enthusiasts who actually enjoy manipulating complex publications with ASCII control codes). Each to his or her own, but my guess is that within six months we'll have sensible development tools and within a year of that, the first great — or at least really good — applications.

## Multimedia applications

The acid test is the quality of the applications that are available to use the new environment. Without wishing to spoil the ending, they really aren't that hot. They're also pretty much what we've come to expect — encyclopedias and (pretty dire) educational programs. Of those

actually supplied with the upgrade kit, only one is a usable Windows with Multimedia application, a version of Compton's Multimedia Encyclopedia.

I should point out here that I love encyclopedias. My Cambridge paper example is well thumbed, despite being less than a year old. I can sit for hours following references and getting lost in the sea of information.

Compton's really isn't like that. It's much harder to browse an electronic encyclopedia anyway, but it can be done. As my colleagues will testify, I can browse through on-line services for hours. Compton's suffers from one of two faults: either there isn't very much in it, or the interface is lousy. I suspect the former because, while it is a little restrictive,

the interface *feels* OK. You just can't, or don't want to, spend hours browsing through it. The quality of the images is pretty poor; if there are any animated sequences I didn't find them, and the sounds make the images seem good.

## Conclusion

Multimedia as the basis of solutions to real problems is still some way off. Encouragingly though, the underlying platform looks quite strong. The basic ideas behind MPC and even Windows/M are right and the prospect of multimedia applications running on the faster Windows 3.1 or even on Windows NT are mouthwatering.

The hardware underneath the user interface is looking pretty healthy, too, if not quite ready to take a starring role on the desktop. Full-motion video has some way to go, but still video, sound and speech are pretty well advanced. Use of scalable fonts (even if it has to be Microsoft's appalling TrueType) should mean that applications which are acceptable on today's 640 x 480, 256-colour graphics cards are stunning on the 1024 x 768 plus 24-bit cards of tomorrow.

What is still missing is the software. The MPC demos are clever, no doubt about it, but they are limited. Graphical packages with sound tacked on are decidedly not examples of the best the technology can produce.

In the end, evolution must take its course. Either revolutionary multimedia applications will appear or the PC will simply have evolved into a better all-round tool for business and education, science and art, engineering and design. Either way, we end up with a better product.

### MPC minimum specification

- 12MHz 80286 or better
- 2Mb RAM
- 30Mb hard disk
- VGA
- CD-ROM drive with audio output
- 8-bit sound input and output
- Audio synthesiser
- MIDI support
- Joystick controller

### Specifications

#### Multimedia PC Upgrade Kit contains:

- External or internal CD-ROM drive
- Pro AudioSpectrum sound card with SCSI interface
- Windows with Multimedia
- Jones in the Fast Lane
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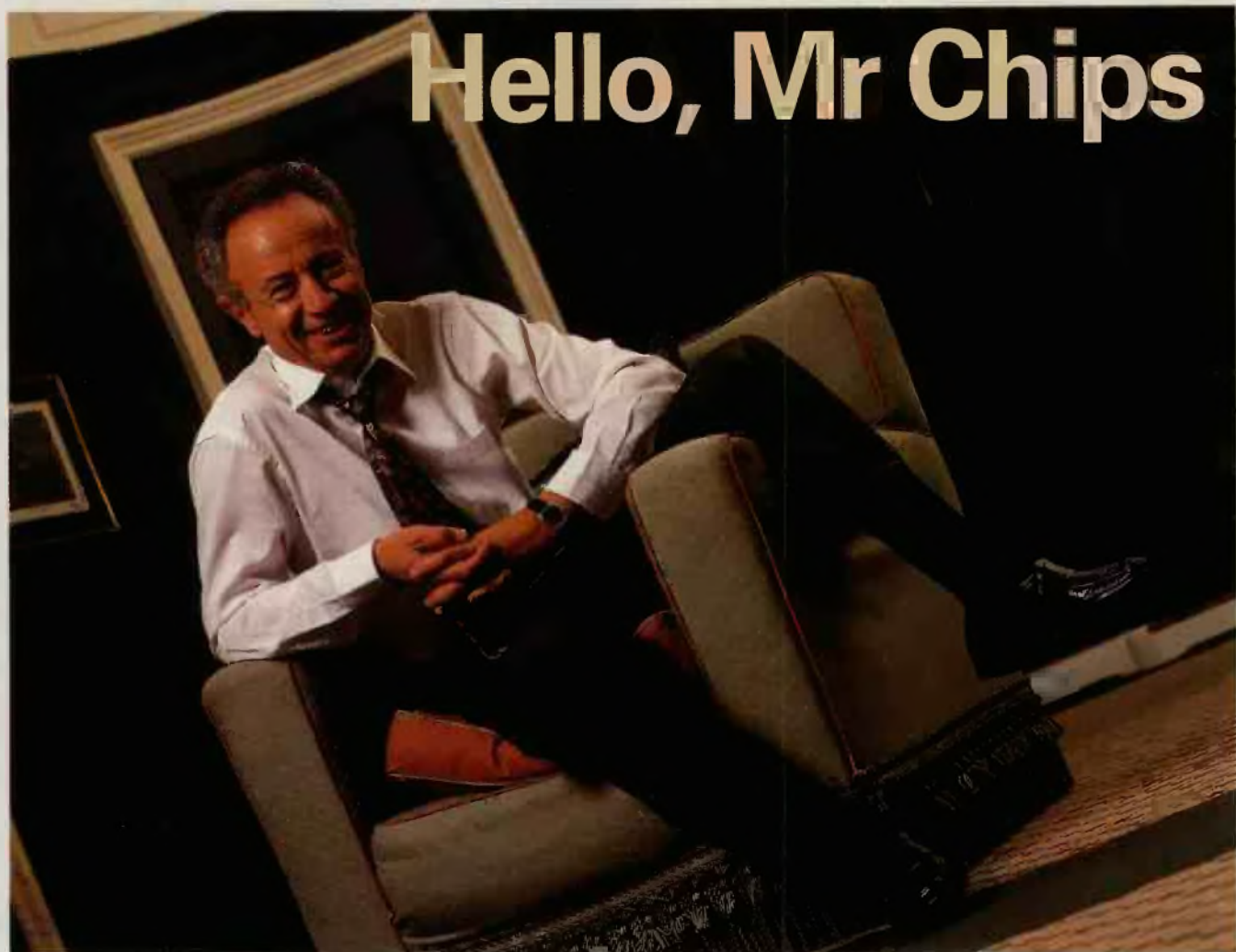
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# Hello, Mr Chips

Andrew Grove, affable world head of worldbeating chip manufacturer Intel, tells Geof Wheelwright about how he sees the future of computing and uppity rival manufacturers, and about how the challenge from RISC chips will turn out to be just a flash in the pan.



Andrew Grove is not your typical computer industry mogul. He is a co-founder of Intel, the largest and most successful microprocessor company in the world, and has led the personal computer industry by the nose for most of its 15-year life — but you wouldn't know it to talk to him.

He greets you with a winning smile, a twinkle in his eye, and a manner that suggests that being president of Intel is just what he does for a living, and that he really can't wait to get home, slip his shoes off and relax. Unlike most CEOs of large US computer companies, Grove does not appear a zealot for PC technology — nor even for Intel itself.

During our interview, he was as comfortable getting into the fairly outlandish poses suggested by our photographer as he was in discussing his then-upcoming keynote speech at Comdex '91 in Las Vegas.

But behind the easy manner and laid-back style is a self-made man in the best traditions of American business. Grove was born in 1936 in Budapest, Hungary, and after making his way to the United States graduated in 1960 from City College of New

York with a Bachelor of Science degree in chemical engineering. He took his PhD at Berkeley (near San Francisco) and landed his first job at Fairchild Semiconductor. There Grove stayed until he was invited to help found Intel with Robert M Noyce and Gordon E Moore in 1968, with the goal of developing a process to allow several thousand transistors to be integrated on a single chip of silicon with relatively high production yields. Shortly afterwards, the first Intel microprocessor was born.

## Market domination

Intel has since come to dominate the microprocessor industry, with PCs from every major manufacturer (except Apple) basing their systems around Intel-architecture chips. Over the past two years, however, Intel's position has been challenged.

MIPS wants to steal the high-end PC business from Intel's 80486 and (when it comes) 80586 processors. Motorola is attempting to woo IBM away from Intel by supplying the RISC chips for the new joint Apple/IBM PC products expected in 1993. And long-time rival AMD has won the right



through the courts to make processors compatible with the 80386 and 80486.

Grove and the Intel management claim not to be worried by these threats. In fact, Intel is currently implementing its most aggressive manufacturing expansion programme yet, with the development of a new facility in Ireland.

He says that the site will include a wafer-scale fabrication plant, an OEM (original equipment manufacturing) PC manufacturing facility, as well as service, repair and support facilities. Probably the most surprising to Intel-watchers is the OEM plant. Intel is not well known for building and selling ready-built personal computers.

Yet tens of thousand of systems will roll out of the Irish factory this year. It's a strange business. The reason for the high sales levels has little to do with the machines' appeal to dealers, or even to corporate computer customers. Intel PCs are only sold through VARs, VADs (Value Added Distributors) and OEMs. The latter is probably the largest element, with systems going to the likes of AT&T, Unisys and Siemens. In most cases, customers are high-end computer manufacturers who need to have PCs to complement their existing ranges of mini and mainframe systems, yet don't want to bother reinventing the wheel and designing an IBM-compatible system from scratch.

### Market testing

Intel is even happy to sell to manufacturers who want to test-market new machines to fill holes in their PC range. Siemens, for example, bought in Intel PCs until it found that it was selling enough to make a Siemens-built model viable. Grove admits that OEM work is never likely to be a major part of Intel's operations, and that whatever success it does have requires flexibility from Intel. AT&T signed to Intel (after years of buying its systems from Olivetti, which it part-owned) only after Intel turned over its PC product development to AT&T for 18 months, and then built its new systems to AT&T specs.

But Intel is not the only company doing this. Taiwanese PC success story Acer (which last year bought up multi-user computing house Altos) recently went through the same OEM PC design process for ICL. Despite its OEM personal computer sales success, Acer has also started selling its own-brand PCs through dealers — an approach Intel has so far declared impossible for itself. Intel's problem is understandable. As the sole supplier of processors to the likes of IBM, Compaq, Olivetti and any other manufacturer of high-end PCs you care to name, Intel cannot afford to upset its customers by being seen to compete directly with them.

Intel does claim that establishing a manufacturing facility in Ireland has been some help in building its European business — which is a more ambitious operation than anything the company has in the US. The site sits on some 170 acres and its manufacturing capacity is due to develop in three stages: first a £40 million PC manufacturing system, then a £200 million microprocessor wafer fabrication plant, and finally a £60 million component assembly and test facility. The site will eventually hire some

2600 employees. Part of the reason for this is the persuasive nature of the Irish Development Agency: with its grants for capital expenditure, 10% flat corporate tax rate, and assistance in payment for the training of staff, it has already persuaded Amdahl, Wang and Apple to locate operations in Ireland.

### Instant factory

Grove is ebullient on the Irish topic. 'The biggest significance of this gigantic operation is that we are going to spend \$700 to \$800 million on just the (chip manufacturing) fab area alone. As for the decision to locate in Ireland, it actually took us longer to make a decision to build a fab area outside the United States than to settle on Ireland as the location for it.'

The Ireland site at Leixlip will not just be a manufacturing operation for Europe, he said. 'It will be supplying our global requirement.'

Development was quick: a greenfield site in January, 1990, was producing just one year later some 250 circuit boards (including motherboards to be used in OEM PCs) and 200 complete personal computers every day.

To most users, however, Intel's manufacturing investments and OEM PC business is a sideshow. The main event lies in its research and development efforts — particularly those centred around the 80586 (codenamed 'P5' at Intel).

Grove says his R&D team has given him strict orders not to talk about the product until it begins shipping next Summer, but Intel has already given a number of detailed press briefings on the subject.







According to European vice-president Steve Poole, the company's focus when developing new microprocessors has until now been on compatibility. The 80186 and 80286 had to be compatible with the 8088 and 8086; the 386 had to be compatible with the 286 and the 8086; and the 80486 had to build in



compatibility with everything that had gone before, operate much more quickly, and incorporate a maths co-processor.

But Poole says the P5 designers were able to work from the ground up developing a processor that would break all land-speed records. 'The design focus for the 486 was that it still had to integrate everything onto a chip — cache, clock, co-processor, etc,' said Poole. 'The 486 falls down in that its floating point performance isn't as good as it could be and its ability to process numbers doesn't offer any significant advantage [over the 386 with a co-processor].'

He reveals that the P5 is a much more complex product than the 486. The 486 packs 1.2 million transistors; the P5 has a 'budget' of 4 to 4.5 million. 'We just have to put a 486 core on it and then we can just add to it what we want — and we want performance, we want something which will

scream,' says Poole. 'It will offer a performance level which stands toe to toe with anything the RISC companies can produce. The emulations we have done so far suggest that it will be eight to nine times that of the 486.'

'We believe that the P5 will re-establish the x86 architecture as a performance architecture, and with it we will offer a future development story that will show a path forward. From a performance point of view, this business of having to choose RISC from a performance point of view will go away. It will be killed. The future of microprocessors will then be dictated by our ability to make process improvements that allow operating speeds to go higher and higher and to continue to design ever larger and larger chips.'

Poole's boss and worldwide head of Intel, the affable Mr Grove, is not quite so forthcoming and claims to be 'not the world's greatest expert on the P5'. But he is quite talkative about how the chip will help Intel knock all the other microprocessor companies into a cocked hat.

'It will be a high-performance processor using a variety of architectural techniques. Its performance headroom is going to be bigger, so it is not going to be a matter of just cranking up the frequency [from, for example, the current ceiling of 50MHz on the 80486DX]. We have also been aided in data integration by advances in silicon technology — advances that have to do with integration, security and other issues that will provide a better-equipped platform for enterprise-wide and networking applications.'

### Computer-supported collaboration

'This is particularly important in our view because of our contention that the decade of the 1990s will see the industry go toward the development of group and enterprise-wide applications. The phrase 'computer-supported collaboration' seems to cover what we are talking about. It will require strong security features and enhanced stability.'

P5 aside, Grove is keen to promote Intel's other processors. 'We have probably had more experience learning the virtues and drawbacks of compatibility than anyone else. If a machine can be made compatible, and reach approximately the same performance levels, there is no contest. But the invisible costs of switching a reprogrammable architecture are huge, and they are not invisible to the supplier.'

'We have seen what you might call the rest of the iceberg. As we have learned the reliabilities of these systems, we have adapted our architectures to platforms where we can put these things to use. The Intel i960 RISC processor, for example, became an I/O processor and has been used a great deal for laser printers. We have now shipped more than 250,000 units — making it the most successful RISC processor. Meanwhile, the i860 is becoming a graphics accelerator and is being used for CAD work.'

It is hard to believe that Andy Grove is the head of a company which so many people in the computer industry charge (off the record) with being exploitative. Some of the answers to my questions show that Mr Grove, while not happy to see the influx of rivals gearing up for the battle to dominate the second PC decade, is more than ready for it.



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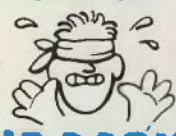
**DAY 2**  
**TAKE A**  
  
**CHANCE**

**DAY 3**  
MAKE 24  
PHONE CALLS  
~  
LOSE  
2 DAYS

**DAY 4**  
CONFUSED BY  
CONFLICTING  
INFORMATION --  
GO BACK  
2 DAYS

**DAY 5**  
RECEIVE  
17 QUOTATIONS  
~  
LOSE 5 DAYS  
EVALUATING

**DAY 23**  
OUT OF SPACE  
ON HARD DISK  
~  
MISS  
A TURN

**DAY 22**  
**STAB IN**  
  
**THE DARK**

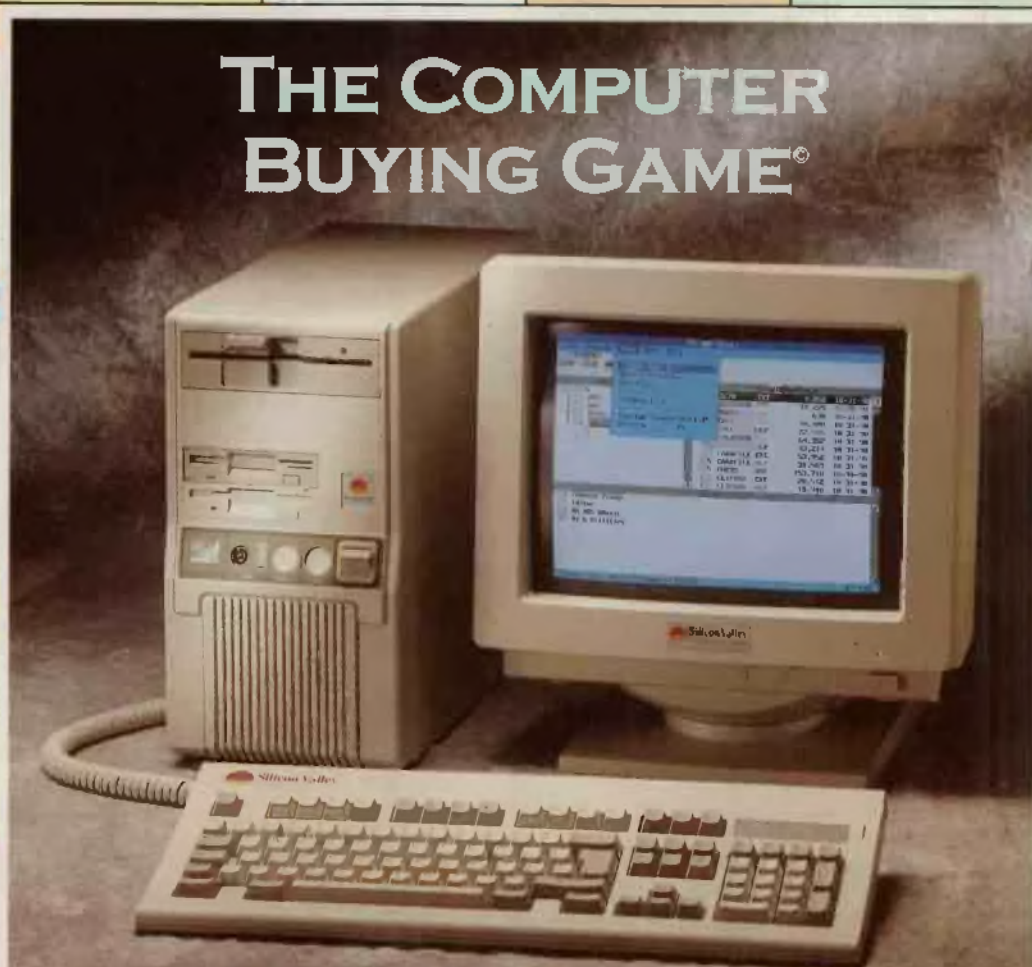
**DAY 21**  
MACHINE FROM  
THE FAR EAST  
BREAKS DOWN --  
WAIT 2 WEEKS  
FOR REPAIRS

**DAY 20**  
LAND BIG CONTRACT  
BY RESPONDING  
QUICKLY WITH  
SILICON VALLEY  
COMPUTER --  
GO ON TO FINISH

**DAY 19**  
**HOPE FOR**  
  
**THE BEST**

**DAY 18**  
LOSE A WEEK --  
MACHINE  
FROM  
THE FAR EAST  
IS SO SLOW

**DAY 17**  
EXCEED  
BUDGET  
**GO TO JAIL**



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**DAY 6**

VISIT  
6 SHOWROOMS  
AND UNTOLD  
DEMOS --  
LOSE 4 DAYS

**DAY 7**

**RISK**  
  
**EVERYTHING**

**DAY 8**

SUPPLIER  
GOES BUST  
~  
GO BACK  
3 DAYS

**DAY 9**

ARRANGE A  
DEMONSTRATION AT  
SILICON VALLEY --  
MOVE AHEAD  
3 DAYS

**DAY 10**

**HAVE A**  
  
**GAMBLE**

**DAY 11**

DON'T GET  
ENOUGH RAM --  
LOSE A WEEK  
WAITING FOR  
UPGRADE

**DAY 12**

ARRIVE AT  
SILICON VALLEY  
**FREE PARKING**

**DAY 16**

MACHINE ARRIVES  
FROM THE FAR EAST,  
BUT IT WON'T  
WORK --  
LOSE 7 DAYS

**DAY 15**

BUY A  
SILICON VALLEY  
COMPUTER --  
MOVE AHEAD  
5 DAYS

**DAY 14**

**FINGERS  
CROSSED!**  


**DAY 13**

MAKE A  
DECISION  
~  
MOVE AHEAD  
2 DAYS



### Thoughts of Chairman Grove On Intel's increasing involvement in producing networking products:

Networks are the key. Our involvement comes from this conviction we have that the applications we are driving towards are by their nature networked. We are using silicon technology to take the drudgery out of installing, managing and maintaining networks, so we have made a deposit on a line of self-installing and self-administering network adaptors.

We have tried to come up with innovative products that fit into the category of application-specific servers — such as our network Satisfaction board. With this product, we are putting a fax server on the network. There are lots of ideas we have [for networks], such as managing backup and storage automatically, and we have to do these things to make computers as transparent to use as possible.

### On the way networks will be used in the future:

The current ratio [of network staff to equipment] is one network administrator per network. Although this is 'doable' today, what if you want to wire up 100 computers? Current average network sizes are ten computers per network and at that rate...10 million network administrators would be needed. It's like when someone in the 1940s extrapolated the size of the telephone network [and decided it] would eventually require everyone who used a telephone to become a long-distance operator, and in the sense that most long-distance calls are now done by direct dialling, they were right. We will try to make network management functions so transparent that administration will just be one more function in any network application.

### On the future of Intel's 'flash' memory storage for portable, notebook and handheld systems:

I see this development running parallel to those in the notebook computer area. A substantial proportion of the user community that needs 'computer-supported collaboration' will be people using portables. With these tools, we are endowing the handheld computer user with the same computational power. Network interfaces and a human interface are mandatory for this whole generic application area to develop.

### On Intel's role in supporting the PCMCIA (credit card-sized) memory card standard:

This standard is not only for memory and storage. It will provide, for

example, a plug-in socket for LAN adaptors. Although Intel has played a major role in PCMCIA, you can't do it alone. My impression is that we are getting there. And the best way to move forward is to have support from a few substantial manufacturers. [Fujitsu, Shar, and Intel are all members of the PCMCIA standards definition body.]

### On the Intel reaction to ACE (Advanced Computing Initiative):

We just stick to providing what is unique. We have built a momentum where we are shipping 20 million 32-bit processors for every kind of RISC processor that's on the market. We are pouring a lot of money into the [further] development of that. There won't be the slightest reason for anyone to consider any alternative. We are 'sticking to our knitting'.

### On the challenge represented by AMD's recent marketing and development of 386 and 486-compatible chips:

What they [AMD] are getting is leftover crumbs from [their right to produce products based on] six-year-old technology. It is exactly the opposite extreme from what we are talking about. Whatever we do, it is still our obligation that no-one takes shortcuts at our expense. [Intel is well-known for challenging through the courts anyone it thinks is infringing its copyrights.]

### On how the new IBM/Apple/Motorola alliance might affect Intel's dominant position in the PC processor market:

Like ACE, this is predominantly a software development. And it is clear from the announcements by ACE, Solaris [the Sun

Microsystems plan to offer its graphical OS on the Intel hardware platform], and from the Apple/IBM group, that the software community has come to the conclusion that to be a viable contender you have to run on the Intel architecture.

The Apple/IBM agreement brings to our universe communities of developers who have not worked on bringing power and application to this architecture. What has happened at the chip end of the deal with IBM and Motorola is that two microprocessor architectures seem to have faded away [the IBM RISC chip and Motorola's 68040]. And there just aren't enough customers out there to support the design and validation [of these new IBM/Motorola chips]. It will be at least a half a billion dollar bill for all this and it is difficult to see even tens of millions of dollars in sales revenues for these processors.

I view all of these developments as a net influx of talent to help develop the [processor] architecture which has so far been limited by systems software architectures. Only a fraction of the power [offered by Intel processors] is being flowed to users because of software limitations.

### On Microsoft's role in the PC industry:

It is and has been the most productive developer of system software. For most of this decade it has been a small company trying to do a big job. It is not a criticism of Microsoft, but the amount of resource and development that went into processor development was not matched by that in systems software — and they are now catching up.





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# Pandoring to Big Brother?

The Pandora's boxes at Olivetti's Cambridge research lab are nodes in an experimental multimedia network. But are they, like the Pandora's box of legend, rather more sinister than they look? Do they contain the stuff of an Orwellian nightmare? Ian Burley reports.

*Andy entered the unfamiliar darkened room and prodded a button on the small plastic badge clipped to his lapel. A red LED on a wall blinked acknowledgement. Noiselessly the lights un-dimmed. A workstation in a recess flashed into life, displaying a document. Andy recognised it as the one he had last been working on. Suddenly, a colleague's picture appeared in a small on-screen window, heralded by a subtle beeping. Andy clicked a key and the colleague's voice came through: 'Andy, I've found you. Good. I noticed your usual workroom had been booked by someone else. Anyway, I've just seen your video-fax report from last night...'*



△ Dr Andy Hopper, looking out from the world of Pandora

The above might pass as an undemanding piece of science fiction or an attempt to set the scene for an advanced office, perhaps ten years hence. But the techno-trickery is a fact of life in part of what used to be Addenbrookes Hospital, in central Cambridge,

and is now the Olivetti Research Laboratories (ORL). The purpose of the lab, set up in 1986 and backed by Digital Equipment as well as Olivetti, is to explore the boundaries of computer applications.

From the number of Archimedes workstations at ORL you might suspect a tie-up with Cambridge-based Acorn Computers. Olivetti has a majority shareholding in Acorn, of course, and ORL's managing director is Dr Andy Hopper, who was behind the development of Acorn's Econet system. Acorn co-founder Hermann Hauser these days heads up Olivetti's advanced research wing — in between developing the troubled Active Book project.

## Doing the dirty work

The jovial Hopper seems the life and soul of ORL, but he's not easy to keep tabs on. The week I dropped in, his schedule included a day-trip to Italy, a couple of days in the States, various meetings in the UK, and a tutorial with an undergraduate. But Hopper is not above getting his hands dirty — the famed Cambridge Fast Ring (CFR) network, which he helped design, crashed during my visit and it was he who got it going again.

Most of the 30 or so researchers at ORL are Cambridge graduates, many with doctorates. ORL's relationship with the Cambridge University Computer Lab is intimate. There is collaboration on research, and students are welcome at ORL, which often takes a close interest in their projects. The set-up follows the pattern in the US, where research centres set up by leading computer firms are well-established around universities.

ORL projects are not necessarily product-oriented, though some have clear commercial applications. Xerox has already licensed the Olivetti-patented Active Badge technology, described in the introductory paragraph. ORL is very keen to distinguish itself as an advanced research, as opposed to a product development, centre. Engi-



neer Dr Tony King explained: 'Once a research project here stops being reasonably difficult, it's time to pass it on to somebody else to develop. Then we can turn our attention to the next cerebral exercise.' There may not be immediate commercial benefits but there can be spin-offs, and valuable experience is gained in fast-maturing technologies.

## Videophones

One exciting project is the Pandora multimedia communications system for Unix workstations connected by a fast network — in ORL's case the CFR. Pandora offers a sophisticated videophone and video email system, video conferencing, and instant on-screen access to a variety of audio-visual inputs: video, audio CDs, TV, radio, and the like.

Currently, it uses a graphical interface based on X-Windows. Despite the relatively low resolution of the Archimedes, picture quality is satisfactory. It's possible to have several incoming streams at once, though this is useful only as a demonstration unless it's coordinated as a video conference.

The Active Badge grew in a curious way out of the Pandora project. The story goes that research engineer Roy Want, who was working on Pandora's audio side, wanted to solve the problem of finding his colleagues in the building. In consultation with Hopper, the Active Badge project was born. Eventually it became Want's full-time work, which he has continued with Xerox in Palo Alto.

Active Badges are remarkably simple devices designed to communicate with sensors mounted on a wall or workstation and networked to a central monitoring system. The badges can tell the system where somebody is, and how near a workstation, and with how many people. The latest prototypes have a couple of small programmable buttons, a red and a green LED, a piezo speaker, and an infra-red transceiver. The infra-red signal is transmitted in 'bright' bursts of about a tenth of a second, enabling it to be reflected reliably off a wall and on to a sensor. Several badge wearers can be present in a room without signals interfering with each other.

A light-dependent resistor extends battery life by pausing transmissions in the dark — that is, when the badge is placed face down, or in a pocket or drawer. An on/off switch was omitted for fear that users might forget to switch on. A short-range field sensor registers radio emitters like security doors and workstations. The badge can thus be used for automatic security clearance, sending an identity signal in response to a radio challenge. It can also alert the system to switch on a workstation to 'resume as last left' when the user returns.

## Visions of Orwell

This has led to a vision of non-dedicated offices or workrooms, which set themselves up automatically for the work of whichever badgeholder happens to walk in. This control could extend to lighting and phone re-direction.

The Pandora system and Active Badges may conjure up Orwellian visions of Big Brother keeping tabs on future office workers. The reality at ORL is rather different. Everyone, including visitors, is given an Active Badge, but at base level this is little different from the security passes increasingly demanded in hi-tech offices. Any more is at your

discretion, because you can always hide the badge's infra-red transmitter from the local sensor.

ORL's receptionist can detect at a glance not only whether somebody is in the building, but where and how available they are. Availability status depends on how regularly a signal is detected at a specific location. Regular contact gives 100% status. Intermittent contact, showing someone on the move, reduces the percentage. After a three-minute gap in contact, the time of the last contact is shown.

## Hardware

Dr King points out that the underlying processing power is rather outdated. Six 5mips Inmos T45s per box sounds impressive, but the transputers were chosen three years ago as individual embedded processors rather than a clearly-defined parallel processing system. Pandora was a hefty hardware project, but Dr King envisages its successor as mainly software based, exploiting tomorrow's 100mips super-workstations.

ORL's current Pandora's box, usually hidden under a desk or table, uses one of its T45s to handle input from the local video camera. The signal from colour Sony cameras is sampled in mono at a VGA 640x480 resolution with 8-bit grey-levels (256 shades). In practice the image is displayed in square format using only 6-bit tones. The frame rate of 12.5 per second is a bit flickery, but acceptable.

A second T45 serves as a video mixer to combine



△ The Active Badge may be an experimental project but looks like a finished product



workstation graphics with the video input. The video mixing is done in analogue form. The Pandora unit has two links to the workstation: the RGB display output, and a transputer link adaptor card for bus-level communications. The system works with an Archimedes, but a PC version is on the way. In effect, the display comes from Pandora rather than the workstation itself.

The third T45 handles audio, which is sampled

△ The Windows-based video conferencing system points towards a commercially viable program





△ Dr Hopper sees the network, rather than the processing power of the terminal, as the limitation to the quality of video messaging

and transmitted at 8kHz — about telephone quality. The fourth T45 acts as a stream switcher, and the other two handle the CFR interface.

The CFR is a 50Mbit-per-second heavily time-sliced ATM (asynchronous transfer mode) network. A analogy for an ATM net is a loop of train carriages circling at high speed with data being loaded and unloaded as required. Two-way response times, vital for Pandora's real-time video and audio synchronisation, are quick because data is packeted in relatively small chunks. In ORL jargon, the granularity is good.

Potential transfer rates of up to 100Mbits per second in networks like FDDI are not necessarily advantageous to systems like Pandora because their data chunks can be too large: their 'granularity is too coarse'. This could be seen to put a question mark over Pandora's future. The Cambridge Ring protocol is not a worldwide standard. Neither Ethernet (10Mbits per second) nor the much slower ISDN digital phone lines will be anywhere near fast enough for Pandora's fancier functions.

But ORL is developing an even faster ATM-style network. Called the Cambridge Backbone, it is already shunting data at 500Mbits per second in the lab — 2Gbits is promised. More speed could see the introduction of colour and higher resolution graphics. With an expected growth in demand for Pandora-like real-time networked multimedia applications, ORL believes ATM networks like the Cambridge Backbone will eventually breed an international standard.

▽ The Acorn Archimedes is used as a workstation running X-Windows



### Pandora's modes

Pandora works in several modes, all currently under X-Windows on a 640x480 monochrome VGA screen. Each mode ascends in complexity and increasing resource appetite. The simplest is where only the local camera's view is being displayed. Virtually any PC has the power to do something like that. Of course, you get a reversed mirror effect. Hopper

explains: 'It's not a mirror, so you can't use it to help you tie a tie or comb your hair. But you can show something to somebody else and the writing will be the right way round.' In fact, there is an option to mirror the display.

'Look' mode lets you peer into a Pandora-equipped room. Twenty Pandora boxes are distributed around ORL and the Cambridge Computer Lab. There is just enough bandwidth to look at 18-19 Pandoras at once, albeit at a slower frame rate. Audio integrity has priority over video quality.

One-to-one video mode is subtly different from the usual sci-fi videophone depiction, where you see only whoever is at the other end of the line. Pandora shows both the remote and local views, on the grounds that most people like to know how they look to the other party — if only to centre themselves in the field of view.

Conferencing mode offers up to four simultaneous calls. It was confusing at first in the brief demonstration I saw because all the sound comes from a single Pandora speaker, usually situated under a desk. With everyone speaking, you need to work hard to know who is saying what. Stereo sound could offer a big improvement here.

### Introverts and extroverts

Pandora's videophone function is used a lot at the lab, but not everybody is drawn to it. Dr King, a chief research engineer for the project, doesn't have one hiding under his desk. He says: 'There are extroverts and introverts. The extroverts, like Andy Hopper and Professor Roger Needham from the Computer Lab, love using the videophone. I suppose I'm an introvert!'

But even he concedes that he would probably get used to the system. On a more personal level, all the ORL staff and some from the Computer Lab can be summoned up to introduce themselves via short recordings using a command called 'chaps'.

Pandora has a modest 16Gb of SCSI hard disk storage. Some data compression is used, ranging between 4:1 and 8:1, but compression is not considered a priority by ORL. Audio and video 'tracks' are filed separately on the system.

Video recordings can be integrated into conventional text-email messages as dynamic annotations. It makes the NeXT speech-annotation facility look archaic. A sliding cursor lets you scroll through the video file or jump sections. There is a full set of editing facilities like cut, paste and delete. Work is afoot to provide rough speech-to-text translation via Pandora.

Pandora boxes aren't on general sale, but ORL is offering them to selected research and educational establishments, at a price. Closer to general sale is a Windows-based mini-Pandora system. In its simplest form, this will let you view Pandora video-mail on reasonably fast standard PCs. A video-capture PC card has been developed and there are plans to offer network bridges giving ordinary PCs a level of compatibility with a Pandora-endowed network — if only at the video-mail level.

Andy Hopper reckons that sending and receiving video-mail from desktop computers will be commonplace by the year 2000. From what I've seen at ORL in Cambridge, I don't doubt him.



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
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Norton 6				£109	
Microsoft DOS 5				£59	
DR DOS 6				£59	
<b>COMMUNICATIONS</b>					
Crosstalk MK IV - Includes Terminal Emulation				£89	
Qdatasoft Datatalk - Very Popular				£109	
Sage Chitchat - Ideal for Prestel Or Telecom Gold				£69	
Laplink PRO V5 - Fast and Effective Data Transfer				£95	
A full range of modems, modem cards etc available. Please call.					
<b>SPECIALIST</b>					
Nazard - A must for businesses with hazardous products				£999	
PC Immune II - Anti virus Software				£29	
Auto Route Plus				£10	
Auto Route add on				POA	
<b>PROJECT MANAGEMENT</b>					
Super Project Expert				£499	
HVG Project Management III				£449	
Project for Windows				£379	

## TAPE BACKUP & CD ROM HARD DISKS

Model	Hard Disk	RAM	Speed	Mono	VGA
Fidcards - XT or AT				POA	POA
Seagate Hard Disks - Full Range				POA	POA
Irwin INTXT Tape Backup Unit				POA	POA
Everset INTXT Tape Backup Unit				POA	POA
Jumbo INTXT Tape Backup Unit				POA	POA
NEC CO-ROM'S				POA	POA
Hatchin CD ROM				POA	POA
Other options available, please call.					

## MICE & SCANNERS

Model	Hard Disk	RAM	Speed	Mono	VGA
Microsoft Compatible Mouse				£30	
Microsoft Bus/Serial				£69	
Microsoft Bus/Serial Windows 3				£39	
Logitech Mouse				£59	
Logitech Scanman 32+ XT/AT/286				£95/£175	
Canon A4 Flatbed Scanner				POA	POA
Epson GT6000 Scanner				POA	POA
Panasonic RS50U Flatbed Scanner				POA	POA

## MODEMS

Model	Hard Disk	RAM	Speed	Mono	VGA
<b>AMSTRAD MODEMS BEST PRICES</b>					
MIRACOM WS3000 INT/EXT			V22/2 V23/22BIS	£249	
MIRACOM WS3000 INT/EXT			V22/2 V23	£185	
MIRACOM COURIER			V32/22BIS/22/21	£435	
DOWDY QUATTRO				POA	
MODULAR TECHNOLOGY			V22BIS/22/2 V23	£249	
HAYES No. 1 in modems				POA	

## LASERS

**SPECIAL OFFER Hewlett Packard Laser Jet III £1045**  
**Hewlett Packard Premier Collection Fonts £20**



Model	Hard Disk	RAM	Speed	Mono	VGA
Canon LBP MK4 - Low Budget			PPM	4	£12K
Canon LBP-8111 - Scalable Fonts included			8	£15MB	£685
HP Laserjet 3P - Popular and Low Cost			4	1MB	POA
HP Laserjet 3D - Duplex Printing			8	1MB	POA
HP Laserjet 3si			16	2MB	£2515
Kyocera F800T			8	£12K	£930
Panasonic 4450I - Excellent value			11	£12K	£1029
Panasonic 4450 - popular postscript			11	2MB	£1569
NEC S600			6	2MB	£1185
NEC Colourmate PS/40			1	4MB	£3725
Star Laser Printer 8-18			8	1MB	£1099
Minolta, high quality at low cost					POA
All lasers include 1 year's on-site maintenance.					
<b>PERIPHERALS</b>					
HP LJet IIIP/III/IV			1MB Expansion		£75
HP LJet IIIP/III/IV			2MB Expansion		£125
HP LJet IIIP/III/IV			4MB Expansion		£170
Full range of fonts & consumables available - please call.					

## PRINTERS

Model	Hard Disk	RAM	Speed	Mono	VGA
<b>9-PIN 80 COLUMN DOT MATRIX</b>					
Epson LX400 - Replaces LX800			180/30 NLO	£120	
Epson FX850 - Popular Office Printer			290/54 NLO	£299	
Panasonic 1081 - Low Price, High Quality			120/24 NLO	£116	
Panasonic 1180 - 4 Fonts and More Speed			192/38 NLO	£113	
Star LC-20-NEW LC-10 replacement			180/45 NLO	£130	
<b>9-PIN 132 COLUMN DOT MATRIX</b>					
Epson FX1050 - Big Brother To The FX850			290/54 NLO	£389	
Panasonic 1695 - Faster Than The Epson			330/88 NLO	£295	
Star LC-15 - Excellent Value For Money			180/45 NLO	£295	
OKI 321			300/62 NLO	£365	
<b>24-PIN 80 COLUMN DOT MATRIX</b>					
Epson LQ450 - NEW LQ550 Replacement			192/84LO	£209	
Epson LQ570 - NEW with Scalable Fonts			210/70LO	£255	
NEC P60			300/150LO	£1	
Panasonic 1124i - Value And Performance			192/62LO	£230	
Star LC24-10 - Plenty of Features			170/57LO	£159	
Star LC24-200			222/87LO	£189	
NEC P20			210/108LO	£1	
<b>24-PIN 132 COLUMN DOT MATRIX</b>					
Epson LQ1070 - New Low End			210/70LO	£369	
NEC P70. Last Forever			300/150LO	£1	
Star LC24-15 - Cheap Letter Quality			170/57LO	£320	
Epson LQ1170 - NEW with Scalable Fonts			275/82LO	£529	
NEC P30 - NEW			210/108LO	£159	
OKI 351			270/90LO	£499	
<b>COLOUR DOT MATRIX PRINTERS</b>					
Epson L860 - Excellent colour quality			290/88LO	£445	
Epson LQ2550 - Fantastic Output			400/133LO	£765	
Star LC24 - 200 Colour Great value			222/87LO	£249	
Star LC200 - Colour			225/85NLO	£165	
Star ZA-200			420/84NLO	£265	
Star ZA-250			420/84NLO	£345	
<b>INKJET PRINTERS</b>					
HP DeskJet 500-Laser-Like Quality			3.5ppm	POA	
HP PaintJet - Full Colour, Unbelievable				£525	
Canon BJ10EX - New Portable				POA	
Canon BJ300				£359	
Canon BJ330				£415	
Other models and manufacturers available, please call.					
<b>PLOTTERS</b>					





# MicroLight 386SX

BiDesign's MicroLight is a glimpse of the future of PC technology: physically striking, small and light, it's a complete 386SX unit perfect for computing while commuting. As Rupert Goodwins reports, this is *really* giving the people what they want.



It's generally held that, in the world of high technology, the Japanese make things smaller. This might be true of walkmen and video cameras, but UK plc also has a fine track record in the art of sophisticated shrinkage. From Clive Sinclair's early matchbox-sized radios through to the Psion Organiser and Series 3, there's a great tradition of taking things to their Lilliputian limit (and, unfortunately, sometimes beyond). Indeed, many of the more

brehtaking examples of Oriental ingenuity are quietly designed here — the Sharp PC-3000 palmtop might have an Eastern air about it but it was born and raised in England, in the offices of Dip.

So it shouldn't be that much of a surprise to find that the MicroLight PC, a hard disk, 386SX computer somewhat smaller than many an external 3.5in floppy disk drive, hails from Sutton Coldfield in the Midlands. Credulity remains unstretched when it transpires that the people behind BiDesign Ltd, the company which produces the MicroLight, are originally from Apricot.

Many aspects of the Apricot product range failed to find favour, but few would disagree that the physical designs were, by and large, elegant, neat and small. Until now, BiDesign has made its crust by importing cheap, Far Eastern computers and providing a CAD (Computer Aided Design) consultancy; although the people in the company were perfectly capable of designing a computer with both hands tied behind their backs, it just didn't make any commercial sense when 286 motherboards were available for well under £50.

## Hardware

At 20x10x2.5cm, the physical size of the computer is the most striking external aspect. In fact, given

that the version we saw was preproduction and lacked lettering or logo, it's about the only external aspect: there are two tiny LEDs on the front panel, next to the 3.5in disk drive door, and there are connectors on two of the remaining sides, but otherwise it's as fine an example of a small metal box as one could hope to find.

There are five connectors along the back: power, mouse, keyboard, serial and video. The power comes from an even smaller box which houses a tiny switch-mode power supply that, to be frank, is rather underemployed. Since the unit takes just over an amp at 5 volts, it would be possible to build a conventional transformer and rectifier power supply of the sort that powers your transistor radio or answering machine for rather less money. Still, this approach is smaller and lighter.

Keyboard and mouse connections are the standard miniature DIN-style sockets that high-end PCs sport these days. The serial port is a 9-pin D-type; for most of the time during the review this was connected to a Microsoft serial mouse or LapLinked to another test computer. The video output is standard VGA; nothing special on the outside.

## Miniature connectors

Most of the left-hand side of the case is taken up by three microminiature connectors. These are for the external floppy disk, parallel port and expansion bus — the external floppy can be of any size and shape up to 1.44Mb at 3.5in. The parallel port is standard in everything except connector. BiDesign points out that the size of the normal connector rules it out, but I'm not really convinced; it's no deeper than the serial port they squeeze onto the back plate and there's a whole right-hand side completely unused. Then again, I didn't have to design the thing; it's a shame, though, that if you want to use a printer (or run software that needs a dongle — we were shown AutoCad not running because nobody had an adaptor for the hardware protection) you're going to have to remember the little adaptor.

Few true portables have made this compromise. In fact, no adaptor was supplied during the dura-



tion of our testing and so we're unable to report on the mechanical integrity of the system (printer cables are notorious for catching on peoples' feet and exerting strong tugs on hapless computers) nor whether it works at all.

The expansion bus is designed to mate with a larger docking unit, and as well as providing all the normal signals from an AT bus also brings out all the keyboard, serial port, video and mouse connectors. This way, you can slot the box into a docking unit that's already wired up with power and peripherals and start using it immediately, without having to fiddle around plugging in loads of separate leads. The (also unseen) docking unit will only have a couple of slots in it, both to keep the size of the thing down and because nobody can think of much to plug into the computer besides a network adaptor and possibly some form of external disk drive—CD-ROM, perhaps.

### Inside

It proved easy enough to get the computer apart: a couple of screws and a firm pair of thumbs on the disk drive surround got the main board sliding out in seconds. Surprisingly, for something that appears quite so unexpandable, there are a couple of good reasons why you might like to do this: the preproduction model we saw had a Cyrix Logic maths co-processor chip soldered onto the main board, but production units will just have a socket. If you want one, you'll have to fit it yourself. The other reason might be to change the hard disk.

It seems like only yesterday that 10Mb filled up all of a generously proportioned full-height drive bay. Now, 60Mb is smaller than a cassette of Jason Donovan and much more enticing; it'll be 120Mb soon enough, promises BiDesign. The hard disk, by Aerial, mounts directly onto the board; there's no connecting cable. This simplifies production, and also makes it easier to just hoik the old disk out if you want more room in your MicroLight.

The floppy disk drive, next to the Winchester, takes up most of the rest of the room on this side of the board. There are a few other components squeezed between the two main items such as a couple of clock crystals and a tiny speaker, but most of the action takes place on the other side where things get more interesting.

Most of the space here is taken up by large square packages. The video is generated by the first example I've seen of a new generation of VGA chips. Made by Acumos, an offshoot from Paradise, it not only contains the normal logic from the old 'single-chip' VGA solutions but also the palette/digital to analogue conversion circuitry and other miscellaneous addressing functions that, until now, have been in separate packages.

Apart from the Acumos, the only major devices

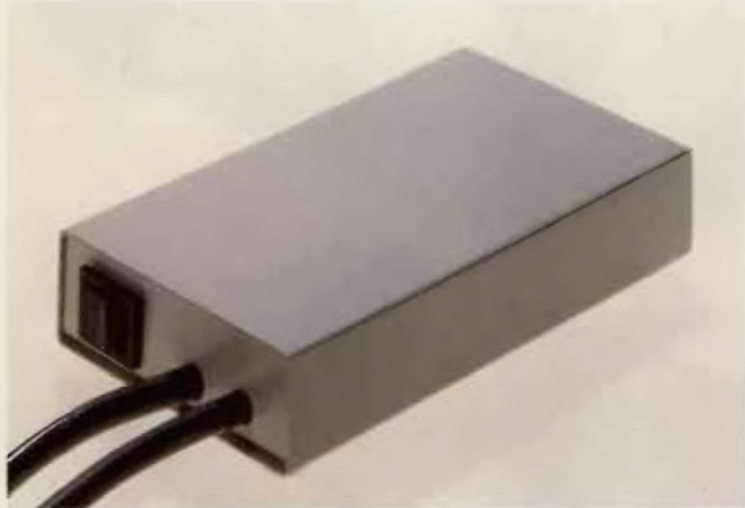
concerned with the video output are two RAM chips — and this is a complete SuperVGA implementation. Unsurprisingly, Acumos is rumoured to be somewhat swamped with enquiries from clone manufacturers; the complete board of the MicroLight isn't much bigger than the original VGA cards. There are a couple of modifications in the VGA area of the board, but these are due, says BiDesign, to it using a very early Acumos chip. Production models will be cleaner.

The other component that all VGA boards need and that is difficult to do without is the ROM chip which holds the video BIOS program. This was conspicuously absent from the main board, and since it's almost inconceivable that it could have been shoehorned into the Acumos device (it would make reprogramming because of a bug rather tricky, for example) I was temporarily puzzled. It turns out that the video BIOS has been put into the same





ROM chip as the main system BIOS; normally, this can't happen because the two bits of code don't occupy the same area of memory and the rule is one memory chip belongs to one memory area. BiDesign has set things up with a little extra logic so that the ROM chip can appear in two different areas: it's a



△ The MicroLight uses an external power supply

cunning cost-saving method that can only be pulled off if the video is integrated onto the main board.

### Topcat

The chips that glue everything together and makes the whole thing work like a real IBM are the Topcat chipset. These come from VLSI (the same people that make and now own the Acorn Risc Machine); they're a popular choice among clone manufactur-

ers and are also to be found on BiDesign's imported full-size computers. This means that the chips have to be quite cheap, and since the company had seen the design work over a considerable period of time there was little trouble deciding that Topcat had the necessary attributes for the MicroLight. Also, the chips don't take very much power.

Neither does the 25MHz AMD 386SX-L, the brains of the operation. Although not the latest, low-voltage version of the chip this is still abstemious enough for laptops. The advantage of running this here, where mains has to be available, is that little waste heat is generated. This saves on the cost and noise of a fan, and makes it possible to make things a lot smaller, without regard for airflow, and a lot denser. Over many hours of fan-free operation, the metal case got only mildly warm.

Next to the processor is 4Mb of RAM, in eight lots of 4Mb x 1-bit chips. You can't add any more than this; I guess you could hang something on the expansion bus, but the lack of speed and the inconvenience would mitigate against that. On the other hand, when 16Mb chips begin to turn up in respectable numbers this will be a natural home for them. By then, we'll probably have 200Mb tiny hard disks too, and at this point the pocket Unix workstation will be with us.

### Cyrix co-processor

On the review model, a Cyrix FasMath co-processor was soldered onto the board; this will be replaced by a socket on production models. It's not surprising, given that BiDesign is heavily involved in CAD, that this facility exists. It's also a good idea to use a Cyrix, instead of an Intel, part.

Cyrix is a relatively new company. It started in

### The Incredible Shrinking RAM

Looking at the MicroLight, it's not unreasonable to think that things can't get much smaller. The biggest components by far are the floppy and hard disk drives — even if you removed all the electronics, there wouldn't be that much of a size reduction.

The biggest problem is the floppy disk drive. Already not that much bigger than the disks it takes, it's clear that, if you stick to the 3.5in standard, the size of the drive will remain pretty constant. Attempts to move to a smaller medium have failed in the past — the 2in disk format as found on Zenith portables didn't surface again — and it looks likely that solid-state alternatives, such as memory cards, will play an increasingly important role. For backups and software distribution, though, the floppy disk remains the lowest-cost alternative and, as a result, is unlikely to die out.

### The demise of hard disks has been greatly exaggerated

Hard disks are another story. Their demise has been predicted for some time by those who produce various forms of memory, but constant improvements in the technology have regularly kept rotating magnetic platters the favourite place to store data. Now that the 2.5in format is becoming more common, the big players are developing new packaging that's even smaller and easier to use in manufacturing; at least one big American company is developing a hard disk that looks not dissimilar to a fat 80386 in packaging and that fits standard integrated circuit sockets.

As for the electronics themselves, the Acumos video

chip shows that there's still room to move more functions on-chip. It's unlikely that economics will make it attractive to add the main processor to any PC-specific circuits on one chip; increased integration increases costs not least because bigger chips have a higher failure rate in production, and, unlike VGA circuits, processors have to be used in a variety of different configurations.

### On-chip cache memory

What is likely is that more and more cache memory will be incorporated on-chip, which lets the processors go faster without imposing too many expensive speed requirements on external RAM and other bus components. The need to go faster will make things smaller, though, since the distance between components has to be reduced in order to get signals across on time: one possibility is to stack components by bringing common bus signals through to the top of their cases.

So, machines with the functionality of the MicroLight will probably halve in size, at the most, although there'll be an increase in power and capacity in inverse proportion. As to how long this will take, it's instructive to look at the ZX Spectrum that's sitting on top of the bookshelves: this takes more Watts, is slightly bigger, has an 86th of the memory and a 20th of the processing power of the MicroLight.

That's around ten years ago. It's true that the MicroLight costs around five times more after inflation, but ignoring the financial aspect we should expect to see something with around 300Mb of RAM and a 250MHz 80586 by the turn of the century. All in a box somewhat smaller than a 3.5in disk drive.



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1988, and is headed by people from places such as Texas Instruments and Intel. One of the ex-TI Cyrixians was responsible (back in the mists of time) for the Coleco Adam home computer, which then turned into the MSX standard.

Although Cyrix is committed to producing microprocessors and 'complex peripheral function' chips, the company is best known for its Intel-compatible maths co-processors. Its chips can be plugged in as direct replacements for the Intel parts but this is about the limits of the similarity. By using its own design (for which it has made seven patent applications) for the chips, Cyrix has increased the speed by up to five times while more than halving the power consumption. In fact, at the time of writing Intel hadn't announced a 25MHz 80387-SX co-processor.

The Cyrix co-processor can operate at any speed from 0MHz to 25MHz; at 0MHz it doesn't actually do any work but it doesn't take much power either. Even if you continually run the chip at 25MHz, it stops about 75% of its internals from working when there are no commands to process by setting their clock speeds to zero. This cuts down its power consumption and heat dissipation without any requirement for special treatment on the part of the hardware or software of the host computer.

The chips can do a lot more per megahertz than the Intel equivalents too, because the Cyrix compo-

nents are largely composed of dedicated logic circuits. The Intel chips are more like a general-purpose computer inside and run internal microprograms to work out floating-point mathematics operations: like any programs, these involve overheads that slow things down.

Given that the MicroLight was preproduction, the quality of the build was very acceptable. Clearly hand-soldered and with a couple of patches, it nevertheless felt (and was) reliable. Some things needed to be cleaned up (most notably the floppy cable and the rather raggle-taggle LEDs that flopped around on the front of the case) and there were some loose ends on the metalwork. I cannot for one moment see BiDesign getting any of this wrong — there was a week's work, tops, for one person in sorting out the final details. The only thing that didn't work during testing involved LapLink III flying the serial port at its top speed — files were corrupted or lost altogether. Dropping down to 57,600 baud from 115,200 fixed that.

### Performance

The performance was very good, easily meeting what I'd expect of a full-sized 25MHz SX computer. The benchmarks are skewed

because of the presence of the co-processor, but in areas where no floating-point maths is involved the computer still gives a good account of itself.

In use, running Windows with 800x600 pixel video, screen redraws were snappy and the disk performance adequate for Enhanced mode. I suspect that many people will find the 60Mb disk the major restriction, especially if a lot of Windowing is planned, but it won't be long before the larger sizes are available.

BiDesign produced this machine because the people who work for them wanted something like this, an easy way to move data and work environment from home to office and back again without the extra bits of a laptop that they didn't want and couldn't use: have you ever tried to manipulate a complex engineering drawing on a monochromatic LCD screen? This really is a complete 386SX computer — with sufficient power to run Windows, or AutoCad, or almost anything — that can fit into your pocket. More sensibly, it and a mouse and the power supply cram snugly into a tiny carrying case; providing there's a keyboard and monitor at your destination, away you go.

### Cursing cramped keyboards

Experience shows that there's a considerable number of people using laptops in this way, who rarely need the internal screen or batteries and positively curse the cramped keyboards. And, for the money, you'd be hard pressed to buy a laptop with a similar specification.

This isn't the first tiny computer that follows this logic. In the July 1990 issue of PCWI I reviewed the Carry 1 which, while not taking the idea nearly so far, is clearly working along the same lines. That, too, evinced a lot of interest; it didn't set the world on fire but wasn't as rigorously designed to be tiny above all else.

The MicroLight (shame about the name, really — didn't they always crash?) has to create its own niche if it's to make an impact (sorry), but it has the indefinable quality that makes people want it. I want one: after a peaceful evening working with it and an uncluttered desktop it was a real wrench to go back to the big, whirring box that did much the same thing.

### Conclusion

The MicroLight is a very good example of the evolution of PC technology. The main processor is a redesign of the original 386SX that works faster and runs cooler; the maths co-processor is much the same. The video chip brings all the VGA functionality into one device: a development of existing technology by a new company. The whole lot is brought together, finally, by a company composed of people who've been involved in previous products and who can reasonably be expected to have some useful experience in the field.

When it becomes available early in 1992, expect to pay £1750 for a system with the basic unit, a SuperVGA colour monitor and a keyboard — roughly the same specification as you'd get if you bought an ordinary 386SX. You should be able to get an extra monitor and keyboard for a couple of hundred — less if you're happy with mono VGA — and start commuting with your office in your pocket.

### Specifications

#### MicroLight 386SX

#### Processor

AM386SXL

#### RAM

4Mb

#### ROM

AMI and Phoenix VGA

#### Mass storage

60Mb

#### Storage options

1.44Mb

#### Keyboard

102-key

#### Monitor/display modes

SVGA 1024 x 768 (16-colour) interlaced

#### Standard interfaces

Custom-shape printer port, one 9-in serial port, PS/2 keyboard and mouse ports, expansion connector

#### Size

204x124x25mm

#### Weight

1kg

#### Bundled software

VGA drivers

#### O/S

MSDOS 5

#### Peripherals

Docking station (around £395) and external 5.25in floppy (ETBA)

#### Price

£1795

#### Manufacturer

BiDesign 021-354 5161





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# Hercules Superstation 3D

The new high-speed Hercules graphics card combines brains and beauty in a small but well-featured package. Rupert Goodwins welcomes its graphic demonstration of the use of raw computing power — and points out that the best is yet to come

It's not unusual these days for a peripheral to have considerably more power than the computers which use it. Laser printers, disk controllers and fast modems all use some of the latest technology, free from the compulsion of compatibility that dogs the MSDOS world. If the Hercules Superstation 3D is anything to go by, this process is accelerating.

The Superstation 3D has more horsepower than most cards. It's really two cards in one — graphics courtesy of the Texas Instruments TMS34020 chip, and a co-processor based around the Intel i860 XR

RISC processor. This potent combination is a major step up from Hercules' last production, the 34010-based Graphics Station, which itself was an equally big progression from the dumb graphics cards that made the company famous.

Both chips live on a fast 64-bit bus, shared by 2Mb of video RAM and up to 16Mb of DRAM — a design Hercules claims can produce 25,000 shaded triangles, or move 50

megapixels, in a second. No attempt has been made to put VGA-compatible graphics on board; but it can take signals from the feature connector on a standard VGA board. The Superstation is compatible with the TIGA 2.0 graphics standard, which works with the TMS340 series of chips; the '020 used is up to 20 times faster than the '010 on some operations.

The raw resolution figures are comparable with other high-end graphics cards, offering from 512x480 to 1280x1024 pixels. There's a tradeoff between the bits-per-pixel (a measure of how many colours can be displayed simultaneously) and screen

resolution — at 576x768 pixels, you can have full 24-bit colour and a choice of 16.7 million colours. At 1024x768, this drops to 15 bits or 32,768 colours, and at the top resolution of 1280x1024 there's a mere 8 bits per pixel. This is the colour depth VGA manages in 320x200 pixel mode.

You can double-buffer the screen, halving the memory available for a picture but allowing one to be displayed while another is being drawn up in the buffer, so that you never see a picture being composed. The resultant succession of finished displays is useful (in fact, essential) for animation.

The video RAM is hardwired into the main board as 16 staggered SIL chips; this can be used for the display, or as particularly fast data or program storage. There's a minimum of 2Mb of slower DRAM for the system memory, which can't be used for display data but can be expanded to 16Mb with two double-sided 2Mb 32-bit SIMMs.

## Feature connector

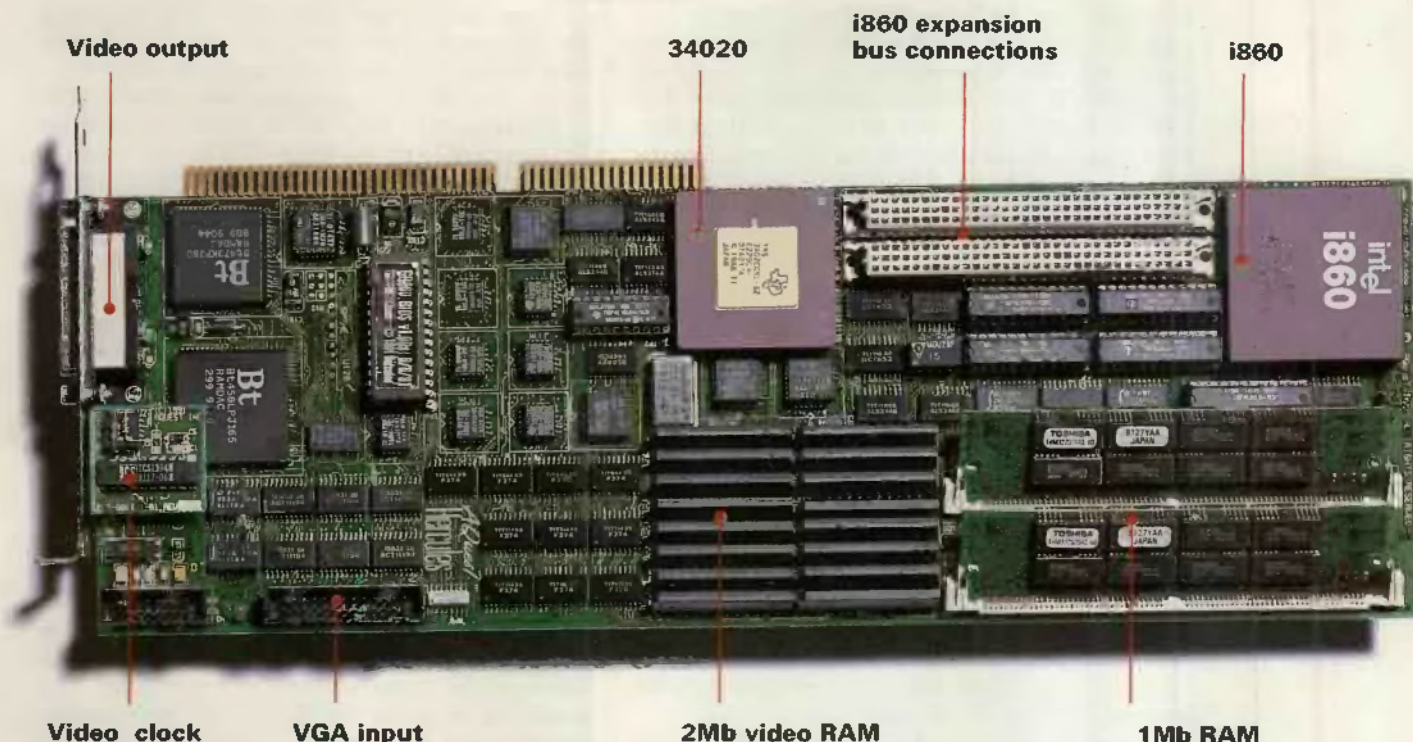
To the right of the video RAM is the VGA input connector. An eight-inch ribbon cable is provided which links this to the feature connector on your VGA card — if you don't have a feature connector, you'll have to have two monitors instead. If you do have this capability, the Superstation will switch the signals from your VGA card through to its monitor when its own modes aren't active. Having two monitors does have its advantages, though, since it's possible for the Superstation to carry on processing independently of the host PC.

Next to the VGA input is another connector, this time for genlock synchronisation signals. Fed with the right frequency, this can force the Superstation's output into sync with an external video signal; thus, with some extra video mixing gear you can overlay the output from the card onto live signals.

A small daughterboard, with a couple of chips and a few passive components, is plugged into a

***"Laser printers, disk controllers and fast modems all use some of the latest technology, free from the compulsion of compatibility that dogs the MSDOS world"***





tiny socket. There's supposed to be a clock chip here, but the company responsible hasn't delivered — Aquest developed this alternative instead.

### Tricky programming

A couple of Euroconnectors bring out all the signals that go to the i860. Hercules has no official line on uses for this bus, but it can be used to add memory, or even extra processors. The Graphics Station card had a similar connector.

Below the DRAM sits the i860 — the original XR variant, said to have 1 million transistors. (I haven't counted. The later XP has 2.5 million and is more versatile but the XR runs slightly faster — getting on for 33mips in the Superstation.)

Aquest Inc, which helped Hercules design the board (and, apparently, holds the copyright on it), was started by some of the XR design team at Intel. Programming RISC chips is tricky because you have to understand the way the chip works in order to get the best out of it. Hercules claims the Aquest team responsible for programming the Superstation

3D graphics kernel can get 25% more performance out of the i860 than can mere mortals. Which is plausible but unproven, because the kernel is unfinished. When ready, it will provide 'real-time transformations of smoothly shaded objects'. In other words, it will use 3D manipulative tricks built into the i860 to produce animated pictures of solid, realistic things. But, in the words of St Augustine, not, oh Lord, just yet.

There are other signs that the software side of the product is a tad unready. Programmers have long lacked the development tools needed to get anything running on the i860. Clearly, Hercules/Aquest have their own tools — the AutoCad, Renderstar and some other drivers use the i860 — but none suitable for release. Intel has no tools in a suitable form, off the shelf, for the Superstation 3D.

All these problems will be fixed in the next six months, says Hercules. Meanwhile, there are people working closely with the company in fields such as virtual reality, so new Superstation 3D products will appear, and of course the TIGA side

### TIGA, TIGA burning bright

The TIGA graphics standard was developed by Texas Instruments for its TMS340 range of display processors. It offers program developers an easy interface hiding the details of the graphics hardware. A TIGA program will run on anything supporting the standard.

This is especially important now that the 34020 is becoming more widely used. This processor will run the same programs as the 34010, but offers many more features: it can search memory for a pixel of (or not of) a certain value; it can do block writes and fast area fills; and it can talk to the new 34082 maths co-processor. Actually, it can talk to four of them at once — sending your

graphics performance 'through the roof,' TI says.

The TIGA standard shields the programmer from having to know whether there are any co-processors attached; in their absence, it can decide to pass commands to emulation software. It can even pass intensive number-crunching back to the host computer, making good use of any extra maths hardware there. Windows 3.1 will come with TIGA drivers, allowing you to install a wide range of high-performance graphics cards with as little fuss (TI says) as standard VGA gives.

In fact, since the TIGA standard is extensible and can accommodate future enhancements seamlessly, TIGA cards

will actually present fewer problems than do the swarms of different SuperVGA cards. Also welcome will be the performance enhancements stemming from the fact that the main processor no longer has to work out the details of screen updates.

TI says that a good number of 34020 boards are either in production or coming soon. Hercules clearly thinks this will be a sizeable market: by the time you read this, it will have announced a Superstation 820, £1000 cheaper than the review model but lacking the i860. A lot of people will fancy high-performance TIGA without needing the full blast of an unfettered i860.



of things is as well developed as anybody's (see page 255). Indeed, the Windows 3.0 drivers that come with the Superstation are TIGA-based already; they're currently limited to 256 colours, but better things are promised. Hercules predicts that, over time, bits and pieces of the Windows drivers will migrate from the 34020 to the i860, giving a considerable increase in performance.

### Installation

Installing the board was reasonably simple. There are no switches or jumpers to set — if you get an address conflict with another card, you have to change the other card. I hope too many manufacturers don't economise in this way. I had to re-site my VGA board (a Tseng adaptor) next to the Superstation to avoid cable snags. Then I needed only to plug my multiscan monitor into the new card and start up.

First impressions were not good. The screen stayed dark, although I could hear the computer go through its normal start-up tests; only when it started to load MSDOS did the VGA pass-through start to work. Hunting through the manual, I found that this is normal — any start-up error messages won't be seen unless you plug a monitor into the original VGA card. Not ideal.

Worse still was the degradation of the normal VGA signal after it had been through the pass-through switching. Screen noise was markedly worse, with a visible decrease in video bandwidth: anaemic vertical lines, shadows to the right of sudden transitions from dark to light... that sort of thing. Worst was dot-crawl, a problem I last saw on the ZX-Spectrum: certain patterns take on the appearance of drifting sand on a river bed. It's usually caused by non-video frequencies polluting the video output.

Hercules says there are problems with some SuperVGA cards, and that later versions of the Superstation will cope better. From my experience with the card supplied, you'd be wise to not bother with the VGA pass-through circuit and stick with a two-monitor solution. It won't cost appreciably more than the card by itself, and avoids the fatuity of a £3500 video adaptor producing inferior output to a £60 Taiwanese board.

Three 5.25in 1.2Mb disks contain configuration, test and driver software. Configuration is mostly harmless: a program called STATION selects and installs most of the software onto your hard disk, sets up various environment variables, modifies your AUTOEXEC.BAT file, and asks you questions about your monitor. The card will work with most monitors, although you'll need a high-performance display for the highest resolution and the higher, non-interlaced scan rates. However, high resolution isn't one of this card's most important features, so even a reasonably-priced monitor is a good companion if you need colour depth and speed more than you need 1280x1024.

Three main sets of drivers come with the card; AutoDesk's ADI format, TIGA 2.0 and Windows 3.0. The ADI drivers will work with AutoCad, AutoDesk 3D Studio and AutoShade, and are currently the only bits of software that use the board's i860. That said, they do use it rather well.

AutoCad works on the display list principle — a drawing consists of a list of commands, each de-

scribing a component. The ADI driver works down the list, painting the screen as it goes. With ordinary boring VGA, the processor in the main computer does all this, and relatively slowly. The Superstation ADI driver has as much of the display list as possible in the fast 64-bit RAM, which is completely independent of the host computer.

The software adds a couple of new commands to AutoCad. 'Spyglass' pops up a small window displaying a magnified portion of the main viewport. You can pan and zoom this in real time — it's true, you can't see the join — and it doesn't affect the operation of the rest of AutoCad. 'Bird's Eye' does quite the opposite — it shows a picture of the entire object no matter what detail is being worked on. You can, by dragging a box around in the Bird's Eye picture, pan and zoom the main viewport, again in real time and without noticeable redrawing. Redraws that took 2.5 seconds on a 33MHz 486 took about a twentieth of the time; this is a very fast AutoCad display device.

Two sets of Windows drivers differ only in their fonts. One uses the 8514/A fonts, the other the more normal VGA screen fonts; both use any resolution up to 1280x1024 at 8 bits per pixel. This resolution is set by the STATION configuration program, and not when you install the driver into Windows. Neither driver uses the i860, but they are very fast.

### Conclusion

In hardware terms, there's little to complain of. The VGA pass-through design seems to be the weakest part. But this board can get very hot. The handbook claims that it takes 7 amps from the 5volt supply... around 35Watts, a lot of heat to dissipate.

This aside, the board is what it claims to be — a fast, flexible graphics processor linked to one of the most powerful microprocessors on the market. The best has yet to come: the hardware might be all there, but it needs a lot more software, particularly developers' tools. When that happens, many people will see this board as a testbed for developing i860 code as much as a product to be designed for. With Intel confidently predicting a rash of i860 products Real Soon Now, this could be a significant part of its future. As it stands, this is a fiendishly fast AutoCad accelerator and a rather overpriced TIGA board. But the potential for great things is there.

### Specifications

#### Hercules Superstation 3D

Resolution	Colour Depth
640x480	24/15/8
756x486	24/15/8
800x600	15/8
1024x768	15/8
1280x1024	8

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£3495 with 2Mb DRAM, £3650 with 4Mb, £3950 with 8Mb, £4395 with 16Mb

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1 Mb ST1	£899	£1199	£1299	£1399	£1599
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# Word 5.0 for the Mac

Version 5.0 of the Mac's top word processor has enough improvements (including, astonishingly, a good new way to cut and paste) to get users rushing for an upgrade. It also shows how Microsoft is faring against the new IBM-Apple axis, writes Jack Weber.

Oscar Wilde, always a perceptive commentator on life's little ups and downs, would have put his finger on it straight away. 'To lose one friend, Mr Gates, may be regarded as a misfortune; to lose both looks like carelessness.'

The much publicised separation between Microsoft and its former best friends, Apple and IBM, has left Bill Gates and his software empire in a strange position of isolated power. As the biggest software company in the world, and a dominant force on both Mac and PC platforms, Microsoft is well placed to influence the future of computing for all of us. But it's clear that that future must now be moulded along more independent lines. Microsoft is firmly committed to Windows, but it's also been putting a lot of effort into getting savvy with System 7 ahead of the competition. All of which must have left many Mac users wondering which way their software was going to go.

Microsoft Word has for some years been the most widely used word processor on the Mac (and that probably means, the most widely used of all applications on the Mac), so the arrival of a major upgrade is clearly a significant event, and one that

may show some pointers to where Microsoft is heading with the Mac.

As with all major applications these days, installation is made bozo-proof by the use of Apple's Installer software. All you do is click the button, and this takes care of loading the main program and its retinue of files into all the appropriate places on your hard disk. Unlike many other applications though, this one installs in compressed form, so you have an additional wait while it unpacks itself afterwards. Once that's over, you'll have lost another 5Mb of disk space but you'll be ready to start.

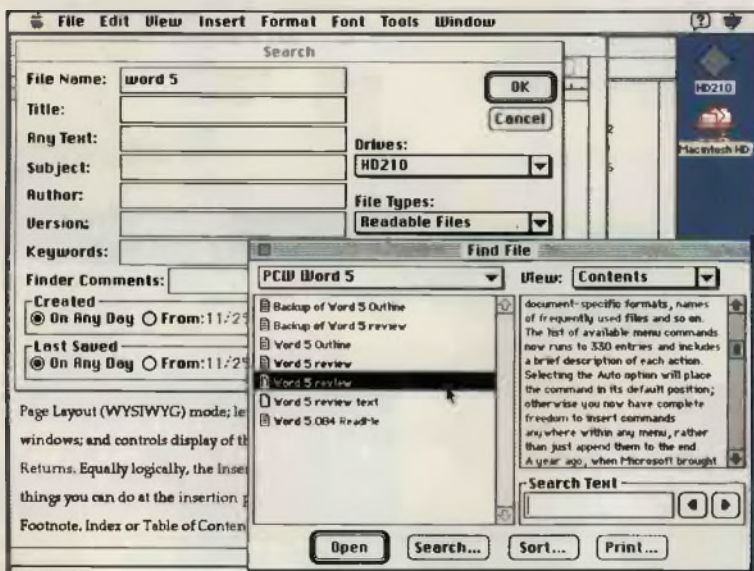
## Tolerance

Word has always been very tolerant about how much RAM you give it, and will happily shuffle bits of document and program code between the hard disk and memory. This version is slightly more demanding than Word 4.0, with a recommended memory allocation of 1024K. But the minimum requirement of 512K means that you could still think about running Word on a 1Mb Mac Plus. I used it for a while on a 2Mb machine, alongside System 7, and experienced no problems at all.

If you're used to Word 4.0, you should be able to launch Word 5.0 and begin work right away. There are numerous and significant differences in the menus and ruler, but the basic personality of the program remains firmly rooted in version 4.0, so it starts to feel familiar very quickly. What helps ease the transition is that the menu bar in particular is now arranged much more logically, with the addition of new menus called View and Insert, and the demise of the old Document menu.

As you might expect, View is concerned with how the document looks on screen. So, for example, it allows you to choose between Normal, Outline or Page Layout (WYSIWYG) mode; and lets you open Header, Footer and Footnote windows; and controls display of the ruler and of invisible characters such as Returns. Equally logically, the Insert menu brings together all the special things you can do at the insertion point, such as put in page breaks or add Footnote, Index or Table of Contents markers, right up to inserting external

▼ The Find File Module consists of a search window, where you define what you're looking for, and a separate listing window that lets you sort, open, print or read any of the files it has found





files in their entirety.

There are, to my mind, a few inconsistencies — I think I'd prefer Print Preview moved from its traditional place under File to go under View, and the Glossary command feels as if it ought to belong under Insert. But, that, of course, is one of the joys of Word — you can customise menus to the  $n^{\text{th}}$  degree, and even save any number of custom menu arrangements to suit specific types of document. The only thing that isn't negotiable is the order and naming of headings in the menu bar; but, as with the previous version, you can add an extra menu called Work to hold document-specific formats, names of frequently used files and so on.

The list of available menu commands now runs to 330 entries and includes a brief description of each action. Selecting the Auto option will place the command in its default position; otherwise you now have complete freedom to insert commands anywhere within any menu, rather than just append them to the end.

### Devious play

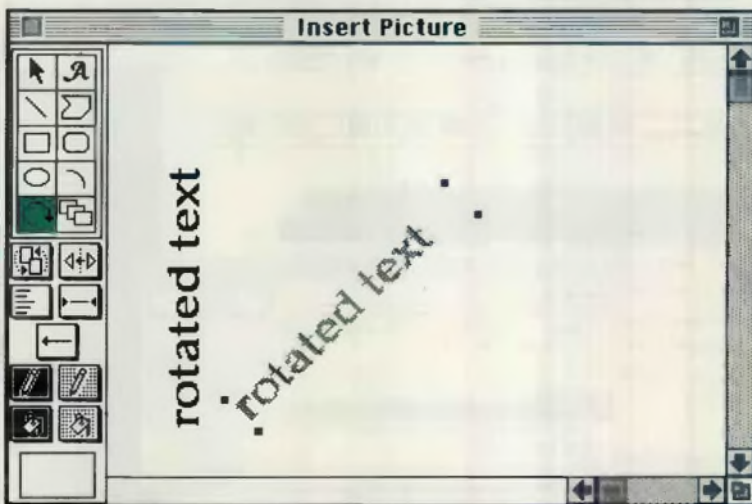
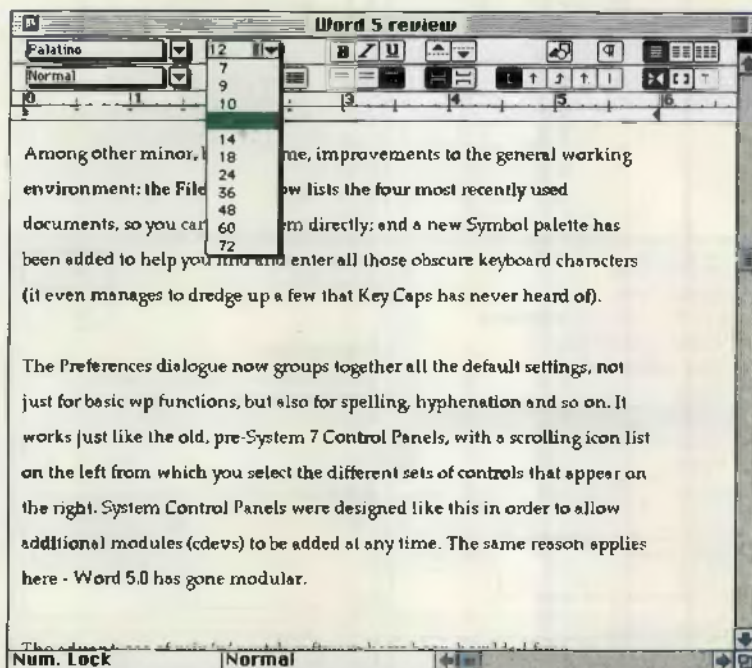
A year ago, when Microsoft brought out new versions of Excel for the Mac and for Windows, it gave them both a tool bar, or Ribbon, beneath the menu bar. The new Word for Windows has one too, and so, now, does Word 5.0 for the Mac. It's an excellent idea — clicking a button to apply Bold text for the odd word or two, or to create a subscript, is much faster than fishing around in a menu. The big disappointment is that the Windows version of Word lets you customise the Ribbon with your own choice of buttons, but this Mac program doesn't. Could this be a devious play by Microsoft to make Windows seem more appealing?

If so, Microsoft makes up for it by adding one thoroughly wonderful feature to the basic text-handling routines. It's called Drag and Drop. If you select any block of text — from a single character up — then click and drag from within the selection, a grey insertion bar will follow the cursor arrow. When you release the mouse button, the selected text drops instantly into place at that insertion point. Alternatively, by holding down the Command button while you do this, you can copy to the new location. The Move command in Word 4.0 achieved much the same but was infinitely more clumsy. If you don't need to place text in the Clipboard and, like me, you're an inveterate shuffler of sentences and paragraphs, then this is the cat's whiskers.

### Improvements

Among other minor, but welcome, improvements to the general working environment: the File menu now lists the four most recently used documents, so you can open them directly; and a new Symbol palette has been added to help you find and enter all those obscure keyboard characters (it even manages to dredge up a few that Key Caps has never heard of).

The Preferences dialog now groups together all the default settings, not just for basic WP functions but also for spelling, hyphenation and so on. It works just like the old, pre-System 7 Control Panels, with a scrolling icon list on the left from which you select the different sets of controls that appear



on the right. System Control Panels were designed like this in order to allow additional modules (cdevs) to be added at any time. The same reason applies here — Word 5.0 has gone modular.

The advantages of mix 'n' match software have been heralded for some considerable time, but with no sign of actual software to match (or mix). Now at last, things are beginning to move, and teams of highly paid people are frying their brains to dream up silly names for the phenomenon. So, Claris' forthcoming MacWrite Pro will bring you 'add-its' while the newly released Word for Windows 2.0 goes even further downmarket with 'applet'. Only Word 5.0 retains any dignity and calls them 'plug-in modules'.

The modules that you can plug in for free provide voice annotations, a file manager, a direct interface to Microsoft Mail and a drawing program. Spell-check, hyphenation and the thesaurus are also now handled by modules, as are the new Symbol palette and grammar-checker. Inexplicably, there is no module for attaching Post-It-type notes, though I, for one, would find this more useful than almost any of the above. (Most suspiciously, this is another feature that's available on the Win-

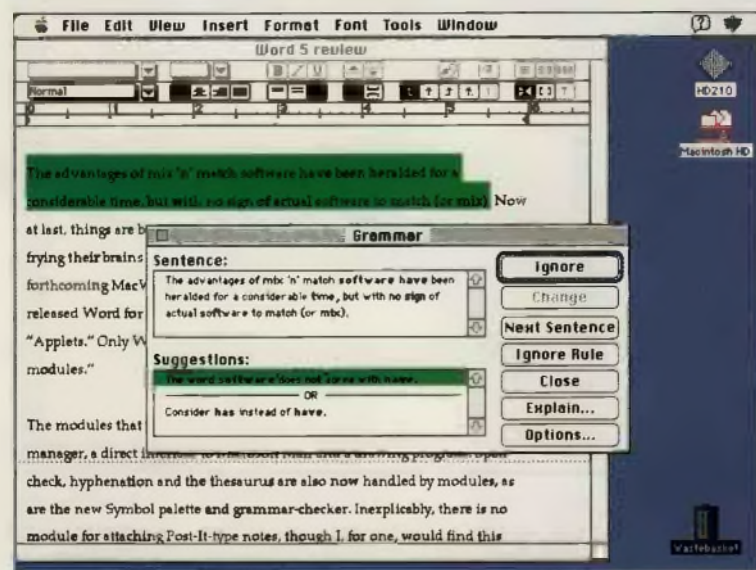
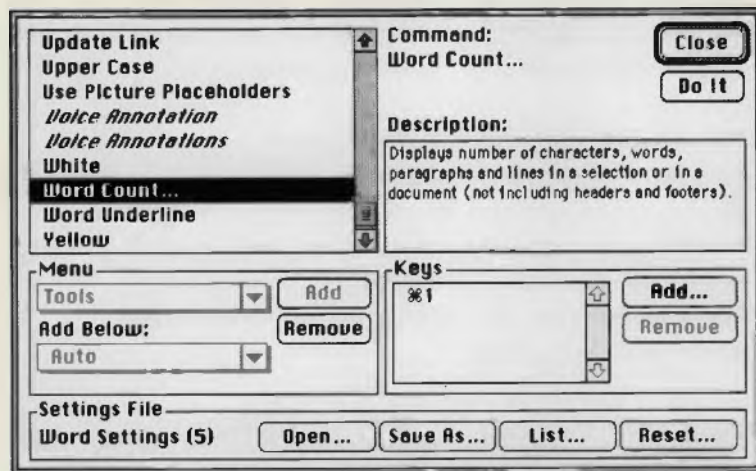
△ Top: The ribbon contains menus and buttons for common text formats and for setting the number of columns. Another button opens up the Graphics Editor module

△ Bottom: The new Graphics Editor is a plug-in module with fairly minimal facilities. It does allow free rotation, but this tends to destroy text unless you stick to 90° steps



dows version but not on the Mac.)

However, Windows' new macro programming language, WordBasic, will appear as a plug-in module on the Mac, though not for another six months. When it does, I hope they'll upgrade Word 5.0 to allow custom buttons on the Ribbon, so that we can run those macros without having to remember



△ **Top:** Commands can now be inserted anywhere in a menu and a description explains what each one does. The two italicised commands belong to a plug-in module rather than to Word itself

△ **Bottom:** Some duff advice from the style and grammar checker

obscure key combinations.

This move towards a modular architecture is absolutely the right way to go with big applications, and seems to offer more scope than the Claris approach which restricts the operation of any add-it to a frame within the document. In Word 5.0, the plug-in modules can operate globally and seem to integrate seamlessly with the main program, even adding their own entries to the list of custom menu commands. Some, like Voice Annotations, are a bit of a gimmick, but most, like the Graphics Editor, provide functions that are more standard.

All the weightier Mac word processors now include some sort of built-in graphics environment, and all of them (apart from WordPerfect) are pretty uninspiring. Word 5.0 joins the crowd with a competent but rather ordinary module offering just a basic selection of drawing tools — no free-hand shapes, no regular polygons, eight colours and just 36 non-editable patterns. As a means of originating graphics, it's not up to much. But it

certainly has a role in making minor tweaks to an imported picture, or even better for adding effects such as flipped or rotated text.

Ultimately, what lets the facility down isn't really a lack of drawing features, but the fact that Word 5.0 doesn't provide a separate layer for the graphics to reside in. Other examples of the art, like Nisus or WordPerfect, let you position graphics freely in relation to the text; Word can only treat them as large characters, or as rectangular frames within the page. So, even something apparently simple, like adding an arrow to point from a label to an imported graphic, calls for tranquillisers and an ability to cope with being humiliated by inanimate objects.

## Spell-checking

Spell-checking in Word used to be slow and ungainly. Now, it's even slower but considerably better in every other respect. You no longer have to click a button every time you want it to make suggestions, and the suggestions themselves are much more reasonable; it also now has the commonsense to look at both halves of hyphenated words separately and to pick up repeated words or rogue capitals in the middle of a word.

The process for adding entries to a custom dictionary is also much less baffling than before. Thanks to the new plug-in architecture, the thesaurus, which used to appear as a DA, is now fully integrated and provides one of the best interfaces to be found in this breed. Unfortunately — and this may be unfair criticism because the review copy came with a pre-release American thesaurus — the range of synonyms offered was often sparse and sometimes blatantly incorrect.

Third of the purely linguistic modules is a grammar and style checker. According to Microsoft's blurb, this was the single most requested feature for Word 5.0. Which means I can't really blame them. It's fast, neatly designed and as useless as all such things. A very simple test will prove the point: feed any typical example of your work into a grammar checker, make the changes it recommends, then compare the two versions. If you prefer the new one shout Hooray and process all your words by this method in future. If not, consign the grammar checker to the bin and reassure yourself that, even if you're no James Joyce, at least you're not a machine. I mean, seriously — this thing lets you enter how many intervening words should constitute a split infinitive. God help us if that's how people are meant to think about writing. Fortunately, many innocent victims will be spared this folly because it only works if you can allocate at least 2Mb of RAM to the application.

## Finding files

Back to sanity, and on to the Find File module. This is actually quite excellent. As the name suggests, it finds files. It finds them by name, date, or file type; by any text string within a file; or by a new set of attributes (title, subject, author, version and keywords) which you can attach to Word 5.0 documents through a Summary Info dialog. All files that match the search criteria are listed in a separate window where they can be sorted, opened, printed, or read as unformatted text without having to open



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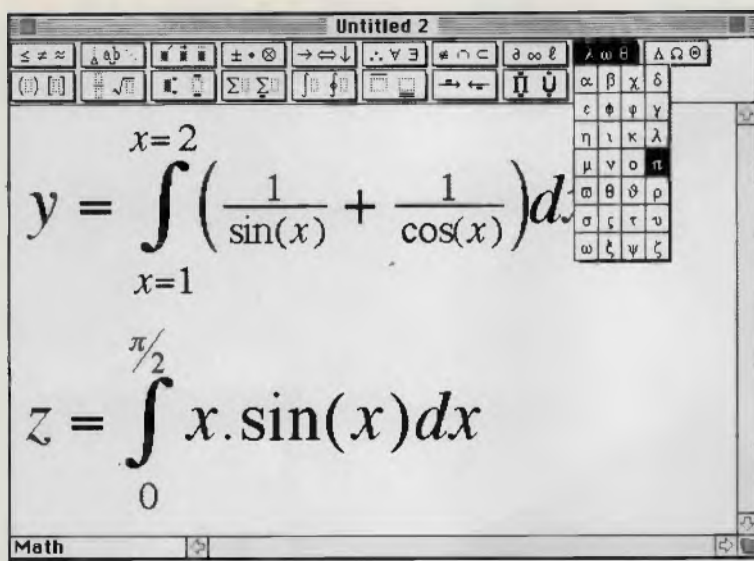
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the file. You can even copy the text that's displayed there — very useful if you just need to lift a section from elsewhere. There are various commercial utility programs available to do this sort of thing, but



△ Word still provides its own Formula commands for creating simple equations. But for more demanding tasks, this standalone editor offers intelligent auto-formatting and a fairly good range of mathematical symbols

this one's a slick performer and it's really helpful to have it built in to a word processor.

All in all, the new modular architecture is well thought out and very neatly implemented. If sufficient modules become available, it will offer benefits to everyone — to users, who'll be able to assemble software for particular uses, and to Microsoft, because it allows the company to pile on additional features without producing an unmarketable monster that will only run on 8Mb machines.

It also fits in with the present climate. Everything now points to increasing interaction between different applications, but that interaction can happen at different levels and it's by no means clear which of those will become dominant. Microsoft, especially a Microsoft that's distanced from Apple and IBM, needs to attract other software companies to its way of doing things. Plug-in modules, some of which already come from outside developers, can do that in a small way; but what Microsoft hopes will do it in a big way, is OLE.

### Compound documents

OLE, or Object Linking and Embedding, is Microsoft's scheme for allowing multiple applications to collaborate on compound documents. Developed from the earlier DDE (Dynamic Data Exchange), OLE is now standard on Microsoft's Windows applications. Since the arrival of System 7, OLE has been able to make use of Apple Events in order to communicate with other applications, and so it now also appears on the Mac, where it both uses, and competes with, System 7's own facilities. Depending on your point of view, the result is either a commendable freedom of choice or a source of paralysing confusion.

Briefly, there are three options for actively inserting parts of one document inside another. First, you can

use System 7's Publish and Subscribe. Word 5.0 is fully System 7 savvy and supports everything from stationery documents to balloons. Because Pub & Sub works between any savvy applications, on one Mac or across a network, it's ideal for workgroup documents. The second choice is to copy something from one document and then use Paste Special in the Edit menu to paste it into your Word document as a Link. This is easy to cope with but requires enough memory for both applications to run together, and demands that you never move or re-name the linked file.

Finally, you could use the Insert Object command. This lets you embed a self-contained object which, when double-clicked, will automatically open its appropriate application for editing. At the moment, embedding works only between Excel 3.0, Word 5.0 and the standalone Equation Editor bundled with Word. It's more flexible than linking but, like linking, won't work across a network.

OLE has a healthy future because of its role in Windows. Whether it also becomes a standard on the Mac may depend on whether other companies can provide alternative ways of exploiting Apple Events. In the meantime we have to accept the lack of certainty. But it's easy to get overwrought by all this — for 99% of all word processing it won't make any difference. The most important factors, as ever, will be formatting and editing. And there, Word has always been among the leaders.

### Style sheets

Word's use of style sheets and its range of table commands have been models of their kind and remain so, even though very little has been added to either. You can, however, now apply shading to paragraphs and to table cells, and there's a new Change Case command which provides five options including Title and Sentence Case. Another much needed development is that Find and Replace will now search for any character or paragraph format, for named styles, and for most special characters such as page breaks.

Mailmerge is one activity that puts many users in a cold sweat. Word's capabilities are certainly among the most comprehensive you can find — explaining them takes up 74 pages of the manual — so they'll never be entirely straightforward, but a new Print Merge Helper offers some support. It appears as an additional ribbon below the ruler, with menus for adding fields and keywords, and will even scan your text and data documents looking for, and reporting, any inconsistencies.

### Conclusion

Is Word 5.0 worth buying? For existing Word users: definitely. Many of version 4.0's more irritating limitations have been addressed and enough new features have been added to justify the £75 upgrade fee. For new users: almost certainly. Word 5.0 is not an entry-level product to be picked up in half an hour; if your needs are basic and likely to remain so, there are simpler, cheaper alternatives that would be more appropriate. But if not, then Word's sheer power, combined with an ability to customise away all the bits you don't need, is unequalled. I see no reason why it shouldn't continue as the most widely used word processor on the Mac.

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# It's my parity and I'll cry if I want to

Don't let the confusion of logging on, stop bits and scripting reduce you to tears. Simon Rockman and our team of reviewers consider communications packages: in the commercial world and in the public domain, good and bad connections can be made.

**P**undits spent years predicting that communications would take off 'this year'. It never happened. Instead, we have seen a slow growth in the use of modems and consequently, communications software. The packages which hold the lead have, in the main, been around for a long time. They have been updated and matured but the lack of a vast untapped market (as exhibited by,

say, the Windows database or graphics markets) has served as a disincentive to spend vast R&D bucks.

## Complicated

One problem with communications is that it is complicated. When everything is working right the process of logging into another machine, getting the data you want and logging out again

can be reduced to a single keypress. Getting to that stage is a confusing mess of cables and com ports, parity and protocol and a recipe for general frustration. To this end there are merits in using a simple program which helps reduce the number of options, and in using a complicated one which an expert has set up for you or which you set up for a naive user.

## How we tested the communications packages



The tricky thing about communications is that there are a large number of variables in any system. When connecting two computers via a modem over the telephone line, the performance of the connection will depend greatly on the performance of each computer, the communications board, the modems, the software at each end and the quality of the telephone line. All these factors are very variable.

In order to test the performance of the communications packages a standard setup was used throughout. It consisted of a 386SX-20 (Olivetti's) on the receiving end and a fast Dell box as the transmitter. The SX-20 was chosen as an average sort of machine and the Dell did the sending because it would be the best case as a host.

## Positive thinking

An error-free direct connection, rather than a modem, was used — more positive thinking. For the Macintosh packages a 16MHz 68000 was used for receiving and a 20MHz 68030 was playing the host. Results obtained using different hardware may vary wildly but the combination of a perfect transmitter and an average performance receiver does provide a standard for comparison.

A number of tests were applied to each package but only three produced significant variations. The file transfer capabilities were tested by transferring files of different lengths at different speeds. All the packages produced almost identical results at speeds less than 9600 bps. Several packages were unable to support speeds greater than 19,200 bps, so the graphs were produced showing 9600 bps and 19,200 bps performance only.

Wherever possible, the efficient Zmodem protocol was used for these tests. If it was not supported then Ymodem was used, and the best Chit-Chat could manage was the antiquated Xmodem.

The speed of terminal emulation was tested by sending (with flow control) a standard 64K block of text. As I have already mentioned, a number of packages were limited to 19,200 bps as their maximum rate, but of those which could go quickly, Mirror, Telix, Qmodem and SmartCom 3 were best able to cope with file transfers. SmartCom 3 also had the fastest terminal emulation by a wide margin. MicroPhone gave the best performance of the Macintosh packages, but the Macintosh environment hampered its performance compared to native PC programs.

All the packages tested worked well at 2400 bps, the normal modem communications speed. Fast modems will have data rates of 19,200 or 38,400 bps, and with these, packages like Chit-Chat should be avoided; also, it would be best to abandon Windows for maximum performance. Only the DOS applications could handle data at ISDN-type speeds.

## Efficiency of programming

The reason for the variations between packages is simply down to the efficiency of the programming, and there is no reason why a package should not have its performance improved significantly between the current and later versions.

Speed isn't everything, of course, and these comments should be read in conjunction with the full review to establish which packages were easy to use!



In this review we will look at software on the PC and the Mac, with the PC options including DOS and Windows packages. It is quite possible that communications is the last bastion of DOS in an increasingly Windows-oriented world.

### The devil you know

It is tempting to want to stick with the package you are familiar with, and this is particularly true of anything that has been automated using a scripting language. The basic job of a comms program is quite simple: it has to take data from the RS232 port and get it into RAM. Usually this will be to display text on the screen but often it will result in a program being transferred from one system to another.

Given this basic requirement, the PC architecture then conspires to trip the software up. Speed is everything and the PC bus isn't very happy about sharing bandwidth. So saving to the hard disk — or worse, floppies — brings the machine to a halt. When a remote system is shovelling bytes at you like mosquitoes in the night, the last thing you want is the escape route for the data to be blocked.

Wherever you turn there are problems. Getting the data in can be tough enough; the PC was never designed to be a power platform so the number of serial ports you can have is limited. Just as the 640K barrier has been broken, it is possible to add more than two or four serial ports to a PC but the software needs to support them. Getting the data through those ports can be a problem thanks to a further limitation of the PC design. The chip which *usually* looks after bit pushing is the 8250, but this has trouble at high speeds (typically above 19.2kbits/sec).

The solution is to swap the chip for a faster 16550 which is faster thanks to its buffering of data, but this can lead to problems unless the software flushes the 16-byte buffer. In the Mac world things are much simpler since the machine has a cleaner design, but communications is never simple.

### Low-cost comms

One aspect of communications software which is unique to the genre is the proliferation of good shareware packages. There are spreadsheets, databases and word processors which are popular shareware programs but none of them lead the field. In the comms world many of the big names are available for the cost of a disk and can be registered if you feel good about them.

Even more confusing is the way these programs flit from being proper com-

mercial packages to shareware and vice versa. Telix, from Exis, was for a long time a shareware program downloadable from a number of bulletin boards, not least Exis' own in Canada. Now it is a full commercial program. Odyssey went the other way, after enjoying significant commercial success as one of the first (if not the first) programs to have software MNP error correction. Today it is a shareware program.

The other shareware packages in this Group Test, Qmodem and WinQVT, both have a loyal following, Qmodem for its simplicity and WinQVT for its sophistication in dealing with micro-to-mainframe connections. Such a high-end purpose is strange in the shareware world where many of the best potential customers — the big corporates — are wary of trusting day-to-day business to a kid with an assembler and acne. Of course, programmers aren't like that any more (they use compilers) but the image still holds.

### Opportunity

With Windows sweeping the PC world it is interesting to see how the market leaders have addressed the new opportunity. Crosstalk for Windows has been around for a while, but Softklone, the maker of Mirror, went to an Australian software house for a Windows package. PCW Editor Guy Swarbrick doesn't think that was such a smart move.

Perhaps the most impressive sideways move is that made by Software Ventures who transferred MicroPhone from the Mac to the PC, but (curse of the PC again) Windows packages are never going to be very fast since they use Microsoft's COMM.DRV which is only capable of 19.2K. Windows 3.1 may run faster but betas we have seen do not offer higher speeds. It is quite possible that once the final tweaking of 3.1 is complete we will see an increase in performance, but it still won't be able to compete with hitting the metal directly.

Most of the programs in this review provide some kind of script language. While writing a spreadsheet macro is a task most users can see an immediate benefit in, writing a comms script requires a little more patience: the whims of a remote system can have some strange effects on your script and it is easy to write something which waits for a line of text it will never get. It's a matter of choosing the right communications program to provide the control and level of scripting you can work with, and a result of experience.

### Broad choice

In this Software Group Test our team of reviewers has looked at 15 comms pack-

ages. With such a broad span there is clearly room for differing needs and preferences. The major factor is who you are buying the software for. If you are an experienced user installing a modem for a friend or colleague then you might be prepared to look beyond the system you are using now and write some scripts. If you are buying a program for yourself you will have a good idea of what you want to call, if not what the facilities are of the program you want to buy. This comprehensive guide to the best of the bunch should make the choice easier.

## AM Technology Vicom Connect

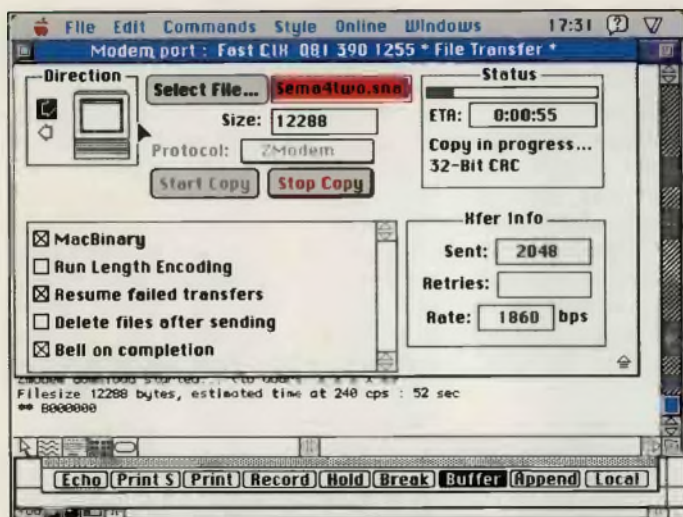


Getting two computers to talk to one another by modem is one of the last areas of computing that still contains an element of

hand-waving, black magic and mumbo-jumbo. The Macintosh itself is easy enough to use, but buy a modem and try to get on-line and you will immediately be plunged into a labyrinth of transfer protocols, parity, terminal emulation and flow control. One magazine that attempted to survey high-speed modems using the Mac couldn't get most of them to work for months, despite the help of several modem manufacturers. Once you have a connection working, it should stay working, but it could take a lot of heartache to try to set it up.

The point is, unless you already know about communications, you can't judge modem packages just by looking at the features and comparing prices. This is one of the key reasons why the leading comms package on the Mac is British. The staff of AM Technology resides in Bournemouth, and are there during office hours to help guide you through the complexities of making that con-





nection. They also have a bulletin board to which you can send scripts you are having trouble with. Moreover, because it is British, Vicom Connect supports Prestel and Campus, which most US developers have never heard of. Other versions of Vicom also support Minitel and other euro-centric emulations.

### Talking you through

The Vicom Connect interface does not conform strictly to Apple standards, but it is relatively easy to get to grips with and, more importantly, it shields users from a few of the complexities of using modems. When you dial a service, a dialog box comes up and 'talks you through' the connection — dialling, waiting for a reply and so on. It also tells you in plain language when something goes wrong. While the various setup routines give you access to parity and stop bits, they are hidden on

sub-menus. Users can fiddle with the more basic controls, and most of the time the defaults on more sophisticated ones will be fine, so you don't fiddle with them unless you have to.

The program comes with a reasonably full macro language with 29 basic commands and 21 advanced ones. It allows you to use simple programming structures like If...Then and sub-procedures. Even in their seventh year of development, none of the variants of Vicom can record macros from keystrokes as you log in. After nagging the designers about this for three years, I have finally come round to the view that it is not such a great loss. You can

log in normally and record what happens on-screen, then cut and paste to create a macro file from there.

Most people (myself included) only need a log-in macro that reads 'Wait for 'login name:/'send 'David'/Wait for 'password:/'send 'sausages''. Which reminds me: if you put your password into a Vicom Connect macro, anyone who can get onto your hard disk and knows how to use the program can get at your password. The company suggests you type the password in each time you log on (or if you're really clever, you can design a macro that lets you type it in in advance then log in later).

When you have typed a macro in, you have to compile it before you can use it. This gives you the chance to correct all the typing and syntax mistakes before you dial up and start building up a phone bill.

When you have typed a macro in, you have to compile it before you can use it. This gives you the chance to correct all the typing and syntax mistakes before you dial up and start building up a phone bill.

### Activating macros

With Vicom Connect by itself, the only way to activate macros is to set them up to activate on log-in or to select the Macro menu item and open the relevant file. Fortunately, one of the big selling points of the Vicom range is that scripts and interfaces

## Classicom

In an attempt to pull in the low-end user, Vicom has produced Classicom, a cut-down version of Connect at a cut-down price. Users can upgrade from it to Connect at any time for the price difference between the two packages. The programs are very similar in use — the differences are:

- Classicom is limited to 2400 baud (or 4800 baud with data compression). But if all you are doing is reading text on-screen this is perfectly adequate.
- It doesn't support the advanced macro commands that Vicom Connect does, and it cannot use front ends or scripts created by the more powerful members of the Vicom range.
- It doesn't support Kermit or Zmodem file transfer protocols.

On the other hand, it has three advantages over Connect:

- It is £100 cheaper.
- It comes with a Mac-to-modem lead (it is often quite difficult to find one that works properly).
- It only takes 400K of memory to run — less than half of what Connect uses.

**Good Points** Economical with memory, upgradable, cheap.

**Bad Points** Limited speed, small range of protocol types.

**Conclusion** Probably adequate for the new user, and can be upgraded if you need more.

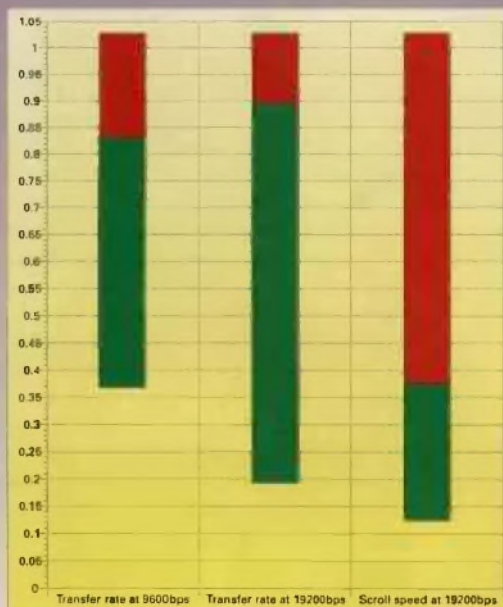
## Vicom Connect

**Good Points** Powerful, upgradable package with UK support.

**Bad Points** More expensive than the simple comms module found in integrated packages.

**Conclusion** Still the best series of Mac comms packages available.

AM Technology  
34-36 Poole Hill  
Poole  
Bournemouth BH2 5BT  
Tel: (0202) 293233  
Prices: Vicom Connect £185,  
Classicom £85





produced with the more powerful programs can be used on the less powerful ones. MultiTerm, the next program up in the Vicom series, comes with an Interface Editor program which allows you to create attractive front-ends for yourself or other users to connect to on-line services.

The top-end Vicom Pro contains a complex and powerful macro language — closer, indeed, to a programming language. Large companies can therefore purchase one copy of Pro (at £595) for their comms junkie to produce powerful front-ends with and Connect for everyone else.

When it comes to sending and receiving files, Vicom Connect supports all the common protocols, including X, Y and Zmodem, MacTerminal and Kermit (and MacBinary versions thereof, so that Mac files come across with data and resource forks intact).

All kinds of variants on the three basic protocols are supported, but the feature that wins my vote for sheer neatness is the way that file receiving is automated. When Vicom detects that the modem at the other end of the line is trying to send a file, it pops up the receive file dialog box and starts automatically — you don't have to tell the program to start receiving, using a given protocol and into a file with a given name. As MacBinary (used for sending and receiving most Mac files) sends a header which gives file size, Vicom will even give you a status bar which shows graphically how long it will take to finish, as well as the effective speed of the transfer.

The Vicom family is not just for modem communication; it can also be used to make a Mac a terminal for a host mainframe, or even for Mac-to-Mac or Mac-to-PC communications across a serial cable. If you use the advanced features found in MultiTerm and Pro, you could make a script attached to a button that would dial up a mainframe, read in data, translate it to a usable format, paste it into a spreadsheet and graph the results.

### Extra pounds

Vicom is not for everyone, however. If you are only going to use your modem occasionally, you can get GreatWorks, an integrated package (spreadsheet, database, word processor and so on) with a fairly rudimentary modem program thrown in

for as little as £99. If you are willing and able to deal with a rather unfriendly user interface with little native support, you can get White Knight for about the same, which is quite powerful. And for the moment, there is no Windows version of the product. But because of Vicom's ease of use, upgradability and local support, I'd say it is worth spending a few extra pounds.

David Brake

## Datasoft Datatalk 4



It has been several years since I used Datatalk in anger, so when I came to review version 4 my memories were of something I didn't like very much which had a dongle and ran badly on an Amstrad 1512. Since I co-ordinated this Group Test, I felt it only fair to don some sackcloth and take one of the lesser packages and let the other re-

viewers have some GUI fun.

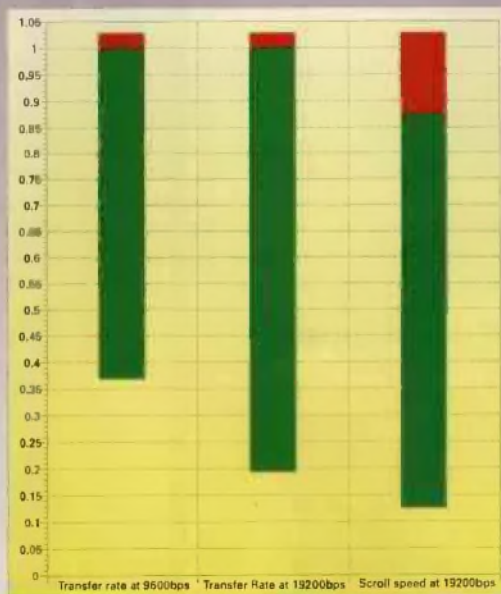
I was wrong. Datatalk 4 is a surprisingly good, flexible communications package. The dongle has gone. It is easy to install and did all that I expected. As it's a British package, it has support for indigenous modems and the phone book is equipped with the numbers of local services.

The program is supplied on a single disk in both formats. The installation routine asks a number of sensible questions and some it could have answered for itself (like which video card you have), and then you're in.

### Refreshingly simple

After using a number of Windows-based programs DOS feels kludgy. There are nearly a dozen command-line switches which handle loading the software as a TSR, memory and a variety of screen formatting functions. But then DOS is kludgy, and there is something refreshingly simple about a comms program which lets you use the whole screen for displaying the information communicated. There is a menu which can be toggled on and off using the F10 key. I found that there were times, like when waiting for a carrier from a remote service, when the menus were unavailable. The same is true of the help function. It is context sensitive but modern by (Windows) standards.

There is a WordStar-compatible text editor which works well but is very much a separate program. You have to exit the editor to get a directory of a disk. Cutting and pasting seems slow but then this is designed as an adjunct to a comms program and not a full-



## Datatalk 4

**Good Points** Fast, good scripting language, support of UK services and modems.

**Bad Points** A little crude.

**Conclusion** Old English charmer.

Datasoft Ltd  
Horton House  
Ditton Street  
Ilminster  
Somerset

Tel: (0460) 57001

Prices: £185; £210 with MNP; £300 with CEPT and VIA secure printing; £1480 10-user network.





blown word processor.

A good selection of terminal emulations is available, including a reasonably rapid ANSI terminal, DEC VT512, VT100 and VT320, a Televideo emulation, a Wyse terminal and an IBM 3101. There is also a custom Datatalk terminal and, unusually, Prestel. The screen refresh using Prestel emulation is adequate given the stone-age modems BT uses. Other terminal emulations are available as a custom option.

As with all the packages reviewed here Datatalk has a little binary book of telephone numbers, supplied configured with a few of the major services and with Datasoft's own telephone number. The setup for modem speed and system parameters are, correctly, specific to the service.

### MNP error correction

One option which makes Datatalk special is the inclusion of MNP, the error-correcting protocol. Modems which support MNP have fallen to the kind of price where the attractions of a software solution have started to wane, but in many applications (particularly when using a portable) it is good to have just in case.

The Utilities menu lets you access the full-screen editor, run some DOS functions, replay Viewdata files and run scripts. The DOS functions include the option to shell out to DOS, which seems a rather recursive thing to do in a program designed to be run as a TSR. The more sensible DOS functions are geared to making sure you can find enough disk space to cope with whatever you are about to download. This is the kind of feature you find in version 4 of a program, after the programmers have used it in anger and thought 'Wouldn't it be nice if...?'

File transfer is comprehensive with a good range of protocols: Xmodem

options include checksum, CRC and 1K blocks; Ymodem and Ymodem-G are supported; and Zmodem, Kermit and Datatalk's own protocol are included. Under Prestel emulation there is the option to download telesoftware using the CET protocol. There are no Compuserve-B options. Thanks to the good tagging options, handling files in batches is reasonably easy. The Zmodem behaves itself and auto-detects incoming data.

Datatalk is very much a programmer's comms package and this shows in many ways. The most obvious is the Datatalk Command Language, DCL, a comprehensive, compiled language with a structure somewhere between batch files and BASIC. At its simplest, macros can be built using a recorder function, at its most complicated, a full terminal emulation can be written. And to a greying BASIC hacker it looks quite fun. The dabbling I indulged in felt much more BBC BASIC than anything I've touched for ages.

The second area in which Datatalk feels like a programmer's project is the manual. Modern software manuals offer a quick way of grasping the salient information and getting going. Datatalk tries to teach you about comms first. This is fine if you know what's going on, or if you have someone to help you, but is not for raw beginners.

### All-round appeal

Most of the programs in this Group Test fall into one of two categories: either a complicated package with more bells and whistles than the Rio carnival designed to be set up by an 'expert' and then used or handed to a naive user who won't fiddle with it; or a simple glass teletype which is easy to use by being limited. Datatalk is neither. It appeals to the enthusiastic amateur and the experienced comms user. I suspect my copy will end up on my notebook.

Datasoft is a bit sticky about users running more than one copy, so if you want to use it to transfer data from your desktop to your portable you'll need two copies, and not just for moral reasons — it is fixed not to work. That aside, for a package I was dreading using, I slowly found myself warming to Datatalk and would recommend it to the DOS user with a small machine.

Simon Rockman

## DCA Crosstalk Mk.4



Crosstalk Mk.4 is a follow-up to Crosstalk XVI, and is a DOS-based version of the popular Windows package of a similar name. If the size and number of manuals is anything to go by, it should be a very powerful program.

Installation was trouble-free and informative, or at least it would have been had I bothered to read the README file displayed when installation is complete. Towards the end of the installation you are given the opportunity to select a different user interface. This is a facility for people used to an earlier version of Crosstalk who don't want to waste time learning a new program but want the benefits of the new release. The package is fairly easy to get to grips with, and has a context-sensitive help system.

The start-up screen shows the dialling directory and a menu of commands at the bottom of the screen. It is a simple task to add a new number to the small existing list. When adding a number you can configure the session: that is, you can choose the terminal emulation, baud rate, COM port, file transfer protocol, startup script and various other variables.

### Emulations

Crosstalk Mk.4 is capable of 21 different terminal emulations including ANSI, ATT513, DEC VT52-VT320,



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### PC 486-33

33 MHZ 80486 CPU, 256K external cache, 8 MB Ram (option 32 mb), Both 1.2 & 1.44 mb floppy drives, Tower Case, Parallel/Serial Ports, MS-DOS 5, Mouse, Windows 3.00, Weitek maths co-processor socket, 1 year on-site maintenance.

	Mono	Super VGA
129 mb 19 ms	£1730	£1940
210 mb 15 ms	£1900	£2110
320 mb 16 ms	£2370	£2580

### PC 486-25

25 MHZ 80486 CPU, 256K external cache, 8 MB Ram (option 32 mb), Both 1.2 & 1.44 mb floppy drives, Tower Case, Parallel/Serial Ports, MS-DOS 5, Mouse, Windows 3.00, Weitek maths co-processor socket, 1 year on-site maintenance.

	Mono	Super VGA
129 mb 19 ms	£1590	£1800
210 mb 15 ms	£1770	£2010
320 mb 16 ms	£2240	£2450

### PC 386-33

33 MHZ 80386, 4 MB Ram (option 32 mb), 64K Cache, Both 1.2 & 1.44 mb floppy drives, Parallel/Serial Ports, Tower Case, MS-DOS 5, Mouse, Windows 3.00, Weitek/80387 maths co-processor socket, 1 year on-site maintenance.

	Mono	Super VGA
89 mb 19 ms	£1180	£1390
129 mb 19 ms	£1230	£1440
210 mb 15 ms	£1410	£1620
320 mb 16 ms	£1870	£2080

### PC 386-25/N

25 MHZ 80386, 4 MB Ram (option 16), Both 1.2 & 1.44 mb floppy drives, Parallel/Serial Ports, Midi tower case, MS-DOS 5, Mouse, Windows 3.00, 80387/Weitek maths co-processor socket, 1 year on-site maintenance.

	Mono	Super VGA
89 mb 19 ms	£1070	£1280
129 mb 19 ms	£1120	£1330
210 mb 15 ms	£1300	£1510
320 mb 16 ms	£1770	£1980

### PC 386S-20

20 MHZ 80386SX, 2 MB Ram, 1.2 or 1.44 mb floppy drive, Parallel/Serial Ports, Desktop Case, MS-DOS 5, Mouse, 80387SX maths co-processor socket, 1 year full warranty.

	Mono	Super VGA
40 mb 28 ms	£ 640	£ 850
129 mb 19 ms	£ 780	£ 990
210 mb 15 ms	£ 950	£1160
320 mb 16 ms	£1400	£1610

### PC 286-20

20 MHZ 80286, 1 MB RAM, 1.2 or 1.44 mb floppy drive, Parallel/Serial Ports, Desktop Case, MS-DOS 5, Mouse, 80287 maths co-processor socket, 1 year full warranty.

	Mono	Super VGA
40 mb 28 ms	£ 560	£ 770
89 mb 15 ms	£ 640	£ 850
129 mb 16 ms	£ 690	£ 900

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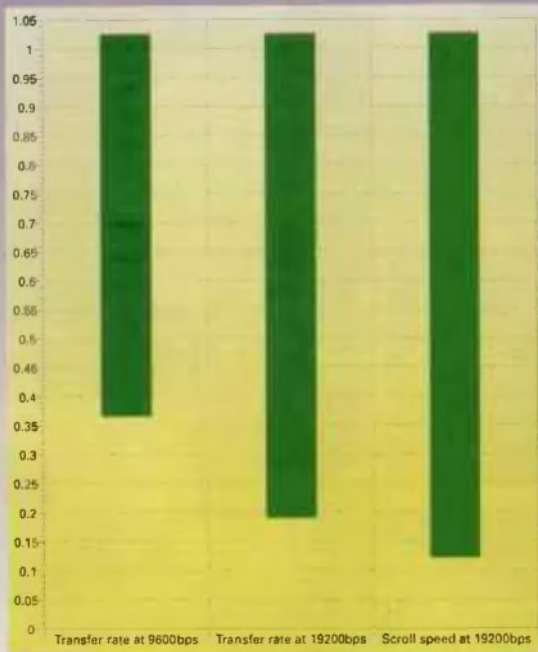
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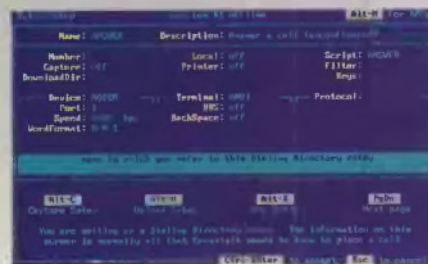
## Crosstalk Mk.4

**Good Points** Sophisticated script language.

**Bad Points** Not for the beginner.

**Conclusion** Powerful and competent.

DCA  
Harvingwell Place  
29-32 Mark Road  
Hemel Hempstead  
Herts HP2 7BW  
Tel: (0442) 231414  
Price: £170



TTY, IBM3101 and Televideo, and there is a keyboard map for each emulation showing where any special keys are simulated. COM ports 1-8 are supported, along with DCA's IRMA card and IBM's 3270 card. If your video card supports more than 80 columns, it can be used to display TTY, ANSI and DEC terminal emulations at 132 columns.

There is support for 11 file transfer protocols including 1024K Xmodem, Ymodem (batch mode), Ymodem-G, Zmodem, Kermit and CSERVERB. There is also an INDFILE protocol which directly supports the IBM 3270 card.

Crosstalk Mk.4 has been programmed using a modular architecture, which not only conserves memory as only the particular terminal emulation and protocol code being used is loaded, but also means that any new features can be incorporated into the program, be it a new protocol, terminal or device. All the popular speeds can be used from 300 to 115,200 bps, but there is no support for 12/75.

### Complex tasks

Scripts can be written using CASL (Crosstalk Applications Script Language), a sophisticated communications programming language that can be used to automate complex tasks. CASL, although advanced, is simple to use and anyone, particularly if they have a knowledge of C, Pascal or BASIC should be able to write complex scripts with little trouble. CASL includes over 250 commands including floating point maths functions and control of screen windows and colours. There are sev-

eral scripts already written, but mostly to log into services in the US.

Any passwords can be encrypted in the script. A script called LEARN, when run, will record subsequent commands and convert them into the necessary commands for a script, rather like recording a macro in a word processor or spreadsheet. Any text editor can be used to write scripts, but there is a good text editor included in the package.

### Receiving CIX

I logged on to CIX and tried downloading a couple of files to see how Crosstalk behaves. I was set up to receive with Zmodem, and as soon as I sent the command to CIX to send a particular file Crosstalk automatically began receiving. While downloading, a bar is displayed showing how much of the file has been received, and there are estimates of time remaining and download speed in characters per second. The size of the file and the exact number of bytes downloaded are also shown.

Crosstalk requires 320K RAM, and if you have the memory, 64K can be set aside for the review buffer which allows you to browse through data that has already scrolled off the screen. When fully installed the program takes up around 1.25Mb of disk space. MSDOS 2.0 or later is required, and the package is supposed to run under Windows, DesqView, TopView and other multi-tasking environments. I did encounter problems when running it under Windows, however. The graphics were corrupted when switching from

windowed to full-screen view and some of the menu text was not visible.

Using a Psion Dacom Fastlane modem (which isn't one of the modems directly supported by Crosstalk Mk.4) set up as a Hayes compatible, there were no problems. Most full-duplex asynchronous modems are supported, including Hayes, Racal-Vadic, US Robotics and Ventel.

### Power package

If it weren't for the fact that I spend most of my computing time within Windows, this would probably be the comms package I would use (a version designed for Windows is also reviewed here). At £170 it isn't cheap, and many people might not need such powerful facilities. But if it's power you're looking

for, Crosstalk Mk.4 should easily handle all your needs.

Mat Beard

## DCA Crosstalk for Windows



Comms packages are rather like word processors: when you find one you like, you stick with it. That's why WordStar still sells. Yes, it's pretty awful, but for people who've always used it, it's familiar.

WordStar was my first word processor (under CP/M) but I grew out of it. Crosstalk for Windows was my first Windows comms package and, despite a couple of half-hearted attempts to wean myself of it, I still use it every day.

I had a bad experience with the DOS



## Crosstalk for Windows

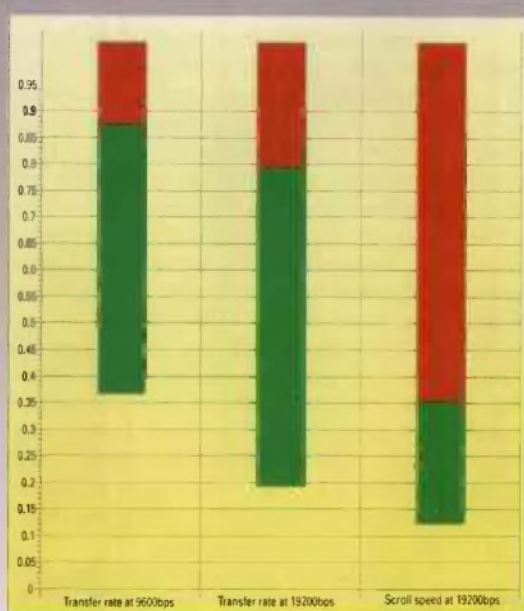
**Good Points** Rich in features.

**Bad Points** Some of which are a little too well hidden.

**Conclusion** Great package, below average user interface.

DCA

Harvingwell Place  
29-32 Mark Road  
Hemel Hempstead  
Herts HP2 7BW  
Tel: (0442) 231414  
Price: £130



and fields are on the first box but, in practice, you often need the extension more than the original.

There were one or two problems with version 1.0. It wouldn't, for example, connect two modems running at the V42bis top speed of 14400 bps. The carrier negotiations took place and the welcome message from the remote machine appeared on screen, but the dialling dialog box remained on top and remained the active window. The only thing you could do was disconnect.

That's fixed now and, for the future, version 1.1 seems to work perfectly well even with Windows 3.1. Version 1.0 seemed to work, too, all except for the dialog boxes which were black on black.

version of Crosstalk five years or so ago. I'd been using Procomm to raid the UK's bulletin boards and grab every bit of public domain software I could find. The company I was working for didn't object, but they didn't like Procomm, so a copy of Crosstalk arrived.

It didn't exactly put me off comms, but it did dampen the enthusiasm. Like many complex DOS applications at the time, it was fairly obvious that you could do fantastic things with Crosstalk. The manual even taught you how to play tunes with the script language. What put me off was that doing simple things, like dialling an on-line service, was, to someone used to Procomm, impenetrably difficult.

### Magic word

When Crosstalk for Windows first arrived, I didn't hold out much hope. I was actually using Windows 2.11 with

Word for Windows 1.0 and Superbase. Word had convinced me Windows had a future and I was determined to use it. Software was a little thin on the ground, though.

I probably wouldn't even have opened the Crosstalk box if it hadn't been for the magic word Zmodem on the outside. Before you could blink, the program was installed. Windows Terminal works, but man cannot live by Xmodem alone.

### Few surprises

Once installed I really began to like Crosstalk. It did most of what I wanted (and a lot more besides) and it did it more or less the way I expected it to. Although it's easier to use than Crosstalk for DOS, I've come across one or two Windows packages since that are a lot easier to use than Crosstalk.

There aren't many surprises. No icon bars or tool boxes.

Just a menu bar across the top, a status bar at the bottom and more dialog boxes than I've ever seen, before or since. There are even more dialog boxes than there appear to be at first. Many have a button marked 'more', which replaces the original with a new box twice the size. The idea is that the most commonly used buttons

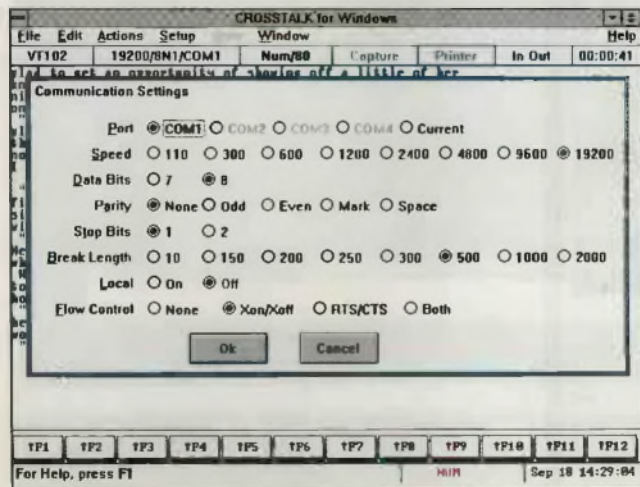
### Four COM ports

Almost everything you expect to find is there. Xmodem, Ymodem, Zmodem, Kermit and Compuserve B protocols as well as Crosstalk's own protocols, support for an enormous range of modems and terminal types and the ability to change fonts. At last, there are also four COM ports. There is still no ability to go beyond 19200 DTE. You can't do it with Windows' COMM.DRV yet, but you will be able to and Crosstalk should support higher speeds.

Useful features, like a simple off-line editor and the ability to copy the screen to a file, the printer or, indeed, the off-line editor (realistically called 'Notes' — Word for Windows it isn't) abound. Little tricks, like a double click on a character on screen sending everything from that point to the next bit of white space as a command, make the program easy to live with, once you are used to its quirks.

### CASL script language

Surprisingly, there are a few basic functions missing. One of the things I always liked about Procomm was the ability to select as many numbers as you wanted and dial them one after another. If you're dialling a service such as CIX where the high-speed lines are very busy at peak times, it makes sense to be able to automatically alternate if you can't get through. You can get round this with scripts. CASL (pronounced 'castle'), the script language, is sophisticated enough that you could not only write a script to dial a fixed set of numbers, you could write one that al-





lowed you to make a selection. That isn't the point.

Another annoyance is the apparent lack of scroll back. The ability to go back through a long message you've read is invaluable and I actually gave up on Crosstalk at one point because of the omission. After only a couple of weeks I was browsing through the manual, trying to find out if I could do some trick or other, when I came across an entry for the Scroll Lock key which, sensibly enough, toggles scroll back on and off. It isn't the ideal solution and it's far too well hidden, but it works.

And that, really, sums up Crosstalk for Windows. It does, or can do, everything you'd want it to. It isn't the easiest comms package in the world to use, but it isn't difficult. Unfortunately, you can't make it play tunes.

Guy Swarbrick

## Hayes Smartcom III 2.0A



In the PC world, Hayes means modems. The company was the first on the market with a successful product in the late 70's and 'Hayes compatibility' is the standard quoted by other manufacturers. With annual revenues of around \$100 million, Hayes, though not a mega-sized corporation, continues to trade healthily in its full range of modems and comms software products.

Smartcom III version 2.0A, reviewed here, is the latest release of Hayes' top-end PC communication software and is aimed at the business market. Hayes also sells the less sophisticated Smartcom Exec and a Mac version, Smartcom II for Mac (not to mention the entry-level Smartcom EZ currently only available in the US).

Version 2, released in April 1991, comes with a number of enhancements over the previous version 1.2. LANs are now supported along with Zmodem

file transfer and 'the rodent' is now recognised. The local area network features are quite comprehensive, allowing multiple machines access to shared modems (via asynch communications servers) and shared printers. Multiple sessions, over multiple ports, also become available in version 2, as well as support for four X.25 (packet switching) connections over one port. These upmarket features underline the business orientation of the product.

The Smartcom III box, complete with shiny-American-business style illustration, contains disks of both formats, a 100-page User Guide, a quick reference card, a thin Network User Guide and a SCOPE Manual for Hayes' comms scripting language (Simple Comms Programming Environment).

Installation takes no time and the setup program de-compresses the software to 1.4Mb. This is not a Windows product and Hayes suggests Windows users load it as a normal non-Windows application, which I did with the appropriate icon.

### Exclusively American

'How about a test drive?', asks the User Guide, again addressing itself to an exclusively American audience by suggesting a US-only toll-free bulletin board to dial. I'm sure the session of 'On-Line with Hayes' is very useful but for all us non-Americans no mention is made of the UK equivalent (on 081-569 1774) which should be fully functioning by the time you read this.

Starting up Smartcom III caused immediate déjà-vu. I had forgotten that I'd used an earlier version years ago, strange collection of utilities and hide-

ously-coloured menu boxes. After a recent diet of swishy, new Windows software, Smartcom III looks very old fashioned.

Despite its ageing appearance, the Hayes product gets you up and running fast and, after a short period of familiarisation, is easy to use. With a little difficulty (about five minutes' worth) I got my modem to burst into life: this is good, as communications software is notorious for stubbornly refusing to oblige, and worse, not telling you why. Once the user has understood the Smartcom approach of splitting setup parameters into 'Activities', such as terminal emulation and file transfer protocol, and 'Connections', phone numbers, modem speed, flow control type and so on which can be mixed and matched, then navigating through the package becomes much quicker.

### Masses of features

Smartcom III has masses of features, and in the confined space of this review many facilities, particularly the sophisticated LAN features, could not be tested. Everything that was asked of the software was delivered, though. Zmodem file transfers worked well and without fuss (not requiring manual selection as in some lesser products), displaying a nice bright red graphical 'progress thermometer' giving percentage, time to completion and transfer rate as well as total time and rate upon completion.

The included SCOPE script language is powerful, allowing the user to customise the package as well as enabling the essential task of automating session activity. SCOPE also has a 'learn' mode





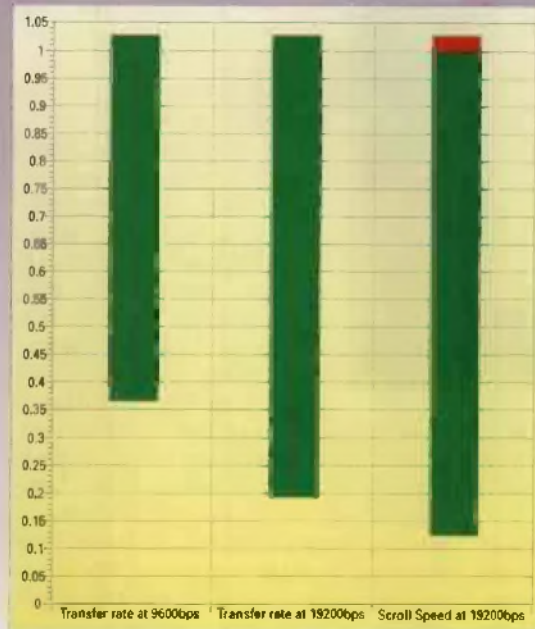
## Smartcom III 2.0A

**Good Points** Loads of features.

**Bad Points** Seems to have occasional arguments with Windows.

**Conclusion** Ageing but comprehensive non-Windows product from thoroughbred manufacturer.

Hayes Microcomputer Products  
1 Roundwood Ave  
Stockley Park  
Uxbridge  
Middlesex UB11 1AE  
Tel: 081-848 1858  
Price: £139



which records scripts for later use and existing scripts from previous versions can be imported.

The original Smartcom appeared before the days of utilities such as Windows File Manager and still has its own data management menus and file-editing facilities, both effective but largely irrelevant and rather crude in today's sophisticated GUI-based environments.

### Keyboard lock-up

Another 'feature' I could have done without was the not infrequent keyboard lock-up, necessitating a machine re-boot. Hayes' technical support line (answering their phone promptly) thought there could be problems running under Windows and suggested a fix which didn't work. Whether it was due to running under Windows I'll never know, but released software running according to manufacturer's instructions shouldn't crash. Hayes say a real Windows version of Smartcom is coming but won't say when.

Apart from the Windows-related glitch, Smartcom III proved to be easy to use and reliable once connected, though it now looks dated in this GUIs-with-everything era.

Nick Edmunds

Where that software has extensive main-frame and general connectivity support, though, MicroCourier is an asynchronous, dial-up, service-oriented program that competes directly with any other package you might consider for personal use.

It is clear that the two products were developed side by side and share much code. Although MicroCourier has a prettier interface, this is achieved by changing the layout and colouration of some of the dialog boxes, putting some large, friendly bitmaps on the buttons and not doing a lot else. The structure of the menus is the same, and the overall functionality matches that of the asynchronous side of Relay Gold for Windows. This is not good.

### European reset

Once installed, the prettier side of the software reveals itself through a new Program Group on the desktop and a

sprinkle of new icons. The install program resets the machine when using the European version of the software—it transpires that this is just to get the date in the right order. Why this should need a reset I have no idea, and why it should ask me when Windows knows perfectly well what system defaults I have set remains an annoying mystery. No other bit of Windows software I have needs to be restarted.

The first icon, Register, is a good idea. It leads you through the filling in of an on-screen registration document, which it then attempts to send to Microcom's own BBS, automatically. Unfortunately, it doesn't know about the UK; although it gives you a chance to add a prefix to the Microcom telephone number it's about to

dial, this is a US 800 number which cannot be called from foreign parts. MicroCourier actually has a UK BBS number (which didn't work, but I did try to call only during the very wee-est of the smallest hours), so it could select this automatically if the company had thought about it.

Then there's a separate Preferences icon which sets up screen colours, initial screen size (like Relay Gold for Windows, this can be one of eight sizes with the font autoscaling to fit. Fortunately, the font is a good deal more pleasant), and so on. The Operator icon leads to a hand-holding on-line demo of the software, which is quite nice, and there are also icons to call Compuserve and the Microcom BBS in the States (again, you must change the number before dialling). This worked, although the slowness of the screen handling made being on line to the States particularly painful.

The final icon is Read Me. This brings up Microcom's own text reader, a painfully bad file viewer which clears the screen and redraws all the text whenever you try and cursor down off the bottom of the window. Why not use Windows' own Notepad, much as everybody else? Anyway, the Read Me file has had a lot of updates since the manual was printed, giving the impression of software in the early stages of its life.

### Quick Buttons & Hotspots

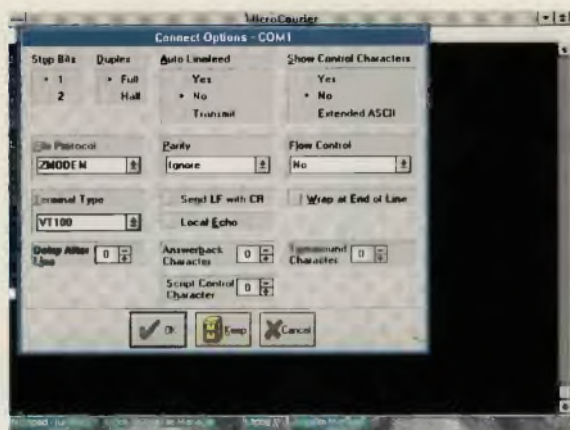
The documentation is quite good. There are two manuals, a User Manual and a Reference Manual. The latter covers the script language, the former the day-

## Microcom MicroCourier 1.0

MicroCourier is a new Windows package that draws heavily on Relay Gold 5.0 for Windows (also reviewed here).







to-day running of the software. There are a couple of features that are worth mentioning; Quick Buttons and Hotspots.

Quick Buttons are ways of assigning script commands to buttons; once you've defined which ones you want, you can click on the vertical scroll bar and it turns into a set of buttons. Click on a button, and the appropriate script function is activated. Alas, there's no way of seeing which button does what, and it's not clear why they needed to do away with the scroll bar to fit the buttons onto the screen.

Hotspots are rather neat; if you have this feature activated (by double clicking with the right mouse button anywhere on screen), then you can click on any text and have it sent back to the host computer. This way, you can point and choose menu items that begin with a letter on the host by clicking on the letters themselves; you can also select filenames and send them back to the host. By changing the script that con-

trols all this, called HOTSPOT.SCR, you can insert filters and translations to add extra text, or even change it altogether, when the selection is echoed back.

Another Microcom innovation is rather less easy to appreciate: when you connect to a service, a miniature keyboard appears in a separate window and you can click on it with the mouse as if you were actually typing. Very nice, except that the keys don't

change when you click on them (so there's no feedback to tell if you've actually done the deed until the host echoes back the character. This doesn't always happen) and it is, as far as I can tell, pretty useless anyway. It's slow and error-prone, and I cannot imagine anyone logging onto a remote system without a keyboard unless they've already got a keyboard emulator in their Windows system (as can happen with PenWindows).

### Bad decisions

I'm afraid that I was unimpressed with MicroCourier. It's not materially different from Relay Gold for Windows other than the lack of serious mainframe connectivity, and that was about the only thing that saved the latter package. It does have DDE, but all the signs are that the interface was designed by someone who didn't have much regard for the standard Windows way of doing things — why bother with your own file lister? — and that some bad design decisions

were made pretty early on in the product's development. The screen handling is possibly the worst aspect of the package; if that were completely redesigned then it might become a pleasant little piece of comms software.

Rupert Goodwins

## Microcom Relay Gold 5.0 for DOS



Of the three Microcom products reviewed in this Group Test, Relay Gold 5.0 for DOS has the purest, longest pedigree. It's really an incremental upgrade on 4.0, with more file transfer protocols and terminal emulations, but at heart and on the skin it's got much of its parent in it.

Installation is simple enough, although there are a couple of unexpected disk swaps to catch the unwary while the three uncompressed 720K disks have their contents siphoned onto hard disk. A brisk question and answer screen then follows, once you've set your preferred comm port (or other hardware — Relay Gold is nothing if not cosmopolitan in its connectivity). It pays to be careful at this point: I set the wrong speed by mistake and it took me a long time thrashing around in the program proper to find out how to change it again.

Once installed, the good old days of DOS applications are forcibly brought to mind. There are no less than 37 command-line switches, allowing you to set useful options (43 screen lines), possibly useful (direct all printer activity to a DOS file)

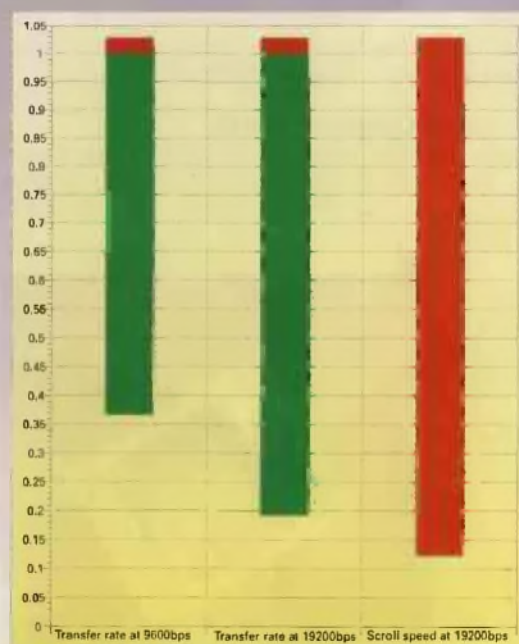
### MicroCourier 1.0

**Good Points** Good help, reasonable manuals, cheap.

**Bad Points** Screen handling, poor Windows conformity.

**Conclusion** Not recommended.

Microcom UK  
2D Dukes Court  
Duke Street  
Woking  
Surrey GU21 5BH  
Tel: (0483) 740763  
Price: £58





Directory of Computers			
Name	Access Number	Speed Type	Notes and Comments
IBM		MODEM: 300 - via 10MHz	
32790		MODEM: 3279 530 graphics	
A HOST		MODEM: Full duplex host	
A PC		MODEM: A PC using RELAY	
ADDS25		MODEM: Adds 25	
AME1		MODEM: AME1 Terminal	
STINCT	9 8181 617 861 3020	MODEM: Lear Single adMS/30	
CIX	9 801 398 9787	MODEM: IBM 3101 model 10	
COMPUSERV	9 871 498 0801	MODEM: Compuserve	
SWACRVS	9 801 287 2509	MODEM: 1180 bulletin board	

Position cursor on directory entry for the following functions:

F1 - Call Name at Cursor	F4 - Review Connect Options
F2 - Answer Name at Cursor	F5 - Access Info for Menu
F3 - Copy Entry to Add a New Name	F6 - Delete Name at Cursor

Esc - Exit    Page - Scroll Forward    Shift - Scroll Back    F10 - HELP

and just plain scary (set size of keyboard stack, specify size of primary comms buffer). If I say that the switches for that lot are /X, /P, /KEYST and /SC, you might suspect that idiosyncrasy sits as high as synchronous comms in Relay's feature list.

### Favourite service

The Main Offline Menu is a list of function key allocations: F1 to call a host, F2 to Answer a call from a PC, and so on. Escape gets you back out to DOS (without the customary 'Are you sure?'), F10 is Help and Alt-K brings up more key options. F3 is probably the most important one for the new user: it lets you create and edit a directory entry for your favourite online service, and then dial it. This is actually quite easy, providing you don't expect Relay Gold to behave like any other comms program; I've no doubt that a new user would have few problems getting the hang of the basic connection. The rest of us, though, steeped in the recent drive towards some sort of common user interface standards, will have trouble.

the cursor on top of them, so it's a matter of experience.

Like its Windows-bound siblings, Relay Gold for DOS has a rich set of file transfer protocols (including Zmodem, INDSFILE and Compuserve-B) and terminal types, and like Relay Gold for Windows has a special affinity for mainframe comms. You can set up to 15 sessions (and with the appropriate hardware, all of them can be dial-in serial ports on your PC, for example) and switch between them.

The script language is the same as that found on the other Microcom products; it's got 165 commands, 45 functions and 115 system variables and is a bit like BASIC only with fewer vowels in the command names. There's a fairly powerful, configurable editor that can be script-driven: it's the sort of rich, quirky environment that people rather enjoy using after going through three months of hell first.

A large collection of example scripts is provided, which together with the tracing error checking should give the curious enough to be getting on with.

The reference manual is well written and has lots of illustrations and examples of the script language in use; if you do decide you need Relay for one of the things it does well, you shouldn't get stuck. Microcom's dial-up bulletin board support may well be helpful too; it's got all the latest software updates and a question and answer forum.

As for the emulation list: 3728, 3279, VT220, VT100, VT52, VT240, IBM 3101, ADM-5/38, ADDS 25, ANSI... if you can't connect to it with Relay Gold, it's probably dead already. It's just a shame that all these features are swaddled together by a user interface that is quite so, well, unusual.

### Comms for techies

This is a technical person's comms package: it works, certainly, and has more features than most people will need. And despite this richness, the very basics of getting online are easy enough to come to terms with. It's when things start to get a little more tricky that the interface starts to get in the way, but if you're setting up SNA links to the corporate mainframe and can spend the time developing the scripts, all this tends to be insignificant.

Rupert Goodwins

## Microcom Relay Gold 5.0 for Windows

Relay Gold 5.0 for Windows is a new product with a pedigree. Launched in September 1991, it's the latest version of a program best known to the mini and mainframe community for its full range of options for connecting small computers to big ones. It's also popular in the US — it was launched there two months before hitting these shores — and is written by Microcom, best known for its origination of the MNP series of error correction and compression protocols.

### High profile

The original Relay Gold has been quite successful with some high-profile clients: the UK Central Office of Information uses it to spray the waiting world with press releases covering the doings of HM Government. Whether it's suitable for us lowly mortals is another matter.

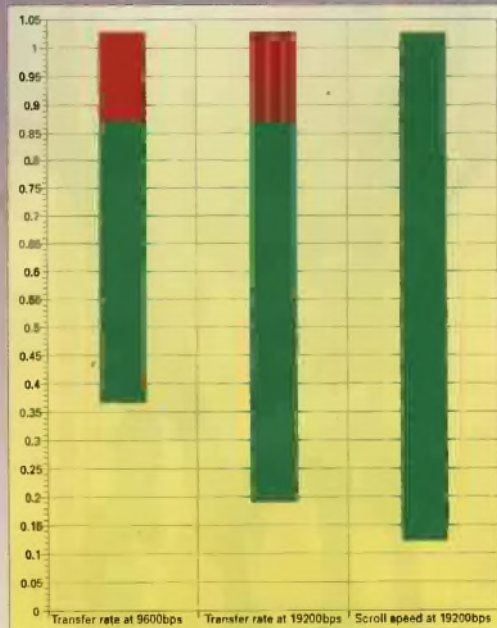
## Relay Gold 5.0 for DOS

**Good Points** Very flexible, good at mainframe comms.

**Bad Points** Terrible user interface.

**Conclusion** No-one's first choice.

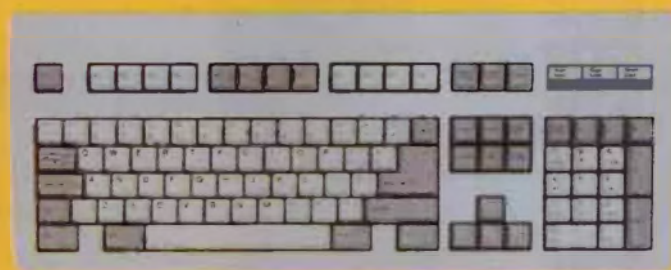
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Unit 25 Boundary Business Centre  
Boundary Road  
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Surrey GU21 5BH  
Tel: (0483) 761686  
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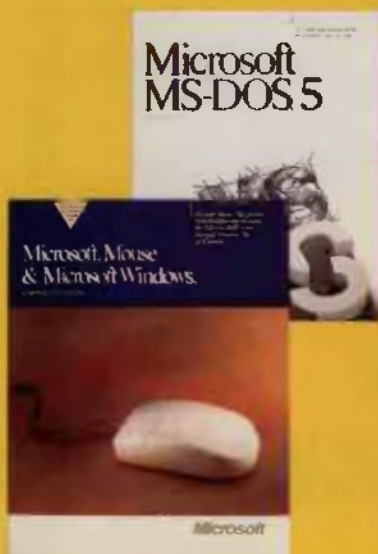
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PROCESSOR	AMD 80386SX	AMD 80386SX	AMD 80386DX	i80486SX	i80486DX
PROCESSOR SPEED	25MHz	25MHz	40MHz	20MHz	33MHz
CACHE MEMORY	n/a	64Kb @ 25nsec	128Kb @ 25nsec	256Kb @ 25nsec	256Kb @ 25nsec
USER MEMORY	2Mb	4Mb	4Mb	4Mb	4Mb
FLOPPY DISKS	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb
HARD DISK OPTIONS	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb
HD ACCESS TIME	9msec*	9msec*	9msec*	9msec*	9msec*
IO PORTS	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN
GRAPHICS CARD	Orchid IIS 1Mb	Orchid IIS 1Mb	Orchid IIS 1Mb	Orchid IIS 1Mb	Orchid IIS 1Mb
MONITOR	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600
MS DOS SOFTWARE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE
ON SITE MAINTENANCE	1 YEAR	1 YEAR	1 YEAR	1 YEAR	1 YEAR
Price: 51Mb	£999	£1199	£1399	£1599	£1999
Price: 105Mb	£1199	£1399	£1599	£1799	£2199
Price: 210Mb	£1399	£1599	£1799	£1999	£2399
Price: 426Mb	£1999	£2199	£2399	£2599	£2999

\* = Effective average access time with 64Kb OnCache on hard drive.

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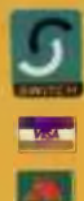
Company \_\_\_\_\_

Address \_\_\_\_\_

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Ti'Ko Computer Corporation, Sales Enquiry Dept., Freepost, Drovers Road, East Mains Industrial Estate, Broxburn, West Lothian EH52 5AU.

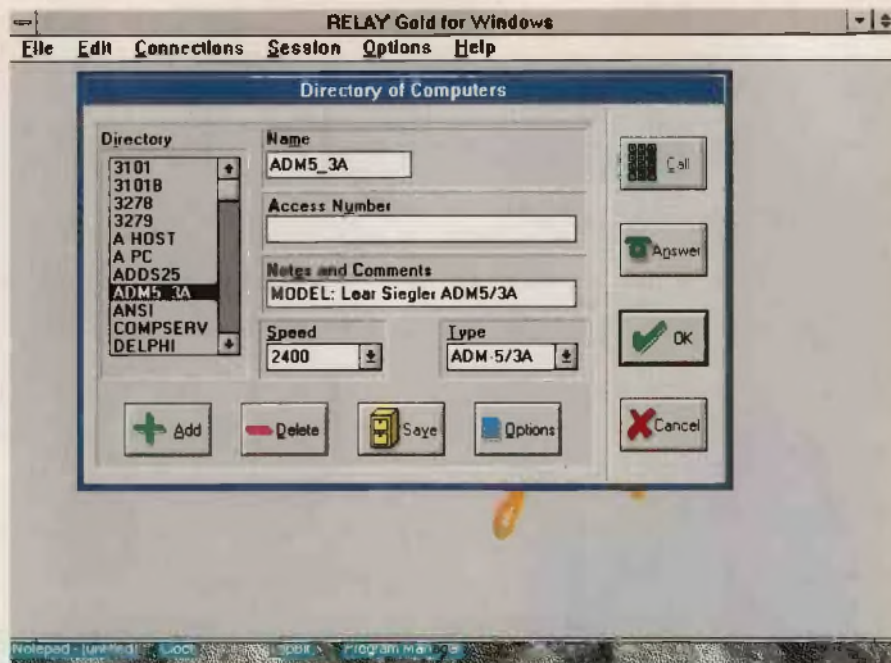






The installation proceeded very quickly — suspiciously so. This was because it completed the procedure the first time I ran the software, taking that opportunity to expand a large set of files. Then, in the setup dialog box that appeared shortly afterwards, I selected the European option (it's that or American — shame it can't find out from Windows) and was told that I'd have to restart Relay Gold again.

So I did. Initially it looked like any other Windows comms package, but on closer examination it turned out to be considerably different. For a start, although you can resize Relay Gold's window, you can only do so to one of eight pre-set sizes — there's no mechanism for just dragging the bottom right-hand corner to the size you want. Similarly, the on-screen font (which, I have to say, is absolutely horrible) auto-sizes to fit the window; there's no other way to change it.



Setting up your favourite service is rather complex. Choosing the Connections menu from the menu bar produces a Directory of Computers: you then pick the type of connection you want (I chose ANSI), rename it, set up the speed, comms port and details such as download status. You then have to go to the Options menu and pick a modem from the list, which is very long and American: it didn't have my Maxam modem but did offer the Zuckermann 1200. You can set different modem types for COM1 and 2. I didn't see any support for 3 or later.

Then you start the session, and in you go. I had to pick a Hayes option to

get my modem going (you can just select Direct Connection and fly the modem by hand), and this sent a load of commands to the remote service once it answered — there was no way of editing this. That done, the online stuff was pretty much standard, except that at the largest window size screen updates are very slow. Even running a 40MHz 386 (albeit in Extended mode with 800x600 video set) it looked more like 2400 bps than 9600.

### Learning a script

I then tried to learn a script. This started well enough, although there was no indication on-screen that one was being generated; to initiate learning, I had to choose Script Macros from the File menu, and then Learn. I bashed away at a standard task, and then selected Learn again to stop it learning. Although it suggested a name to save the script as, and I selected the Save option from the dialog box that popped up, subsequent investigation failed to find any trace of the script anywhere on the disk, so I can't comment on the Learn option although the wide variety of scripts provided did give an idea as to the script language. This seems simple if sometimes difficult to read and prone to convoluted syntax. It is compatible with earlier versions of the language.

The program supports CompuServe-B+, Kermit, all the Xmodem and Ymodem

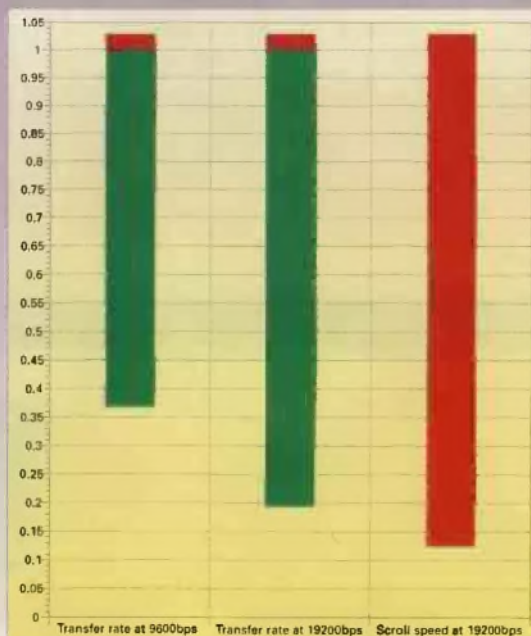
## Relay Gold 5.0 for Windows

**Good Points** Lots of mainframe support.

**Bad Points** Scripting unreliable, Windows special features lamentable.

**Conclusion** Not for the likes of us.

ComWare International Ltd  
Unit 25 Boundary Business Centre  
Boundary Road  
Woking  
Surrey GU21 5BH  
Tel: (0483) 761686  
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PCW92



variants I've ever seen, its own Relay protocol and Zmodem. You can't configure this last one. It does have automatic detection of downloads, although it's not very fast and, as with script learning, there's no indication on-screen that a download is taking place.

### Good connections

Where Relay Gold for Windows comes into its own is with the micro-to-mainframe connections. Lacking an IBM 4381 mainframe or similar, I can merely report that it claims to handle synchronous modems (with an extra SDLC dial-up module), 3270 co-ax boards, Token Ring, SNA/SDLC, QLCC, X25 gateways and others. 3270 emulation is helped by an on-screen keyboard; you can assign scripts to some of the keys, although you can't easily see which scripts are attached to which keys.

Of more immediate interest, it supports bi-directional DDE links, which is probably essential for its chosen market. It can also handle up to 15 sessions simultaneously, so you can if you wish buy a modem for each of your COM ports and talk to two services at once.

There's a little editor which can be overlaid onto the main screen, if you want to change a script (or any other text file) while in the program. It's not very pleasant to use, since it doesn't let you switch back to the main window by just clicking on it, and it doesn't have its own controls — you have to Close it from the main program's File menu.

### Sound at heart

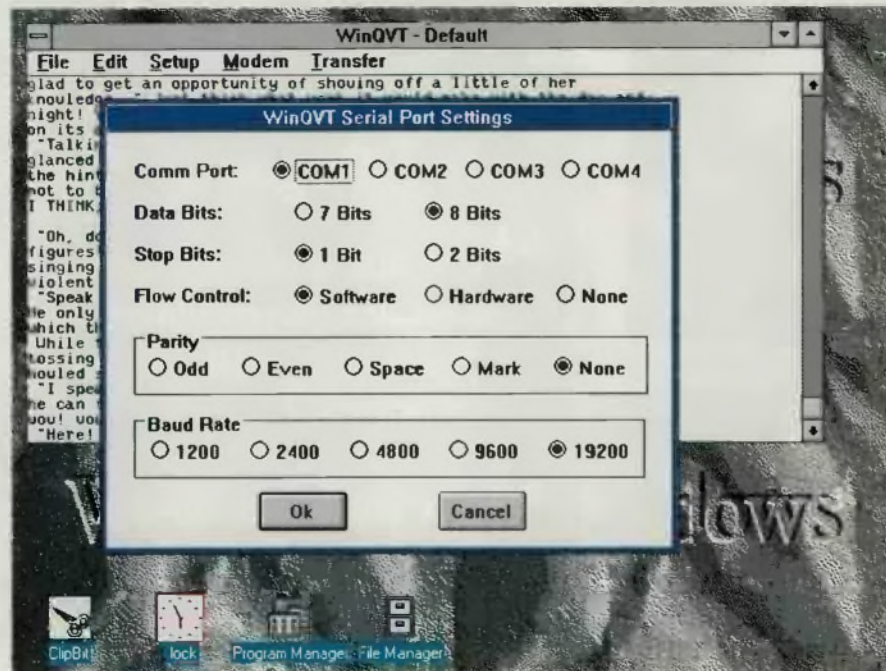
It has to be said that this is a somewhat shoddy Windows adaptation of what is at heart a sound comms engine. Its major targets are laptops, and more specifically those attached to large companies with mainframes; here the fact that it's not an elegant (or, indeed, very standard) Windows program won't matter so much — people will be using it for a fixed number of tasks and won't be so concerned about the fine details of mouse control or script learning.

As a general-purpose comms package to browse around CIX or your local bulletin board, Relay Gold for Windows cannot be recommended. You'll know if you need it; if you don't, you don't.

Rupert Goodwins

## QPC Software WinQVT

There's a strong tendency for applications developers to push development just too far, when they're delivering a



package to market. Thus we have oodles of high-end products with bits and bobs tacked on the sides: terminal emulators with built-in schedulers, bottle-washers and egg-timers. This is most often known as 'singing spreadsheet syndrome', and quite a few of the products in this Group Test suffer from it.

WinQVT doesn't. It's a shareware terminal emulator for Windows, written by QPC Software of Penfield, New York State, and isn't distributed through normal channels: you have to be an existing communications user in order to get your hands on it. Copies of the unregistered version are to be found on conferencing systems and bulletin boards across the globe, so your first exposure to the product will be as the contents of a ZIP compressed archive file.

This demo version unpacks into your Windows directory, coming with a few help and example files, a revision history and some custom fonts (about which more later). There's no install program or batch file, so you have to

link the executable file into your Program Manager or equivalent yourself.

### Getting the job done

WinQVT has few frills. It knows its job, which is as an accurate emulation of the popular DEC range of serial terminals: the custom font file distributed with the shareware release is intended for this job, being used by QVT to precisely duplicate the thin and aesthetically pleasing DEC character set. The usual range of baud rates are supported, along with some additional emulation modes which employ the IBM character set and the ANSI escape codes commonly used to deliver colour changes. These are provided, it seems, to honour the system by which WinQVT is most commonly distributed: American bulletin boards use software which assumes that the IBM line-drawing character set is available on the terminals used to connect to them, and the characters in the DEC font which have the same codes as the lines in the IBM set look most peculiar.

The terminal window can be set to one of only a few sizes from the menu, since it ties the font size displayed to the window size. It is possible to shrink the window by grabbing the bottom-left corner with the mouse, but it's plain that the authors feel a 10 by 40 character view of an 80 by 25 window is not a sensible option. The smallest available font size is roughly 6-point, handy for connecting to a corporate mainframe and keeping an eye on what's happening in the terminal window, while working at some other Windows application on the rest of the screen: WinQVT happily multi-tasks, even





when downloading.

The range and capability of the various download protocols supported by WinQVT are its other strong points; automatic detection and handling of Zmodem downloads is provided, along with the ability to minimise the whole terminal window while the download is in progress. Even the most CPU-intensive Windows program can then be run in the foreground without jeopardising the download.

### The demon within

Running a DOS character mode program did cause me one or two problems while downloading. Xmodem, Ymodem and Kermit protocols are supported, in a cascading menu. When using an older PC with a single serial port in order to communicate with the modem, it is necessary to disconnect any serial mice which might be cluttering up the port, otherwise QVT will complain about an 'Invalid comm port in Config File' and crash with the dreaded Unrecoverable Application Error message. It's possible to drive Windows without a mouse by using the cursor keys, tab, return, and the defined menu shortcut Alt-key combinations, but true to its roots as a DEC terminal emulator, QVT locks the numeric keypad into number only mode. Navigating the download protocol menu on a PC without an Extended keyboard can become truly frustrating — at every turn, it seems, the demon within the machine flips back from cursor to Num Lock mode.

There are a couple of minor niggles

like this: the shareware, 'demo only' version is shipped with versions of the special DEC fonts which are optimised for EGA displays only. Used on the now near-ubiquitous VGA display, there are problems with the window refresh when another application has overlaid the QVT window, and also with scrolling, when the edge of the QVT window is 'beneath' the bottom edge of the screen. These bugs are to be found only in the unregistered version: understandably, QPC wants you to pay for your use of its product and sees no reason to provide a 100% perfect shareware demo.

### Obtuse scripting language

Registration is \$25: I sent an assortment of dollar bills through surface post, and after several weeks received a slim red manual and disk. The manual is dry but informative, failing only where the package fails by making only scant mention of QVT's equally scant scripting language. This is obtuse enough to be worth ignoring: it's clear to me from the state of the manuals that this is a part of the product destined to grow in future releases, though I suspect these versions will be slow in arriving. QPC's other offerings in PC terminal emulation seem to be targeted more at the corporate network market than the script-driven, serially-connected BBS and conferencing market.

QVT is tightly targeted, capable and nicely designed. Well worth the registration fee and refreshingly short of unnecessary decorations.

Steve Cassidy

## Sage Chit-Chat



Chit-Chat from Sage PC Business Software looks as though it *should* be a good package, if the quality of the box is anything to go by. But you shouldn't judge a book by its cover.

First impressions are that Chit-Chat is a touch outdated. Reading through the installation notes (that come in the very nice box, along with several brochures for other software and stationery, office furniture...) lead me to believe it was written around the turn of the century, or whenever it was that people used IBM PCs and XT's. Looking at the copyright date shows that the latest version of the manual was written in 1987. I was right: it is a touch outdated.

After the program files have been manually copied to a directory on a hard disk, it is time to run the install program. You can then configure the program to whatever hardware you are using — well, almost. You can choose from either COM port 1 or COM port 2, any video type (as long as it isn't VGA), virtually any modem (as long as it wasn't made in the last five years), a path for file transfers and any number(s) to dial for an outside line.

### Showing its age

When the configuration has been saved, typing 'chitchat' starts the program and the main menu appears. This shows the program's true age: it was born in 1985. All actions are assigned to function keys shown at the bottom of the screen. Pressing F2 brings up the phone directory which contains a

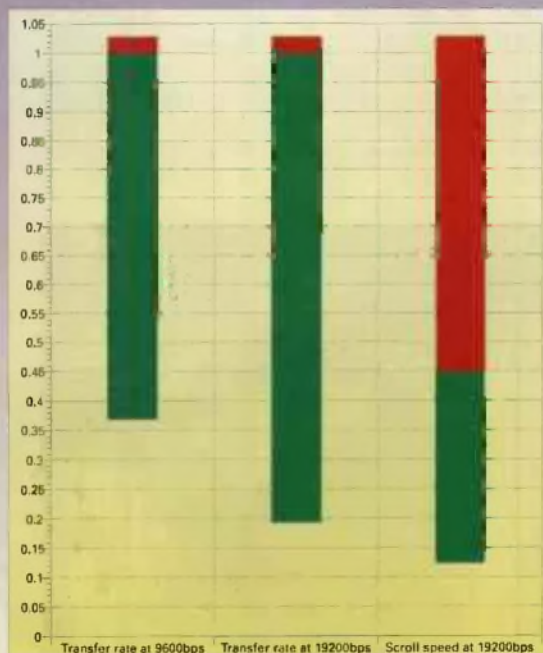
## WinQVT

**Good Points** Simple to use, low disk space requirements.

**Bad Points** Techies-only installation, half-present scripting.

**Conclusion** Neat, shareware Windows terminal.

QPC Software  
PO Box 226  
Penfield  
NY 14526, USA  
Registration: \$25





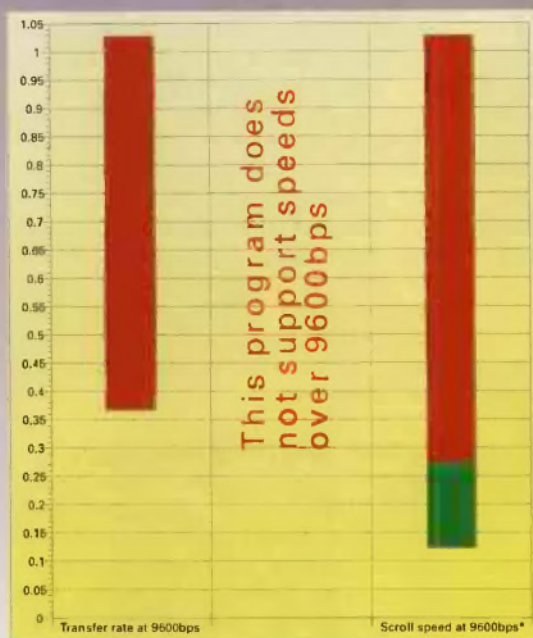
## Chit-Chat

**Good Points** Nothing too complicated.

**Bad Points** Nothing too complicated.

**Conclusion** Future versions might be worth looking at.

Sage PC Business Software  
Benton Park Road  
Newcastle upon Tyne NE7 7LZ  
Tel: 091-201 3000  
Price: £99



whole host of preconfigured numbers for things like Telecom Gold, Prestel, Easylink, One-to-One and various public domain bulletin boards. Most of these are useless — there was none of this 071/081 for London in 1985 and most of the numbers start with 01. Other numbers can be added to this list; up to 32,000 entries can be stored if you have the disk space, and a searching system finds the number you want. But, adding another number clearly shows the program's limitations.

There are two protocols to choose from, Xmodem or DDS-X, the latter for the sole purpose of linking to other machines using Chit-Chat, thus rendering it useless. That leaves you with Xmodem, which isn't exactly rapid.

The software can emulate several terminals: DEC VT52, VT100, VT220, Televideo 910, Lear-Siegler's ADM3A, Teletype and Viewdata. Baud rates up

to 9600 are supported, including the fairly redundant 12/75. There is an automatic log-on facility which can automatically transmit three character strings. Each string is sent when a particular character is received by the serial port; if there is no suitable character a 'D' is used to indicate that the character string should be sent after three seconds.

### Pause problems

When a new number has been set up, it can be selected from the directory by highlighting it and pressing return. A more conventional terminal screen is shown, and the specified number is dialled. The program uses pulse dialling and there is no way of switching to tone dialling (which was rare in 1985). If you start to dial a number on the PCW phones and pause for a while between digits, you get cut off. This is a problem

if you have set up the program to dial 9 automatically, as it places a comma after the 9 causing the dialling process to pause. You have to go out of the program, change the configuration so that it doesn't dial 9, restart the program and change all the numbers so that they are preceded by 9.

The alternative to choosing a number from the phone directory is selecting 'terminal' from the main menu which, when correctly configured, allows you to use the AT command language (and tone dialling). Once connected to CIX all seemed fine, until I tried using the CIX text editor and instead of what I was typing appearing on the screen there was a load of garbage. This wasn't due to line noise, as it only happened when trying to use

the text editor and nowhere else.

### No personal touch

There isn't much scope for personalising the program: you can't assign functions to the function keys, as these are already used, but the program can record 'tasks' to perform when instructed. These predetermined 'tasks' can be set to start at a given time, when there is nobody around, rather like a video-recorder. An example of such a task would be to connect to Prestel after 6pm and download the share price index, or connect to CIX and download any messages, though I don't know what would happen if the numbers were busy because there is no retry option.

There is a built-in text editor, so long messages can be composed before sending thus cutting down the amount of time on-line. There is no mouse support in this or any of the other features, and there is no cut and paste or undo and so on, but the main reason why I couldn't use Chit-Chat was the colour of the text — bright orange on a black background.

### Update urged

It's difficult to work out who Chit-Chat is aimed at as it's so old; it isn't really adequate for anybody. I certainly wouldn't recommend it to anyone, but it might suffice for someone new to the modem world who just wants the basic functions.

If there was ever a program in need of an update, this is it.

Mat Beard

Phone directory		12:11:52
Current block:	Transmit errors:	Receive errors:
TELECOM GOLD 300	01 583 300	300 MODEM
TELECOM GOLD 1200/75	01 583 1275	12/75 MODEM
TELECOM GOLD COMSHARE 300	your local Comshare number	300 MODEM
TELECOM GOLD COMSHARE 1200/75	your local Comshare number	12/75 MODEM
TELECOM GOLD PSS 300	your 300 baud PSS number	300 MODEM
TELECOM GOLD PSS 1200/75	your 1200/75 baud PSS number	12/75 MODEM
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BRITISH TELECOM RADIOPAGING	01 258 3551	300 MODEM
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CBBS LONDON	01 399 2136	300 MODEM
CBBS SU	0392 53116	300 MODEM
CIX 2400	0813981244	2400 MODEM
CIX 9600	0813989787	9600 MODEM
CI TEL	01 679 1880	300 MODEM
WACKNEY AB	01 985 3322	12/75 MODEM
Main menu	Find Entry	Connect to Host
		Add Entry
		Edit Entry
		Delete Entry
		Help



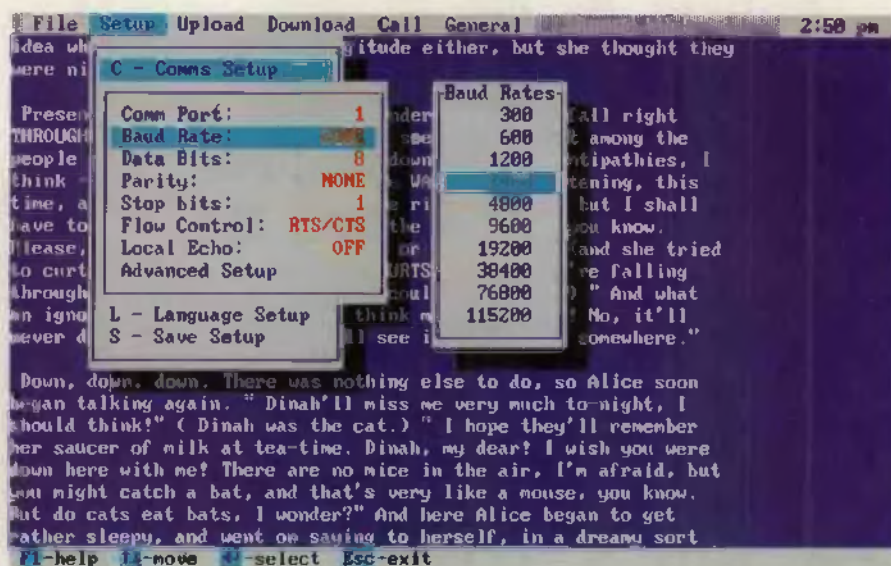
## Skyro & Don Milne Odyssey 1.50



Although it began life as a commercial program, Odyssey has recently become shareware. In a rather pleasant change from the norm, the shareware version is fully functional — it isn't restricted to lower speeds, for example. Registration provides a number of utilities, including a script compiler and a proper manual, which is essential if you're to make any use of the program's powerful scripting language.

Odyssey's initial claim to fame, and the reason for its considerable popularity among users of some bulletin boards, was its provision of error correction in software. When it was first released, this was a remarkable innovation: modems with MNP correction were expensive, and many users didn't want to replace their old modems anyway. The switch from non error corrected comms to MNP correction is a revelation: it's rather like the switch from a computer with a cassette recorder for data storage to one with floppies. Suddenly, comms stopped being a fight against random line noise characters and became a useful communication medium.

If this weren't impressive enough, a few releases later Odyssey was offering MNP 5 data compression in addition to error correction. This effectively doubled the speed of a non-MNP modem on text downloads, by removing redundancy. Downloads of files which were already compressed, with ZIP or ARC for example, are not subject to the same speed increase



since you can only remove redundancy once.

Although it doesn't have built-in support for the faster 16550A UART, a separate program is available that enables the FIFO buffer if the PC is fitted with this faster version of the standard UART.

### Protocols & emulations

Odyssey has the usual collection of download protocols: Xmodem, windowed Xmodem, Ymodem, Ymodem batch, Ymodem-G and Zmodem, as well as Kermit and the proprietary Compuserve-B+ protocol. In common with many other comms programs, Zmodem downloads are detected and started automatically — a very useful feature which saves quite a

bit of fiddling around and wasted on-line time.

There is a reasonable selection of terminal emulations: TTY, ANSI, VT52, VT100, VT320, DG200 and Prestel, although this Viewdata emulation is only available at extra cost. There's also a debug terminal option which shows all the control codes, and which is invaluable if things aren't going according to plan.

An installation routine is provided which unpacks the compressed file off floppy and does an elementary install. This program sets the colours to appropriate values for the LCD on a laptop, for example, asks if you want pulse or tone dialling, and looks for modems attached to any comm ports it finds — enough to get you online. From this

### Odyssey 1.50

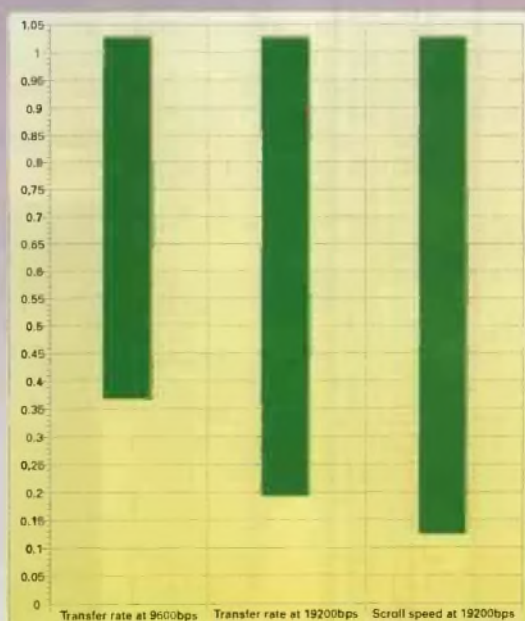
**Good Points** Bargain price, good script language.

**Bad Points** Limited documentation.

**Conclusion** Impressive.

#### Distributor

Shareware Publishing  
3a Queen Street  
Seaton  
Devon EX12 2NY  
Tel: (0297) 24088  
Price: £59 + £4 p&p excl VAT;  
Viewdata module available for an additional £30





starting point you can configure Odyssey further: there is a list of over 35 modems which Odyssey knows about, but configuration should be straightforward even if your modem is not on this list.

### Shelling out

One of Odyssey's features I have always found astonishing, and I don't believe I've seen it on any other DOS comms package, is the ability to 'shell out' to a DOS prompt while in the middle of a download. You have to be a little careful which programs you run at the DOS prompt when you've done that — some are less friendly than others — but it does mean that if you think you're going to run out of disk space because of the size of the file you're downloading, a quick shell to DOS and a tidy-up in the middle of the download is quite feasible.

But for me, what has always been Odyssey's greatest strength is its script language: on more than one occasion it's saved me from a great deal of trouble. Unlike many script languages built into comms packages, Odyssey's has been designed and specified with a view to doing more than simple automated log-ons. I've been able to write very complex scripts to load data from files on the PC into mainframe programs which were not designed to accept data from other than a patient human operator.

### Script compiler

An Odyssey script doesn't have to look like a script in a comms program. Menus and dialogs are easy to implement, and you can even turn off the terminal window itself so that the user sees only your script and not the communication between the PC and the host.

Once the script has been developed, it can be compiled using Odyssey's separate script compiler. This protects the script from prying eyes and tampering fingers, and also allows scripts to be run which would otherwise be too large to fit in memory.

If MNP error correction and data compression in software were all that Odyssey had to offer, it would be an impressive piece of software. However, these features are only part of an unusually capable comms program. With all its other features, particularly the excellent script language, it's hard to beat. If you have a modem which doesn't support MNP error correction or compression, the program will pay for itself eventually, and not only in the reduced online time afforded by the data compression feature — the error correction is at least as important in making comms

easy to use. If you need a comms program with an unusually competent script language, look at this one.

David Morton

## Softklone Mirror III

When a program has a name like Mirror and it hails from a company called Softklone, you get the impression someone is trying to tell you something. On reflection you might opine that Mirror is a copy of something; after reading the manual you are left in no doubt that that something is Crosstalk XVI. But Mirror outpaces Crosstalk XVI and has grown to be better than anything its rivals aspire to.



The package is incredibly feature-rich. When Mirror was first launched it was novel enough to run as a TSR, and popping up by presenting its screen as two halves sliding in from the edge of a CGA screen was deemed as dead clever. Today of course, none of that bears a second glance (well, you might pause to glance at the shell-suit CGA palette and spit).

### Magic letters

What will bear a second glance is the

size of the package and the magic letters on the manual which read UK. Here is a leading American program which has actually been adapted, substantially, for local use; not just a few parameters but to an extent which includes a Prestel emulator. I'm beginning to feel a little sorry for all the software houses which have invested in producing Prestel terminals only to have been let down by the system BT provides. The only people who get excited about Prestel are travel agents, who are catered for by an add-in to the add-in Prestel module which provides secure printing for insurance documents and tickets.

One sign of the age of Softklone is its size. Spread over five disks you can see the middle-agespread of features — not that this is a bad thing, there is little in the way of make-weights. The manuals are similarly hefty and could prove a little daunting for the first-time user, but then this is a package aimed at the user who knows what they want and if that includes network support, mini-to-mainframe links and some of the less common emulations (like Prestel) they won't find it elsewhere.

The inclusion of MNP error correction is a major benefit to users of modems which lack the hardware to deal with the vagaries of sending data over a PSTN. The documentation is comprehensive in the handling of MNP. There are the usual features — a dialling directory, a WordStar-compatible full-screen editor, and mouse support. The add-in system provides a good suite of protocols: Zmodem is handled by the popular DSZ routine. The Prism add-in will run Crosstalk scripts.

### Luddites

There are some computer users who dislike Windows and hate the Mac. If it doesn't have a command line they don't want to know. As machines get faster and user interfaces get better the numbers of these Luddites has started to







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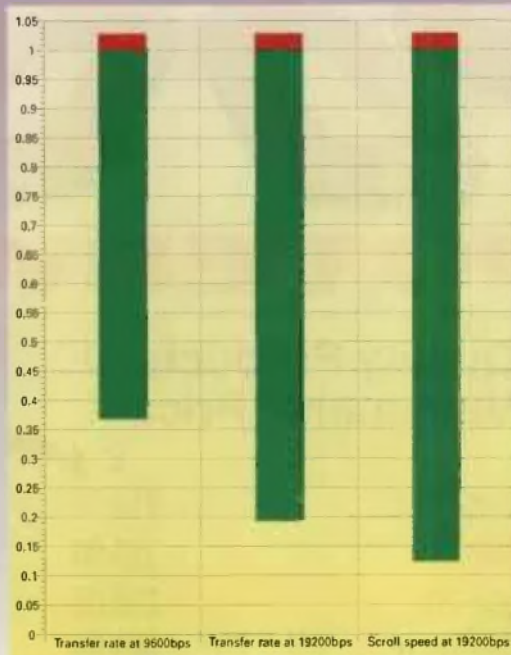
## Mirror III

**Good Points** Comprehensive.

**Bad Points** Complicated.

**Conclusion** Commendable.

Softklone (UK) Ltd  
Preview House  
Boundary Road  
Loudwater  
High Wycombe  
Bucks HP10 9QT  
Tel: (0628) 819200  
Price: £179



dwindle, but it is for them that Mirror was born. The basic user interface is a command line. Yes, there are menus and controls but most of those will only be used when online.

Basic housekeeping, file manipulation and logging on is done from the command line. This isn't necessarily bad: once you are used to it a command line is quicker than a GUI — that's why the techies like it. The command line approach also leads you into the scripting language which is powerful and comprehensive, detailed in a separate tome to the standard manual.

### Buying in bulk

I don't think many people will buy one copy of Mirror III, but lots will buy it in bulk. It offers all the features you could want and comes from a secure company with good support in the UK. Softklone has fought shy of producing a Windows version, which, given the command-line nature of the program, isn't too surprising, but it's a shame. The move to Windows will overtake DOS packages and it would be good to know that there was an upgrade path.

Simon Rockman

## Softklone Talking Windows

Talking Windows UK (to give it its full title — the original version comes from Australia) and I got off to a bad start. As a founder member of the Campaign Against Self-Assembly Manuals, opening the box to discover a ring binder

and a tightly shrink-wrapped pile of pages didn't exactly endear the product to me. When I started to put the thing together I almost gave up there and then.

Like many such manuals there was a set of pages and a set of tabbed cards with labels that read 'Setup' and so on. Nice idea. Normally, those tabs come between chapters or sections in the manual. Not here. They go wherever seemed appropriate at the time. The card marked '3270', the one after 'ASCII terminals', goes about halfway through one chapter.



### Rough guess

It got worse. Having installed all the pages and guessed roughly where the cards were supposed to go, I discovered another batch of pages. The software supplied was version 2 and these were the changes to the manual — over 50 pages. What's more, the instructions

on where they should go are inaccurate, and they're printed on a different sort of paper, trimmed differently and punched differently, so the end result is a mess.

It became more of a mess when I tried to turn back to the front of the manual to find the section on installation. The ring binder is so flimsy that it burst open, spilling pages all over the rather crowded floor of the 19:50 Victoria to Ramsgate.

Having found the installation section, I nearly threw the thing out of the train window. As a founder member of the Campaign Against Windows Applications With DOS Installation Programs, I was shocked. The whole idea of Windows is to make life easier. You really shouldn't, in this day and age, have to create the direc-

tory from the prompt and copy two disks' worth of files into it. The manual does explain how to add the icon to Program Manager, but this really is ridiculous.

What's the program like? Do you really need to ask? The menus are minimalist. They have very little on them because the application does very little. You can set up an online service by choosing Service from the Call menu. The only other options are Hang Up and any services you have already set up.

### Labyrinth

Choose Service and you will find, as you will find when you choose most of Talking Windows' options, that you are faced with a dialog box which is but the start of a seemingly endless labyrinth of further dialog boxes. The services currently installed are listed on the left, next to OK and Dial buttons. Under that, there's a box that displays a comment on each service (not a bad idea) with Hang Up and Connect buttons. Presumably, the difference between Dial and Call is that one sets up the modem first and the other assumes the setup is OK. I say presumably because the manual doesn't appear to mention either buttons and only talks about dialling and hanging up from the Call menu.

Suppose you do, for some reason, want to use Talking Windows. You'd now select New from the choice of four buttons at the bottom of the dialog (the other four are Alter, Delete and Menu, which adds a service to the Call menu).





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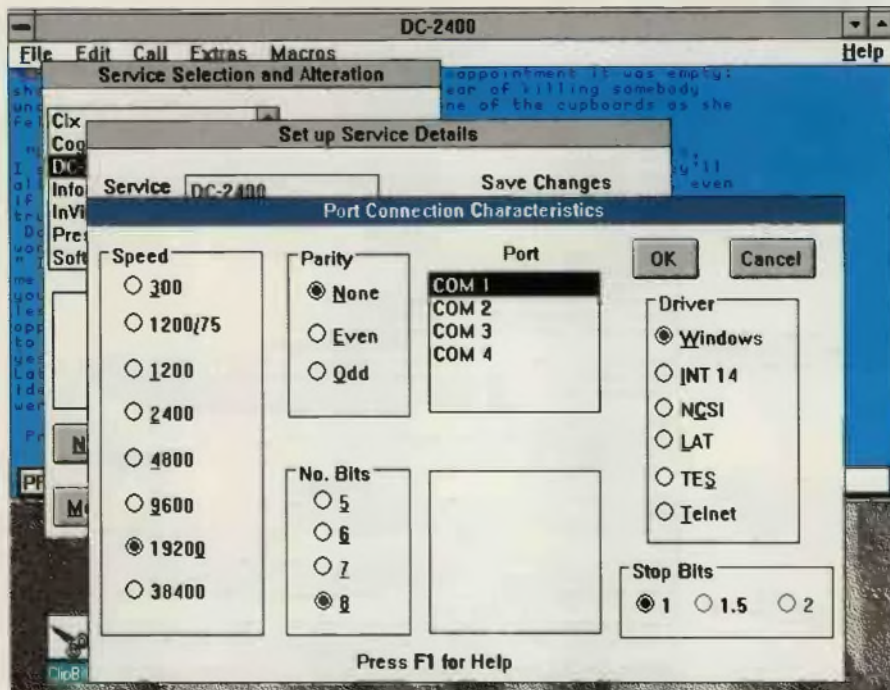
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you to keep it as a reminder or, almost exclusively with Prestel, to keep a range of menus on screen. Clicking on options or page numbers on Frozen Windows carries out the desired action. Mostly.

### Off the edge

The other 'feature' online is that you can have 80 or 132-column terminal emulation. You have no control over the display font though, and for reasons known only to Corporate Workgroup Resources Pty, the 80-column font when used with an 800 x 600 video driver puts the last two columns off the edge of the screen.

If you aren't unconvinced, Talking Windows has Zmodem, Xmodem and Kermit transfer protocols (but not Ymodem or Compuserve-B), ANSI, VT-100 and VT-220 emulations, online help, macros (with recording facility), the ability to run across a network and DDE support. The manual also claims mouse support. On a Windows application? You don't say...

Guy Swarbrick

## Software Ventures MicroPhone II 3.0 for the Mac

I have to admit to a tinge of bias in looking at MicroPhone II: I use it a lot, day in day out, for my general communications. It's therefore a pleasure to kick off by being grumpy about the packaging: nearly 20% of MicroPhone's big yellow and beige box is filled with a slab of foam.

In the box we find the customary Tyvek envelope (this time with four 800K disks), three manuals, plus some quick reference cards. In my review copy, mention was made of an introductory membership for Compuserve, though I couldn't find the normal Compuserve pamphlet in the pack.

MicroPhone is clearly pitched to be a tool for use with online public access data resources and conferencing systems. Only one of the four disks contains the program: the others are entirely taken up with

From New, you'd get another dialog. This one has fields for service name and description as well as the phone number, and, in addition to OK and Cancel, four more buttons. You might think, if you've been paying attention so far, that each leads to another dialog box. You'd be wrong. Three do. The fourth, Set-up, swaps the other three for another three. There are eight in all (the third trio has a blank member) which drop you into Port, Modem, Login, Emulation, InFilt, OutFilt, ToClip and ToHost dialog boxes. If the people at Softklone don't mind, I have a message for the Australian authors:

this is what menus are for.

The manual makes much of the program's VideoText features and they are, indeed, quite good (though not as good as Odyssey or Datatalk). But unless you are one of the rapidly dwindling number of non-travel agent users of Prestel and use it exclusively and have deep religious grounds for not using another comms package, the VideoText stuff isn't enough to justify a purchase.

The only truly original feature, useful mainly for the not very useful VideoText parts of the program, is the Frozen Window. Quite simply it freezes the current display window, allowing

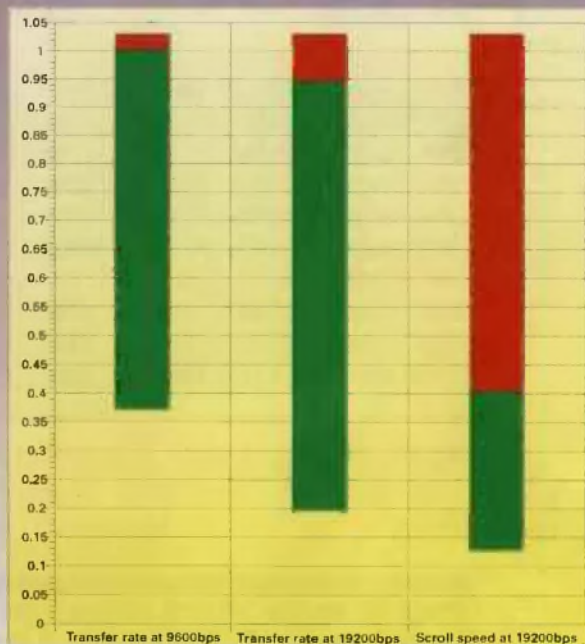
### Talking Windows

**Good Points** Passable Prestel support.

**Bad Points** Everything else.

**Conclusion** What a crock...

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Loudwater  
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Price: £249







extensive environments, ready-tailored for use with a wide range of US-based services.

There's no copy protection to combat, and just dragging all of the program disk into a new folder on the Mac hard disk is enough. The first time you run MicroPhone, you're asked for user name and 'organisation' details, which are displayed each time you start up; then, with little fuss, you're given the typical white-background Mac 'document' window and a collection of menus.

### Advantages

This isn't, however, where MicroPhone's chief advantages lie: it's the script language and the means of working with scripts which excite most attention. All the pre-built environments are supplied as MicroPhone Settings files, in which are held all the communications parameters like baud rate, modem type and phone numbers, and couplets of scripts and icons.

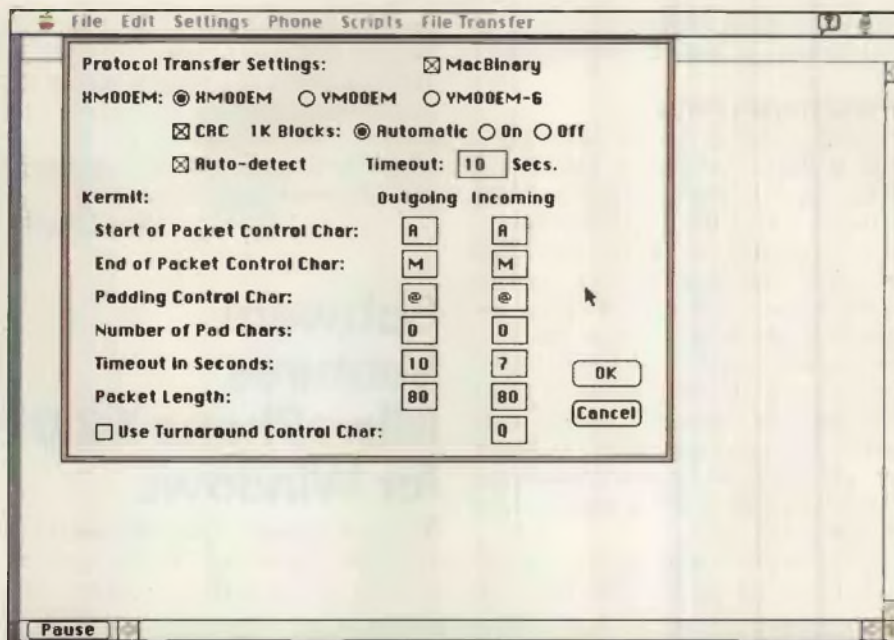
## MicroPhone II 3.0 for Mac

**Good Points** Good scripting facilities, lots of extras.

**Bad Points** Extras only marginally useful in UK, restricted range of terminal emulations.

**Conclusion** Biased towards BBS and online systems, and well suited to them.

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To run a script, you may either choose it from the Run dialog, or click on an icon in MicroPhone's floating icon palette. Loading one of the pre-built settings files will most often present a terminal window that is almost ignored in favour of an icon palette, to semi-automate all the tasks that go with use of an online system. These are split into 'online tasks' and 'offline tasks', commonly allowing messages from you to be written while offline and uploaded to the host, reducing online time and cost.

As an attempt to make systems like Compuserve, MCI Mail and Genie easier to use, this is a creditable start — for US users. If you live somewhere like Boardman, Ohio, you could buy

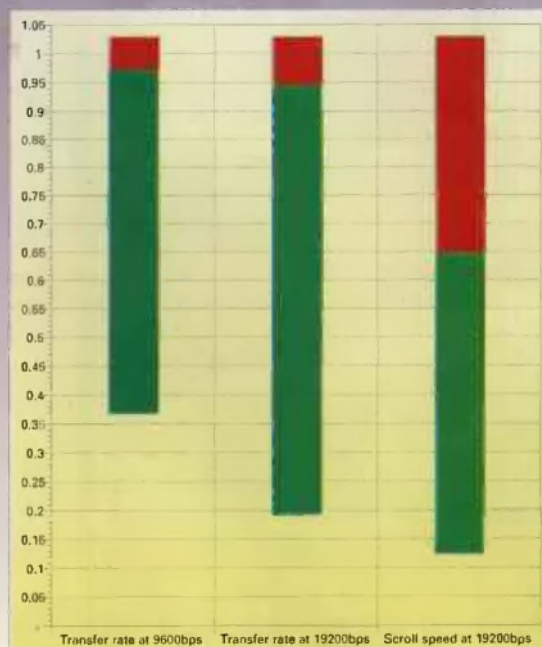
MicroPhone II, find the appropriate file and get cracking. Sadly, there are very few PCW readers in Boardman, Ohio. Here in the UK, only one or two script, palette and online service combinations are going to be of much use; modifying scripts is where you'll spend some time, if you want to exploit MicroPhone to the full.

### Interaction

The script language is complete and warrants the largest manual; what is most curious is the way the user interacts with the scripts. Rather than using a text editing facility to present the text of a script, MicroPhone shows a highly complex dialog box. Elements of the box, describing optional components

of the part of the script language currently being worked on, appear and disappear; it takes a bit of fiddling before you come to understand the rules for inserting, editing and deleting lines from the scrolled listing of the script at the top of the box. If you're going to write scripts, or play with the existing ones, it's best to make sure your mouse is in top condition because that's the only way to drive what happens inside the dialog box.

There is a cluster of facilities for importing and exporting scripts from their hidey-hole in the settings file, but strangely enough there's no provision for moving a script to the Micro-Edi-





tor, which MicroPhone inserts into the Apple menu whenever it is running.

### Persistence pays

Having said that, the rest of the package, with its configurable emulations, wide range of download protocols (including a very nifty Zmodem implementation) and the snazzy 'download progress' fuel-gauge display, warrant some persistence with the scripting language. If you have to deliver scripts to others and don't want them played with, you can even password them. The manuals reflect the package, with very simple and easy-to-follow beginner's chapters, and then a yawning gap before the cold towel intensity of the scripting reference.

A version 4.0 is promised, presumably to come more into line with cur-

rent trends on the Mac, to use System 7 features and possibly also the Comms Toolbox — my copy had a sticker on the outside promising 'free upgrade to version 4.0'. For all its curiosities, MicroPhone knows who its audience is and addresses them correctly.

Steve Cassidy

## Software Ventures MicroPhone II 2.0 for Windows

The first version of MicroPhone II for Windows, introduced in the summer of 1990, lacked such essentials as the

### Logging on to comms software

The 15 packages reviewed here span three operating environments and budgets from under £20 to over £300, so it isn't surprising that the differences are substantial. The ones to avoid are easy to pick out: anything which is expensive and fails to do the job can be passed on immediately.

Sage is clearly not serious about Chit-Chat. The lack of an upgrade in many years, not even to include the 'new' London phone numbers in the dialling directory, tells you that.

Talking Windows and Relay Gold for Windows are awkward and slow. Talking Windows at least has the saving grace of supporting Prestel graphics but this is not a huge advantage unless you are a travel agent.

MicroCourier has the unfortunate distinction of being worse than Relay Gold, but at least it's cheaper: at £58 you get a supported Windows product for shareware money. Relay Gold for DOS is well worth avoiding; the menus are esoteric and it does not feel solid. Running in a DOS window under Windows violates the system integrity.

### Horses for courses

The Mac packages really boil down to horses for courses. The Vicom camp tends to be supported by those Mac users who have always used Vicom and feel at home with the Hayes software.

The cut-down Classicom smacks of a marketing exercise: bundling a modem lead is almost as smart a move as keeping the maximum speed is a dumb one.

For general use, the battle is between Vicom and MicroPhone, and in the PCW office for example, usage is evenly divided between the two. MicroPhone is faster, particularly at

scrolling text, but Vicom wins because it has superior UK support and can be easily upgraded from basic functionality to great sophistication.

### Good communicators

And so to the winners. **Datataalk 4** emerged from the tests as something of a dark horse, a commendable package with a script language which looks manageable. **Mirror** is an ideal purchase for the large company that needs to customise a program.

Deciding between Mirror and Datataalk is down to personal preference. If pushed Mirror would win, if only because of Datataalk's sticking to the rules and requiring two copies if you want to use it to transfer files from your laptop to the desktop. Mirror has the advantage of a better manual and the ability to run Crosstalk macros — enough to merit its inclusion in the PCW Shortlist.

Now we come to the battle which has raged in the PCW office for a while — **MicroPhone vs Crosstalk for Windows**. Previous versions of both products had problems: Crosstalk sometimes failed to realise that you were online, and MicroPhone didn't have Zmodem. The decadent solution was to use both, but with disk space a valuable resource we split into two camps.

Crosstalk has an ultimately more powerful script language in CASL, with the advantage of compatibility with Crosstalk down the generations. But for everyday use, a script language which is easy to use (and as it's from the Visual Basic people, MicroPhone's language is very easy) is probably more important in a Windows application.

Despite its high price, the **PCW Seal of Approval** goes to **MicroPhone II version 2.0 for Windows**.



popular Zmodem file transfer protocol and didn't bother with DDE (Dynamic Data Exchange). Version 2.0

remedies these oversights and adds such delights as a proper help system.

Installation involves just a simple command from within the Program Manager. The software then installs itself, creating a new program group and adding both the main program and a large collection of scripts which have their own icons. MicroPhone is particularly strong in this area: you can create a script for a particular service which can be launched from the desktop without the user having to know anything about the whereabouts or nature of the program itself.

### Faithful to Windows

The software has a familiar aspect to it: it follows the Windows interface scheme faithfully with most of the working area being taken up with the actual comms. There are seven menu headings along the top of the screen: File handles the saving and retrieval of configuration files (called Settings) and printing; Edit is concerned with cutting and pasting stuff from the work area into the clipboard, and DDEs; and Settings, Phone, Transfer and Help handle configuration, the phone book, file transfer and the full help system.

All these menus are logically set out and accessible; those users familiar with communications already will have no problem whatsoever in using any of them, and those who are not will not be further hindered by the interface. The help, if not completely context-sensitive, is at least context-aware; it might not always provide the precise entry you want, but it's usually close.

The Scripts menu, however, is one of the strong points of MicroPhone II. The first entry is Watch Me, which opens a window with a small editor in it. This automatically receives the sali-



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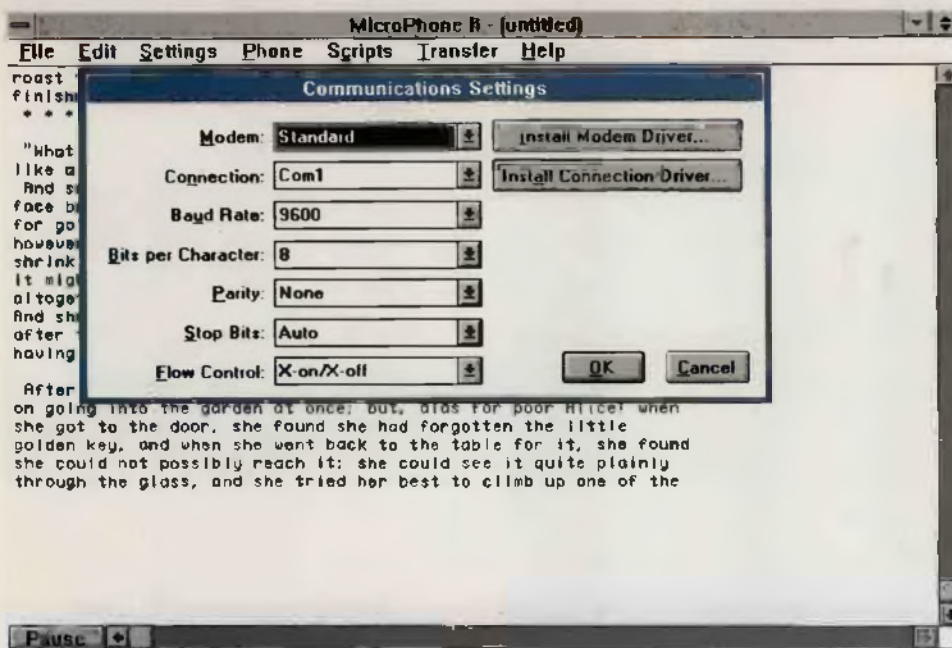
	AM Technology	AM Technology	Datasoft	DCA	DCA	Hayes	Microcom	Microcom
	Classicom	Vicom Connect	Datataik 4	Crosstalk Mk4	Crosstalk for Windows	Smartcom III	MicroCourier	Relay Gold DOS
<b>Protocols</b>								
<b>Xmodem 1024</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>Ymodem</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>Ymodem-G</b>	Receive only	Y	Y	Y	Y	Y	Y	Y
<b>Zmodem</b>	N	Y	Y	Y	Y	Y	Y	Y
<b>Kermit</b>	N	N	Y	Y	Y	Y	Y	Y
<b>CSERVEB</b>	N	N	Y	Y	Y	Y	Y	Y
<b>Terminal Emulations</b>								
<b>ANSI</b>	N	Y	Y	Y	Y	Y	Y	Y
<b>VT52</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>VT100</b>	Y	Y	Y	Y	Y	N	Y	Y
<b>VT102</b>	Y	Y	N	Y	Y	Y	N	N
<b>VT220</b>	N	Y	N	Y	Y	N	Y	Y
<b>VT320</b>	N	N	Y	Y	Y	N	N	N
<b>IBM 3101</b>	N	N	Y	Y	Y	N	Y	Y
<b>TTY</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>TV</b>	N	N	Y	Y	Y	N	Y	Y
<b>Prestel</b>	Y	Y	Y	N	Y	Y	N	Y
<b>Fastest Rate Supported</b>	4800	57600	115200	115200	19200	115200	19200	38400
<b>Number of COM Ports</b>	2	Unlimited	8	8	4	4 (PS/2 8)	2 (PS/2 8)	2 (PS/2 8)
<b>Re-try on Busy</b>	Y	Y	Y	Y	Y	N	N	Y
<b>Save Buffer</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>Scroll-back Buffer</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>Number of Commands</b>	30	70	120	400	300	165	250	250
<b>Run Script on Start</b>	N	Y	Y	Y	Y	Y	Y	Y
<b>TSR</b>	N	N	Y	N	N	N	N	N
<b>Network Support</b>	N	Y	Novell	Y	Y	Y	N	Y
<b>Text Editor</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>132 Column Support</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>Mouse Support</b>	Y	Y	N	N	Y	Y	Y	N
<b>Choice of Fonts</b>	Y	Y	N	N	Y	N	Y	N
<b>Progm'ble Function Keys</b>	N	N	Y	Y	Y	Y	Y	Y
<b>Up/Dn-load Speed Indication</b>	Y	Y	Y	Y	Y	Y	Y	Y
<b>Operating Env'ment</b>	Mac	Mac	DOS	DOS	Windows	DOS	Windows	DOS
<b>Host BBS Mode</b>	N	Y	Y	Y	Y	N	Y	Y
<b>Context Sensitive Help</b>	N	Y	Y	Y	Y	Y	Y	Y
<b>Print Selected Text</b>	Y	Y	Y	Y	Y	Y	Y	N
<b>NMP</b>	N	N	Y	Y	Y	Y	N	N



## COMMUNICATIONS SOFTWARE

	Microcom	QPC Software	Sage	Skyro	Softklone	Softklone	Software Ventures	Software Ventures
	Relay Gold Windows	WinQVT	Chit - Chat	Odyssey	Mirror III	Talking Windows	Microphone II Mac	Microphone II Windows
Protocols								
Xmodem 1024	Y	Y	N	Y	Y	N	Y	Y
Ymodem	Y	Y	N	Y	Y	N	Y	Y
Ymodem-G	Y	Y	N	Y	Y	N	Y	Y
Zmodem	Y	Y	N	Y	Y	Y	Y	Y
Kermit	Y	Y	N	Y	Y	Y	Y	N
CSEVERB	Y	N	N	Y	Y	N	N	N
Terminal Emulations								
ANSI	Y	Y	N	Y	Y	Y	Y	Y
VT52	Y	Y	Y	Y	Y	Y	Y	Y
VT100	Y	Y	Y	Y	Y	Y	N	Y
VT102	N	Y	Y	Y	Y	Y	Y	Y
VT220	Y	Y	N	Y	Y	Y	N	N
VT320	N	Y	N	Y	Y	N	N	N
IBM 3101	Y	N	N	N	Y	N	N	Y
TTY	Y	Y	Y	Y	Y	Y	Y	Y
TV	Y	Y	N	N	Y	Y	N	N
Prestel	N	N	Y	Y	Y	Y	N	N
Fastest Rate Supported	38400	19200	9600	115200	115200	19200	57600	115200
Number of COM Ports	2 (PS/2 8)	2	2	8	4	4	unlimited	4
Re-try on Busy	Y	Y	N	Y	Y	N	Y	N
Save Buffer	Y	Y	Y	Y	Y	N	Y	Y
Scroll-back Buffer	Y	Y	N	Y	Y	Y	Y	Y
Number of Commands	250	40	30	100+	400	100	80	60
Run Script on Start	Y	Y	Y	Y	Y	Y	Y	Y
TSR	N	N	N	N	Y	N	N	N
Network Support	Y	N	N	N	Y	Y	Y	Y
Text Editor	Y	N	Y	Y	Y	Y	Y	N
132 Column Support	Y	Y	N	With scrolling	N	Y	Y	Y
Mouse Support	Y	Y	N	N	Y	Y	Y	Y
Choice of Fonts	Y	Y	N	N	N	Y	Y	Y
Progm'ble Function Keys	Y	Y	N	Y	Y	Y	Y	Y
Up/Dn-load Speed Indication	Y	Y	N	Y	Y	N	Y	Y
Operating Env'ment	Windows	Windows	DOS	DOS	DOS	Windows	Mac	Windows
Host BBS Mode	Y	N	Y	Y	Y	N	Y	Y
Context Sensitive Help	Y	Y	Y	Y	Y	Y	Y	N
Print Selected Text	Y	Y	Y	Y	Y	Y	Y	Y
NMP	N	N	N	Y	Y	N	N	N





ent details of your interactions with a dialled-up service in the main work area, carefully filtered and turned into valid commands in MicroPhone's script language.

The script language itself is rich and fully supports all MicroPhone features. This includes DDE, and you should be able to hook MicroPhone up to Excel, for example, and get stock prices popped into your spreadsheet. Actually, the permutations with DDE are endless — I even considered writing a set of scripts that would take text from one conferencing system, pass it to a word processor for reformatting and then post it, automatically, as a reply to any messages in which it recognised certain key words. The script language is vaguely

similar to Pascal, but it's easy to use and understand; there are lots of example scripts provided and the manuals are clear and well thought out.

### Common types

In use, MicroPhone II was slightly more uneven than first impressions promised. I immediately ran into problems with its terminal emulations — it supports a few common types, most notably VT52, VT100 and ANSI. The trouble came when the window in which MicroPhone was running was less than the number of screen lines that the emulation had been set up to use.

MicroPhone has a scroll-back buffer, which you can access via a scroll bar down the right-hand side of the screen;

when the window was too small, the software insisted on displaying a fixed point in that buffer. All the action took place off-screen, well below the point displayed, and it proved impossible to set things up so that I could reliably see what I was typing and what the response from the online service was unless I resized the window to contain the whole of the emulated screen.

When it first started up, MicroPhone assumed a 25-line screen regardless of the actual setting. I habitually use 50 lines, so it was annoying to have to go into Setup, switch to 25 lines and then back to 50 before I could use the software properly.

Having said that, I did enjoy using MicroPhone because when it behaved itself, it was a well designed and reliable software package. It had just about every feature I could think of, excepting only that the terminal types and file transfer protocols were curiously few in number. It had X,Y and Zmodem, but not all variants and nothing like Compuserve-B or Kermit. The Zmodem implementation seemed satisfactory. I soon got into the habit of initiating a big download and minimising MicroPhone until it completed — the icon in the bottom left-hand corner of the screen displays both file size received and the percentage of the complete transfer it represents.

### Better integration

MicroPhone II has lots of other features such as a mini-BBS and network capability (INT 14, NetBIOS, Ungermann-Bass, and others), and what it doesn't have you can most likely write for it. Perhaps it's because it comes from a Mac background, but it feels better integrated with the Windows environment than many DOS conversions I know. It was fast enough (on a 40MHz 386 it had better be) with screen handling at a small font size, although larger fonts did seem to make it struggle a little.

This software has its problems but they're easy enough to work around. Those aside, generally speaking MicroPhone II is a very good piece of work and should find favour with newcomers and old hands alike. It's easy to use, but includes enough functionality to do just about anything a Windows comms package should. I'd be happy to buy this software.

**Rupert Goodwins**

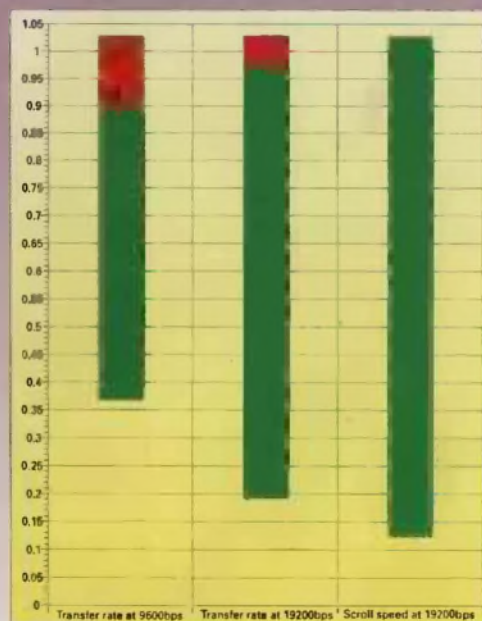
## MicroPhone II 2.0 for Windows

**Good Points** Fully featured, good manuals, excellent scripting facilities.

**Bad Points** Could do with more and better terminal emulations and file transfer protocols.

**Conclusion** Good.

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						✓	✓		✓						0.1	✓						£49 Husky (External)
		✓	✓			✓	✓	✓							5							£99 Comrade (PC Half-card)
		✓	✓			✓	✓	✓							11							£119 Calibre (PC Half-card)
4800		✓	✓			✓	✓	✓			✓	✓			5							£149 Econolax (PC Half-card)
		✓	✓		5	✓	✓	✓							5							£149 Viva 24M (External)
		✓	✓		5	✓	✓	✓					✓	✓	5							£179 Supra (External)
		✓	✓		5	✓	✓	✓							5	✓						£199 Modular Technology 5024/5
		✓	✓		5	✓	✓	✓					✓	✓	5	✓						£219 Bison (External)
		✓	✓		5	✓	✓	✓			✓	✓			5					9600	✓	£233 Champ (PC card, 62% length)
9600 9600		✓	✓		5	✓	✓	✓			✓	✓			5					9600	✓	£333 Combo (PC card, 62% length)
9600 9600		✓	✓		5(a)	✓	✓	✓			✓	✓	✓(a)	✓(a)	5							£333 Compact (Tiny Portable, 9v battery)
		✓	✓		5	✓	✓	✓					✓	✓	2	✓	9600					£449 Vole (External), Coypu (PC Half-card)
		✓	✓		5	✓	✓	✓					✓	✓	2		9600 14400					£499 Forval (PC card)
		✓	✓		5	✓	✓	✓					✓	✓	1	✓	9600		10430			£549 Courier DS (External)
		✓	✓		10	✓	✓	✓					✓	✓	1	✓	9600					£599 Tricom Tornado Quin 10/42

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# The robots are coming — at a dumb crawl!

We're invited so often to be impressed by the Japanese that their robotics exhibition in London came as a relief. Its stupid automatons served to show how far work in the area has *not* progressed. And we're not doing so bad in Britain, either. Nick Beard reports.

**T**he Science Museum in Kensington, West London, recently held an exhibition of 24 Japanese robots. There seems little doubt that industrial robotics has been intimately linked with the vigorous success of the Japanese manufacturing sector in recent years, and the devices on display at the Science Museum were impressive enough as a testament to that success. The show was nevertheless disappointing, for two reasons. The first was the organisation of the exhibition, the second was the limited skills of the robots.

Most visitors had to queue for a long time to get in — it's a comforting thought at least that science can sometimes excite a generally scientifically illiterate population. The people density in the Victorian building was frequently so great, though, that it is hard to see how the exhibition could have been considered safe. In addition, people in wheelchairs would have found it especially hard to see what was going on. Technical details were sparse, and the demonstrations were not continuous. (Do state-of-the-art industrial robots require tea breaks every fifteen minutes? Have they found so militant a shop steward already?)

The main disappointment, though, was with the robots. Not that they were not good at what they did, but, somehow, there was little that surprised or amazed. Many of the robots were production line workers, with little capability outside the job they had been taught to do. Dr Neil Cossons, director of the museum, said: 'Robotics is an important area of technological development with extraordinary implications for the future not only of industry but for the day-to-day lives of all of us.' This is true — but the display was restricted largely to the mechanics of indus-



SHADOW PROJECT PHOTOGRAPHY BY JOHNNY MILLAR



trial systems. Few of these devices could have a domestic role, unless you are prepared to order your home with the precision of a Japanese car manufacturing production line.

A flower-arranging robot, for example, offered an impressive demonstration of the precision with which two powerful servo-controlled arms can be made to act in unison. They spun and waved with a perspex-stemmed flower between their fingers, each arm apparently 'knowing' where the other was, barely bending the stem — barely, but enough to drop the stem and then carry on, unwittingly empty handed. Clearly, the system had no mechanism for correcting its pre-programmed 'world model'.

One of the most appealing robots on display was the painter — the Panasonic Portrait Drawing Robot. This was adapted from a system designed for use in printed-circuit-board construction. It involved a video camera linked to image processing software, which converted a still grabbed from the camera into a string of instructions for the robot arm holding a paint brush. The result was an impressive artistic impression (see the pictures of my son, Alex, alongside).

### Brush strokes

The system takes coarse and fine definitions from the camera image, and converts these into a series of lines with which to construct the image. A bit of 'intelligence' is applied to detect the eyes, which are painted with more detail. The robot, with a variety of brush strokes, then paints the picture. But how state of the art is that? It is over a year, for example, since a French company, Kreon, demonstrated its 3D 'automatic sculpture system' at the Applica 90 high-tech conference in Lille. This device used a combination of laser and prism to extract depth information from an image through a single video camera, which then controlled a machining tool — a simple robot this! — to cut away all those bits of wood that did not look like the object being sculpted.

Sanyo's cleaning robot — out of order on the day of my visit — had the makings of a more striking flexibility and independence. This device also had a world model, but one it had found for itself as it wandered around avoiding things with ultrasound and infra-red sensors. Yet (even when working) it was behind bars. Were none of these machines sufficiently robust — in physique or intellect — to be let loose among the crowds of observers? What does that say about their applicability in the real world? It's tough on the streets, you know! Tougher than the Science Museum, surely?

One feature being shown was compliance, crucial in domestic systems. It means the ability to alter the way a limb moves according to the resistance it meets, just as we do when clearing tables or washing children. The compliant motion arm had been developed by the Mechanical Engineering Labs of the Agency of Industrial Science and Technology.

There was some evidence at the exhibition of the move towards greater robot autonomy, with a different approach to conferring wit on the things. Most robots are programmed. Their

every act and response is painstakingly prepared and stored as a set of instructions to be followed to the letter, however brainless this appears to an outside observer. A robot system will keep on spray-painting a car, even if the car has fallen off the painting platform.

These precise programs have enabled robots to be very effectively exploited in a range of tasks, following their instructions very reliably. Biological systems do not generally work like this, which is perhaps why industrial robots surpass people in some tasks. But domestic environments are usually less structured and predictable than industrial ones.

A useful domestic robot would not need to be especially rapid, just robust. If it could be trusted to confine its attentions to empty coffee cups, not to get lost or stuck, and not to abuse the cat or eat unattended wristwatches, it could be left to wander round the house as a slow, background process that kept the place clean.

Until recently, received wisdom was that such robots required a powerful reasoning system, a sophisticated visual capability, and sufficient computational resources to build thorough world models. This wisdom is being challenged. As an alternative to the rigid robot, dutifully and stupidly doing what it is told, come what may, many researchers are exploring approaches based on techniques such as neural networks, genetic algorithms, and artificial life models such as 'swarm intelligence'. One of the leading advocates of such 'bottom up' approaches to robot control is Rodney Brooks (see 'Frontiers', PCW May 1991).

### Behaviour sets

Brooks is enticing machines along a route towards behavioural robotics. 'Notions of world modelling are impractical and unnecessary,' said Brooks (*Building robot*, Flynn and Brooks, 1989, IEEE/RSJ International Workshop IROS 89, Tsukuba, Japan 236-243). The key idea is that instead of breaking down a complex task into a fixed sequence of steps which take place in a carefully modelled world, the robot is equipped with a set of behaviours.

This presents an interesting possibility — complex behaviour can stem from complex environ-



▽ Frank (the tank) is one of a series of robotics platforms offered by TAG





ments rather than complex programs. Each behaviour is a potted skill set, with its own views about when to act (such as follow object, or avoid object). The next problem is to give one robot lots of behaviours, in a way which avoids conflicts. One approach was Brooks' subsumption architecture, which is built on competence layers. Each layer has sufficient (and no more) computational resource to

add to the competence of the lower layers, and only one behaviour can be active at any time.

Two British companies working in the field of neurally controlled robots are The Technology Applications Group, and Artificial Life Technologies. Martin Snaith and Owen Holland, of TAG and ALT respectively, discuss approaches to controlling tasks that can be active simultaneously. There ▶

### Out of the shadows

One of the biggest problems of building a robot in your attic is persuading people to take you seriously. Yet the people who make up The Shadow Project are very serious about their plan, which is to build a robot domestic assistant. Richard Greenhill, one of the main project coordinators, issues a challenge: 'Prove that we're crazy, that it cannot be done — or fund us!'

The Shadow strategy is to imitate the human body — at least in terms of shape, size, movements and strength — and work towards ever-greater performance. The long-term goal (likely in practice to be a ceiling) is around 90% of human performance.

There are benefits to the human shape: our world is designed to accommodate it. The range and subtlety of motions involved in using human hands to clear a table after a dinner party is enormous (and it rarely defeats us, even in the aftermath of a wine excess). We are happy to potter about shifting stuff from table to sink in a highly efficient manner, with hardly a thought.

Most robots, however, are rigid things in both physique and intent. Flexible responses to complex environments are difficult to program, and the mechanics of flexibility — through servos and control rods — are not much easier. Clearly, the pre-programmed sequences of a car-painting robot are of little use to a domestic assistant. Something a little softer is needed.

The Shadow Project intends to build a compliant robot, using air-bag muscles to power movements. You may remember a toy, sometimes called a Chinese finger trap, consisting of a finger-sized tube made of a knitted, braided material. If you stick in a finger you can't get it out again, because the material contracts as you tug at it. Shadow's artificial muscle is similar, except that the muscle-like contraction is triggered by inflating an embedded rubber balloon.

The Shadow team attaches these muscles to a wooden skeleton strong enough to be self-supporting but light enough to be moved pneumatically. Richard Buckley, designer of the structure, has made a point of mimicking human anatomy when this seems to bring benefits. 'We do this even where it contravenes conventional robotic wisdom, such as having a muscle crossing two joints,' said Buckley. This is

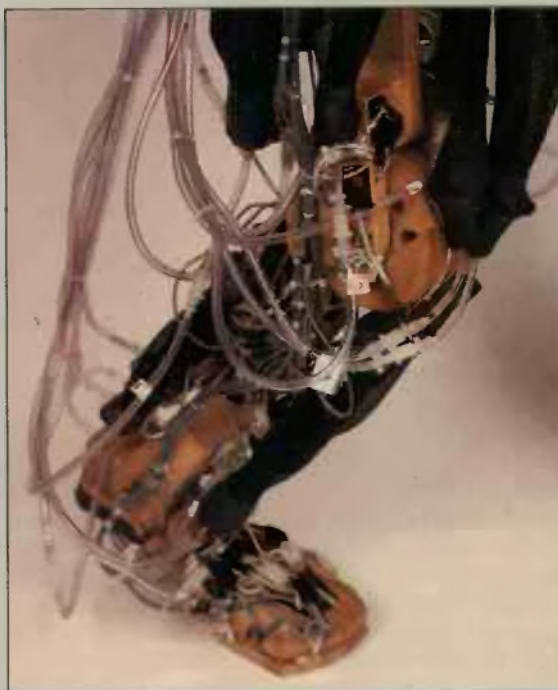
how our bodies are built, and may confer as yet unforeseen benefits on the robot.

Work to date has concentrated on walking and vision — the robot remains armless, and is rather stupid. It has legs, however, which surpass many of the efforts of 'formal' establishments receiving fat funding. One academic at a recent robotics conference, who preferred to remain anonymous, said the Shadow Project's work was far ahead of any in UK university robotics labs. The robot uses a pre-programmed gait, though this is being adapted to include a neural network system to monitor and guide the basic 'dumb' walk. Progress here is slow, however, as the neural network programs are being developed by Richard Walker, a mathematics student who can only spend significant time on the project during university holidays.

The system is controlled by an Acorn Archimedes RISC 540, running programs largely written in Basic, supplemented with chunks of assembler where necessary. The computing power is clearly inadequate for a fully autonomous device, but the group claims it is deliberately focusing on the mechanics. 'Lots of people are working on computer power,' said Greenhill. 'If we wait until the computer power is available, we will have lost a lot of time.'

Another realm of Shadow Project research is vision. Here, the design principle of mimicking human structures has been set aside, as there appear to be few accessible benefits. Instead, by using shortcuts to get the job done, the team has developed an approach that enables effective recognition and distance computations to be carried out quickly and cheaply. Much of the work is based on 'active' vision systems, using lasers and measuring reflected beams.

Shadow Project workers are understandably frustrated by their lack of recognition — and funds. One spin-off which might help is Digit, a kit consisting of a pair of rods joined to make an



elbow, with a muscle (like a tricep) on the outside of the joint and a spring (like a bicep) on the inside. A simple transducer in the spring provides feedback which enables the position of the joint to be controlled. The system can be plugged into an Acorn Archimedes or BBC Micro so that students can have a computer-controlled lever up and running in one lesson. Graphical user interface software will make the system easy to use, and it should be a hit in classrooms where the National Curriculum 'control and measurement' material is being taught.

The Shadow team has managed to obtain small grants, but without the backing of a company name or institutional title it is hard to get significant funding. They feel unfairly overshadowed (pun deliberate) by some of the well-funded establishments. The project seems gradually to take over the lives of those involved, as they spend ever more of their spare time and money on the robot.

'We go to conferences and show our robot and people ask us: "Which company are you from?" And then: "Which university are you from?" And then they look astonished when we are from neither background,' Greenhill says. 'In fifty years' time, when the first domestic robots are marketed, I would like to think they will be British, not Japanese. Unless funding is improved, this will not be the case.'





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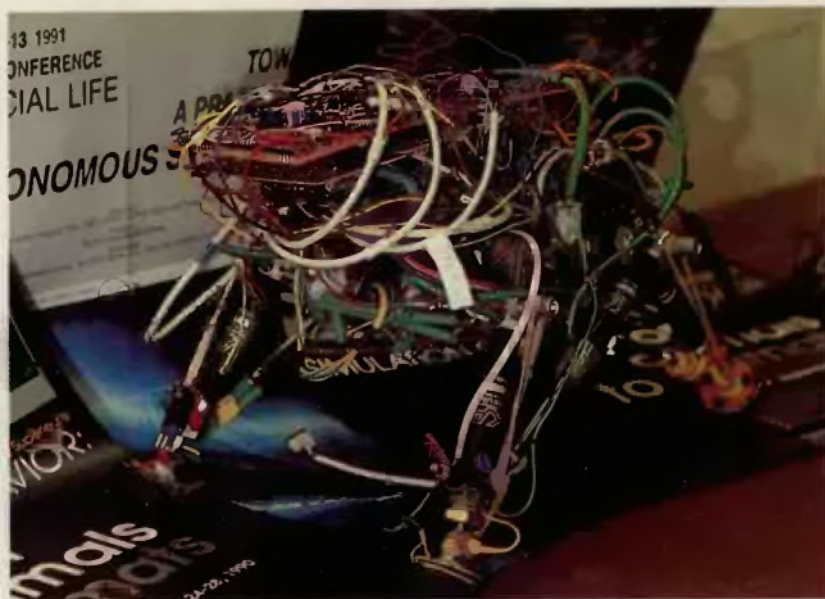
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△ Igor, TAG's four-legged robot which helps in research into the control of walking

are four outcomes:

- The behaviours run together, using the same effectors: for example, whistling and breathing at the same time.
- The behaviours run together, using different effectors, like walking and chewing gum.
- The behaviours do not work together because the same effectors cannot do two different things at the same time, like eating and roaring at an enemy.
- The behaviours do not work together because one action makes another impossible, such as flight and grazing.

The main problem is to handle the last two conflicts. This remains an active research area. TAG offer a series of robotics platforms, such as Frank (the tank). The Frank series includes various tracked (hence tank) robots, with a chassis supporting a range of sensors and control systems. A number of neural network boards are available,

plus onboard digital cards including Z80, 68000 and 80286 processor systems. Frank is small, about a half-metre in length, with a built-in motor. Frank I has an analogue neural backplane, and Frank III has an IEE1000 digital backplane. Frank II has both.

Many experimental systems include a rat's nest of wires and pipes, alongside a mess of wheels and pulleys. Complete systems often do too, though in our own case they are hidden beneath a rather attractive skin and include clever self-maintenance mechanisms. Robot wires are not self-maintaining, and unlike nerves in developing organisms (babies, for instance) cannot be relied upon to plug themselves into the right place.

Lots of knotted copper seems inevitable — until you see Frank, which is a tidy chap by virtue of the organising scheme that is his back(plane). A series of N-Euro boards — simple neural network cards — is available to plug in and control Frank's behaviour. Each card has 12 neurones, each of which takes the sum of its inputs and applies a transfer function (output generating, such as a threshold) which can be adjusted by a knob on the card. This is a bit like having a volume control attached to the side of your head — though in our case we would probably need about ten million million such knobs.

### Purposeful creatures

TAG also offers Igor, a four-legged robot designed to support research into control of walking. TAG's simplest device is Sterling, built on a radio-controlled car chassis and ideal for 'Braitenberg vehicle' experiments. These are named after the work of Valentino Braitenberg, of the Max Planck Institute for Biological Cybernetics. He devised a series of 'cars', each wired with remarkably simple control strategies but which displayed behaviour highly reminiscent of purposeful creatures.

One of the simplest cars has two light sensors at the front, at the right and left corners. These are connected to the motors for the rear drive wheels, so that light hitting the right hand sensor makes the right wheel go faster. The result? A car which avoids lights. Cross over the wires, and the car chases light. These vehicles reiterate the point made above — complex behaviour does not always need complex software beneath it.

Neural networks and related strategies for robot control will not supplant the classic robotic processes, but will supplement them, rather as neural networks and genetic algorithms are supplementing expert systems in other areas of artificial intelligence work. The result may be a domestic robot, but probably not for many years yet.



### Resource Guide

**Technology Applications Group (TAG) is on (0665) 604895; fax (0665) 510624.**

Prices: Frank £1999; Sterling £499; Igor £999. N-Euroboards: 12-neuron board starter kit £499; various other sensors etc available.

**The Shadow Project is on 071-609 8522; fax 071-607 7151.**

**The Science Museum, Exhibition Road, London SW7, 071-938 8000. (The Japanese Robots exhibition closed at the end of October.)**

**Artificial Intelligence at MIT: Expanding Frontiers**

Patrick Winston and Sarah Shellard (eds), MIT Press

A very high-quality survey of a wide range of AI projects going on at MIT, including a few chapters on robotics, with contributions from Rodney Brooks. Highly recommended volumes.

**The Magic Machine**

AK Dewdney, Freeman

A collection of Dewdney's very readable papers from his *Scientific American* column, including accessible stuff on Braitenberg's vehicles.

**Designing Autonomous Agents**

Pattie Maes (ed), MIT/Elsevier

A collection of papers on learning from biology to engineering. One of the still small number of general collections on behavioural robotics.



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# Memory lanes

You can cram only so much RAM onto a silicon chip — probably not enough for the next generation of software. David Morton explores the routes old (cogs and valves) and new (superconductors, holograms, even single atoms) taken to assuage RAM hunger.

Nothing seems to be quite as effective at evoking waves of nostalgia among PC users as the discussion of memory capacity and technologies. Normally rational people wax lyrical about a machine they used long ago, and about how little and how slow was its memory.

Perhaps this nostalgia is fuelled by the hunger

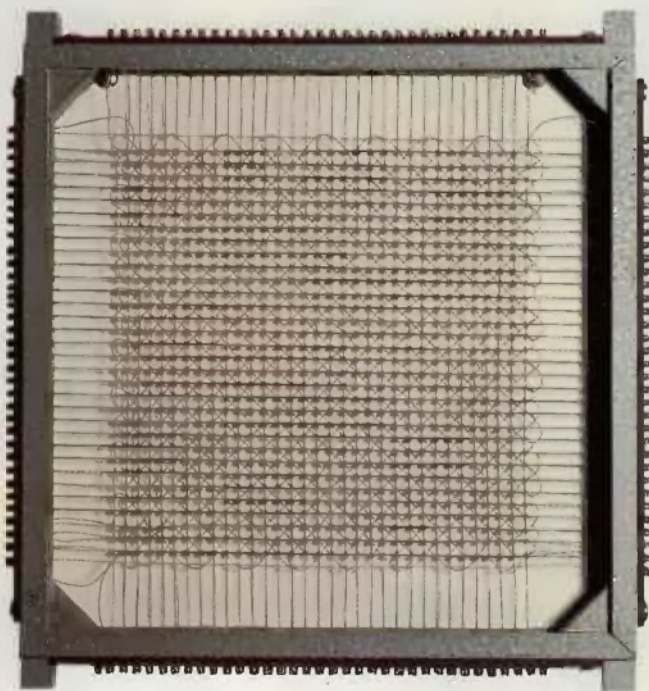
ters had access times more closely related to a present-day floppy disk than to the few tens of nanoseconds of present-day SIMMs. Unlike the relatively meaningless measures of processor power — MIPS, Dhrystones and the rest — it's easy to grasp the scale of progress represented by a machine's memory capacity, and to appreciate just how far the technology has progressed, and just how much further it may have to go.

The question of when mechanical calculating machines metamorphosed into true computers is open to some debate, but it's probably fair to say that the switch occurred in the middle to late 1940s. Babbage's Analytical Engine, the much vaunted precursor of truly programmable calculating machines, never made it off the drawing board, although it's intriguing to speculate what would have happened if what we now call information technology began with the industrial revolution, rather than having to wait for the electronic age.

## Mechanical memory

The memory in Babbage's machine was mechanical. The positions of wheels in the 'Mill' of the Analytical Engine (the Arithmetic Unit, in our parlance) were in effect the CPU registers, and the position of wheels in the 'store' were the equivalent of memory, storing operands and intermediate results. When IBM's first 'Automatic Sequence Controlled Calculator' (ASCC) was delivered to Harvard University in February 1944, it used electrically-driven counters and relays for the same purpose.

A remarkable feat of electrical engineering, the ASCC used more than 2200 counter wheels for storage and summation, and 3300 relays for its control circuits. It was also 8ft high, 51ft long, and weighed more than five tons. The ASCC was considered a success. In 1946 a member of the staff at Harvard wrote: 'Experience has shown that the machine will operate approximately 90% of the time without failure of any kind, and on one occasion has run as long as four weeks without interruption... the calculator is far more nearly infallible than the personnel in charge of its operation.' It seems the machine had more in common with its



△ Traditional core storage. Data is erased when it is read, so has to be rewritten after every read

for storage demonstrated by recent applications. Word processors which eat up tens of megabytes of disk capacity when all their features are installed are becoming commonplace, and the same applications need 2Mb of memory as a minimum and may well benefit from several megabytes more.

While this is to be applauded as progress, it is nevertheless useful to recall that early users of computing machines (usually engineers and scientists) did useful work with memories of as little as a few hundred characters — and that those charac-

PHOTOGRAPH BY JOHNNY MILLAR - EXHIBITS COURTESY OF THE SCIENCE MUSEUM



successors than appearances might suggest.

Electronics entered the realm of computing within two years when mechanical counters were replaced by vacuum-tube flip-flop circuits based on a principle familiar to present-day integrated circuit designers. Vacuum tubes were less prone to wear and tear than their mechanical precursors but were rather more difficult to keep cool. Technicians who worked on vacuum-tube machines tell horror stories of bugs which went away when the cabinet was opened, making repair a time-consuming process. But despite the engineers' best efforts at compact design, a single bit of storage still required one or two valves, depending on the design. A more compact means of data storage was needed, although valves would still be used in the central processor.

A large number of techniques were tried, including using tanks of mercury as acoustic delay lines. The two solutions adopted by IBM for its commercial machines were remarkable both in the radically different directions they represented, and in the way that they preceded elements of certain modern technologies. The magnetic drum, introduced in the early 1950s and able to store a few hundred words, was the distant ancestor of the now-ubiquitous hard disk, although it was four inches in diameter and sixteen inches long.

### Demolition job

But unlike the hard disk on a modern PC, which holds megabytes of data ready to be loaded into fast RAM, the magnetic drum on the early machines was in effect the main system memory. Since the drum held a few hundred bits, and rotated at 12,500 RPM, its access time was measured in milliseconds rather than the nanoseconds we're now used to. Programmers tell stories of drums which broke from their bearings and spun out of control, demolishing concrete walls.

Much more bizarre was the 'Williams tube' memory, which used a cathode ray tube of the type then used in radar displays and TV sets. IBM researchers realised that the image on the phosphor of a CRT exhibits a few fractions of a second persistence. Rather than using optical sensors to read the data from the face of the tube, they discovered that by attaching electrodes to the front surface of the tube, they were able to detect the pattern of dots written on the tube face.

This was developed into a commercial product in IBM's 'Tape Processing Machine' of the early 1950s, in which twenty CRTs stored 700 bits each — a total of roughly 1.5K — with an access time of 128 microseconds. This machine also had a drum store which served as auxiliary storage to supplement the CRT memory, with 5000 characters of additional storage, and as an 800-character I/O buffer.

While it was frighteningly unreliable, at least in its earliest implementations, the Williams tube memory system represented two significant steps in the development of computer memory: it was random access, unlike the drum store with its inherent waiting time, and it was dynamic: the data needed to be regularly refreshed if it wasn't to fade away. Although this seems like a poor property for a memory device to have, it isn't a serious limita-

tion in practice, since refreshing the data is merely a matter of reading it and writing it again. The dynamic RAM used in most modern computers needs to be refreshed in a similar way, although a simple read of the data is all that's required.

The poor reliability of Williams tube memory, and the bulk and slow access time of the drum storage devices — at least when used for program and data store — meant that a different technology was needed. The chosen method, initially called magnetic-ring storage but known later as magnetic core memory, was so successful that it remained in use for many years. Indeed it is still used in some applications — notably those which require data storage to be very robust and relatively invulnerable to radiation.

### Magnetic properties

A core memory consists of a large number of small rings of a magnetic material known as ferrite. The rings are threaded onto an X-Y grid of wires, one ring at each intersection. The magnetic properties of the ferrite are chosen carefully, such that current flowing down the wires can magnetise the material, but only if the current is sufficiently large. By ensuring that the current down one wire is slightly less than that required to magnetise the ring, and that the same current passed down two wires is sufficient, the X-Y grid of wires can be used to uniquely address any ring in the core matrix.

Core storage was an improvement on the Williams tube and not only in terms of reliability. It is unusual in that the memory is non-volatile — you

▽ Nickel is one of the various metals which have been used for delay loops







△ FC Williams and a Williams tube stare out from a Ferranti Mk 1 computer. The 'door' was shut to read the data

can remove the power from a core store and the data will remain intact. Until, that is, you read the data. Reading data from a core memory is destructive: a read resets the store to zero. So with a core memory the critical time is not just the time taken to read the memory, but the time to read the data, and then restore it, so that it can be read again.

By the mid fifties, IBM was shipping machines with 36 planes of core store, each with 64x64 elements — a total of 18K — and with a read-write cycle of 9 microseconds, although the computer itself only required 12 microsecond access. The



△ An experimental magnetic drum. Early drums were used as main storage; programs could be optimised by taking into account the speed of rotation

memory array was held in its own 8x5x2.5ft cabinet and the whole thing weighed nearly three-quarters of a ton.

### Transistors arrive

So successful was core store that it survived the introduction of the transistor. While transistors replaced vacuum tubes in all other parts of the computer, the core store had been developed sufficiently far that it was both cheaper and consumed less power — and took up less space — than the equivalent array of transistor flip-flops. Eventually, the arrival of integrated circuits marked the end of the road for core memories in mainstream computers and introduced the seemingly endless climb in

memory capacity.

As production techniques became more and more refined, the RAM cells etched into the surface of the silicon substrate could be made smaller and smaller. It's this etching process that governs the density of bits on a given sized piece of silicon — known as a die — and hence the size of RAM chip that can be produced at an affordable price. It is possible to buy capacity by using larger die sizes than normal, but this tends to be expensive, as the possibility of a flaw in the substrate — and hence a defective chip — increases significantly with larger dies, leading to a much lower and hence less profitable yield of working chips.

One way round this is to produce a large number of circuits on one piece of silicon, and interconnect only those ones which work. This 'wafer scale integration' technique has been pioneered by Sir Clive Sinclair's company Anamartic, and the company is producing some interesting commercial products using the technique — although the chips have been a long time coming, and tend to be expensive.

### RAM chips

The RAM chips used in most computers are 'dynamic' — they hold the data only for a few milliseconds unless they're refreshed. The refresh cycle only needs to be a read — rather than the read then write of a core memory. Since individual storage elements of the RAM chip are arranged internally as rows and columns one refresh cycle can update a whole row. Refresh cycles, while they're not a significant overhead in performance terms, do increase the memory's power dissipation. For this reason some laptop machines — most notably Psion's MC range of portable computers — use so-called 'static' RAM. This needs no refresh cycle, but each memory element is nearly twice as complex as the memory element in a dynamic RAM. Static RAM can also be placed on 'standby' where the power to the memory is reduced to the point where there isn't enough for normal operation, but there is sufficient to retain the stored data. This is used to good effect in the RAM card storage devices used in pocket computers: an internal Lithium cell provides the standby power while the card is out of the machine, and the computer's own batteries provide the operating power when in use.

RAM chips won't continue to get ever denser. The maximum definition of the etch process which creates the individual transistors on the surface of the silicon substrate depends on the wavelength of light used: the so-called diffraction limit specifies the smallest spot to which you can focus a given wavelength, no matter how much money you spend on a lens. At present the best that can be achieved with UV light — which has the shortest wavelength — is lines of one third of a micron in width. Hitachi's 64Mbit RAM chips, which are expected to enter commercial production in the mid 1990s, will use lines this small.

Any improvement will require a shift to shorter wavelengths still, which means using X-rays to etch the silicon surface. This is expected to be able to produce lines as small as a tenth of a micron.

The demise of the conventional RAM chip has been predicted before: in the early 1980s IBM





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attempted to produce a prototype computer based on superconducting circuits known as Josephson Junctions. These work at speeds 20 to 50 times as fast as conventional semiconductors made out of silicon, or the faster gallium arsenide, while consuming about one thousandth of the power. IBM



△ An early Ferranti magnetic drum. Today, Conner would get this much store onto a 2.5in disk

abandoned the attempt in 1983, since it perceived that the project was too early, and that there were very significant benefits to be gained from pursuing conventional semiconductor technology.

### Superconductors

Josephson Junctions consist of two layers of superconductor separated by an insulator, and their principle problem is that a material has to be very cold indeed to exhibit superconductivity. At the time of IBM's experiments, the temperature needed to be  $-269^{\circ}\text{C}$ : just four degrees above absolute zero, and an extremely expensive temperature to maintain, requiring liquid helium as a coolant. More recently, new materials have been discovered — the so-called 'high temperature' superconductors — which become superconducting at  $-150^{\circ}\text{C}$ , maintained using cheaper liquid nitrogen.

At present the largest Josephson memory devices that have been built (by NEC of Japan) store just 4kbits, hardly a threat to the 16Mbit DRAMs now entering production. Nevertheless, research efforts into Josephson technology are likely to continue, now that there are signs that it could be put to more practical use with the newer superconductors. The 'Holy Grail' of superconductor research is the room temperature superconductor which will have a remarkable effect if it ever becomes a reality — and not just on computer technology.

A little slower than the Josephson Junction's pico-second response time, but no less promising, is holographic memory. This has been under investigation for some years — the BBC even developed a holographic system for the archival storage of digital video signals in the mid to late 1970s. Although this system recorded onto moving film, the data recorded was a hologram representing the digitised version of a video signal, rather than the pictures themselves. Although a remarkable technological feat, the BBC's holographic recorder was ultimately let down by the medium on which it

recorded — the film of the time was simply not up to the task. The result was that the recorded signal was erased on playback — not an asset for an archival storage system. So although the innovative elements of the BBC's design were successfully licensed to a UK manufacturer, who had plans to produce an erasable version for computer storage, it was never commercially developed.

However, other organisations have continued to work on holographic storage techniques, and these days the preferred medium is either a stack of photo-refractive crystals, or a polymer film. Although the access times for the current prototypes are in the range of 10 to 100 microseconds — much faster than a hard disk, but slower than RAM — researchers expect that access times similar to present-day RAM will be achievable.

What is special about these devices is their size. The Swiss Federal Institute of Technology in Zurich is developing a technique for storing holograms on top of each other on a thin polymer film, which will offer capacities 10,000 times greater than present day hard disks, with sub-millisecond access times. Because the holographic storage technique is inherently parallel — a large number of bits can be read or written at once — the data transfer rate is extremely high: the small prototype devices currently under construction in the US, with capacities of 200Mb-300Mb, are expected to achieve data transfer rates of 100Mb-200Mb per second. Production devices are expected to have a capacity of more than 100Gb, and offer transfer rates faster than a terabyte per second.

Much further away is a technology which may never be a practical memory technology, but which does probably represent the limit of what can be achieved. Using a device known as a Scanning Tunnelling Microscope, IBM researchers were able to arrange 35 Xenon atoms on the surface of a nickel crystal, to spell their company name in letters just 5 millionths of a millimetre high. The IBM team spent 22 hours writing those three letters, and suggested that while it was a dense storage medium, it wasn't a particularly rapid one. But German researchers have demonstrated a similar technique on a different substrate material, which takes only a few milliseconds. There's no suggestion yet that this sort of atomic-scale etching could be developed into a viable data storage medium, but it does indicate that there's a lot of development potential to go before we really do run out of memory capacity.

### Progress

Although this technology is only in the research labs of the large computer corporations, and much of it will need a lot of development before can sit in an office unit, the technologies are here now and they're being developed. In forty years the machines we use now will seem as small and underpowered as the machines of the fifties do to us. The sad thing is that, although I can't imagine how one would set about writing a word processing package that would fill up most of a 100Gb holographic storage module, or cause a Josephson computer to display a wait cursor while it's checking the spelling of a document, I have a nasty suspicion that someone will manage it eventually. Such is progress.



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GS 425	486 25MHz	8 Mb	16 Mb	8	114	N/A	16 COLOURS	—	—	—	£3499	£3799		
	EISA TOWER SYSTEM - 8K CACHE										+VAT=£4111.33	+VAT=£4463.83		

## 14" VGA MONITORS

MODEL	MONO/COLOUR	DOT PITCH	VGA 31.5KHz	S-VGA 15.75KHz	E-VGA 35.5KHz	1 Yr On-Site	T&I & Support	EXC VAT	INC VAT
GS 1405	MONO	N/A	640x480	800x600	—	•	•	£100	£117.50
GS 1425	COLOUR	39mm	640x480	—	—	•	•	£200	£235.00
GS 1430	COLOUR	31mm	640x480	—	—	•	•	£230	£270.25
GS 1460	COLOUR	28mm	640x480	800x600	1024x768	•	•	£250	£293.75

## OPTIONS

DESCRIPTION	EXC VAT	INC VAT
1Mb x 9-Bit SIMM Memory Board	£50	£58.75
287-12MHz Maths Co-Processor - For GT 212	£100	£117.50
387-16MHz Maths Co-Processor - For GT 316	£85	£99.88
387-25MHz Maths Co-Processor - For GS 316	£100	£117.50

## OPTIONS

DESCRIPTION	EXC VAT	INC VAT
387dx-28MHz Maths Co-Processor - For GS 320	£150	£176.25
387dx-25MHz Maths Co-Processor - For GS 347	£150	£176.25
387dx-33MHz Maths Co-Processor - For GS 335	£150	£176.25
337Mb SCSI Hard Disk Drive - 10.7ms Access	£999	£1173.83

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To: Silica Systems, Dept PCW-0292-66, 1-4 The Mews, Hatherley Rd, Sidcup, Kent, DA14 4DX

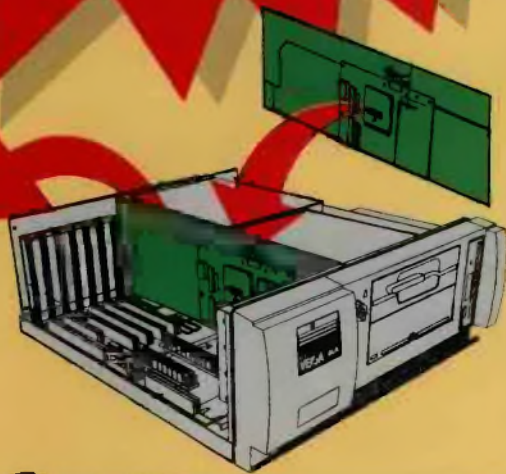
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- 1 Select Platform/Case depending on physical size (expandable or compact) & DATA BUS (16 bit, MCA, or EISA 32 bit).

Platform	DATA BUS	Case	Uses
Powerflex	ISA(AT)16bit	Desktop	General bus./Home
B Station	EISA 32 bit	Slimline	Powerful Workstation
B VEISA	EISA 32 bit	Desktop	Power Users
MP System	MCA 32 bit	Desktop	IBM MCA alternative
Power range	EISA 32 bit	TowerType	File-serving/Xenix

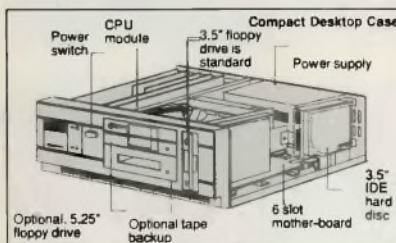
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- 4 Select options and ST bundles and extended 3 year warranty.

## PowerFlex



386sx	386sx-16 Super-VGA Colour Models				
Model	4096	16000	28000	34000	ST models
1Mb	£949	£999	£1299	£1699	£150 Extra
2Mb	£999	£1049	£1349	£1749	£200 Extra
3Mb	£1049	£1099	£1399	£1799	£200 Extra
5Mb	£1149	£1199	£1499	£1899	£250 Extra
16Mb	£1649	£1699	£1999	£2399	£250 Extra

Other modules instead of 386sx-16	
286-12	£100 less
386sx-20	£100 extra
386sx-20c	£200 extra
486sx-20	£500 extra
486-25	£Call



386sx-16 100Mb

S-VGA Colour **£999**

**The powerful systems for general business use with 286, 386sx-16, 386sx 20, 486sx or 486-25 modules.**

The PowerFlex is a 100% PC AT compatible system based on the 16 bit Industry Standard Architecture. Consider its advantages:-

- CPU upgradeable to the latest technology.
- Very attractive design with small footprint, yet room for 4 storage devices and 6 slots.
- Excellent value for money. 386sx systems recommended for any one considering a 386sx. Provides better value than most non-upgradeable systems!

### Module Options

286-12Mhz, 386sx-16Mhz, 386sx-20Mhz with 32K cache, 486sx-20Mhz or 486-25Mhz. Optional maths co-processor sockets.

### Desktop Case

Attractive with small footprint, yet with four drive bays (two 3.5" & two 5.25" - enough for hard disc, both floppy drives and tape streamer/CD ROM).

### Motherboard Features

16 bit full ISA (AT) compatible. Zero wait state memory with fast video/fast BIOS features. Various RAM models expandable to 5Mb on board and 16Mb using a slot. LIM 4.0 support. One 8 bit and five 16 bit ISA (AT) slots. ALR slot for CPU modules. Serial & parallel ports.

### Flexible Storage

1.44Mb 3.5" floppy disk drive fitted as standard. Optional 5.25" drive (fitted in all ST models). Fast IDE hard drive options 40Mb to 340Mb (15ms). Optional 120-700Mb streamers.

### Panasync Colour Screens

Enhanced 16 bit Super-VGA controller (1024 x 768 1Mb). Very high resolution 14" Panasync multifrequency screen (1024 X 768 0.28 dot pitch with 2 year onsite warranty!) Optional Panasync 17" screen.

### Standard Items

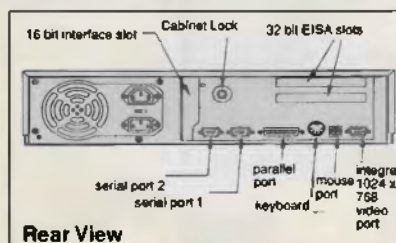
All systems come ready to use with MSDOS 5, keyboard & Panasync Super-VGA screens.

## Business Station



486sx	486sx-20 EISA Super-VGA Colour Models				
Model	50	100Mb	200Mb	340Mb	ST models
1Mb	£1399	£1549	£1849	£2149	£150 Extra
2Mb	£1449	£1599	£1899	£2199	£200 Extra
5Mb	£1599	£1749	£2049	£2349	£200 Extra
10Mb	£1799	£1949	£2249	£2549	£250 Extra
17Mb	£2149	£2299	£2599	£2899	£250 Extra

Other modules instead of 486sx-20 EISA	
386-33 EISA	£50 less
486-25 EISA	£450 extra
486-33 EISA	£750 extra
486-50 EISA	£Call



486sx-20 EISA 100Mb

S-VGA Colour **£1549**

**The 32 bit EISA slimline systems  
with 386-33, 486sx, 486-25 or  
486-33 CPU modules.**

These amazing systems represent the most powerful range of slimline DOS systems available. The power-users dream machines!

- Full 32 bit EISA based. High performance!
- CPU upgradeable to the latest technology.
- Highly integrated. Very slim design but still caters for 3.5" & 5.25" storage devices.

### Module Options

80386-33Mhz, 80486sx-20Mhz, 486DX-25Mhz or 486DX-33Mhz. 486DX-50 soon. Optional co-processor sockets on the modules. 486sx module can also take full 486-25DX chip providing a co-processor and further increased performance at low cost. 64Kb CPU cache module available to further boost performance (Strongly recommended with 386-33 module).

### Slimline Case

Slim yet has three drive bays (two 3.5" & one 5.25"). Attractive front plastic cover.

### Advanced Motherboard Features.

32 bit full EISA bus (ISA compatible). Various RAM models expandable to 33Mb on board. Four 32 bit slots:- Two 32 bit EISA slots (will also take 8 bit & 16 bit cards). One 32 bit slot for CPU modules. One 32 bit slot for 64Kb CPU cache module and one 16bit ALR slot for fast network cards. Ports:- 2 serial, 1 mouse & 1 parallel. Integral 1024 X 768 Super-VGA adapter with 256K RAM (max 512K.)

### Storage

1.44Mb 3.5" floppy disk drive fitted as standard. Fast IDE hard drive options 40Mb to 340Mb (15ms). Optional 5.25" floppy drive (fitted in all ST models) or tape streamers. 5.25" device not possible on 340Mb models.

### Panasync Colour Screens

14" Panasync screen (1024 X 768). Optional Panasync 17" screen.

### Standard Items

MSDOS 5, keyboard & Panasync screens.

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## Business VEISA

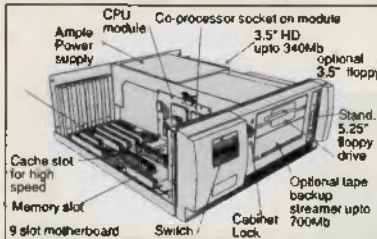
486-33 EISA 100Mb

S-VGA Colour **£1899**



386-33	Business VEISA 386-33 Super-VGA Colour			
Model	100Mb	200Mb	340Mb	ST models
1Mb	£1449	£1749	£2149	£150 Extra
2Mb	£1499	£1799	£2199	£200 Extra
5Mb	£1549	£1949	£2349	£200 Extra
10Mb	£1999	£2299	£2699	£250 Extra
17Mb	£2199	£2499	£2899	£250 Extra

Other modules instead of 386-33 EISA	
486sx EISA	£250 extra
486-25 EISA	£300 extra
486-33 EISA	£450 extra
486-50 EISA	£950 extra
64Kb Cache	£call



### The 32 bit EISA desktop power systems with 386-33, 486sx, 486-25, 486-33 or 486-50 CPU modules.

(The MP System is similar but uses the licensed IBM 32 bit MCA bus). Upgradeable EISA systems provide speed and performance ideal for:-

- Designers & engineers longing to stretch CAD/CAM to its limits.
- Software developers & power users using Windows and other large programs.
- Desktop high performance file serving or Unix/Xenix.

#### Module Options

80386-33Mhz, 80486sx-20Mhz, 486DX-25Mhz or 486DX-33Mhz & 486DX-50Mhz. Optional co-processors. Optional 64K CPU cache. (Strongly recommended with 386-33 module).

#### Desktop Case

Attractive with small footprint, yet with four drive bays (two 3.5" & two 5.25" - enough for hard disc, both floppy drives and tape streamer/CD ROM).

#### Advanced Motherboard Features

32 bit full EISA bus (ISA compatible). Various RAM models expandable to maximum of 17Mb on board and 49Mb using optional module.

Nine slots:- Four 32 bit EISA slots (will also take ISA cards). Two 16 bit ISA (AT) slots. One 32 bit slot for CPU modules. One 32 bit slot for 64Kb CPU cache module and one for optional 32bit RAM module. Ports:- One serial; one PS/2 mouse; one parallel.

#### Storage

1.2Mb 5.25" floppy disk drive is standard. Optional 3.5" drive (fitted as standard in all ST models). 40Mb to 340Mb IDE hard discs. Optional 120Mb to 700Mb tape streamers.

#### Panasync Colour Screens

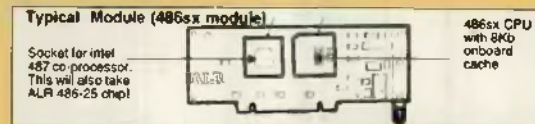
Enhanced 16 bit Super-VGA controller (1024 X 768 1Mb). 14" or 17" multifrequency Panasync screens.

#### Standard Items.

MSDOS 5, keyboard & 14" Panasync screen.

## Time-Link CPU Exchange Service

Should you need to upgrade the CPU module in your PC, simply purchase the module required and send back your old module for credit. As intel CPU prices continue to fall, module exchange prices will change. Please call our sales staff for the latest prices and details of which modules are compatible with your system.



Old module	Upgrade to the following (simply return your old module)
286-12	386sx-16
386sx-16	386sx-20
386sx-20	386-33
386-33	486sx-20
486sx-20	486-25
486-25	486-33
486-33	486-50
486-50	Dual Process

## ST models

Special Time (ST) models are enhanced systems that are available for the PowerFlex, BusinessStation and BusinessVEISA platforms. They include all features and benefits of standard models and also the following extras.

- Both 3.5" & 5.25" floppy drives are fitted as standard, allowing the use of any PC disc.
- BusinessStation on board video adapter:- upgraded to 512K video RAM).
- Microsoft compatible mouse & paint package.
- One or more of these business software packages.  
1Mb ST models: One package  
2Mb ST models: Two packages  
5Mb ST or above: Three packages  
Select from:- PC Tools 7, Wordstar 5.5, dBase III plus and Framework XE.



## PowerVEISA /PowerPRO

486-50 EISA 340Mb

S-VGA Colour **£3949**



386-33	PowerVEISA 386-33 (no cache) Super-VGA Colour				
Model	100Mb	200Mb	340Mb	600Mb	1000Mb
5Mb	£2299	£2599	£2999	£3599	£4199
10Mb	£2799	£3099	£3499	£4099	£4699
17Mb	£3049	£3349	£3749	£4349	£4949
33Mb	£3599	£3899	£4299	£4899	£5499

Other modules instead of 386-33 EISA	
486sx EISA	£250 extra
486-25 EISA	£300 extra
486-33 EISA	£450 extra
486-50 EISA	£950 extra
PowerPRO	£call

### The 32 bit EISA vertical systems with 386-33, 486sx, 486-25, 486-33 or 486-50 CPU modules.

- Upgradeable EISA based tower systems with incredible power.
- Ideal for Networking, Unix/Xenix and other power users.
- The PowerPRO features optional dual processing with up to 1024K CPU cache & Compaq SystemPRO compatibility.

#### Module Options

80386-33Mhz, 80486sx-20Mhz, 486DX-25Mhz or 486DX-33Mhz & 486DX-50Mhz for PowerVEISA & PowerPRO. Dual processing options for PowerPRO models. 64Kb cache module fitted as standard.

#### Vertical Expandable Cases

Six 5.25" drive bays - enough for full height 1000Mb hard disc, both floppy drives and tape streamer/CD ROM). 300W power supply. Plastic cover on PowerPRO. PowerVEISA has black front to case & no plastic cover.

#### Advanced Motherboard Features

32 bit full EISA bus. 5Mb RAM (Max 49Mb.) PowerVEISA motherboard, identical to BusinessVEISA. PowerPRO has 12 slots (eight 32 bit EISA slots, two 16 bit ISA slots. 2 special slots for VEISA CPU/cache modules or dual processing modules). Ports:- 2 Serial, PS/2 mouse & 1 parallel. Max. 49Mb on board RAM.

#### Storage

1.2Mb 5.25" floppy disk drive fitted as standard. Optional 3.5" drive. 100Mb to 340Mb IDE or 600Mb & 1000Mb EISA SCSI drive options. Optional tape streamers: 120 to 700Mb

#### Panasync Colour Screens

Super-VGA controller (1024 X 768 1Mb). Panasync screens.

#### Standard Items

Keyboard & Panasync Super-VGA screens. Select required operating system.

## Options for all platforms

All options requested at time of ordering are installed by our experienced configuration staff.

- Additional 5.25" or 3.5" floppy drive £79. (Both drives are fitted as standard in ST models).
- Super-VGA RAM expansion (from 256K to 512K on Business-Station) £49. (This is standard on ST models).
- Microsoft compatible serial mouse & paint package £39. (This is standard on ST models).
- 120Mb internal tape streamer £299.
- 250Mb internal tape streamer £399.
- Tape streamer card (only for dual floppy PCs). £99.
- 700Mb Tape streamer & card £999.
- 3 year extended warranty. Please call for prices.
- Extra RAM memory (more than the standard models shown) £50 per Mb. Please note that RAM can only be increased by set steps for each model. Ask our sales staff on details.
- 17" Panasync screen £600 more than 14" models. Maximum on this screen is 1280 x 1024 but only 1024 x 768 possible with the standard card supplied. Multifrequency 0.28 pitch. 2 year onsite Warranty.
- Dot matrix and laser printers at special prices.

## Advanced Logic Research and Time

ALR Inc. are one of the leading PC manufacturers in the USA. They have been pioneers in the design of advanced upgradeable, modular systems for DOS, Novell & Xenix. ALR were the first company to produce the 8Mhz IBM XT compatible, the first to ship the 386 (ahead of Compaq), the first to introduce 'Just Upgrade the CPU' concept, the first to produce a 286 system upgradeable to a 386sx or a 486 and also the first to produce EISA based, affordable upgradeable systems. ALR designs are now being used by many other manufacturers worldwide. ALR technology & quality with Time service & support and the Time tradition of providing 'better value' will ensure that these systems quickly become market leaders in the UK.

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# Norton Desktop for Windows

Steve Cassidy professes himself pleased in general with the full version of Norton Desktop for Windows, but he's baffled by the backup capability. Absurd, he calls it...

We didn't call the last article on Norton Desktop for Windows a 'review' (Benchtest Preview, October 1991) because we used a beta test copy of the product from Symantec. I received a shipping, complete version just before the last article hit the bookshelves, and over the last three months it's been used as the default Windows shell on all the MSDOS machines I regularly employ — a Compaq 386/25 during the day and a Compaq Portable III 286 at home.

## Floppies

But let's look at Norton Backup first: click on the Oozelium Bird, one of the permanent icons in the utility dock down the right-hand side of the screen, to activate the Norton Backup utility the first time. You'd better have some floppies ready, because NBW will want to test your hardware and will require some floppies which it will overwrite in the course of its test.

Once you have defined the set of files you want saved, by way of a sequence of wildcard file and directory specifications, and stored that list and the chosen destination path for the backup in a .SET file, all that remains is to have a numbered series of floppy disks beside you.

Hardened veterans of PC use will shudder at the idea of sets of floppies: back in the bad old days a 10Mb hard disk backup could take hours, and a stack of floppies higher than the machine. It's not nearly so bad today, because most aftermarket backup programs incorporate several forms of data compression; NBW will by default not

compress your data at all, but if you choose the right option you'll find a three-fold reduction in the number of floppies needed. Using optimal compression and NBW's proprietary disk format, 4Mb of spreadsheet files fit on

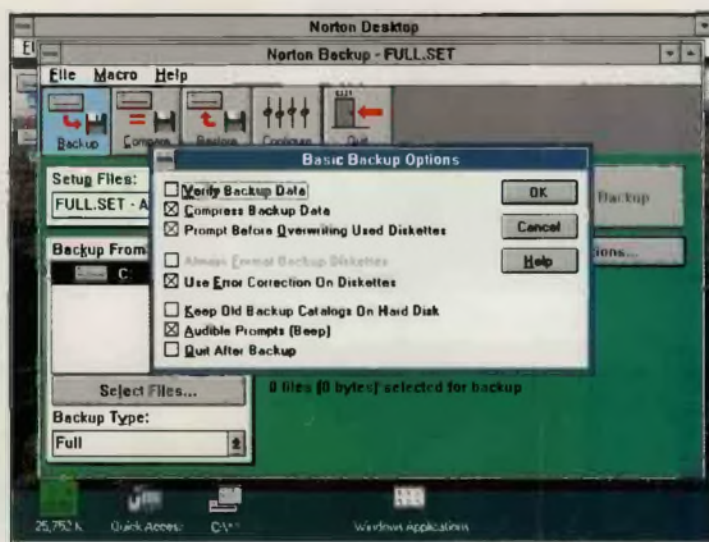
PC, and later it returns. You have a blank machine with a stack of disks beside it. How are you going to get the data back on the machine? Norton Backup is a Windows program. Your copy of Windows is on the disk, not on the machine. OK, fine; surely you can use DOS-level restore on the NDW Emergency file maintenance and recovery disk. After all, it has the DOS-level Norton Disk Doctor on it...

Nope. It may be that the DOS-level Norton Backup can restore the saveset: the NDW manual suggests that NBW will restore savesets built with the DOS product, so it's a fair guess that the converse applies. But Norton backup for DOS is a separate product, for which you must fork out more cash.

This seems absurd, given all the other DOS-level utilities on the Emergency disk. I battled to produce a minimal Windows executable set, which just fits into a self-extracting ZIP file on a 1.44Mb disk, and gave up, since it's very difficult to decide which parts of NDW are necessary to the backup program. I simply rely on the presence of another PC nearby, from which I can LapLink the appropriate Windows, DOS and NDW subdirectories in the event of a crash.

## Mac-like graphics

The graphic parts of NDW remind me of a very good Macintosh program; there is a great deal of depth to be found in all the component parts. This rewards the self-motivated and inquisitive, and frustrates those who have a job to do. It takes ages to exit from Windows, be-



a single 1.44Mb disk, taking less than three minutes on a 386SX/16.

But what about that expensive tape streamer? Sorry. NBW doesn't seem to recognise or even have hooks for external drivers for any tape devices. You can back up to floppy, or to a given drive and subdirectory (thus, across a network to a file server, for instance), but devices which don't appear as drives are not available.

There's a creeping gotcha waiting for you, though. Let's assume that you have taken a complete backup of all your 40Mb drive C, because your laptop has been dropped, the case is cracked, and you're having it fixed. You'll take the backup and then low-level format the drive (if possible), so the repairers can't get at your data. Away goes your



cause it's set to save the configuration each time you quit — if you can find the right menu choice, this can be disabled and becomes quicker than the Program Manager. A separate menu option saves the current configuration.

The various desktop icons are configured so that they don't produce pop-up menus when single clicked; another menu option allows their menus to appear, which in the case of the drive icons suddenly provides the

facility to change the labels (mine now say '5.25in floppy' and 'Hard Disk' instead of 'A' and 'C'). This is the only way I can get to the Windows version of Smart Erase purging — a window can be opened which resembles the drive and directory window, listing the deleted files in each directory.

Other neat features include the installation of new programs in the Quick Access Program Manager replacement: simply open a Drive window and find

the .EXE file you want; drag into the appropriate Quick Access window, and it will be installed. If it's a Windows program, the resident icon will be dug out and displayed.

Despite some niggles with various design and delivery decisions, I stick by the conclusion I gave in the original review: Great Stuff.

NDW costs £99 (SRP).

Symantec is on (0628) 776343.

## Orchid ProDesigner IIS-HC

Mike Hardaker has spent three months with the latest version of the Orchid ProDesigner SuperVGA video card. Unimpressed at first, he now thinks it's well worth the money.



For years I had read comments in magazines referring to the general all-round magnificence of the Orchid ProDesigner range of SuperVGA video cards for PCs. Friends reckoned that the ProDesigner II was the bee's knees if you were after 256-colour Windows 3.0 displays, especially at resolutions higher than VGA's standard 640x480 pixel level.

### Back to base

I had been struggling for some time with the (perfectly adequate but unexciting) 16-bit Paradise card (the Western Digital offering) which was usable at 800x600 pixels as long as I stuck to the standard 16 colours of VGA. I bought the extra 256K of RAM which was necessary for it to run this resolution in the full 256 colours supported by the card, but the screen redrawing became so slow as to render the beast almost useless — I stuck with the base palette of 16 colours. Everyone told me the same story: if you want the full 256 (and can't afford a video card with a graphics co-processor like an 8514 or TIGA card) then the ProDesigner's your chap.

So when I heard that Orchid had

produced a new version of the ProDesigner which was even faster than the original, I was interested. When I heard that it had the Sierra RAMDAC chip which allows no fewer than 32,000 simultaneous colours on screen, I just had to have one.

### Bad drivers

First impressions weren't too great; yes, it was quick; yes, I could see 32,000 colours on screen at any one time (as far as I could tell, anyway). But the Windows 3.0 drivers at SuperVGA were the worst I had ever seen. Unlike most 800x600 drivers, the Orchid drivers used the large fonts and, worse, the 120 pixels per logical inch (known as lpi, for some reason) of the 8514 driver. The net result is that you get no more screen real estate than if using standard VGA fonts and 96 lpi with the orthodox VGA 640x480. Sure, the resolution is rather finer, but that's not the point: SuperVGA is a Good Thing because it lets you see more on screen at any one time.

I downloaded various sets of upgraded drivers from Orchid's BBS in the States, but they were all the same. I browsed the messages on the BBS to find that quite a few other users felt about the giant fonts much as I did — and was not heartened by the Orchid replies which suggested the company's attitude was, 'Well, tough'.

The Paradise card was back in the machine when I saw a message on CIX which referred me to some 'fixed' drivers, able to provide the extra screen space which the card should have offered all along. A quick download (well, as quick as 400K can be) and everything in the garden was rosy.

With sensible drivers making the

thing worth using, the Orchid ProDesigner IIS-HC shows itself to be a fine high-performance video card. The speed is incredible considering that there is no graphics co-processor in there (the Tseng Labs ET4000 chipset is to thank for that), and the option of 256 colours is really handy when manipulating graphics files.

The 32,000-colour option is not all that useful, however, even though it is mighty impressive — particularly as it renders pictures at the same speed as the 256-colour mode. Since so few Windows applications support so-called True Colour, there's not a lot you can do with it under Windows 3.0 except fire up a selection of 256-colour bitmap files and marvel at the way each one retains its own palette (rather than approximating it while using the palette actually owned by the foreground application). Under DOS you can look at Targa format graphics files, but those are about as common as rocking-horse droppings so one tends not to.

### True colours

In due course, I expect more applications will emerge which are capable of supporting True Colour, and the ProDesigner IIS-HC will come into its own. For the moment, however, the card is still the best low-cost (£299) 256-colour card for graphics users, especially under Windows. One last request, though: can we have some 1024x768 drivers which use the VGA fonts too? 8514 may be a genuine standard here, but it's a waste of a big screen to have letters and numbers standing there all of an inch high.

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# When I'm cleaning Windows

Various more or less dodgy versions of Windows, plus other assorted beta releases, finally frightened PCW Editor Guy Swarbrick into confronting the anarchy on his hard disk. Which in turn led to a weekend delving into the innards of Dells old and new.

Delaying the delivery of Windows 3.1 has given Microsoft the opportunity to add things that would otherwise have been available only as extensions or in future versions, most notably the sound section of what used to be called The Multimedia Extensions to Windows and is now, rather more sensibly, referred to as Windows with Multimedia.

Full details of the additions haven't been announced (Microsoft itself may not be sure yet—see the article, on page 230 of this issue, on Windows with Multimedia). But what's interesting is that the additions are being made at all.

Windows 3.1 isn't exactly in a sorry state, but there is much that needs fixing. Microsoft initially promised developers that all 3.0 applications would run without problems. By Beta Release 2 (the latest, as this went to press, although the next version was imminent) there were still many problems. A hatful of Windows 3.0 applications will not work under 3.1. These applications, in general, break the rules. They worked under version 3.0 even though they transgressed rules which the original documentation glossed, or covered ambiguously. Now 3.1 has implemented the original rules more strictly, applications fall over.

## Unhappy developers

Not Microsoft's fault, exactly, but most definitely it's Microsoft's problem. Far from rolling over and allowing Microsoft to go ahead, some of the bigger developers (most notably Borland/Ashton-Tate) have pointed out just how unhappy they are. Microsoft said their apps would run. No conditions.

The launch, then, has been put off until First Quarter 1992, far enough off, Microsoft hopes, to iron out the problems. That's fine. Except, of course, it isn't fine. To counter the propaganda



IBM put out about OS/2 2.0 (also delayed, surprise, surprise) Microsoft has made sure that everybody, from the press to the eager-to-be-paying public knows not only just how good Windows 3.1 is, but how good its successor Windows NT is. Now it isn't going to deliver.

But that isn't what bothers me. Rightly or wrongly, we expect software deadlines to slip. What bothers me is that at this late stage Microsoft is still adding things to Windows 3.1. Also, it's putting a strain on my hard disk. Windows 3.1 is OK most of the time, but I'm not altogether sure I trust it yet. I feel much the same way about the multimedia extensions, with less solid justification.

To get around the problem, I have four copies of Windows on a Dell 433P: two each of 3.0 and 3.1, with and without Multimedia. That causes more problems than you might think, but the most obvious one is space.

To compound the problem, I'm dabbling with a program to help make the production of PCW easier. I haven't decided which language I'm going to use yet, so I have Turbo Pascal 6, Turbo Pascal for Windows, and two copies of

Borland C++ on the hard disk. Two copies of C++? As with Windows 3.1, the latest version is a beta. I use that most of the time, but I like the security of the old version.

Tot that lot up and, roughly, you get 110Mb. On the 105Mb drive in the 433P, that would be a neat trick. And to complicate things further, I am supposed to spend at least some of my time writing and using software, so some applications would be nice.

## Brainstorm

At first I considered using SuperStor to double the capacity of my existing drive. I know a couple of people swear by it (including PCW Technical Editor Frank Leonhardt and Straight Talking columnist David Morton), but I just couldn't face risking anything important with a software compression system. Still, it seemed an attractive option, until I had a brainstorm.

As well as my 433P, PCW has an almost identical 325P with a 300Mb hard disk. The plan, then, was to swap the drives over. It got more complicated than that, of course.

The drives in a Dell P chassis are fairly well hidden, so I decided to take a far simpler approach. I'd simply take the 433P card out of my Dell, swap it for the cache card in the office machine, swap the expansion cards over, and LapLink some files.

That was the end of that weekend. Swapping the processor card for the cache proved simple enough, and much to my surprise the new Dell 433P announced itself as such on rebooting. The old machine had claimed to be a 425P, due to an earlier BIOS ROM revision (even more confusing is the fact that the processor card contains a 486-25 clocked at 33MHz).

As luck would have it, the 300Mb



drive was formatted under DOS 3.3 in ten partitions. I started to devise sensible strategies for storing the mass of data on the two laptops and three 386SX 20s I had at home at the time (what would I do without Group Tests?), then decided instead to get ruthless.

Using LapLink Pro as a file manager proved easier than I expected. I managed to get all the files I thought worth keeping into one partition and then copied that to one of the SXs. With the drive reformatted, I simply copied everything from the old 105Mb drive to its new home.

I had a few unexpected problems along the way. The 5.25in drive on the 300Mb machine stopped working and I swapped it for the drive in the other Dell. I expected to have to make a service call the following Monday, but oddly the drive worked fine in the other machine. The Monalisa card wouldn't work at first, either — amazing how soon after learning that you need to disable the on-board VGA, you forget the fact.

Finally, both machines were working. The 33MHz 486, 300Mb hard disk, 8Mb RAM, 24-bit video, Pro AudioSpectrum, CD-ROM-equipped compact desktop box even had the grubby, lived-in outer case from my old machine. What more could I want?

## Going for structure

And that was when the trouble started. My attitude to hard-disk arrangement has always been, well, anarchic, unlike Andy Redfern (former PCW Technical Editor, current ByteEurope Editor) who always amazed me with his ability to think up, remember, and type obscure but structured paths.

I've changed a little over the years. Gone are the days when I let software installation programs determine where files were going to be put.

Word for Windows might suggest C:\WINWORD, but I'd insist on C:\WINDOWS\WORD. Other than sticking all Windows applications in the Windows sub-directory, though, I was still pretty easy.

Having four versions of Windows present changed all that. I could, I suppose, have put them all away under one of the four directories, but how could I be sure which of them would still be there in six weeks time? It was time for a strategy.

C:\APPS seemed the sensible place for applications. C:\APPS\WP could be home for Word and GrandView. Well, for Word for Windows 1.1, Word for Windows 2.0 and GrandView. Call me paranoid...

Crosstalk for Windows went in

APPS\COMMS\XTALK and so on. Documents were arranged with a similar sort of order under the DOCS sub-directory, but I made a decision to organise by project, rather than file type. So DOCS\PCW\JAN92 contains Project, BMP, Word and GrandView files related to last month's issue.

The problem then was that the Windows applications had been installed under two versions of Windows, altering two different WIN.INI and PROGMAN.INI files and creating two sets of .GRP files. Now that the applications had been moved to the APPS directory, none of it worked.

The process of getting it all working was easier than I expected. First, I had to remove all the redundant entries relating to long deleted applications from the Windows 3.0 WIN.INI file. (Let's hope Windows NT is a little more intelligent in the way it handles applications. I really can't see why the entries for an application can't be removed from the WIN.INI file when the application icon is removed from the Program Manager. Under Windows 4.0 the file and program managers will be merged, but that's a long way off.)

I edited the remaining entries to point to the correct sub-directories for the recently moved applications. Then it was simply a matter of gathering together .GRP files from various locations, and copying a full set to all the versions of Windows on the hard disk and editing the PROGMAN.INI files to reflect the additions.

It couldn't be that simple, but it is. The only exception I've come across is Distant Suns, a planetarium program which only works from a version of Windows installed in a sub-directory called WINDOWS. This must have made sense to someone, somewhere.

## PC Kwik

After enthusing over the PC Kwik PowerPak last month I have to say I've given up using it. I thought the slight loss of speed caused by switching to PC Kwik would be offset by the advantages. In the end, I just couldn't live without Fast!.

That's a shame, because the other parts are good. When Windows 3.1 is more stable, which I suspect will happen in the next few days with the latest Beta version, I might even switch back. You wouldn't think, with the Dell 433P as my main Windows machine, that a software cache could make that much difference to the performance, but it does. The signs are that 3.1 will be fast enough without help. If the direct access to the Western Digital hard-disk controller is fixed (it conflicts with

QEMM at the moment), the cache may cease to have any significance.

## CompuAdd capers

CompuAdd was deeply upset about the problems we had both with the 433E in our Hardware Group Test in the November issue and the Technical Support people we spoke to. We were asked if we would re-test a 433 that had been tested by Compaq to ensure that it was set up correctly.

It arrived and, reassuringly, worked straight out of the box. It ran Windows, anyway, which was one problem we'd had with the first machine. To test it more fully we set up another machine alongside to LapLink some applications across.

Now, we're a bit pushed for space when we're trying to persuade 45 manufacturers to take back their 386SXs (see January issue), and when the first wave of dot matrix printers for the next Group Test is arriving, so we take shortcuts. One keyboard and one monitor are more than enough to transfer files between two PCs; except that after we'd removed the keyboard from the transfer machine and plugged it back into the CompuAdd, it stopped working. Not the keyboard, the CompuAdd.

## Harassing tech support

A little experimentation narrowed the problem to three possible sources: the motherboard, the keyboard connector, or the controller. We decided the latter two were more likely and CompuAdd sent one of each by overnight delivery. They arrived at 10am, but our reception people forgot to tell us and we spent half a day harassing CompuAdd Technical Support. Somebody seemed determined that we shouldn't get one of these machines to work — a theory reinforced by the fact that the CompuAdd still didn't work after the transplants.

A phone call to tech support resulted in the conclusion that, after all, it was the motherboard that was at fault. They'd send another one. It didn't arrive, nor did the engineer CompuAdd promised to send out to fix it. This was supposed to be an exercise in which the Bristol-based US giant proved the worth both of its machines and its customer service. It had failed on the first count and was looking increasingly as though it would fail on the second.

After 48 hours the motherboard still hadn't arrived. CompuAdd had decided not to send it and asked for the machine back. Eventually, we got the motherboard and installed it without too much trouble. Everything seems to work fine. More next month.



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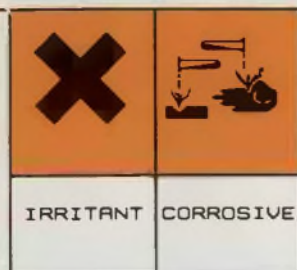


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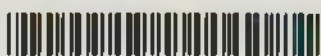
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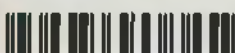
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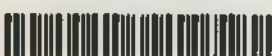
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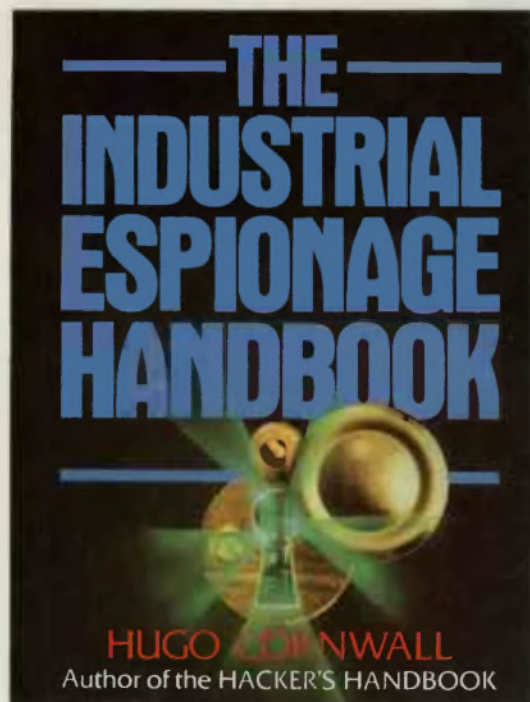
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## The Industrial Espionage Handbook

Author: Hugo Cornwall  
 Publisher: Century  
 Price: £9.99  
 ISBN: 0-7126-3634-X



Hugo Cornwall clearly hopes this book will match the considerable success of his *Hacker's Handbook*. It follows a similar formula — take a shady, attractive area which most people have heard of but few understand, and combine hard fact and anecdote to explain just what it's all about.

Of course, when you understand the area you are better equipped to operate in it. Mr Cornwall and his publishers take pains to point out where laws can be transgressed, but ethics are up to the reader.

The book takes in all manner of industrial espionage, being careful not to ignore the mundane, low-tech approaches like sifting through garbage and getting at your target's employees. It starts off by listing reasons for spying: as it says, the line between espionage and market research is far from clear.

Let's say you want to read up on telephone tapping. The Handbook has a chapter on this and the associated activity of bugging; it discusses the options, but stops short of telling you exactly where to clip your Bug-O-Matic. Enough detail is given for the technically aware to intercept cordless or cellular telephone calls, but nothing is

divulged which isn't freely available from other sources.

Considerable room is given over to the human side of industrial (and, indeed, classic) espionage. There's a discussion of the sort of people who get involved, interspersed with copious anecdotes and examples of where techniques worked and failed.

All the major sources of information are covered — Company House, newspaper libraries, even CD-ROMs (as newspapers become increasingly available on these and on online databases, the amount of readily available information is rapidly increasing). There's a faint feeling of disappointment that so much important espionage is a matter of slogging through public records and methodically analysing what you find.

Cornwall maintains a sober attitude, though not at the expense of readability or wit. In the Countermeasures section, for example, he says competitors may be kept off-guard by repeatedly changing a product's shape and name, 'even if actual technological innovation is minimal. Hire an ex-IBM staffer to help you do this.'

I'd be surprised if *The Industrial Espionage Handbook* achieves the same success as its predecessor. Industrial espionage isn't as sexy as hacking, and it's been around for a lot longer. This book is better written, better researched, and I guess more dangerous than Peter Wright's *Spy Catcher* — better preparation for the would-be spy, that is. It's slightly out of date in a couple of areas: CT2 cordless telephones, for example. Also, I was unable to find mention of using undelete utilities to explore the old floppy or hard disks.

There is little in the book to surprise those who already have an interest in the practical side of espionage. For the newcomer, or casual reader, the benefits come from having so many strands tied together. Expect the same level of detail as you'd get from a good magazine article, and you won't be disappointed. Look for the inner details of how to reprogram your competitor's PABX, and you will. If anything, this book's a tad too sensible to cause the sort of rumpus that fuelled the *Hacker's Handbook*, but it's worth a look if you want a guide to help you sort out the fact and fiction of this murky area.

Rupert Goodwins

## CompuServe from A to Z

Author: Charles Bowen  
 Publisher: Bantam  
 Price: £23.99 (includes US\$12.50 CompuServe usage credit)  
 ISBN: 0-553-35461-2

People do all kinds of things on CompuServe. They meet, exchange confidences, and (sometimes) quarrel, never to mail each other again. They look up ancestors, ask for help in buying computer equipment, check the news wires, and even go shopping. *CompuServe From A to Z* aims to help you do all these things, too.

Unlike CompuServe's own *Almanac*, which lists all the forums in alphabetical order by topic, *CompuServe From A to Z* lists things you might want to do or look up, and then tells you where to go for them. Look up Economics, for example, and you will see that the *Economist* is available on-line through the magazine database, and you will also find a list of the relevant databases in Iquest. Look up Mail, and you will get ten pages of detailed information on how to send mail within and outside of CompuServe.

The book's organisation is its strength. You could find the information on-line, but it would take you a lot of time and trial and error, all at upwards of US\$12.50 an hour. CompuServe's own user guide is clear and well organised, but it's not aimed at helping you find things on-line: it's aimed at teaching you how to use the system. The *Almanac*, on the other hand, is confusing: genealogy is listed under 'communications/bulletin boards', subsection 'hobbies'. In *CompuServe A to Z*, you look up genealogy and you're immediately directed to the genealogy forum (GO ROOTS) and told how the forum works.

CompuServe is relatively friendly but it's vast. This book is a genuine aid to getting the best out of the system.

Wendy M Grossman

## Stupid PC Tricks

Author: Bob Le Vitus with Ed Tittel  
 Publisher: by Addison-Wesley  
 Price: £17.95  
 ISBN: 0-201-57759-3

The subtitle of this book is: *17 insanely great programs to make you PC more fun*. Or, if you're a practical joker, to make someone else's PC drive them nuts.

Consider, for example, Mutant. This



little TSR program creates noises. All sorts of noises. Things like haunted house creaking noises, and mysterious rapping noises, and the sound of squirrels arguing. For the technically advantaged, some of these noises are guaranteed to induce panic: they are meant to sound exactly like worn hard disk drive bearings. For sadists who like to live dangerously, Mutant can be easily installed on someone else's PC from a floppy disk.

*Stupid PC Tricks* isn't really a book. It's a set of 17 programs, with accompanying manual. It is fun, however, even if you don't like that sort of thing.

One program selectively changes the colours of characters on the screen (sort of like the Cascade virus mentality). Another plays 20 different bugle calls, a third plays the entire three minutes and 12 seconds of the William Tell Overture, and SSB plays all four verses of the Star-Spangled Banner (useful education for Americans, who tend to think the song only has one verse). Two others talk to you: one delivers insults, the other flattery.

A number of the programs are actually useful, since they double as screen savers. Bugres sends makeshift bugs to chomp away at your screen — couple this with Mutant, and anyone not in on the secret is likely to call in the Society for Psychical Research. Other screen savers are Explosiv, which puts up an attractive display of fireworks, and GR, a graphics plotter.

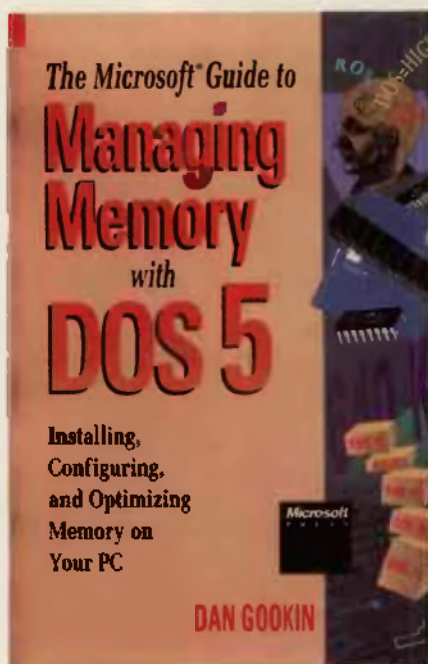
Also worth mentioning is Parascan. When your office mates are convinced their PCs are in serious trouble after you've hit them with some of the other programs, run this. It's a mock virus-scanner which always finds infections and knocks them out. Literally.

Wendy M Grossman

## Microsoft Guide to Managing Memory with DOS 5.0

Author: Dan Gookin  
Publisher: Microsoft Press  
Price: £9.95  
ISBN: 1-55615-381-3

One of the main things that computers are always short of — apart from speed, MIPS, general power, disk space and sufficient screen resolution — is memory. These days this is not a hardware problem — certainly for PCs. Chips are cheap. What costs more (indeed



thus far, seemingly too much) is the brain power required to persuade programs to exploit today's machines but still run on yesterday's.

So the early DOS barriers are still to be broken. They have been fenestrated (geddit?) but not removed. DOS 5 pushes the barrier a bit further away,

and might even make your machine seem a little faster. The additional qualifications DOS 5 confers on your PC are sophisticated enough to warrant attention — there are different ways of getting the best from your system, and which is the best for you depends on what you want to achieve.

This book is a good place to find out how to tweak your Config.sys file to best advantage. I almost regret having to praise this slim volume, as it opens with the line 'FREEDOM FREEDOM Can't you just smell all that extra RAM?' If you get past that without throwing it on the fire, it should serve you well.

After a brief overview of memory technology in PCs, Gookin takes the reader through the practicalities of memory expansion — what to buy, where to plug it and all that. This is followed by an exploration of DOS 5, focusing particularly on extracting every bit of space from your machine.

'Setup scenarios' start with general strategies for improving PC performance on 8088/6, 286 and 386 machines, followed by specific examples.

As memory options become more varied, more users will be running machines that are sub-optimally configured. This book should help.

Nick Beard

### OCTOBER'S TOP TEN BOOKS

Author	Title	Publisher	Price	This	Last
Petzold C	Programming Windows 3	Microsoft	£27.95	1	2
Livingston B	Windows 3 Secret	IDG Books	£36.95	2	3
Person R	Using Excel 3 For Windows	Que	£27.45	3	6
Baumgarten E	Using WordPerfect 5.1	Que	£25.95	4	10
Microsoft	MS-DOS Programmer's Reference	Microsoft	£22.95	5	-
Fingerman D	Ami Pro Made Easy Version 2	Osborne McGraw Hill	£15.95	6	-
Swan T	Mastering Turbo Pascal 6	Sams	£27.50	7	-
Minasi M	Complete PC Upgrade & Maintenance Guide	Sybex	£24.50	8	-
Woram J	PC Configuration Handbook	Bantam	£24.95	9	1
Simpson A	Mastering WordPerfect 5.1	Sybex	£24.95	10	-

List supplied by The Modern Book Co of Praed Street, London W2.



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M1818	£239	M1709	£299
M2518	£535	M1918	£349
M1824L	£269	M4016	£799
M3524L	£799	M1924L	£429
M2524L	£599	HJ100	£199
HJ770	£454		
CANON (Inkjet printers)			
BJ10EX	£185	BJ10EX ASF	£49
BJ10EX Battery	£35	PJ1080A	£459
BJ300	£335	BJ300	£379
BJ300 ASF1	£89	BJ300 ASF2	£59
BJ330 ASF1	£109	BJ330 ASF2	£79

CITIZEN (2 year warranty)			
120D+	£110	124D	£143
Swift 9	£149	Swift 9x	£198
Swift 24e	£225	Swift 24x	£291
Sw. 9/24Stand	£17	Swift ASF	£55
Sw. 24x Stand	£25	24x ASF	£119
PN48	£203	1200+ C64	£125
EPSON (new models)			
LX400	£110	LX850+	£143
FX850	£275	FX1050	£356
DFX5000	£1087	DFX8000	£1993
LQ200	£173	LQ450	£177
LQ570	£212	LQ870	£369
LQ860 C	£459	LQ1010	£277
LQ1060 C	£616	LQ1070	£327
LQ1170	£447	LQ2580 C	£694
SQ850	£437	SQ-2550	£633

HEWLETT PACKARD			
Quietjet	£351	Paintjet	£448
Paintjet XL	£1053	RuggedWr	£927
Pjet Mac	£498	DeskWriter	£321
Deskjet 500	£274	Djet 500c	£489
Djet FX80 card	£49	Djet RAM	£138
IBM			
Proprietary III	£CALL	Pro IIEXL	£CALL
Pio. X24E	£CALL	Pro. XL24E	£CALL
Quietwriter III	£CALL	Qw 5204	£CALL
Execjet 4072	£CALL	ASF's etc.	£CALL

MANNESMANTALLY			
MT81	£110	MT82	£211
MT91	£539	MT730	£519
OKI			
182E Par	£189	182I Par	£189
182 Serial	£229	182 Par	£299
192 Serial	£335	193 Par	£375
193 Serial	£415	320 Par	£329
320 Serial	£369	321 Par	£399
321 Serial	£439	292 Colour	£425
293 Colour	£569	294 Colour	£779
380 Par	£239	390 Par	£479
390 Serial	£579	391 Par	£629
391 Serial	£535	393 Mono	£739
393 Colour	£799	393 Cw/Tx	£1799

PANASONIC			
KX-P1170	£110	KX-P1180	£105
KX-P1123	£136	KX-P1124L	£160
KX-P1635	£280	KX-P1624	£281
KX-P1654	£281	KX-P2624	£349
SEIKOSHA			
SP1900+	£99	SP2400	£125
SP2415	£209	SL92	£189
LT20	£239	SL120	£309
SL230	£399	SLP1000	£179
STAR			
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LC15	£179	LC24/10	£145
LC24/15	£247	LC24/200	£175
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ASF's from	£60		

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HL4	£589	HL4/PS	£1049
HL4-V	£699	HL4/PS	£1349
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CANON			
LBP-4A	£565	LBP-8/III+	£982
LBP8/III+	£1376	LBP8/III+	£1484
EPSON			
EPL-4100	£569	EPL-7500	£1176
HEWLETT PACKARD			
LJ III (UK)	£690	LJ III	£1023
LJ III D	£1738	LJ III	£2524
HP LASER PERIPHERALS			
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Adobe Postscript (Laserjet II)			
Pacific Page Postscript			
Pacific Page Postscript XL			
Turboscript III Postscript			
IBM			
4019E	£749	4019	£999
PANASONIC			
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KX-P4455	£1463	Toner etc.	£CALL
STAR			
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LP8-II	£895	LP8-III New	£975
LP8-IIPS	£1177	LP8IIT	£1329

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T2000SX/20	1659	T2000SX/40	1799
T3100SX/40	1799	T3100SX/80	1939
T 2000 SXE	2086	T3200SX/40	1755
T3200SX120	2059	T3200SX Col	4115
T5200/20	2464	T5200/200	2769

## AMSTRAD

	Mono	Col	14HR
PC5086SD	305	385	465
PC5086DD	345	425	505
PC5086HD40	504	584	662
PC5286 Games	---	---	749
PC5286SD	429	499	566
PC5286HD40	625	699	777
PC3286SD	387	467	547
PC3286HD40	626	699	777
PC3386HD40	808	879	956
PC3386HD80	1095	1165	1249
PC4386SX	1095	1249	---
LAPTOPS			
ALT286/20	955	ALT286/40	1175
ALT386sx40	1245	ALT386sx80	1454

## NEW LOW PRICES

## CONSUMABLES

DATA SWITCHES			
PARALLEL			
2/1 Manual	£20	3/1 Manual	£25
4/1 Manual	£30	2/1 Manual	£35
SERIAL			
2/1 Manual	£25	3/1 Manual	£30
4/1 Manual	£35	Others	£CALL
CABLES			
Parallel	£10	Serial	£10
TONER			
HP IJVI	£49	HP IJVI	£45
Can. 4420	£21	Can. 4450	£24
Can. 4450	£65	Other	£CALL

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8.5"x11"x2000	£15	A4 70gx2000	£20
A4 90gx1500	£20	A4 Cui x 500	£5
35 STATIONERY			
1000 Statimnts	£30	500 Invoices	£20
779s	£34	Rem. Advice	£32
INKJET CARTRIDGES			
Canon BJ10e	£15	Can. Buj130	£10
Canon BJ300	£10	HP Deskjet	£11

DISCS			
Unbranded-each	10	100	250
360k osdd	30p	20p	18p
720k osdd	50p	40p	35p
1.2Mb osdd	70p	55p	50p
1.44Mb osdd	75p	60p	55p
Branded (usually Verbatim)			
360k osdd	50p	45p	40p
720k osdd	50p	47p	45p
1.2Mb osdd	70p	60p	55p
1.44Mb osdd	110p	100p	95p
CF2 3in osdd	110p	100p	95p
Unbranded 10s in 10 cap plastic box			
Price includes labels			
DISC BOXES			
10 cap. Slimpak	£1	£1	
50 cap. lockable	£5	£4	
100 cap. lockable	£5	£5	
Posso stackable 150	£15	£15	
Loose labels per 500	£4	£5	
Laser Labels 100 sheets	£20	£20	

## FAX

AMSTRAD			
FX5050	£389	FX9600AT	£399
BROTHER			
Fax 160	£339	Fax 305	£429
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Fax 170	£539	Fax 250	£729
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SF1000	£229	SF1100	£309
SF2300	£449	SF2300M	£559
SF4010	£1149		
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TF251	£769	TF381	£1789
TF381M	£1999	Others	£CALL

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Intel Connection CoPro Fax Card			£449
Fax-It for Windows for above			£20
Worldpoint 2496 Fax Modem			£495
LineShare 2000 splitter			£159
JT Fax Card			£179
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*Includes TAM and autoswitch			

**ORDERING DETAILS:** Please either telephone with your credit card number, or send a letter with cheque/credit card number/official order. Full details are in the 'Terms' section in the last column of the opposite page. You are also welcome to collect your order.

## ALR

### POWERFLEX RANGE

Basic model 12.5MHz 80286 1x3.5in FDD, DOS 4.01, quality keyboard, desktop case. VGA graphics, 1Mb RAM expandable to 17Mb. Special slot allows processor to be upgraded to 386 or even 486!

	Mono	Colour	Super
80286/12.5	695	795	845
386SX/16	875	975	1025
386SX/20	1045	1145	1195
486SX/20	1295	1395	1445

Expansion Options			
40Mb HD	120	90Mb HD	220
120Mb HD	320	210Mb HD	420
SX16 card	189	SX20 card	369
486/25 card	1299	RAM per Mb	50

### BUSINESSVEISA RANGE

Desktop case, 4 EISA slots, 2 ISA 16-bit slots, 1Mb RAM expandable to 17Mb (48Mb with expansion board). Processor upgradeable to 25 or 33MHz 486. Slot for 64k cache/pack. 1 floppy drive. VGA.

386/33	1295	1395	1445
386/33 cache	1645	1745	1795
486SX/20	1745	1845	1895
486/25	2095	2195	2245
486/33	2595	2695	2745

Hard Disk prices as per Powerflex

## HANDHELDS

Poet PC	£699
Z88 and peripherals	£CALL
Casio Digital Diary	£CALL
<b>SHARP IQ</b>	
IQ8000	129
IQ7200	119
ZQ2250	59
IQ PC Link	55
IQ8000 Wallet	25
IQ Printer	99

Phone for more details on accessories

## AGENDA

AgendaA 32k	129	AgendaA 64k	159
32k Storage Cd	25	Printer Lead	19
Spreadsheet	25	Finance Card	25
Traveller Card	25	PC Link Pack	25
Mac Link Pack	59	BASIC Lang.	19
Leather Case	19	Fax Modem	309

## DIP/PORTFOLIO

DIP are the manufacturers of the Atari Portfolio and both machines are identical. Existing and new Portfolio owners should phone for a full catalogue of DIP/Portfolio products.

Atari Portfolio	£137
Portfolio Professional	£339
Portfolio 512k version	£339
64k Card	69
Card Drive	55
256k Expander	129
Serial I/F	49
DOS Utils	39
Comms s/w	39
Modem	169
Finance Pack	39
Other Items	CALL
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First Steps	449
External drive	50
0.5Mb+clock	30
8833 CM	199
Class of 90s	449
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0.5Mb RAM	25
A500 PSU	39
A3000s	CALL

## AMIGA

Cartoon C.	329	Class of 90s	449
First Steps	449	A590 HD	249
External drive	50	0.5Mb RAM	25
0.5Mb+clock	30	A500 PSU	39
8833 CM	199	A3000s	CALL

**SEE THE AMAZING PRICES ON HANDHELDS**

## MISC

Logitech Scanman 32 NEW	£89
ScanPlus A4 Scanner+s/w	£269
Logitech Pilot Mouse	£20
Amstrad official mouse	£20
9-25 way adapters	£5
Manual Printer Switches from	£20
Auto Printer Switches from	£35
Mouse mat	£3
Universal Printer Stand	£17
Surge Protector Plug	£2
Surge Prot. 4-way block	£25
500VA UPS	£295
Printer Ribbons	£CALL



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### MC200 PACK

Psion MC200, Spreadsheet, 256k Flash SSD, Carry Case and Mains Adaptor RRP £727

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# DABS PRESS QUALITY IBM COMPATIBLE PERSONAL COMPUTERS

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## PRICES (VGA systems, including DOS)



Processor	No Monitor	Mono	Colour	Super
80286 16Mhz	£379	£459	£569	£599
80286 20Mhz	£399	£479	£589	£619
386SX 16Mhz	£429	£509	£619	£649
386SX/20	£469	£549	£659	£689
386SX/25 cache	£549	£629	£739	£769
386DX/25	£569	£649	£759	£789
386DX/33 cache	£699	£749	£859	£889
386DX/40 cache	£729	£809	£919	£949
486DX/33 cache	£999	£1079	£1189	£1219

These prices include Desktop Case with Turbo/Reset switches and LEDs, (MiniTower for 386/33 and 486), 200w PSU, 1Mb of RAM, expandable to 4Mb (286), 32Mb (386) or 64Mb (486), VGA card (see panel), VGA monitor as listed, IDE controller for 1 or 2 hard discs, 102-key keyboard, 1x3.5" or 5.25" high density floppy disc drive, 2 serial ports, 1 parallel port, game port if required, bus mouse port if required, maths co-processor socket, MS-DOS 5 with Q-BASIC, (DOS 3.3 available) BIOS manuals, 12 months return-to-base parts and labour warranty.

### BOARDS

286/16	99	286/20	109
386SX/16	199	386SX/20	259
386SX/25C	279	386DX/25	279
386DX/33	379	386DX/40	479
486DX/25	699	486DX/33	799

All boards have OK RAM and expand to bracketed figure. All take copro

### NOVELL

CARDS			
NE1000	£109	NE2000	£129
NE1 Compat	£85	NE2 Comp.	£99
NE2 C.MCA	£199	WD Elite16	£129

### NETWARE 2.2

5 User	£375	10 User	£998
50 User	£1658	100 User	£2648

### NETWARE 3.11

20 User	£1678	100 User	£3398
250 User	£6198	Upgrades	£CALL

### STREAMERS

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300Mb Int	399	300Mb Ext	449
JUMBO			
120Mb Ext	293	120Mb Int	213
250Mb Ext	354	250Mb Int	284
Controller	68	Option	£CALL

### WANGTEK

60Mb Ext	574	60Mb Int	470
150Mb Ext	673	150Mb Int	549
525Mb Ext	1185	525Mb Int	1050

Please call for advice on fitting kits and interfaces.

### CO-PROS

Compatible	Intel
8087 5 Mhz	59
8087 8 Mhz	79
8087 10 Mhz	109
80287 (all speeds)	62
80387SX 16 Mhz	75
80387SX 20 Mhz	82
80387SX 25 Mhz	CALL
80387 DX (all speeds)	112
80487SX	312

Compatibles are AMD or IIT for 287, ULSI for 387, all 80387DX supplied work at speeds from 16-33Mhz

### VIDEO

Herc only	15	Pro IIs	199
256k VGA	45	1Mb SVGA	69
1Mb CEG	199	Orchid Pro Iix	149

Call for advice on video cards, or see panel above.

### SEAGATE HARD DRIVES

IDE			
ST125A	144	ST138A	174
ST351AX	135	ST3120A	229
ST1186A	369	ST1239A	395
ST1201A	375	ST2383A	775
ST2274A	749	ST3096A	199
ST11480A	899	ST3144A	269

### SCSI

ST125N	157	ST1133N	399
ST157N	170	ST177N	237
ST1096N	244	ST296N	221
ST2106N	448	ST2125N	468
ST4128N	548	ST1186N	478
ST1201N	498	ST2209N	618
ST1239N	528	ST4350N	808
ST3476N	848	ST2383N	816
ST4385	929	ST1480N	998
ST2502N	1088	ST4702N	1148
ST4766N	1198	ST4767N	1348
ST41200N	1668	ST41650N	1988

### MFM

ST225	128	ST125	154
ST138	157	ST151	238
ST251	178	ST4096	358

User knowledge is assumed when bare drives purchased. Many other models available - please call.

### MEMORY

SIMM (Amstrad, Olivetti, ALR etc.)			
256kx9	10	1Mb x9	35
4Mb x9	130	256kx8 (Mac)	10
1Mb x8 (Mac)	35	4Mb x8	130
SIPP (Most dealer-built PCs)			
256kx9	10	1Mb x9	39

### DIL

64k x 1	£2.00	64k x 4	£2.00
256kx1	£1.25	256kx4	£5.00
1Mb x1	£5.00	Others	£CALL

### COMPONENTS

Kyocera Hard Card 32Mb	£149
IDE Hard/Floppy Controller	£25
2 serial/1 parallel/1 game cd	£25
2 x game port card	£15
Single Serial Port	£12
Single Parallel Port	£12
4 serial port card	£35
AdLib synthesiser card	£75
Soundblaster card	£99
102-key tactile click keyboard	£32

### REDUCED PRICES ON SEAGATE HARD DRIVES

80286 16Mhz	£379
80286 20Mhz	£399
386SX 16Mhz	£429
386SX/20	£469
386SX/25 cache	£549
386DX/25	£569
386DX/33 cache	£699
386DX/40 cache	£729
486DX/33 cache	£999

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£30 OFF OUR TOP-SELLING MODEL IDEAL FOR WINDOWS 3	
80286 16Mhz Colour VGA	£569
MiniTower Case add	£10
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44Mb Hard Disc add	£120
Mouse add	£15
Total 2Mb RAM, so add	£35
TOTAL	£789

### HARD DRIVES

DAPS	FR
------	----

### NEW MONITOR PRICES

UPGRADING AN XT (8086)?	
XTs have no main board expansion, so an expanded (not extended) or LIM card is required with an EMS driver. Our 'Evelex RAM' card can be fitted with 1Mb (£149) or 2Mb (£199). Any program supporting expanded or LIM memory will 'see' the extra memory.	
UPGRADING A 286 OR ABOVE?	
Main board expandable? If so you need either proprietary RAM (Compaq, IBM, most laptops etc.) or standard SIMM, SIPP or DIM RAM (prices above). Sometimes the first 1Mb must be removed. If not/expandable, you need the AT RAM card (same price as XT, goes to 8Mb at £50/meg).	

### DABS PRESS PC OPTIONS

The prices quoted above are for complete systems with one floppy drive. To add a hard drive, second floppy etc. to your chosen system, decide the capacity, and add to the price above. These prices only apply when the hard disc is purchased as part of a PC system. Prices for these components bought separately are shown elsewhere on the page.

20 Mb	add £50	40 Mb	add £120
90 Mb	add £220	124 Mb	add £260
211 Mb	add £420	422Mb add	£900
613Mb	add £995	Larger	£CALL
20 Mb for 8086	add £150		
32 Mb h/card for 8086	add £125		
Larger sizes for 8086	£CALL		

### MODULES

APPLE			
Portable 1Mb	219	Portable 2Mb	569
Portable 3Mb	859	Portable 4Mb	999
Mac II 2Mb	108	Mac IIc 1Mb	79
Mac IISI 2Mb	169	Mac IISI 6Mb	689
LW IINTX 1M	79	LW IINTX 4M	229

### CANON LASER PRINTERS

LBP-4 1Mb	169	LBP-4 2Mb	299
1Mb Add-on	169	LBP-8II 1M	119
LBP-8 II 2Mb	199	LBP-8II 4M	299

### COMPAQ

Call with Compaq expansion part no. and/or confirm that your Compaq does accept proprietary RAM upgrades.

### OKI LASER PRINTERS

400 1Mb	149	400 2Mb	319
4420 1Mb	199	4420 2Mb	349

### PANASONIC LASER PRINTERS

1000/EXE 1M	209	1000... 2Mb	289
T1200XE 2Mb	159	T1600 2Mb	159
T3100SX 2Mb	159	T3100SX 4M	379
T3100 512k	109	T3100 2Mb	159
T3200SX 2Mb	159	T3200SX 4M	379
T3200 3Mb	219	T5100 2Mb	159

### FINDING US

Drive to Junction 17, M62 and leave the motorway heading south (follow sign for Prestwich/Salford). Go south on the A56 through the pelican crossing at the hospital, then through the main lights in the village and on to the next pelican crossing. Turn right immediately after this crossing into Warwick Street. We are about 100 yds down the street on the right.

Trading hours 10.00 to 5.00 Monday-Saturday.

### CARRIAGE

Hardware: £7 per box. Software £7 per order. Consumables and small items: £2 per order. Next day service, Offshore UK and foreign also available. Call for details.

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UK residents add 17.5% VAT to all prices except books. We also supply many products not listed here. All goods UK sourced with full manufacturer's warranties etc. Export orders welcome, no VAT, carriage charged at cost. Official orders accepted from public sector/education/ listed PLCs only, otherwise cheque/cash/PO/credit card no. with order. Minimum order £10. Tender invitations welcome. Trading hours 10.00-17.00 Mon-Sat, other times by appointment. Prices and manufacturers specifications subject to change without notification. Goods offered subject to being unsold. Goods not offered on a trial basis - restocking fee on non-defective returns. All returns must have prior authorisation. Full terms & conditions on request. Fax 061-773-8290. Mobile telephone no. 0831 250699. Proprietor D. Atherton. 061291

### SPECIALS

#### HARD DISC MOBILE RACK

Transport your hard disc from one machine to another. 1 unit £40, 2 units £75.

#### SOUNDBLASTER DELUXE

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## Leisure Suit Larry 5 — Passionate Patti does a little Undercover Work

Computers: IBM PC; Mac; Amiga  
Supplier: Sierra  
Price: £39.95

Larry Laffer, the 40-year-old multi-untalented jet-setting superdork, is back for a whole new adventure. He is teaming up with his old friend and partner, Passionate Patti, in the latest episode of the ongoing saga of 'Leisure Suit Larry'.



Larry has had a somewhat chequered past. Back in 1988, when we were first introduced, he had just turned 40 and was 'in the land of the Lounge Lizards', where he was seen to frequent brothels and seedy clubs in the search



for... well, whatever it is you find in that kind of place. The following year, Larry went 'Looking for Love (in several wrong places)' and got involved with the KGB and the fiendish Dr Nonookie, and it was here that we first met Passionate Patti. This was by no means the last we saw of Patti, as she played a major role in Larry's next adventure, 'Passionate Patti in Pursuit of the Pulsating Pectorals', where she and Larry became better acquainted.

The story of Larry and Patti's torrid affair is documented, in computerised

form, in an exposé entitled Leisure Suit Larry 4: The Missing Floppies. There is only one copy of this masterpiece, and Patti herself owns it. (She has invited me round for an exclusive interview and a private screening of her favourite film — Star Trek VIII: The Wrath of Chaka Khan, so I'll have to see what arises. Watch this space.)

Larry is now back on the straight and narrow, working for Silas Scruemall, the head of Porn Prod Corp, as a videotape eraser. Silas will be better known to you from his earlier years, when he was in charge of the largest pornography syndicate in the world, and produced classics such as 'Willy's Wonka and the Chocolate Fantasy' and 'Pervertigo'.

In a recent interview in *PLAYSPY* (a magazine that accompanies the new Larry adventure), Silas revealed why he decided to go legit and into network television: 'Money, basically. Y'know, I think people have this idea that pornographers are really wealthy, driving around in imported sports cars and throwing their money around. Nothing could be further from the truth'; '...as much as I loved providing a service to these people, it's a dead-end job, y'know? I mean, I hafta think of myself once in a while.'

It was the growth of cable and network TV that drove Silas out of hard-core porn and forced him to go legit. He could no longer compete with the filth and perversion that is so readily available in the comfort of people's own homes, for a few pence a day. 'If you can't beat 'em, join 'em' he says. 'He

formed Porn Prod Corp, and we're in the middle of producing what will undoubtedly be the highlight of next season's TV.' Silas wouldn't expand further on the content of the new production, so donning my white suit and gold medallion, I entered the world of Leisure Suit Larry to see what's in store.

Once into the game, it becomes obvious that Silas isn't the only person affected by the popularity of network TV. At a secret East Coast location, Mr Bigg holds a meeting to discuss how his business is doing. Vinnie, one of his

henchmen, explains that drug sales are at an all-time high since LP's started to include subliminal messages saying 'Just Do Drugs'.

Bruno, another henchman, has bad news about the X-rated film sales. Even rap music with continuous pornographic lyrics hasn't managed to boost the filth business. As he puts it, 'The result is obvious: painfully declining penetration.' Mr Bigg, however, is unsympathetic. 'I understand the problem, what I want are solutions!'

Elsewhere, in Hollywood on the West Coast, the Directors of the Porn Prod Corp are also holding a meeting where the members are rather more optimistic. One of Silas Scruemall's yes-men explains their plans to take the network TV world by storm with a series of 'America's Sexiest Home Videos' hosted by the sexiest woman in America, who shall be known as Vanna Black.

The search for America's sexiest woman has been narrowed down to three finalists. The eventual winner should be virginal and untouchable, yet sexy and... well, with other qualities which I'm not allowed to mention.

Silas decides that the final audition should be carried out in the contestants' natural habitat, and without them knowing. What they need is a complete dork, someone that only the sexiest woman in the world could be interested in and would drop whatever she was doing for him. Who do they know that is such a loser?

In walks Larry, and promptly spills coffee all over Silas... enough said. The scene is set; it is Larry's task to travel around America in search of America's sexiest woman. I won't give away any clues, but once you have the resumé of the three women, you're on your own, with only a mini video camera and an AeroDork credit card for company.

Meanwhile, Vinnie has good news for Mr Bigg. He has discovered an organisation called the 'Campaign Against Nearly Everything', or CANE for short, and by infiltrating this group they may be able to get the filth off the airwaves and back onto video. It is due to the movements of CANE that Passionate Patti enters the story at various points, and you then take control of her, rather than Larry. She loses her singing job at the Piano Pit, and is recruited by the FBI to help put a stop to the criminal element (CANE) that is screwing the entertainment business.

The game uses Sierra's new user interface, introduced in King's Quest V, which consists of several icons at the top of the screen that are hidden unless the current 'tool' moves over them. Clicking on one of these icons changes



the 'tool': there are tools for walking around, touching things, looking at things; there is also a suitcase tool in which you keep all the things you collect, and you can use any of the contents as a 'tool'. And, there is a zipper tool, which is for... well, surely you know what your zipper is for.

The game has an adult theme with non-stop sexual innuendoes, though they are more amusing than offensive and anyone who is likely to be offended by harmless fun should steer clear. Al Lowe, the creator of the LSL series, still manages to produce amusing and unique games. The humour is on a par with the Carry On films. A little more subtle perhaps? Perhaps not.

Mat Beard

## Nighthawk F-117A Stealth Fighter 2.0

Computers: IBM PC  
Supplier: Microprose  
Price: £39.99

*Baghdad, January 17, 1991 — The still darkness of early morning suddenly gave way to the flash and roar of exploding bombs. Iraqi anti-aircraft artillery batteries began firing wildly into the sky, not knowing what or where their targets were. Operation Desert Storm had begun.*

Yes, yet another flight simulator from Microprose. F-117A is the sequel to the popular F-19 Stealth Fighter, so if you are familiar with the cockpit of that, you should be able to climb aboard the new plane and start flying sorties with little or no training.

The F-117A was developed by Lockheed and the key to its success was the concept of a 'faceted' surface, with no curved surfaces anywhere on the aircraft. This faceted design made applying James Maxwell's equations, that predict how a body will reflect or scatter electromagnetic radiation, much easier than on conventional 'aerodynamic' planes. Thus, using computer modelling, it was possible to design a plane with virtually no radar cross-section. The combination of its shape and radar-absorbent material gave the F-117A a radar cross-section equivalent to that of a small bird or insect (it also makes it one of the ugliest planes I've ever seen).

Your first mission is a training mission that requires no flying ability; in fact, it requires no ability of any kind — you can't fail. Lifting off from Suda-Bay on Crete is simply a matter of putting

your foot down, so to speak, and pulling back on the stick. Once airborne, lift the landing gear, engage the auto-pilot and you're on your way to your primary target which is set in the Inertial Navigation System.

Flying over the Mediterranean and into Libyan airspace, to the site of the surface-to-air missile (SAM) radar installation which must be destroyed, can take several minutes. You can use this time to get to know the controls, or

if you're confident enough, there's an option to accelerate the passing of time so you get to the target, in Tripoli, twice as quick.

When nearing the target, switch the Heads Up Display (HUD) into ground attack mode and activate the forward IR camera to lock on to the target. When about 30 kilometres away, open the bay doors, select an AGM-65D 'Maverick', and when the HUD indicates missile lock — fire away.

### PC CHART

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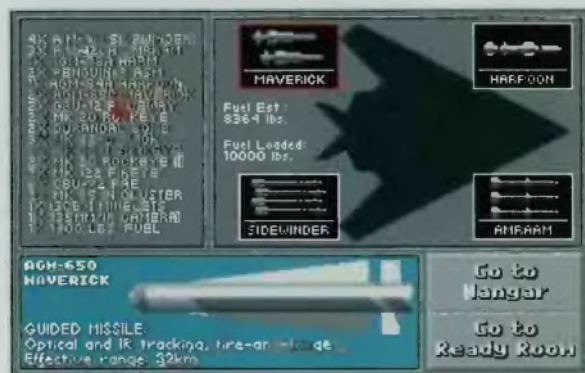
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Charts supplied by Software Circus at The Plaza, Oxford Street, London W1 (071-436 2811) and at 282 High Holborn, London WC1 (071-404 4492).





With the primary target destroyed, the plane (if still in auto-pilot) heads towards the secondary target, a missile



boat between Tripoli and Malta. Adopting the same procedure, destroy the target, perhaps using an AGM-84A 'Harpoon' fire-and-forget to add a little variety. When both targets have been blown off the face of the Earth, head towards Sicily and the friendly airbase

at Sigonella. Landing is fairly tricky, but if you use the Instrument Landing System, after a while it's a doddle.

When you have flown a few training missions, it's time for the real thing — and this time the enemy aircraft may be attacking. The mission could be anything from photo-reconnaissance to blasting a nuclear missile site in the middle of Libya. Either way, you must use any flying skills you picked up during training to avoid being detected, otherwise the MiG enemy planes will be on to you like flies round you-know-what, and you'll begin to wish that you read the section on dog-fighting in the manual.

If you manage to avoid radar detection or out-fly the MiGs, use an appropriate weapon to destroy the target, or photograph it or whatever, and then make like a hockey player and get the puck out of

there. If you make it home and land safely (or even if you get vaporised on the way) there will be medals all round and possibly a promotion.

There are various areas of conflict in this game, from the Persian Gulf in 1984 to Desert Storm in 1991. There are

even wars set in the future — Vietnam in 1994, Cuba in 1995 and Korea in 1996, enough to keep any elite flying ace busy. You can choose from three different types of conflict: Cold War, where the political situation is very dodgy and you may only attack designated targets; Limited War, where any military targets are fair game; and Conventional War, where anything that moves is a target and the more civilian villages you destroy, the more medals you get (pretty sick, really).

I'm not usually a big fan of simulations, but this one, requiring at least a 16MHz 386 and VGA graphics, looked to have potential. The in-flight graphics aren't stunning but they're not bad, and there are some very good still-images.

The sound emanating from my MediaVision Thunder Board was quite annoying: there is a monotonous drone to simulate the engine noise and a loud beep each time you are picked up by enemy radar. The playability would be greatly improved if the plane could be controlled by a mouse rather than a joystick or the cursor keys — more people own mice than joysticks.

This game can be great fun, or it can be taken seriously. I'm quite partial to stocking the missile bays with AIM-9H 'Sidewinder' and AIM-120A Amraam air-to-air weapons and atomising as many MiGs as I can before getting shot down. It doesn't win many medals, but it's good fun.

Mat Beard

## LEISURE LINES

Brainteasers courtesy of JJ Clessa.

### Winner of November 1991 Prize Puzzle

A doublegoof this time — we're getting worse! Firstly, there was a mistake in the Quickie. Of the 40 pairs of socks, there should have been 10 red pairs, 10 white, 10 yellow and 10 blue. And we also assumed that you could not distinguish between a right and a left glove in the dark, although as many of you pointed out, you would be able to.

In the Prize Puzzle, we underestimated the number of possible solutions — there were 626 in total, one or two more than we originally thought! Because of this we accepted any correct answer as eligible for the prize entry. We won't list all the possible solutions here, although some readers did. However, one answer is 4,938,271,605 which, when divided by 9, gives the

palindromic number 548,696,845.

The winning card drawn at random came from Mr Gary Jones of Bristol, who receives our congratulations and a prize very shortly. To all the others, keep trying — it could be your turn next!

### This month's puzzles

Leap Year is with us once again, so you don't have quite as much time for this month's puzzle as you did for last month's, but you do have more time than you had for last year's!

#### Quickie

A man travelling to London arrived at his station to find he had forgotten his wallet and credit cards. However, he happened to have a Scottish £50 note which he offered to the ticket office to buy his £40 ticket. Alas, the ticket office refused to accept the note, so he went across the road to a pawnbroker and pawned the note for £40.

When he got back to the station, he met a chap he knew who, seeing the chance of a bargain, bought the pawn ticket from him for £30. So, our man bought his rail ticket and still had £30 to spend. The other chap got a pawn ticket for a £50 item for only £30. The ticket collector got his money and the pawnbroker still has the £50 note. Who made the loss?

#### Prize Puzzle

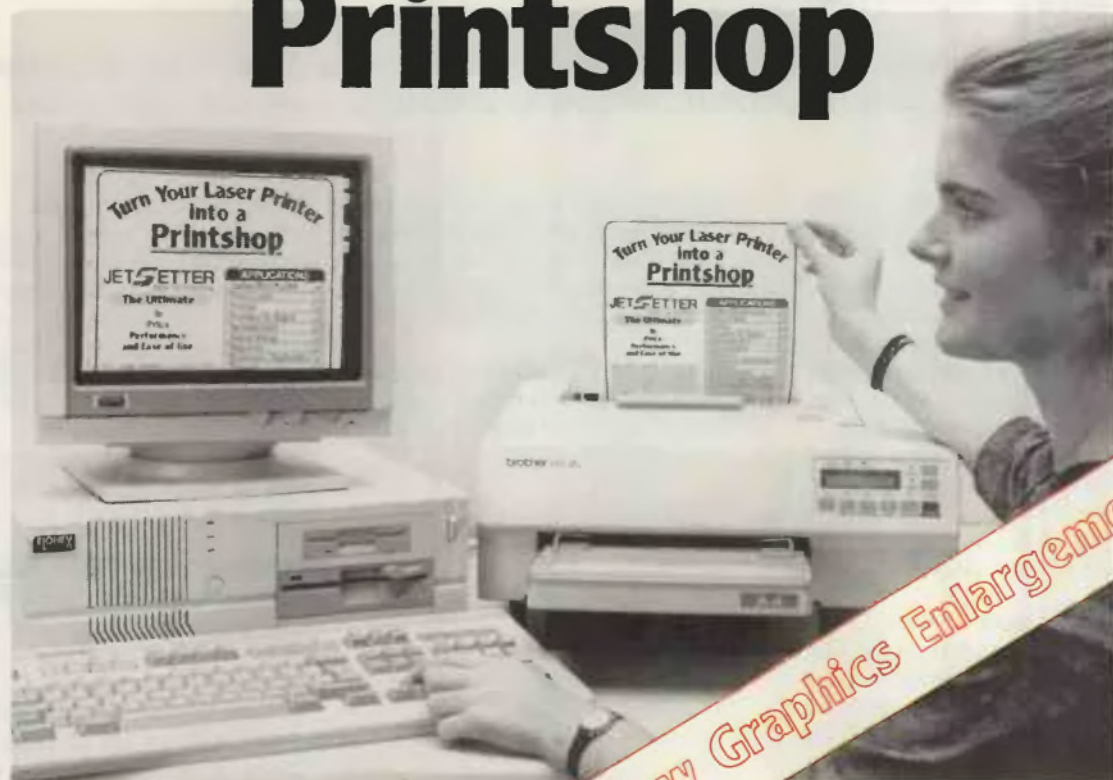
Short and sweet — something to make the micros move!

We want you to find the smallest six-digit integer in which all the digits are different, and which divides exactly by both the sum and product of its digits.

Send the solution on a postcard or on the back of a sealed envelope (no letters please) to: February Prize Puzzle, *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG, to arrive before 29 February 1992. Good Luck!



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# Pieces of eight

Mike Mudge stimulates your little grey cells as he presents a combinatorial problem with application in computing. What can you do with eight ones and eight zeros?

The area of investigation this month has been suggested by W Johnson of Broom in south Yorkshire. It is concerned with the combination formed from eight ones and eight zeros. Of the 12,870 combinations of eight ones and eight zeros which are possible, it is the case that 256 have the following interesting, and useful, property.

Groups of four digits taken from a recurring listing in any 16 adjacent positions represent the numbers 0,1,2,...15. For example:

000011110110010100001111 etc  
represents

0137FEDB6C925A48

There are actually only eight distinct combinations, each of which has 15 related combinations generated by rotation and another 16 generated by inverting the sequence and rotating. For example:

101001101111000010100110 etc  
represents

A4936DB7FEC80125

**Problem 1** Design and implement a computer program to generate the eight distinct combinations referred to above. Verify that they are unique, and that the remaining 248 such combinations can indeed be generated as described.

The usefulness of the property lies in enabling an efficient binary-to-hexadecimal or hexadecimal-to-binary conversion routine to be constructed. The heart of this converter for binary-to-hexadecimal is:

**Problem 2** Design and implement a Binary-to-Hexadecimal/Hexadecimal-to-Binary converter using the kernel suggested above, and compare its performance with any other such converter you may have access to.

**Problem 3** Consider the possible extension of the above ideas to the design of general number base converters.

*Note:* Although such converters are of little interest in the world of computing, they constitute a valuable set of tools for some number theoretic investigations. See later 'Numbers Count' articles.

Attempts at some or all of the above problems may be sent to Mike Mudge, 22 Gors Fach, Pwlltrap, St Clears.

iving by the closing date.

It would be greatly appreciated if such submissions contained a brief description of the hardware used, program listings, run times and a summary of the results obtained, along with suggestions for further work in this area, all in a form suitable for publication in PCW.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

## Review, July 1991: Aliquot Sequences and Safe Primes

This problem produced a very large response, most contributors concentrating on the Sequences of Safe Primes.

Nigel Backhouse 'laid the problem to rest' with a copy of 'Long Chains of Nearly Doubled Primes' by Günter Löh, *Mathematics of Computation*, vol 53, number 188, October 1989, pp751-759.

Chains up to length 13, viz  $k=12$ , were discovered in a search up to  $2^{50}$  in Fortran 77 which ran for 520 CPU hours on a Siemens 7.882 computer.

Typical of many submissions, I mention Jim Duncan who found  $k=7$  starting with 1909919 in C on an Atari 1040 ST, and Paul Leyland who advanced to  $k=8$  starting at 85864769 in an hour or so on his Elonex 386B-2S, again programming in C.

However, after much soul searching, the very worthy prizewinner this month is Robin Merson of Farnham, Surrey. Robin, 'at last pushed to prepare multi-length routines for the Amstrad computer', used QuickBasic to find a longest sequence of  $k=11$  starting at 554688278429 and used a graphico-theoretic study to conjecture that for  $k$  greater than 6, the smallest starting value  $q_1$  has  $\log(q_1) \sim (27k-77)/8$ . Viz a sequence of length 20 is predicted with a 26-digit starting value.

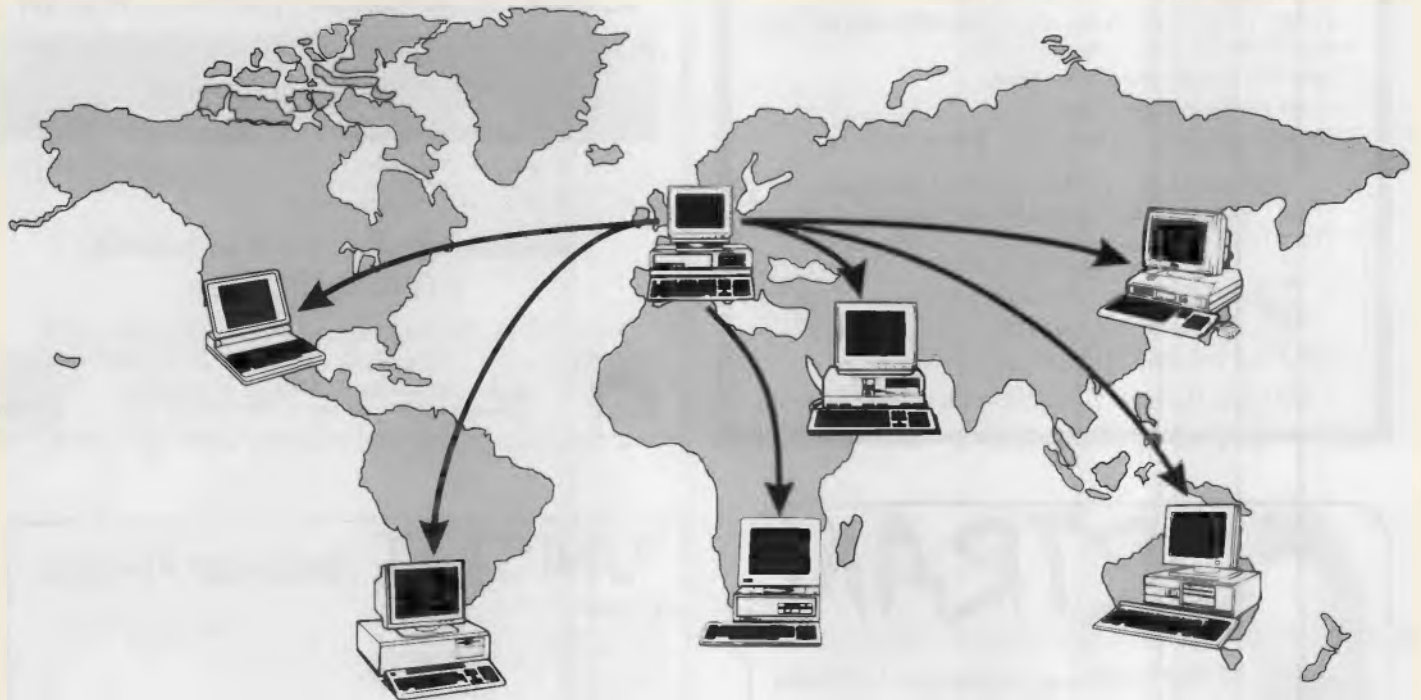
Mike Mudge welcomes correspondence from readers on any subject within the area of number theory and computational mathematics. Particularly welcome are suggestions for future Numbers Count articles.

```
BINA$ = "100110100001011110: HEXA$ = "936DA480125B7FEC"
H$ = "": L = LEN(B$)
L = L + (4 - L MOD 4) MOD 4      'Make L a multiple of 4
B$ = RIGHT$ ("000" + B$, L)
FOR P = 1 TO L STEP 4
H$ = H$ + MID$ (HEXA$, INSTR(BINA$, MID$ (B$, P, 4)),1)
NEXT
```



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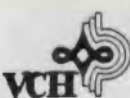
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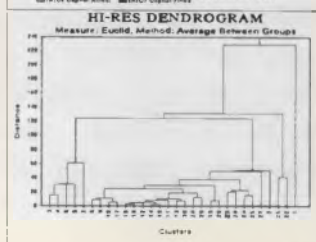
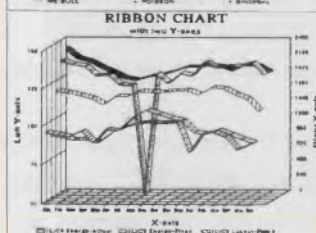
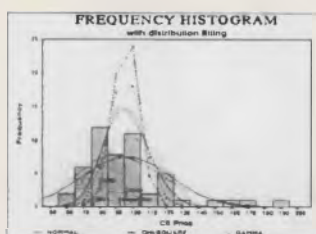
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# Minds in chaos

There's chaos in that brain of yours — and that's official. But of course chaos has a kind of order, as computers helped show. Now they're being used to model mental disorders and even take on patients. Nick Beard reports from the electronic psychiatrist's chair.

**P**sychotherapy is an old subject and yet a new one. This might seem perverse, yet madness is as old as mankind — only in recent decades have effective therapies been available. These have transformed the experience of psychological difficulties for the many sufferers, bringing hope where there was none.

In psychiatry, as in almost every other realm of medical science, computers are being used to model problems, to help devise new therapies and in some cases even to deliver them.

Modern psychiatry is not just about drugs and electroconvulsive therapy, though wise people understand the need for these things. It also includes psychotherapy — the 'talking cures' that are often associated with Freudian thinking. There are many flavours of psychotherapy (with little to choose between them) and at the root of most of them are a pair of crucial ideas: the unconscious and insight.

## Buried motives

The unconscious is a concept older than Freud, though it was he who made it part of common parlance. It refers to motives buried in our minds, making us feel things without realising precisely why, and do things that are not immediately understandable — or always desirable. A primary theme of psychotherapies is that by talking with a therapist (who usually responds in a stylised way) troubling unconscious factors can be made accessible to consciousness. Insight is thus gained into the problems and the hope is that insight brings relief.

These unconscious factors are often seen as 'conflicts' between core beliefs and views. *Mummy loves me* and *mummy went away* might be conflicting statements, and therefore too painful to hold in consciousness at the same

time. One is therefore buried — but the conflict surfaces elsewhere, and troubles follow. Of course this is a gross simplification, and probably has no bearing on how psychotherapies work in practice (if indeed they work at all — a point unlikely to be resolved for a long time). But our example is a rough model of what happens. Models used

*"In psychiatry, as in almost every other realm of medical science, computers are being used to model problems, to help devise new therapies and in some cases even to deliver them"*

in practice tend to be more subtle.

Few informed people now believe in the vast and completely unscientific edifice that Freudian analysts use, but at the core of most therapies is a model of motive. Thoughtful users recognise the models as potentially helpful *metaphors*, though some commentators (and not a few therapists) abuse them by seeing them as cognitive *mechanisms* of motive.

Soon after computers were programmed to handle 'natural' languages (real languages, the ones we speak and write, rather than just programming languages) Joseph Weizenbaum created 'Eliza'. This program mimicked a Rogerian psychotherapist, whose style was chosen deliberately for the ease with which it could be programmed. It

required no complex language model, as generally, Rogerian therapists say little. 'I have been feeling rather miserable,' offers the patient. 'You say you have been feeling rather miserable,' suggests Eliza.

Not a sophisticated conversationalist, Eliza — if you say something completely ridiculous, she will not know. 'I blenheim smeal warthog,' you say. 'You say you blenheim smeal warthog,' parrots Eliza. This is rarely of much therapeutic value — though Weizenbaum never intended it to be. There have been serious attempts to model the psychotherapeutic process with computers. Psychotherapy could be described as cognitive detective work, so perhaps computers could be set up as training grounds for detectives?

Kenneth Mark Colby, Professor of Psychiatry and Biobehavioural Sciences at the University of California School of Medicine, Los Angeles, has been working on this problem for years. As long ago as 1962 he began publishing papers on the simulation of neurotic thinking in computer programs, and the treatment of such programs by 'psychotherapy' — telling the program things to 'make it feel better'. Colby was first a psychoanalyst, but also moved into programming. The first of his models was a program developed to pour its heart out, to 'free associate'.

## Worrying 'beliefs'

Free association simply means trying to express and explain one's beliefs. However, like the person with a *neurotic* problem, some of Colby's program's 'beliefs' were simply too 'anxiety provoking' to express. Obviously a program feels no anxiety (at least not one written as anything other than Fortran or Cobol). The program therefore tries to reduce the 'anxiety' (a numeri-



cal score) associated with each belief. To do this the program uses a number of transformations, based on things that people seem to do with uncomfortable ideas. For example, *deflection* might be used to change *I despise my father* into *I despise my boss*. This is far less 'anxiety provoking', since *you must love your boss* is not a core belief of the program, unlike *you must love your father*.

The program was later supplemented with the ability to respond to suggestions made by the operator 'therapist', who would offer remarks such as *Father cares for you* to see how the system responded. There were limitations on what the program could understand. It knew some things, such as 'hate' and 'love' being antonyms, and that various other ideas (such as despise, loathe, dislike, not-be-a-fan-of) were related to 'hate'. It knew little of the more subtle forms of conflicting beliefs.

It could consider 'God loves mankind' and 'God destroys half the population of Africa with one virus' simultaneously, without any sense of peculiarity. In 'Fuzzy Fundamentals' (Frontiers, September 91) we considered Douglas Adams' Electric Monk Plus from *Dirk Gently's Holistic Detective Agency*. This had 'an entirely new multi-tasking Negative Capability feature that allowed them to hold up to 16 entirely different and contradictory ideas in memory simultaneously without generating any irritating system errors...'. It would happily think the two thoughts above, 'understanding' them too. Colby's program did not understand them, avoiding 'anxiety'.

### Therapy program

Colby has recently released a new program, *Overcoming Depression* (see Short Reviews, PCW December 1991) which adapts some of the principles learnt during the work with neurotic programs to produce a system aimed at providing therapy for patients. It is based on a form of psychotherapy known as cognitive therapy, which is motivated by the view that depression causes (or is caused by — it doesn't matter too much which way round you put it) negative modes of thinking.

Cognitive therapy seeks to help sufferers change their thoughts to more constructive and positive ones. Using a 'natural language interface' the user interacts with the program in much the same way that you might speak with a doctor or therapist. Interactive dialogue is interspersed with more 'tutorial' sessions, and the result is a convincing system providing a constructive — and hopefully therapeutic — exchange. Its

use of English is not perfect, but if you are prepared to forgive the odd grammatical glitch, it works.

Some people believe, for various ideological reasons, that there is no place for science in psychiatry. They would prefer to keep psychological experimentation and speculation (mind studies) free of the constraints of neurobiological science (brain studies). Neuroscientists, however, continue to discover links between the chemical soup and electrical buzz of our brains and the thoughts in our minds.

Computers have an important role here too. It is hard to reverse-engineer the brain, so simulation studies are important. There will be few regular readers of this column who are not now familiar with neural networks. Practical neurocomputing has grown into a significant industry, with increasingly sophisticated products and a burgeoning consultancy market.

The debt to neurobiology — wet science — owed by this industry is far smaller, however, than much of the promotional hype implies. Neurobiology, on the other hand, is benefiting from the improved neural network simulation platforms that are now available (see Frontiers, December 1991).

Steven Grossberg, Professor at the Center for Adaptive Systems of Boston University, Massachusetts, has developed a simulated neural network (a gated dipole network) that behaves in a way that bears some resemblance to particular mental and neurological disorders. The network is able to account for some of the manifestations of hyperactivity in children. If such kids are given amphetamines (sometimes called speed, because of its notable stimulant effects), paradoxically they 'slow down'. Grossberg made testable predictions on the basis of his research with artificial neural networks.

### Brain damage

Other studies, such as those of Daniel Levine at the University of Texas, have attempted to model aspects of brain damage using neural networks. Damage to the frontal lobes can produce attention defects, such that people continue to engage in activities that would otherwise become deeply boring, highly repetitive actions.

Like any computer, the brain cannot be understood by merely examining structure. The innards of a PC are the same, whether it has been running Windows, Unix or even OS/2. It is not until behaviour or function is examined that mechanisms can be understood. As the brain's activities are primarily electrical, recordings can be

made — which can then (hopefully) be linked to structure and function.

Such recordings make up the EEG (electroencephalogram — brain wave trace) which is a time series of data. This allows new mathematical and computational techniques to be used. A realm of modern mathematics that would probably have not come about without computers is non-linear dynamics — or chaos. This has provided a mathematical framework for examining many biological phenomena.

Chaotic systems follow strict and simple laws, though their behaviour can never be predicted very far into the future. This is a result of extreme sensitivity to initial conditions, sometimes known as 'The Butterfly Effect'. Scientists have used the mathematical techniques of chaos theory to study human brains: for example, there is evidence of chaos in the EEG. Much of the fuzz that dances on the graph of an EEG had been assumed to be noise — random rubbish. Tests for chaos show that there is hidden structure.

The mathematics of chaotic dynamics have been used to explore the differences between the EEGs of people suffering from epilepsy (which, it must be stressed, is not a mental illness), and also to account for activity in specific neural circuits (such as in the sense of smell) and in single nerve cells.

### Resource Guide

#### Artificial Intelligence and Natural Man

Margaret Boden, MIT Press

Described by one reviewer as 'the human being's guide to machine intelligence'. Readable and thorough survey of cognitive skills and problems that have been simulated by software. Recommended.

#### Neural and Cognitive Modelling

DS Levine, Lawrence Erlbaum

Detailed review of neural nets from cognitive and neurobiological scientists' point of view. Well referenced.

#### Chaos in Brain Function

Erol Basar (ed), Springer Verlag

Short collection of fairly specialised papers. Not just EEG work, but also single cell and EEG-structure studies.

#### Fractal Physiology and Chaos in Medicine

Bruce West, World Scientific

Survey of fractals and chaos in various areas of medicine, including cardiac anatomy and physiology, lung function and neural systems.

#### Overcoming Depression

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(Reviewed in PCW, December 1991)





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- ☐ As-Easy-As-Spreadsheet program. Compatible to 1-2-3.
- ☐ Extra DOS Toolbox (3 d) - Essential for the DOS user.
- ☐ Brother's Keeper 4.5 (3 d) - Fine, full-featured genealogy program.
- ☐ Dancad 3D 2.5G (5 d) - Wire-Frame drawing tool (HD).
- ☐ PKUNZIP - Tools to create/extract archives.
- ☐ Express Check (2 d) - To manage your cheque accounts!
- ☐ Formgen/Formfill (2 d) - versatile form generator and form filler.
- ☐ Home Inventory 4.0 - Keeps track of everything you own.
- ☐ Meal Master 6.14 (2 d) - Complete recipe filer. Comes with over 450 recipes to start you off.
- ☐ Mr. Label 5.2 - Powerful & versatile label maker.
- ☐ Ledgermaster (4 d). Modular/Integrated accounts/invoicing.
- ☐ PC-File 5.1 (3 d) - General database program (HD).
- ☐ PC-Key Draw 3.76 (4 d) - Powerful drawing & design (HD).
- ☐ PC-Type 4 (4 d) - Word processor. Spell, check, Mail Merge.
- ☐ Piano Man (2 d) - Create and play music.
- ☐ VgaPaint. Full colour paint package. (VGA)
- ☐ Vaccine and Virus Killers Ver. 80 (2 d) - Collection of utilities designed to protect your system from viruses! This disk will find (and destroy) over 200 different Viruses & 500+ virus strains.

## CLIP ART (PCX)

Note: These disks contain clip art in PCX (PC-Paintbrush) format. They can be used with WordPerfect 5.0/5.1, PageMaker, Ventura Publisher, Windows or programs that read PCX files.

- ☐ Accent/Dingbats
- ☐ Alphabet Soup (2 d)
- ☐ Animal woodcuts (9 d)
- ☐ Babies (2 d)
- ☐ Birds (2 d)
- ☐ Business (2 d)
- ☐ Butterflies
- ☐ Cars
- ☐ Cats and dogs
- ☐ Church (4 d)
- ☐ Education (2 d)
- ☐ Family (2 d)
- ☐ Fish
- ☐ Food (2 d)
- ☐ Headlines (2 d)
- ☐ Health/Medical/Dental (2 d)
- ☐ Holidays (3 d)
- ☐ Houses (3 d)
- ☐ Kids/Caricatures (2 d)
- ☐ Ladies (2 d)
- ☐ Men (2 d)
- ☐ Misc (4 d)
- ☐ Months
- ☐ Old F. banners (4 d)
- ☐ Sport (4 d)
- ☐ Teddy Bears (2 d)
- ☐ Travel (2 d)
- ☐ Wedding (3 d)

## EDUCATION

- ☐ Amy's First Primer - Six learning programs ages 4-8. (CGA)
- ☐ The DOS Learning System - Learn to use DOS with this great program. Covers all versions of DOS 2.0-4.01.
- ☐ Lotus 2.2 Learning System (5 d) - Learn Lotus easily and quickly.
- ☐ Typing Teacher - Five programs to improve speed and accuracy!
- ☐ World 2.99 - Globe! Learn about cities & countries. (CGA).
- ☐ Tutor DOS (4 d) - The supreme DOS tutorial. Everything you wanted to know about DOS and more! (HD)
- ☐ Language Tutors - German, French, Spanish, Italian, Cantonese, Japanese, Hebrew.
- ☐ Pre-School Education (2 d) - A Collection of Simple tests and games with good reward, and lots of colours and sounds (CGA).
- ☐ Translators/Dictionaries: German, Italian, Spanish.

## CGA GAMES

- ☐ Adventure Game Toolkit (3 d) - To create adventure games.
- ☐ Arcade Games 1 - Pac-man Hopper, Space Invaders, Fusion
- ☐ Arcade Games 2 - Double Q-Bert, Breakout, Beast
- ☐ Basstour - The ultimate fishing game.
- ☐ CGA Tetris Collection (2 d) - Ten great versions of this game.
- ☐ Chess Challenges (2 d) - 4 Good games + super Tutorial.
- ☐ Kids' Games - Fun for the under-12 set.
- ☐ Strategy Games - Risk, Qihello, Chess, Nyet and others.
- ☐ Super Solitaire (2 d) - 15 great variations.

## EGA/VGA GAMES

- Note: These games require EGA or VGA graphics.
- ☐ Commander Keen - Sensational game. Superb sound and graphics!
  - ☐ Caddihack - Golf game, great graphics.
  - ☐ Captain Comic 4 - Fabulous sound, graphics & more!
  - ☐ Dark Ages - From the creators of Commander Keen!
  - ☐ Duke Nukem - Top quality arcade game 640K (HD).
  - ☐ Hugo II, Whodunnit! - An animated 3D adventure.
  - ☐ Last Hall of Darkness - Graphics Adventure game.

## ATM FONTS FOR WINDOWS

- ☐ ATM Fonts for Windows Vol. 1 (4 d) - 30+ Fonts for Adobe Type Manager. Will work with all Windows applications.
- ☐ ATM Fonts for Windows Vol. 2 (4 d) - 30+ Additional fonts.
- ☐ ATM Fonts for Windows Vol. 3 (4 d) - 30+ Additional fonts.
- ☐ ATM Fonts for Windows Vol. 4 (4 d) - 30+ Additional fonts.

## WINDOWS 3.0 GAMES

- ☐ Games for Windows 1 - Kiois, Worm War, Almonds, Lunar Landers, Checkers, Backgammon and more!
- ☐ Games for Windows 2 - Space Walls, Hextris, Mines.
- ☐ Games for Windows 3 - Tetris, Concentration, Taipei, Archonoid
- ☐ Chess for Windows - Play the tremendous game of chess.
- ☐ TAPEI 5.0 - Mahjongg for Windows.
- ☐ WinWill 1.2 - 'Wheel of Fortune' type game.
- ☐ War heads 1.0 - Missile command type game.

## WORDPERFECT 5.0/5.1

- ☐ Art & Graphics Vol. 1 (2 d) - Over 90 graphics.
- ☐ Art & Graphics Vol. 2 (2 d) - Another 90 graphics.
- ☐ Art & Graphics Vol. 3 (2 d) - 90 further graphics.
- ☐ Art & Graphics Vol. 4 (2 d) - 90 more graphics.
- ☐ Art & Graphics Vol. 5 (2 d) - 90 more different graphics.
- ☐ WordPerfect 5.1 Learning System (3 d) - Learn now to use WP easily and quickly with this great tutorial (WordPerfect is NOT required).
- ☐ Super WP 2.2 (4 d) - Can emulate WordPerfect and others.
- ☐ WordPerfect 5.1 Macros (2 d) - Over 100 worthwhile macros.
- ☐ WordPerfect 5.0/5.1 Tools (2 d) - 17+ Fantastic utilities.
- ☐ PC-Draft II & III (2 d) - Art/Graphics for WP 5.0/5.1. (CGA)(HD).
- ☐ By Design - Desktop publisher and Graphic Design for WP.

## DESKTOP PUBLISHING

- ☐ Banner & Sign makers - Banners or signs for any occasion.
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- ☐ Typesetter PC 1.8 (2 d) - True WYSIWYG shareware DTP program.
- ☐ Optika 2.20 - Paste-up program reads all kinds of Graphics files.
- ☐ PrintPartner (2 d) - PrintMaster & PrintShop clone.

## WINDOWS 3.0

Note: These disks require Windows 3.0.

- ☐ Active Life 1.5 - Tremendous "Personal Information Manager"
- ☐ Almanac - The ultimate calendar for Windows!
- ☐ Aporia - Icon-oriented user interface.
- ☐ Atlas - An Atlas of the United States.
- ☐ BackDesk - Pop-up menu and virtual desktop.
- ☐ Bible Windows - Display Bible verses.
- ☐ Classic Time Pieces - High Colour display a few different clocks.
- ☐ Clip Book 3.0 (3 d) - Includes ToolBook Run Time ver. 1.5.
- ☐ Command Post 7.0S - Great File Manager/Menu system.
- ☐ Cursor Utilities - Alter the hourglass to any shape.
- ☐ Decor - Graphics resource browser and editor.
- ☐ Elana - Easy change of System 1N1, Win 1N1, etc.
- ☐ Fractals & Mandelbrot (2 d) - Fascinating/Stunning graphics!
- ☐ Grab Plus 6.0 (2 d) - The Pop Up Address and Envelope printer.
- ☐ Hyperdisk 4.21 - Make Windows run 2 to 10 times faster.
- ☐ Icon Utilities (3 d) - Full set to create, review and manage icons.
- ☐ KFree 4.0B - Display Free Memory.
- ☐ Metz Utilities (2 d) - Full set of useful utilities.
- ☐ Paint Shop - Display, convert, alter and print pictures.
- ☐ PC Project 3.0 - A very nice project manager for Windows.
- ☐ Pixello - To view and catalogue graphic files.
- ☐ Postscript Screen Fonts (3 d) - Groups of Avant Garde, Bookman, Courier, Garamond, Helvetica, Korinna, Palatino, New Century Schoolbook, Symbol, Times, Zapf Chancery & Zapdingbat.
- ☐ Quotes for Windows - 3 great programs give you daily quotes.
- ☐ Screen Savers for Windows - 12 various Windows screen savers.
- ☐ The Great Icon Collection (4 d) - 3,000 of the best icons!
- ☐ Toolbook Programs Vol. 1 (2 d) - Applications/Utilities.
- ☐ Toolbook Programs Vol. 2 (2 d) - More as above.
- ☐ Toolbook Games - A phenomenal collection of games.
- ☐ Toolbook Tutor (2 d) - Learn to use the Windows Toolbook.
- ☐ Union 3.0C - Great communications program.
- ☐ Utilities for Windows (4 d) - 50+ utilities that will help you get the most out of Windows, as well as making Windows easier to use!
- ☐ WinBatch - Windows batch language.
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## Getting the picture

Spreadsheet graphics are an invaluable aid for coping with the data explosion, but they are of limited use confined to your screen. Tim Frost reports on new methods of colour printing and projection which are fuelling a growing interest in presentation graphics.

A somewhat odd alliance of companies came to light just over a year ago with a Best Business Presentations roadshow put on jointly by Hewlett Packard, 3M, Polaroid and Harvard distributor SPC. The idea was that the combined use of computer graphics software and hardware for business presentations is only now beginning to mature and needs promoting.

Presentation graphics is the fastest growing software area, but the technology to display and distribute the images has always been a little complex and costly for the average business manager.

That is not to say that managers are technically incompetent, rather that their main job is to run companies and not to try to get various bits of presentation hardware to work together. If systems don't integrate easily, more or less offering themselves for use, they don't get used at all.

### Data explosion

Spurring the move towards greater use of computer presentation techniques is the explosion of data — the amount being handled is trebling every two years, according to a commonly quoted figure.

Here the phrase 'information technology' has a real meaning. Without extra technological means of showing essence as well as detail, data can become just a blur of numbers. Data, no matter how well researched, is no use at all unless it can be easily assimilated.

Spreadsheet programs integrating graphs, and semi-DTP word processors, have started managers on the path to clearer display of information, whether it be numbers or text. But this is really only the tip of the iceberg and deals with information on the printed page or the monitor screen.

But the power, colour and resolution of a PC with a VGA screen is primarily restricted to the single user. That image, beloved of computer ads, of a small smiling crowd gathering around a proud manager displaying his latest financial discovery (or are they watching him play Tetris?) is hardly a realistic or very professional way of disseminating complex data to a group in a formal meeting.

Professionalism is now becoming



the order of the day, because the majority of businessmen anticipate doing an increasing number of presentations, either for internal company consumption or for sales pitches. The laser printer has increased the quality of the printed presentations, but generally minus one major feature useful to hammering home a point — colour.

### Traditional methods

The traditional methods of displaying information to a group — white boards, overhead projectors (OHP), 35mm slides, and occasionally video (usually on a TV monitor) — still account for the vast majority of presentations. Computer-generated 35mm slides and OHP foils are still considered quite sophisticated by many companies.

Manufacturers and software companies believe more managers are starting to use new hardware systems, and consequently making greater use of graphics software. The belief is that the 'early adopters' market is saturated and that the general market must now be addressed. Early adopters in any field are enthusiasts who will find a way of using new technology no matter what the cost. They are great to kick-start new technology commercially, but they represent a tiny proportion of the potential market for a user-friendly product at the right price.

Presentation software is becoming faster and easier to use, so that managers shouldn't need to spend half a day translating data into graphics or struggling to remember how to use a package. Business graphics packages exploiting the consistent Windows user interface are beginning to appear. It is no accident that Harvard Graphics for Windows was slated for launch within a few months of the roadshow.

But what can you do with all those



wonderful on-screen graphs? The acceptable routes have been to transfer the computer image to 35mm film for projecting larger presentations, or to OHP foils for boardroom presentation.

Polaroid and HP (and a lot of other printer companies) are hoping that for more routine work, this transfer will be done increasingly in-house rather than by an imaging bureau. Polaroid has two compact film-recorder models, one with 2000-line resolution and the other with 4000-line. Processing is no problem with the company's instant-image technology: Polaroid offers both colour and white-out-of-blue transparency film that can be processed by a simple hand-held device.

### Colour printer

More important are the interfaces between the film recorder and software packages. The new recorders will process TIFF, CGM and TARGA formats, and come with utilities to work with most of the usual graphics software packages. And they connect both to PCs and Macs.

HP's contribution is the 500C inkjet printer, designed with the idea that it will be used mostly for making basic hard copies of information like letters, memos and spreadsheets. With a black ink cartridge, the 500C functions exactly like its monochrome sibling, the Deskjet 500. But colour can be attained by replacing the black cartridge with a triple-chamber one holding cyan, magenta and yellow inks (this arrangement is relatively simple to implement with an inkjet printer, in theory at least — though three chambers and print nozzles have to be crammed into a manageable cartridge). HP recognises that, for the time being anyway, people will put up with a little inconvenience if it provides affordable hardware for colour printing.

But the major change is being spurred by companies like 3M, which are developing the use of colour LCDs to project computer images directly from a PC onto a large screen.

### Heavy projectors

Projection TVs which can be used for data projection have been available for some years. Many companies have installed them into boardrooms and presentation suites. The electronics in the units, very similar to that in a TV, drives three very high-power screens, one each for red, blue and green. Specialised lenses re-focus the three colour images back together onto the screen.

Image quality is high but there are drawbacks. The projectors tend to be large and heavy, and the light output

from the three screens is limited — they are best used in semi or complete darkness. And each time the unit is moved, the three guns and lenses have to be realigned. This is no problem in a fixed venue but otherwise it can be a hassle, even with semi-automatic alignment.

An overhead projector is a lot more useful for office presentations where equipment has to be wheeled in and out. The light output is greater, it is easily transportable, and requires the minimum of alignment.

So some bright spark came up with the idea of putting a LCD panel on top of an OHP, combining the convenience of a direct computer connection with the ease and brightness of the OHP.

The business world has yet to take to this set-up — primarily because of the cost and quality, but also because of a lack of interest in presentation graphics in general. Initially these screens were monochrome, relatively low in resolution, and slow. But developments have been dramatic in LCD technology. Supertwist and tripletwist LCD screens give almost an infinite variety of greyscales, instead of the black or clear options of the early LCDs. Colour and thin film transistor switching is, if you will excuse the pun, completing the picture.

Colour and cost are deeply linked at the moment. 3M's contribution to the business graphics packages are two LCD panels that differ mostly in the number of colours they can display.

The cheaper panel offers VGA resolution in 16 colours. Bearing in mind, that graphs and bullet point 'slides' normally make use of only three or four colours, this is a restriction only when displaying scanned images or the output of paint packages.

3M's 5800 panel is more state of the art. It delivers 24K colour options, but can still be switched to work as an 8, 64 or 4913 colour screen. To display a wide variety of colours is not always an advantage. Slides of charts with a uniform background and blocks of colour will not necessarily display uniformly if the screen is capable of thousands of colours. There will be some change over the surface of a colour block. By restricting the palette to just a few colours, pie-chart segments (for instance) will be better displayed.

### LCD projectors

Early colour screens used three LCD layers, one for each colour. These are giving way to single-layer screens on which each pixel has three colour LCD elements.

A panel may be built from a matrix of 100,000 LCD pixels, each turned on by

a current in its own 'power lead'. On a normal LCD screen, as used by calculators, the current to one element can turn an adjacent one on just a little, giving rise to a slight general fuzziness.

This problem has been resolved by the use of thin film transistors (TFT), semiconductor devices effectively etched in the blank space beside each LCD pixel. They control the switching of the pixels and require a higher current to operate, and so are not triggered by tiny 'crossover' currents.

Speed is not critical in graphics presentations. Many users will be content if the screen is fast enough to allow mouse movement to be seen clearly. The slower, cheaper panels refresh at around 10 frames per second. The more advanced LCDs are fast enough to use for TV, although there is still some lag in switching them off, causing a blurring on some types of movement.

### White light

Several companies are developing LCD-based projector TVs that can be used for TV or data work. The most prominent product is the Sharpvision unit, very much a cross between an OHP and a TV projector. It uses an OHP-style high-power metal halide lamp with a colour temperature of 9000 degrees, making it a good white-light source.

The light is split into three paths using dichroic mirrors which filter and reflect the red, blue and green light components through three TFT-controlled LCD panels. More mirrors and optics re-combine the three colour beams into a single path to pass through the main lens. The LCD panels measure only a few inches square and the bulb faces downwards, so the whole package can be made incredibly tiny by projection TV standards: 24x13in and weighing around 30lbs.

### Attracting business users

This size and weight, with minimal alignment requirements, is already beginning to attract business users. The light output isn't quite there yet, and both resolution and switch-off speed need improving. But for a first product, it performs remarkably well.

The hardware/software alliance is not wasting its time and money promoting the concept of presentation graphics. The lowest presentation technology, white-boards, will continue with its hands-on immediacy, but scribbled OHP foils and very basic slides will become an increasing liability.

I give it five years until the bulk of the average presentations uses desktop produced graphics directly accessed from a PC.



# System Science

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# What's in Hands On

## Beginners 346

After explaining the MSDOS command line in some detail over the last few issues, Chris Cain turns his attention to the Mac's 'user friendly' finder. Real programmers never use mice, of course, but WIMPs are an easy way for the rest of us to take control.



## Utilities 348

Karl Dallas has been looking at three books which come complete with example software. *DOS 5 Complete* has some general DOS utilities thrown in, *Guide to Connectivity* includes some useful networking programs, and *Novell NetWare Power Tools* has a disk of, er, Novell power tools.



## Spreadsheets 352

According to Steve Cassidy, Version 3.1 of Lotus 1-2-3 will not be giving way to 1-2-3 for Windows. Indeed, version 2.0 may have some life left in it yet. David Colver has some advice for users selecting a spreadsheet for use in a financial environment and compares 1-2-3 with Excel.



## Databases 357

As promised, this month Kathy Lang looks at address book applications for personal use, and compares Portex, Address Book Plus and Top Priority.



## Low Level 361

Dan O'Brien investigates the length of things, and finds a TSR that is short both in size and life expectancy.



## Windows & OS/2 370

Prepare for the future! But which? Ken Morse looks at OS/2 2.0 and Windows NT. Both are now in the hands of a select group of developers, but will it be technology or politics which decides the winner?



## Macintosh 374

The Apple II is alive and well, living in schoolrooms across the USA. Mick O'Neil wonders why. Lower-cost Macs have led to a rush of pretenders to Microsoft Works' integrated-package top slot. Has ClarisWorks overtaken Works 2.0? Plus a look at Fractal Design Painter, a Mac art package for artists, and Gallery Effects Animator.



## Unix 378

If you thought the user-supported Emacs was good, wait until you read what DJ Walker-Morgan has to say about Perl. If you've never heard of Emacs then you haven't been paying attention.



## Networks 382

What happens when you need to run more than one transport protocol across a network? What is a transport protocol? Ralph Bancroft describes a few, using the Royal Mail as an analogy, and discusses their relative benefits.



## Readers' Tips 387

Henry Chang has a cheeky but effective kludge for getting Windows to open applications with the correct default directory, and Lloyd Wood has a few more tips for anyone running a PC in a Mac Window. If you are looking for a good party game, Dr John G Wright describes a method for refilling inkjet cartridges which, if it works with your printer, could save you a fortune.



## Computer Answers 389

Cheap 486 motherboards may look like a good way to boost the performance of an ageing AT, but what are the pitfalls? What does PCMCIA stand for, and what happens when your LaserJet falls ill? Have you ever wondered about some of the Hayes modem AT commands? The meaning of AT&J appears to vary between makers, for instance.



### Guidelines for the Hands On section — how you can contribute to PCW

Hands On is here to provide you with a forum to impart your wisdom to the rest of the readership. As always, we'll pay you for anything we use.

For most of the departments we'll pay £60 per printed page. For Computer Answers and Readers' Tips we'll pay £25 per tip, with a bonus of a subscription to the magazine for the Tip of the Month. Contributors should supply an invoice for the relevant amount.

What are we looking for? For the applications section — Databases, Word Processors and Spreadsheets — we're looking for macros, sections of query language or useful tips and shortcuts. Low Level is for all real programming, whether it's in assembler or Pascal, C++ or Modula 2. We're not looking for 15 pages of listing. What we are looking for are concise implementations of innovative algorithms. Quiche eaters only need apply.

The four 'platform' departments — Macintosh, Windows & OS/2, Unix and Networks — are slightly different. User tips, programming tips and news of hot new products are all welcome.

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With Computer Answers we'll try to answer your questions, but if you have a better answer, or we can't help someone, feel free to chip in.

All submissions should be sent to 'Hands On' at the following address: *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG.

Make sure that everything you send is clearly addressed to 'The Editor' of the right department.





## Apple core

Chris Cain turns from IBM PCs to examine the basics of the rival Apple Macintosh range, with its famous user interface designed to be as easy as possible for novices to pick up.

**T**aking a break from the IBM PC and its many clones, the 'Beginner's' column this month casts an eye over Apple's Macintosh range. These machines with their friendly front end, stylish design, and extortionate price tag, offer an alternative path into the world of personal computing.

The Macintosh standard is one of the few not compatible with MSDOS to achieve success in both the business and home computing markets. Most Mac systems seem to sell to creative people like designers, illustrators, writers and the odd musician.

Getting to grips with a Mac is easier than with many other machines because it uses a WIMP interface as the standard method of interaction whatever program is running. Once you're familiar with the operation of, say, a word processor, you can pick up the basics of an art application within a matter of hours. The fact that the programs are poles apart in function doesn't enter into it.

Here we'll be taking a first look at a program called the 'Finder', the part of the Mac Operating System that deals with general file handling. After reading this column you should be able to load and run applications, copy data from disk to disk and customise the Finder's appearance. We will also concentrate on System 7, the latest version of the Mac OS, as it always pays to keep abreast of latest developments.

### Finder's keeper

First we'll look at the screen layout, the location of important icons, and the menus that house useful items. The latter are positioned at the top of the screen and are accessed by placing the pointer over the title and pressing the mouse button. Unlike Microsoft Windows, the mouse button must be constantly held down to keep the full menu

display until a selection has been made. The standard Mac mouse only has a single button so there's no way you can press the wrong one by accident.

The latest version of the Finder has eight standard drop-down menus along the top of the screen. From left to right these are Apple, File, Edit, View, Label, Special, Balloon Help and Application. Each has a set of items dedicated to a specific area of computing operations, such as file handling, on-line help, and information displays.

The File menu is perhaps the most important when starting out. The first option available under it is New Folder which, when selected, creates a new storage folder complete with a small icon in colour or black-and-white, depending on your system.

### Facts about folders

Folders are for storing programs and data, much like sub-directories in MSDOS, and can be set up on any writable storage device such as a hard or floppy disk. You can also put them on the 'desktop', the background display, so that regularly used applications and files are easy to access.

Doubleclicking on a folder icon with the mouse will open a window displaying the contents. To put something into the folder, you drag it there in a WIMPish fashion. To execute any applications within a folder, you need only double click on the relevant icon.

Copying things is a case of moving icons from window to window, but if you want to keep both the original and the copy in the same folder, or on the same disk, you must use the Finder's Duplicate function. Located, rather logically, under the File menu, this will make an exact copy of any selected file or folder. It cannot be easily used to make copies of whole floppy disks, though — to do that you must drag one

disk icon onto another.

Disk icons are displayed for all volumes currently available and can usually be found near the top right-hand side of the screen. When you insert a floppy disk its icon appears on the desktop, and then when you remove it, by choosing Put Away from the File menu, the picture disappears.

### What a waste

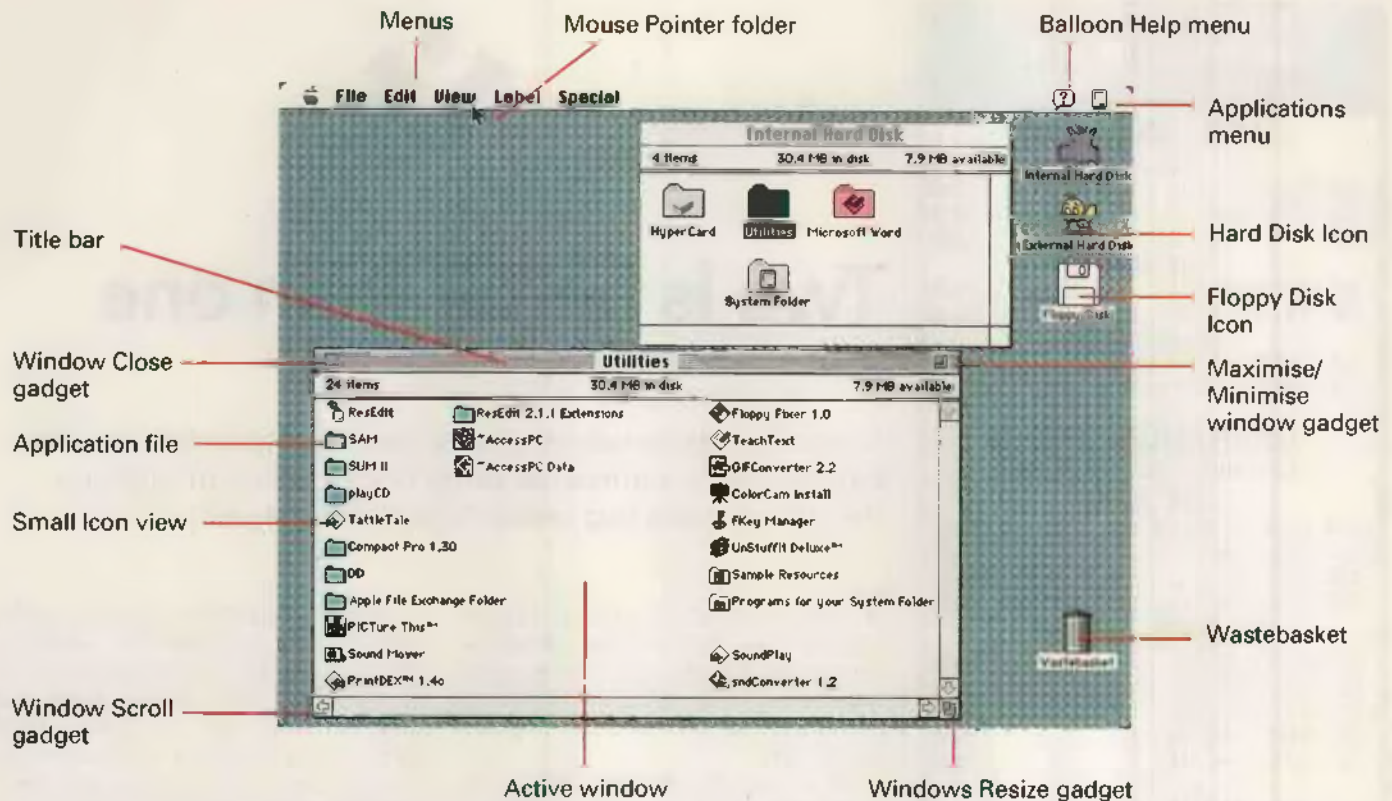
A disk can also be put away by dragging its icon to the Wastebasket, a special folder used mainly when deleting data from disks. Anything placed into this folder, easily identified by its dustbin icon, can be deleted by selecting the Empty Wastebasket option in the Special menu. This menu houses other important and destructive items, including the command to erase disks and an option to shut down the machine. Software shutdown is one of the most appealing Macintosh system features, but it can prove unpopular when in the wrong hands.

Another useful part of the Finder is its labelling facility, which lets you assign different colours to application, data and folder icons. This then enables you to put them into different groups such as work, personal, art, word processing and utilities.

Seven colour groups can be defined, or eight if you count non-labelled items, making it easy to create your own personal desktop structure. To label an icon you select it with the mouse and then choose one of the groups from the Label menu.

To define your own names and colours for each of the groups, you need to employ a special Control Panels item accessed via the Apple menu. Doing so brings into view a window containing various programs, used to change certain aspects of the computer's operation. Double clicking the one named





Label produces a small routine that allows you to select new colours and rename the existing groups.

The Apple menu itself is interesting and unique, because the user can add items to it by placing them in the Apple Menu folder. This lives inside yet another folder called the System folder, found in the root directory of the current boot disk. The System folder contains the software that makes everything work, including the Finder and all the functions we are discussing here. Next month's 'Beginner's' column will take a closer look this.

If you're starting to get confused with all this talk of folders and icons, fear not... Apple has provided on-line help in System 7. Selecting 'About Balloon Help' from the Balloon-shaped menu will tell you more, and choosing 'Show Balloons' brings help into play. Whenever the mouse lingers on a menu or icon, a speech balloon will pop up telling you exactly what it does. To turn off this feature, you must choose to 'Hide Balloons'.

In future, all Mac programs should offer balloon help — or at least those that boast a fair degree of complexity.

### Changing the view

The last two things everyone starting out with the Mac should know is how to change the window views and what the Edit menu does. The former enables you to set your own preferences regarding the display of files and fold-

ers, while the Edit menu can save bags of time when copying them. It also plays a large part in almost all applications software — I'll explain exactly how before the end of this column. For now, we will concentrate on View and the ways in which it can change the desktop.

Holding the mouse down on the View menu reveals seven different items, each of which will change the display in the currently active window. Selecting 'By name', for example, will list the contents by name and in alphabetical order. Similarly, choosing 'By small icon' gives you a batch of small icons, and 'By icon' returns to the default larger icons. Personally, I still believe these are the best way to view things, even if they do mean having to use the window's scroll bars to see everything.

The Edit menu is slightly more complex so we'll look at each item in turn, starting with Select All. This does just what it says: choosing it will select all the files and folders in the active window — extremely handy if you want to copy everything from one window to another. Select All can also be used in most Mac applications to select all data on screen before performing an operation. Usually, this operation involves a device called the Clipboard, and that brings us neatly to Cut, Copy and Paste.

The Clipboard is a special program that allows you to move pieces of data

easily within and between applications. Once the data has been selected, performing a Cut or Copy transfers it to this area where it waits patiently until required. The difference between Cut and Copy is that Cut removes data from the screen, while copy simply puts a copy of it in the Clipboard. To retrieve things, you select Paste from the Edit menu and the information is copied into the currently active window. The contents of the Clipboard can be seen at any time by choosing Show Clipboard from the bottom of the edit menu.

### One at a time

A device like the Clipboard makes exchanging and editing data incredibly easy. Anything can be put into it, including pictures and sounds, but only one item can be stored at any one time. This is, perhaps, the only drawback with what is otherwise an excellent editing system.

The last command under Edit is Undo, located at the very top of the menu, which cancels the last user command in an application. Ninety-nine per cent of software supports this helpful feature, but it isn't really that much use under the Finder filing system. In fact, I can't think of a single operation that can be cancelled using it.

Next month we'll continue with the Mac and its easy user interface. We'll concentrate on the System folder, the rest of the Control Panels and 'program aliasing'. Until then...



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## Two is better than one

A practical demonstration can clarify written instructions: Karl Dallas recommends some book/disk combinations. He also corrects last month's BOOT.COM utility.

Typing-in programs is a pain, I know. Just one little error and the whole system can hang. That's why I always greet warmly any book that not only tells me how but shows me, too, preferably on a floppy disk.

Of course, it costs you. While the lower end of the computer magazine market can manage to stick a floppy on their covers at no extra cost, the book-plus-disk package seems inevitably to take your expenditure into the supertax bracket. But it is convenient.

I've been looking at a trio of books that come with disk or disks inside the back cover, and each of them includes some very handy utilities. Whether they are worth the extra money is up to you to judge. *Caveat emptor*, which means have a good read in the shop before you buy.

### DOS 5.0 batch files

While *DOS 5.0 Complete* (authors, Manfred and Helmut Torns Dorf) tells you pretty well everything you wanted to know about the new MSDOS but were afraid to ask (or unable to find in the supplied manual) the accompanying disk includes a whole raft of utilities which are far from being DOS 5.0 specific. In fact, the authors seem fairly certain that it'll be read by people with lower versions, because they often provide specific instructions on how to amend them for DOS 3.0 or whatever, in the rare cases where they won't run straight off the disk.

Actually, a number of them make specific calls to other files assuming that they are pre-determined locations on your hard disk, making them less than portable until you have edited them. These locations are decided by the supplied installation program, which also modifies your CONFIG.SYS and AUTOEXEC.BAT files. I hate installation programs which do this without giving you the option of saying no, especially when, as in this case, they manage to screw up the files and make the system unusable.

### Manual installation

Supposedly, the installation program allows you to insert different command line parameters (though not control the editing of your system files), and even tells you how to do this in its opening screen. However, as the text of the book makes clear, you actually have to edit the installation batch file to achieve this, which is a hassle. Far better to

install them by hand, which is just a matter of copying them into the relevant directories. Since the modifications to the system files are actually quite simple, a couple of SET commands plus installing the ANSI.SYS driver, this is actually less of a problem than using and/or editing the installation program.

However, as I say, in some cases the programs won't work unedited if you haven't used the installation directories. In most cases, this is not a serious problem.

**"Whether book/disk combinations are worth the extra money is up to you to judge. Caveat emptor, which means have a good read in the shop before you buy"**



The supplied disk includes 76 batch files, plus a few bits of assembler and a whole section of QBasic listings (the documentation tells you how these need to be adapted for GW Basic, usually just by inserting line numbers).

### Missing listing

One problem is that there is no listing of the files on the disk, and no page references for where they can be found in the book. None of the supplied files are listed in the index. You can produce a complete listing of the disk contents by running DIR /S from the floppy's root directory, using the new DOS 5.0 /S switch which lists the contents of sub-directories, but this still doesn't give you page references.

I actually went through the entire volume, listing them by hand, and then sorted them into alphabetical order, but frankly this is just plain silly. Also, there are several files which do the same thing. For instance, there is FORMAT1.BAT, &FORMAT.BAT, FORMATA.BAT, and SFORMAT.BAT, all of which protect you from the risks of accidental formatting. There is also &ADDPATH.BAT and ADDPATH.BAT, GETFUNC0.BAT and GETFUNC.BAT, and so on.

This duplication echoes that of the book. For instance, the DIR parameters are detailed on pages 199 and 200, and also on page 693; likewise the ANSI commands are on pages 366-374 as well as pages 788-791. Judging by their names, the authors are of Germanic origin, but from this example the myth of Teutonic methodical thinking is just that, a myth.

However, having said this, there is nevertheless some useful stuff on the disk. For instance, the following one-line batch file will display the date and time across the top of the screen:

```
@PROMPT
$e[s$e[f$e[7m$t$h$h$h$h$h$h$h$h
time $d
$ps$g$e[K$e[u$e[0m$ps$g
```

This can be typed in from the command line, if you want to see how it works (use DOSkey, then you'll be able to save it to a batch file as well, using the technique I showed you last month).

One problem could be that if you left it like that for too long, it would burn-in that image across the top of your screen. In that case, why not try PRESERVE.BAT? You won't find this on the disk, but it's basically just a command to run a QBasic program that blanks the screen and fills it with a random pattern of multicoloured dots.

The QBasic program below is pretty short (and anyway it's on the disk) but it's a good example of how easy it is to

do quite sophisticated things.

```
DEFINT A-Z
RANDOMIZE TIMER
VidMode = 9
VHeight = 350
VWidth = 640

SCREEN VidMode
WHILE INKEY$ = ""
    VColor = RND * 15
    y = VHeight * RND
    x = VWidth * RND
    PSET (x, y), VColor
WEND
SCREEN 0
SYSTEM
```

Your batch file must have the following calling routine:

```
QBasic /Run
c:\basic\starsky.bas
```

(assuming you have followed the recommended directory structure). The SYSTEM command in the last line returns you to the command line prompt.

Of course, this isn't as sophisticated a screen saver as those you can buy commercially, or even those you can get in shareware form. It has to be run specifically, compared with those that stay in memory and check keyboard activity, coming to life only when nothing is happening. Also, after a minute the screen is full of coloured dots which could burn-in the screen in their own right, so I'd put in a loop which blanks the screen every so often, to avoid this. (I'd be interested in readers' suggestions of the best way to do this.)

### Easier path handling

The disk contains a number of programs designed to make path handling easier. Anyone with a reasonably-sized hard disk knows the problem with PATH: it just gets longer and longer, and either you run out of environment space, or DOS takes so long searching through directories to find the file you need that the whole system grinds to a halt.

Obviously the environment-space problem can be improved by enlarging it with the SHELL command in CONFIG.SYS. The book's installation program increases it to 1000 bytes, which is probably more than you'll ever need, but the basic syntax is as follows:

```
SHELL=C:\DOS5\COMMAND.COM
/P /E:xxxx
```

where xxxx is the size of space you want. The default is 256K.

The simple way to enlarge your path temporarily is to use the %PATH% system variable, thus:

```
PATH C:\NEWDIR;%PATH%
```

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which will add the required new directory to the beginning of the path. (If you're short of environment space, you may find the end of the existing path dropping off the conclusion of the path.) Note: do not use the syntax SET PATH or PATH= or this will not work. Also, for some reason it will not work if you type it in from the command line, so it's got to be in a batch file.

This is only half the story, however, and surprisingly the Tornsdorfs do not tell the rest of it. Adding something to your path is all very well, but you also need to be able to find the old path again. It's quite simple, really: you store the old path in an environment variable, which we can call (surprise, surprise) Oldpath.

The following batch file will store the old path and replace it by a new one:

```
Rem Newpath.Bat
SET OLDPATH=%PATH%
PATH %1;%PATH%
```

This requires the parameter of the new directory to be added to the path; for example, NEWPATH.C:\WIN3 will add C:\WIN3 to the beginning of the old path, storing the previous path in the %Oldpath% variable.

Then you can return to the old one with the second batchfile:

```
Rem Oldpath.Bat
PATH %OLDPATH%
```

You'd think Manfred and Helmut could have included that, wouldn't you?

## Doing more with ANSI

One thing that is good about this disk is its coverage of ANSI commands. Most people — me included, I'll confess — tend to dismiss ANSI as a way of prettying up your screen, which in these days of GUIs seems rather redundant. But you can do a lot more.

The following command will store your current directory and allow you to return to it by pressing the <F10> function key:

```
PROMPT $e[0;68;"CD
";"$p";13p
PROMPT $p$g
```

ANSI allows you to store command sequences using the PROMPT command (which is why it is necessary to restore a standard prompt afterwards — the line between the two commands is also essential). Then, if you do a CD you can get to where you were by pressing <F10>. Of course, it will always take you back to the same place: if you want to get back to somewhere else, you have to run the program again.

The command is the core of a program listed in the book (and included on the disk) as SAVEDIR.BAT, but the core is the PROMPT command.

This is a fascinating and infuriating

collection which had the potential to be an indispensable set of programs. If you're prepared to take the time to unravel them, it could be well worth the trouble.

DOS 5.0 Complete, by Manfred and Helmut Tornsdorf, costs £32.45 from Abacus, including one high-density 5.25in disk.

## Networking utilities

While the Tornsdorf's disk is (ostensibly at least) a set of the files listed in the book, the two disks included with *Guide to Connectivity* aren't in the book at all. They are actually some pretty valuable utilities which could cost you several times the book's price if you bought them in your average computer shop. Of course, as the name implies, they are aimed at network users, and while this collection wouldn't be of much use to the solo worker, they'd be invaluable for virtually any small LAN, especially (but not only) if it is NetWare based.

There is, for instance, a full four-user version of Higgins, for my money one of the best workgroup scheduler and email programs around. If you don't fancy it, there's also the rival Right Hand Man program, which includes an enormous number of memory-resident SideKick-type utilities, all of which can be popped up from within any other program.

## Spoilt for choice

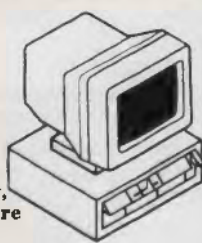
In fact, the problem is that the two disks spoil you for choice, since they also include Systat, a utility to display status information and/or statistics for a given file server; PostMaster, an electronic mail package for use with Novell NetWare networks, which can use Novell's Message Handling Service (MHS) to communicate with other email systems; CaLANDar, another scheduler; Ftligh, which flashes a light in the upper right-hand corner of the screen whenever your PC accesses a network drive; the LAN Labs performance testing program; Office Minder, another workgroup productivity program that includes electronic mail, telephone messaging, personal and group scheduling, project and resource management, telephone directories, text editing and a to-do list; Qslim, a printer queue manager; and Remotely Possible, a remote-control program for Novell LANs, allowing you to access and control other PCs on a LAN from your PC.

This latter utility has already provided a lot of help in running my own system. The cut-down version allows one workstation to act as a host and the other to be a guest, but it does provide elements of peer-to-peer networking in a client-server situation, which is valu-

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able at times if only for swapping files.

Some of the programs have a 30-day 'time bomb' embedded in them to persuade you to buy the full product, but the versions of Higgins and Remotely Possible are not disabled in this way.

The book's good too.

*Guide to Connectivity*, by Frank J Derfler Jr, costs £36.95 from ZD Press, including two high-density 5.25in disks.

### For network users and standalones too

Again, my third book-plus-disk collection (*Novell NetWare Power Tools*, by Mike Edelhart) is for network users — but in this case, not only, since there are some great programs that anyone can use, like a super TSR-management program which could be used for handling network drivers and any other memory-resident program.

It allows a 'mark' to be made to identify where a TSR is loaded, so that any programs loaded above the mark can be unloaded and the memory freed. There are commercial programs which offer this facility, but TSRW31 does it particularly elegantly.

I also liked STACKKEY, which is basically a buffer-stuffer along DOSkey

lines, with a variable buffer size and permitting programmed pauses to be inserted into batch files. It works in conjunction with BATUTIL, which allows the current time, date, day of week, the total amount of free disk space, memory and EMS, CPU and co-processor type, existence of a given file on the DOS path, comparative file age, and so on, to be displayed at will.

There are a number of program-specific utilities, like batch files to interrogate cc:Mail for the arrival of post, and a very powerful menu generator, as well as specimen SHELL.CFG and log-in scripts which will explain how to do things you can't find in the vast official Novell documentation.

Of the three book/disk combinations I've looked at here, this is the one I find most useful personally, but then I've got a network. Standalone users should find it worth checking out, though. There is a comprehensive description of all the files and what they do, which makes it better documented than either of the other two.

*Novell NetWare Power Tools*, by Mike Edelhart, costs £46.99 from Bantam Books, including one high-density 3.5in disk.

### Corrections to BOOT.COM

A number of readers have been having trouble with the BOOT.COM article in last month's 'Utilities' column. Although it was tested before publication, it is quite possible that the instructions given will not work for many people. A corrected sequence (once you are in debug) is shown below.

[Note: Make the bits between the quotes a different font — bold, italics or something. The bits between the quotes are the prompts from the machine. The other bits are what you type. The quotes should be removed once the type style has been changed!]

```
- a 100
####:0100 int 19
####:0102 <Enter>
```

```
- rcx
CX 0000
```

```
: 2
- n boot.com
- w
```

Writing 00002 bytes

```
- q
The computer's prompts are shown in bold, you enter the responses shown in italic.

```

It has been found that this method of resetting a PC does not work with all DOS/BIOS combinations, laptops being the most likely to fail. An alternative but fallible method is:

```
- a 100
####:0100 jmp ffff:0000
####:0105 <Enter>
```

```
- rcx
CX 0000
```

```
: 5
- n boot.com
- w
```

Writing 00005 bytes

```
- q
Thanks to everyone who has contacted 'Hands On' suggesting solutions to this problem.
```

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## Money matters

Steve Cassidy despairs of restrictions placed on him by version 3.1 of 1-2-3, and David Colver comments on the dwindling fortunes of Lotus in the financial world.

This month we have a two-part column: one half from yours truly, and the other from David Colver who has some views on choice of product based on his experiences in and with the financial community. He's not exactly 1-2-3 friendly, and I'd be pleased to receive contributions from people with similar experience who don't share his conclusion. And as far as I can tell, he's not an undercover marketing man for Microsoft, either, having pointed out to me in the past such Excel delights as the negative bar chart display bug in version 2.

But first, a brief word about a former version of 1-2-3. Or, kind of a former version: 1-2-3 release 3.1 is still around, even though 1-2-3 for Windows is among us. There are those who have stuck with Lotus through thick and thin, and who have taken the view espoused recently in *Lotus User* magazine that Windows is an unnecessary layer of complexity, and that true salvation lies with proper development of a friendlier, character-based interface.

### Gordian Knot

Lotus 1-2-3 3.1 has additional facilities which use the same memory management standard as Windows, making it possible to run the two products side by side: for anyone who desperately wants to hang on to character-mode spreadsheeting while using something Windows is particularly good at, this offers an important mechanism that some of the earlier versions couldn't provide. Very old versions, of course, can be made to coexist with protected-mode Windows by virtue of not having any advanced features which might collide (like extended memory management...), but that's no help. If you have a huge Gordian Knot of a spreadsheet, you won't relish having to

dig out a copy of 1-2-3 version 2.0 in order to get at it on your Windows machine.

Now, while 1-2-3 uses DPML as its memory management system, it doesn't use Microsoft's higher level facilities; in particular, the Lotus product constructs and maintains its own virtual memory swapfile.

This has made 3.1 slower at some operations than preceding releases, since any access to disk equates to a slowdown, and common virtual memory techniques include the moving of working memory pages to and from the disk. This is somewhat extraneous to my point, however: the point is that under some circumstances, version 3.1 of 1-2-3 will complain bitterly that it cannot continue working, when your hard disk has plenty of free space, and it has decided to open a virtual memory swapfile. This error will crop up when your disk has become fragmented, because the swapfile, just like the Windows one, insists on having a contiguous area of disk to work with.

Swapfiles are, generally, the only kind of file which place this restriction on your system, and it's more likely than not that you have a fragmented disk. In the normal course of events, the swapfile allocator routine nips about the disk until it finds a megabyte of unblighted room, and then on you go.

### Copy protection

You'll need to run a disk defragmenter, though, if this condition occurs. Just so long as you use one which understands 1-2-3 release 3.1: the package is of course copy-protected by means of a hidden file (called STOPLOK dot something-or-other) whose physical location is stored inside the 1-2-3 executable. Move the file, and your copy won't run.

Norton Speed Disk understands this



problem, but PC Tools Compress doesn't, unless you explicitly tell it to watch out. But then, Lotus doesn't make it evident to the normal punter what that file might be called — after all, you might be a software pirate, not someone with a problem generated by the virtual memory scheme of the company's own software...

An answer is to move on to 1-2-3 for Windows, at upgrade prices, or to acquire a level of knowledge about the low-level architecture of the PC which has nothing to do with the job you'd like the accursed box to perform.

### The domain's the thing, or knobage!

'Knobage' is a wonderful word. People come to it expecting some dark and obscure concept, when in fact it is a measure of functional elegance. The Model T Ford had five foot-pedals, three for changing gear, a brake and an accelerator: the Rover Sterling has two foot pedals. Comparatively, that makes the Model T 'high knobage', and the Sterling 'low knobage'.

A system, be it a physical, procedural or electronic process, fits your chosen area of activity (or 'domain')

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It is in this environment that a single worksheet can have considerable impact on the national economy, even though it is modest in size.

This is not some distant, intangible effect: the analyses can touch every household. Spreadsheets were used to set the prices that could be charged by the recently privatised monopoly suppliers of water, gas and electricity. Some can be particularly large and demanding, with ten or twenty minute recalculation times and sizes north of five megabytes.

Which packages are used in these high-profile domains? Although computer magazines love Group Tests between competitive products, there are only two spreadsheets of importance in

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8	Japan	Y100	"Y"0

well, or badly. If it fits badly, you're going to have to twist a variety of knobs on it to make it do what you want. The number of knobs available, and the number you must twist to get the desired result, is measured by the system's 'knobage'.

David Colver has some things to say about the fit of spreadsheets to his area of expertise. I suspect, if I had explained the idea of 'knobage' to him, this piece would incorporate the concept.

### Spreadsheets in Finance by David Colver

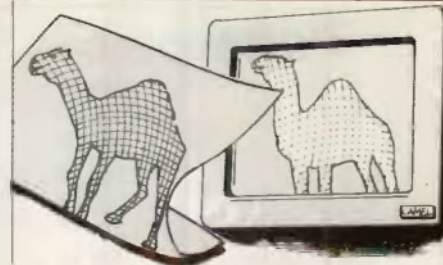
In my local high street there are three newsagents: I visit one every day. There are four estate agents: I have never set foot in any of them. But one day I will, and the one I pick will involve itself in the largest financial transaction I will then have made, the sale of my house.

this market: Lotus 1-2-3 (in all its versions) and Microsoft Excel. Borland's Quattro, Computer Associates' SuperCalc 5 and the rest may have their fans, but they are not to be found here.

### Dwindling share

The bad news for Lotus is that its share, once close to 100%, is eroding rapidly among the banks. The institutions that I know came to office automation later rather than earlier, making substantial investments in PC networks only recently, have chosen Excel without exception. Those that were quicker off the mark are more likely to be using 1-2-3, but I know of three who have switched or are contemplating switching. More tellingly, I know of absolutely no switches in favour of Lotus, even though 1-2-3 has been through nearly twice as many improved versions as Excel.

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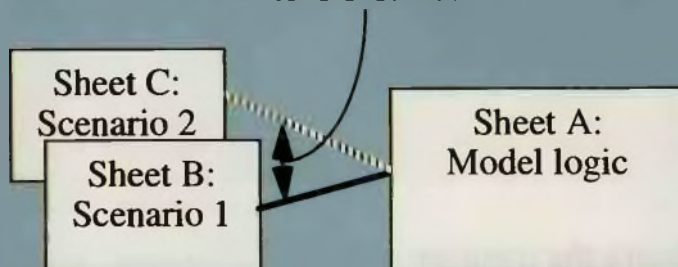
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#### Scenario switching:

File Links Change command  
adjusts all formulae on A which  
refer to cells on B so that they refer  
to C instead.



Excel is not without its disadvantages. It is notoriously resource-hungry, needing a significantly more meaty machine than 1-2-3 to perform well. Switching involves cross-training, both of existing employees and new recruits, since many of them come from accounting firms where Lotus has remained more popular. So why the trend?

Here are some of the reasons I've seen in the organisations I've met. Some are historic: the first versions of Excel had a number of properties which were absent in contemporary versions of 1-2-3 but have since been added.

#### Apple compatibility

Excel is available in a version for the Macintosh. Of the top ten merchant banks, two are Macintosh users, and others considered Apple but chose PCs, normally Compaqs, to toe the corporate IT line.

UK merchant banks are facing competition from US rivals who make extensive use of graphics to present their findings. You can do this using PCs, as many of the Americans do; but it is still much easier on a Mac, the advent of Windows 3.0 notwithstanding.

Lotus 1-2-3 for the Mac is with us now, but on that platform Excel has had a clear run, and a ninety-something per cent market share, for nearly five years.

#### Forgiving nature

Like all Mac/Windows programs, Excel has an Undo command for reversing the last action, and has done from the very first version. Undo was added to recent versions of 1-2-3, but many people turn it off because it is implemented in a way that eats memory.

#### WYSIWYG

Presentation has always been important in finance applications. You simply can't support a request to investors for the sort of money merchant banks

deal in with fixed-character width, dot-matrix output on music lined paper with sprocket holes.

But users of early versions of 1-2-3 could only control high-quality laser printers by learning an arcane escape sequence. They could only use a PostScript printer in 12-point Courier in portrait orientation. And as for printing graphs...

Recent versions have fixed all this, but (until the very latest versions) only by bundling in third-party afterthoughts. There was never any market for these products with Excel, since it has from its first release had access to the full formatting capabilities of Windows, with control over type sizes, page orientation, print preview and so on.

#### User-defined formats

1-2-3 and Excel both allow users to choose the way numbers are displayed, but if you don't like the built-in formats 1-2-3 offers, that's just tough. As a result, for example, in cases where a spreadsheet is dealing with amounts in various currencies (quite common in a bank) you might indicate which amounts are in which currencies by placing text labels in adjacent cells. Excel lets you roll appropriate number formats to your own specification. (See the diagram on page 353.)

Custom formats are particularly useful with dates, which are just numbers with special formats. You can easily persuade Excel to show noon on Christmas day as

12:00 PM on Wednesday, 25  
September 1991

by setting the cell format to

h:mm AM/PM "on" dddd, d  
mmmm yyyy

The best 1-2-3 release 3.1 can do, using standard formats is:

25-Dec-91

12:00 PM

in separate cells. If you want more elabo-





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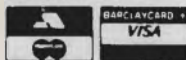
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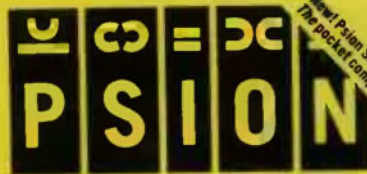
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rate formats, the date and time together in the same cell, or sight of the day of the week, start coding.

### Automatic Type Coercion

*[Automatic Type Coercion is the standard computer science term for the process of matching data to a desired type.]*

Excel will automatically convert between text, numbers and dates. The simplest use of this involves entering dates into a cell, something which is common in banking to calculate the number of days during which interest accrues on a loan or bond. Excel is content to receive

25 Dec ;

It will fill the year in automatically. The standard way to do this in 1-2-3 is @date(91,12,25).

As a more complex example, if I want to know the square of the number of days since my grandmother's birthday, which is of course a universal constant with profound implications in physics, I can write

```
= "Universal constant is  
"&(now()-"7 February  
1900")^2
```

and Excel will automatically convert the text to a date number, and then convert the result of the calculation back to text. The 1-2-3 equivalent requires the conversions to be coded explicitly:

```
+ "Universal constant is  
"&string((@now-  
@date(0,2,7))^2,4)
```

### Names

All spreadsheets can associate names with rectangular areas of the spreadsheet, but this idea is developed in the Microsoft product to the point where spreadsheets can easily avoid any use of coordinates whatsoever.

Which do you find easier to understand as a calculation of price earnings ratio,

+B3/C9

or

```
=SharePrice/  
EarningsPerShare ?
```

You can express formulae using meaningful names in 1-2-3, but it is not at all common to see it done exhaustively. The difference is that Lotus formulae interpret names literally, whereas Excel adjusts the way it interprets a name according to the context.

### Arrays

In most spreadsheets, there is a one-to-one correspondence between formulae and cells: a formula calculates a value which occupies a cell. However, Excel also allows a special kind of formula which can manipulate numbers in

blocks or lists. These array formulae are an inspired piece of lateral thinking by Microsoft. They allow you to do in one formula what takes several using conventional methods.

For example, in one formula (not command) Excel allows you to:

- transpose a row of data so that it becomes a column of data;
- perform multiple regression (curve-fitting) analysis;
- count the number of times an item is repeated in a list; and
- extract data from a corporate database (or, in the case of a bank, online information services such as Reuters) and unpack it, one field to a column, one record to a row.

All of these are possible in 1-2-3, but not with single formulae. They require add-ins or the spreadsheet to be cluttered with cells containing intermediate values.

### File linking

Like many spreadsheet packages now, Excel and 1-2-3 allow you to write formulae on one worksheet which refer to cells in another.

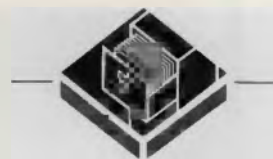
Excel's File Links command allows you to redirect simultaneously all the references (of which there may be hundreds) on spreadsheet A which refer to cells on spreadsheet B so that they refer instead to spreadsheet C. If spreadsheet A contains the logic for your model, and B and C contain data for two different scenarios you want to investigate, you can switch between them with one command. (See the diagram on page 354.)

The lack of any equivalent of the File Links mechanism (or even a text search and replace, which would do the job almost as well) means that the only way to switch between scenarios in a 1-2-3 model structured along these lines would be to find each inter-spreadsheet reference and edit it by hand. In practice, you would address the problem using alternative structures.

The feature lists of 1-2-3 and Excel are pretty similar these days, and there isn't much that can be done in Excel that can't be done in 1-2-3. It may take a bit more coding, and you can choose from the large supply of products to add-in anything that Lotus left out.

On the other hand, when you are already working 16-hour days, and a multimillion pound transaction has just a few days to run, you might find yourself turning to a product which has features to solve the problems I've outlined built in from the ground up that allow you to concentrate on the issue being modelled rather than on the modelling package.





## Facts at your fingertips

Kathy Lang compares packages which aim to do for your computer what the Filofax did for yuppie breast pockets.

When I wrote in the December issue about handling names and addresses, I promised to look at some packages tailored for handling this kind of data. Apart from the products needed by the likes of the large catalogue-based mail order houses — which can afford large and expensive computer systems and specialist consultants to evaluate them — these products fall into two main camps: those intended for 'personal' use, and those aimed at workgroups needing to share data.

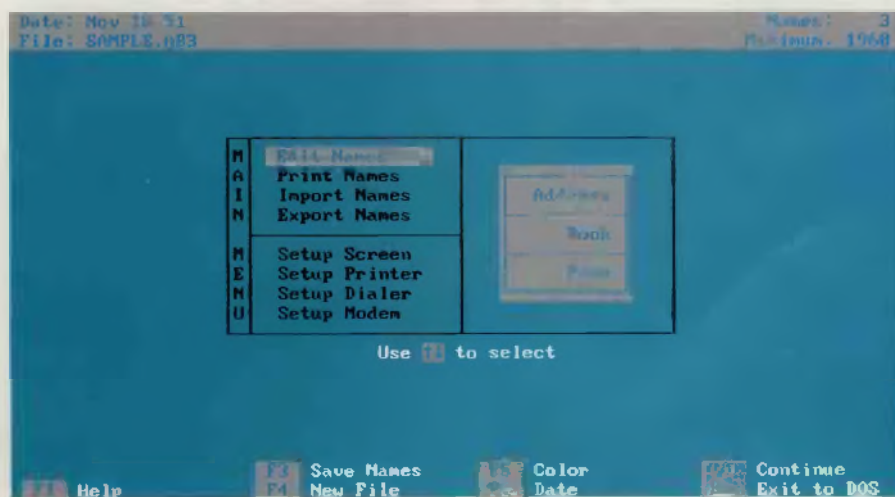
Of course, the features individuals need are usually found also in 'workgroup' packages, but at quite a hike in price. So this month I shall concentrate on what you need and might expect to get at the 'personal' level, and move on to 'work group' packages in a future column.

The epitome of personal paper databases is, of course, the Filofax, a trademark that is well on the way to following in the steps of Biro and Hoover as a generic term. (To avoid arguments, I shall use the word 'organiser' to cover Filofax itself and the army of imitators and competitors which have arisen in

the last five years or so.) With the success of the organiser as a compendium of manually filled-in sheets, it is hardly surprising that packages which generate organiser sheets from the computer have also grown in popularity.

Probably the best known of the more modestly priced products is Portex, which includes address book, diary and appointments management, and word processing facilities. Portex comes in two flavours, Personal and Professional; the Professional version can be networked, so in that form it approaches the 'workgroup' package. Portex includes three main functions: address book, task/diary management, and basic word processing with a mail-merge facility.

As comparable products at the personal level, I chose to look at the two companion packages from Power Up!, Address Book Plus and Top Priority. Address Book Plus provides name and address facilities a little more powerful than Portex Personal; Top Priority is a time scheduling program and 'To Do' list handler as well as a simple diary manager. Both Portex Professional and



Address Books Plus has auto-dialling facilities and allows you to customise colours

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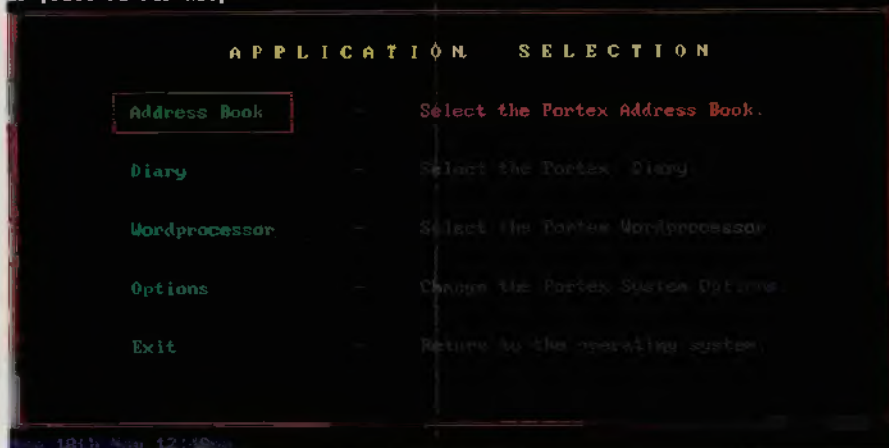
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Portex is excellent value for money, but some of its features are a little too Basic

Address Book Plus have auto-dialling facilities which will work with a range of modems.

All three packages work directly under DOS, and thus rely on their own screen and printer handling; a version of Portex for Windows is in an advanced state of development. You might be interested in the special Filofax version of Lotus 1-2-3, 1-2-3 Executive, which is available including a Filofax binder on special offer until the end of January.

### Names and addresses

Both Portex and Address Book Plus provide a standard format for names and addresses, with no ability to customise the fields themselves. The Portex format is slightly fuller, with two address fields. It manages to show the whole of a record during screen edit by having mini-windows on each of the longer fields, which can be expanded to show and edit the complete field.

Both provide three name elements: title, Christian name and surname, with no provision for suffixes such as Esq or honours or even degrees, apart from adding them to the surname. This could be a disadvantage if you want to use the same set of names and addresses to construct standard letters with personalised salutations — Dear Mr Smith OBE might not go down too well. Neither can you, except by using a precious comment field, cope with the automatic variation of salutation between friends (by Christian name) and strangers (by title and surname), nor with the more esoteric salutations — Dear The Right Reverend Carey doesn't look too good either.

Both packages provide multiple address files, though Address Book Plus is more limiting in this area: you can have up to 1500 addresses in each file, against the 'thousands' of Portex, and merging

of lists is a simple append operation.

Portex, on the other hand, allows some control over merging, notably to exclude duplicates, making it much easier to merge addresses from different sources, and to keep several lists for the sake of speed and convenience, only merging them when a composite set is required. You could say, though, that this allows you to do something I've argued strongly against before, namely to keep duplicate copies of the same address. Like fire, such a feature is a good servant but a bad master.

Both packages give you a fixed but quite extensive list of settings for sorting — they seemed to cater for all the needs I could think of. More significant differences emerge over selecting addresses to edit or print. When editing, both provide simple pointer movement features between and within records. You can also search for particular character strings. Address Book Plus is not 'case sensitive': that is, whether you enter the search string in upper case, lower case or a mixture, is irrelevant — a search for "BLOGgs" will match "blogs" and BLOGGS" and "bloGGS".

Portex is a bit more intuitive: a search string in upper case will match whatever the case of the target string, but a string entered in lower case or a mixture will only match if the target has exactly the same combination of characters and cases. So "BLOGGS" will match "blogs", but "Bloggs" will not — it will only match "Bloggs" in the target record.

Address Book Plus allows you to search in particular fields, or to search for the same string in any field, or to search for string matches in several fields with a hit occurring only if all matches are found. Portex always searches all fields, and provides a special 'wild card' which allows you to construct a search which spans fields.



This would allow you to find, say, a Smith who lives in Paris no matter in which fields the information is stored, provided Paris occurs later in the record than Smith.

To handle selection of groups of records, both packages let you mark, temporarily, the records to be selected. The address record format in Address Book Plus includes a field called 'codes' which allows you to have up to ten single-letter codes for each record. The meaning of these codes is of course down to you, but you can give each one an explanation such as 'fellow golfer' or 'employee', and Address Book Plus will give you a pop-up display of the significance of all the codes when a function key is pressed. The codes can then be used, individually or ANDed together, to select a range of records for editing or printing.

Portex Personal's selection features are not so versatile, being limited to marking particular records individually, or selecting blocks of sequential records. Portex Professional provides much more flexibility, indeed more control than Address Book Plus, though you have to think a bit harder to get it.

You can mark groups of records (not necessarily sequential blocks) according to the text contained in any field. And you can make as many selections as you like, each one being additive. So you could use the Comments field in the same way as the Codes field is used in Address Book Plus (though if you wanted to select on more than one code, you would need one selection pass for each code, and you would not get the pop-up reminder of the meanings assigned to codes). But you could also, in the same operation, mark with complete flexibility records containing desired values in other fields, for example to produce a list of customers with a specific postcode.

### Printing

Both packages provide a range of record formats and paper sizes, and both come with some customised paper to match the organiser included in the price of the product. Address Book Plus, being an American product, comes with paper and organiser of a type common in the US but slightly smaller than the Filofax size most usual in the UK. Portex Professional comes with a Filofax-size binder.

The Portex range of papers includes several which are actually two pages side by side, making it easier to feed into a range of printers — and also, of course, printing at twice the speed. Both packages allow some control over which fields are printed, though less

flexibly than most people would like. Address Book Plus allows you to list the same name and address up to three times — by individual, and company name, and by 'profession' — to help you find, say, the dentist's number even if you can't remember his or her name. Portex allows you to print both addresses for one entry.

As perhaps befits packages aimed at the personal end of the market, neither can print to PostScript printers. Most of these can nowadays also behave like the HP LaserJet II, which is supported. A Windows version of Portex would, of course, avoid this problem.

To achieve greater printing flexibility now, you could use the import/export facilities. Both packages allow ASCII files to be brought in and out, so you could also use the names and addresses with your word processor to do mailmerge functions if your word processor can import ASCII files. In Portex, you can use the built-in word processor for the same purpose; the facilities are adequate without, of course, rivalling those for which you pay three times the price.

### Diary and time organisation

The other major use of organisers is to handle diaries, meeting arrangements and the like, and to remind you about those urgent tasks that should have been done yesterday. Portex includes a simple diary facility; Top Priority provides more powerful features including an extensive 'To Do' handler. Both provide a comparable range of printing options and import/export facilities along the lines of the name and address programs. Portex has the advantage of being integrated with the name and address features, and includes a modest ability to cross-reference between the two.

Portex allows you to enter diary items as you would in a paper diary, with the added feature that items may repeat. This allows you to enter an appointment and then have it repeat automatically every Thursday or on the second Monday in the month. Repetition may be 'forever', until a preset date, or for a specified number of occurrences.

Either type of appointment can be set to Nag you by being re-entered on following days, even after its nominal date, until specifically cancelled — good news for those of us who have customers who want things yesterday! Some sample diary files are included, including one which is blank apart from the display of public holidays.

Top Priority provides much more extensive time and task handling. You can enter any number of tasks, or goals

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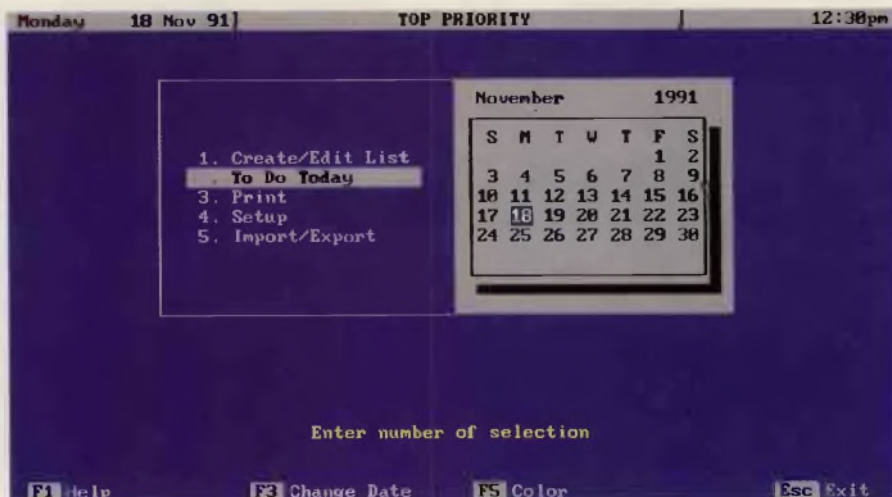
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— tasks with sub-tasks. Each may have a priority and a due date, with repetitive and nagging features like those in Portex, with the addition that you can preset a date in advance of that on which a Nagging task is due, so that you start being reminded of it beforehand.

Sub-tasks can be assigned dates which are calculated from those for the main task, so that revising the overall task date automatically updates those for all sub-tasks. The 'To Do Today' list is assembled by scanning all tasks and sub-tasks; events and appointments with a time assigned appear at the top of the list, with tasks in priority order below.

Tasks can also be assigned to categories, which are essentially another selection dimension, allowing you to show just those tasks for which one employee is responsible, or all phone calls.

In addition to the features I've already mentioned, Portex Professional provides support for a variety of languages including the most popular European, so you can print your diary dates in French if you like. Password protection may keep your most secret appointments from the kids, while the stopwatch may help you keep track of where your working time goes. More important for most will be the built-in calculator (with a facility to copy results into the word processor) and keyboard macros which can be particularly useful in streamlining a complex selection of name and address records which you need regularly.

#### In use

All these products use colour if you have it, but only Address Book Plus allows you to customise the colours; I use colour screens for everything else, and find the brightness level appropriate to colour backgrounds not high enough when colour text is shown on

black, as is the case in Top Priority and Portex.

You may often want to access phone numbers while running some other program, or enter an appointment or a task without stopping what you're doing. Top Priority and Portex Professional both have a TSR mode, but I found this of limited use, since Top Priority doesn't display on top of any graphics screen, and Portex didn't work properly with the only graphics program I tried, namely Ventura — the display was reversed on return to Ventura, and no amount of screen refresh helped.

#### Which to choose?

Portex Personal provides excellent value and a good range of basic features. Its name and address facilities are nearly as good as those in Address Book Plus, which scores on more flexible record selection. Portex Professional does better than Address Book Plus in this area, but of course it costs a lot more; you might like to compare it against one or two of the more upmarket products I'll be looking at in a later column.

The time and event handling of Portex is very basic, and Top Priority is a lot more powerful in this area. Again, the real competition here comes from the higher priced products. But I have a feeling Top Priority will still be able to hold its head up — and the price is very fair for what it does.

Portex Personal costs £49.95, Portex Professional £149.95. Details from Showerings on 071-922 8821.

Address Book Plus costs £39.95 software only (on offer now — normal price £49.99), or £79.95 for kit including organiser, paper and so on; Top Priority costs £79.95. Details from Power Up! on (0252) 376000

1-2-3 Executive costs £149.99 until the end of January. Lotus is on (0753) 532443.





## Terminal, but Still Relevant

Dan O'Brien on the resilience of software, and a TSR program from John Worley which allows one version of DOS to imitate another. And there's Style Corner.

**A**ridiculously broad query to boot up this month's column: How long do things last in the personal computer industry? Folk wisdom would seem to indicate 'not very'.

Instructions last millionths of a second. Major software products clock in with a fractionally longer lifespan. And any product, hardware or software, that keeps its head above water in these pages for over twelve months deserves Methusaleh status. Even at the end of November, products fell silently through neglect into the 'best before 1991' category. DesqView users will understand.

My favourite reference guide on questions such as this (*Lifespans — How Long Things Last* by Frank Kennedy, whose contents include the revelation that sunbeams live 8.3 minutes and bath-sponges average fifty years) seems to claim the exact opposite. Since most computers contain few moving parts and software is just information, it reports, most systems should last forever.

I wouldn't go that far, myself, but software does seem more resilient than it would at first glance appear. I have a Usenet report here of a gentleman in Washington State, in the Northwest of the USA, for example, who has been booting up his CP/M rack system (all seven feet of it) with an 8in system disk last written to in 1982.

Code can survive its shelf-life in other, less tangible, ways too. WordPerfect may have replaced WordStar in the charts many moons ago, but a straw-poll of programmers *still* reveals a majority who automatically type Ctrl-QA to search and replace.

The best way to preserve a program, though, is to freeze it. That's what IBM did to Edlin and Debug back in 1982, when it insisted that they should remain constant and unchanged for all subsequent versions of DOS. Microsoft

duly followed suit, and the line editor and curious command-line debugger that still lives in a corner of DOS 5.0 is pretty well byte-for-byte the same odd, primitive scrawl that flew out with the first DOS utilities.

**Bombing out**  
With one annoying exception. Every new ver-

sion of DOS instigates a tiny change to the DOS utility suites. Each of the proglettes makes a call on start-up to INT 21h, AH=30h, the DOS function that returns the version number of the currently running DOS, and compares it with the DOS version the utilities were compiled for. If they differ, they bomb out. Laudable for preserving the integrity of DOS, but a little irksome if you're testing your code under a number of different DOS versions and don't fancy re-installing a new set of DOS utilities onto your hard disk every five

***"Even at the end of November, hardware and software products fell silently through neglect into the 'best before 1991' category. DesqView users will understand"***

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minutes.

Hence this month's listing: a Terminate and Stay Resident program (another piece of code which outstays its welcome, I suppose) which allows one DOS version to imitate another. Well, 'hence' is perhaps too strong a word; in fact, the reasons why this listing is worth publishing are very distant from its apparent purpose, as we'll see. But before we do, a small word about TSRs.

Readers of this column will fall readily into two camps regarding discussions of TSR coding. The first, more hardened crew, will mutter 'not that again' and turn swiftly to the cut-price SIMM ads in the back of this issue. The second camp will consist of everyone else, who will squeak in fear at such low-level pursuits and retreat into the



illusory safety of the 'Spreadsheet' column, where I know full well they will be firmly broken on the wheel of Mr Cassidy's Real Programmer talents.

Hopefully, this month's code, contributed by shareware author John Worley of

Havant, should be simple enough to calm novices, while — as John himself comments — containing enough nice points to be of interest to experienced programmers. Principally, once resident, it takes up only 32 bytes. Also, not once does it use the terminate and stay resident call.

### Faking it

Before we dive in, however, a small proviso: while John (who is also head of Clockwork Software, a shareware com-

#### BEGIN 'FAKEDOS' CODE

```
code segment para public 'code'
    assume cs:code
    org 100h
VERSION EQU 1006h          ; Emulates DOS V6.0!
BEGIN:  JMP INIT            ; Skip to start
SIGNATURE:  DB 'FAKEDOS ' ; Note 1/case 'f'
; ===== RESIDENT INT21h TRAP =====
TSR:      CMP AH,030H       ; Is it getVersion?
          JNZ CARRYON       ; No? Then carry on
          PUSHF             ; Else simulate INT
CALLIT:  DB 09AH            ; with a PUSHF,CALL
OTH21OFF DW ?
OTH21SEG DW ?
          MOV AX,VERSION    ; And patch in
          IRET              ; our version
CARRYON:  DB 0EAH           ; else JMP (*don't* call)
OLD21OFF DW ?              ; into old
OLD21SEG DW ?              ; handler

; ===== CHECK ALREADY INSTALLED =====
ASSUME CS:CODE,DS:CODE
INIT:     MOV BYTE PTR SIGNATURE,'F' ; modify search string
CHECKINS: MOV DX,CS         ; remember this segment
          XOR BX,BX         ; Start search at seg 0
CHECKINS10: MOV ES,BX      ; segment to search
          MOV SI,OFFSET SIGNATURE ; point to signature
          MOV CX,10        ; signature length
          MOV DI,8         ; offset of signature in mem
          REPZ CMPSB       ; compare ten bytes
          JZ FOUND        ; we found it!
          INC BX           ; increment segment
          CMP BX,DX        ; are we still below our seg?
          JB CHECKINS10    ; if not continue search
INSTALL:  MOV AX,3521H     ; get address of INT 21h handler
          INT 21H
          MOV OLD21OFF,BX  ; and paste into TSR code
          MOV OTH21OFF,BX  ; (twice)
```



```

MOV OLD21SEG, ES
MOV OTH21SEG, ES
MOV ES, CS: [2CH]          ; address of our environment
MOV AH, 49H                ; release to DOS
INT 21H
MOV AH, 48H                ; request new memory block
MOV BX, 2                  ; two paragraphs in size
INT 21H                    ; segment returned in AX
MOV BX, AX                  ; remember segment
DEC AX                     ; segment of its MCB
MOV ES, AX
MOV ES: [1], BX            ; make it self-owning
MOV SI, OFFSET SIGNATURE ; copy signature and code
MOV DI, 8                  ; to MCB and memory block
MOV CX, 8+21               ; signature and code
REP MOVSB
MOV AX, 2521H              ; redirect INT 21h
MOV DX, 16                 ; to offset 16      PUSH ES
; relative to MCB
POP DS
INT 21H
PUSH CS
POP DS                     ; reclaim DS
MOV DX, OFFSET INSTALLMSG ; point to message
QUIT: MOV AH, 9            ; print message
INT 21H
MOV AX, 4C00H              ; terminate program
INT 21H
FOUND: MOV DX, OFFSET ALREADYMSG
JMP QUIT
; ===== DATA =====
INSTALLMSG DB 'Pretending to be another
DOS', 13, 10, '$'
ALREADYMSG DB 'Already pretending!', 13, 10, '$'
CODE ENDS
END BEGIN
—END 'FAKEDOS' CODE —

```

pany that produces SIMON, one of the niftier TSR text editors, and BAT2COM, an excellent batch file compiler that you really must try) contributed the code and comments listed here, he will be a little shocked to discover his simple print-screen utility transformed into a DOS version faker. That's because I've toyed with the resident portion of the code, for reasons to be explained later. While this alters the purpose of the TSR quite radically, it results, in fact, in a change to the code of only 27 or so bytes. I'll explain my motives after John has explained his. Needless to say, any bugs you discover in the source arose from me.

John writes: When DOS executes Terminate and Stay Resident programs such as this for the first time, the code is loaded into memory above its own copy of the environment, and following on from a 256-byte Program Segment Prefix (PSP). The PSP contains data needed by DOS when terminating the program, or when making it memory resident. This seems to make 256 bytes the minimum memory required by a TSR.

There are ways to reduce this memory wastage, however. Only the first 92 bytes in a PSP are actually required by DOS, so you could collapse the code into PSP space and save as much as 160 bytes. Alternatively, the install program could relocate itself with its PSP in high memory, free up its original location, and install the TSR code as low as possible before quitting.

However, the two paragraphs required by our tiny resident routine is so small that a satisfactory block of memory can always be found *below* the installation program: the 48 bytes once occupied by Autoexec.bat will usually be free, unless you are installing the TSR from within that batch file. To be absolutely certain that there is spare memory beneath the TSR, we will release its environment block (which will be 160 bytes or more) before requesting the memory block for the resident code.

### Installation code

A closer look at the installation code reveals the following: firstly, the code which is to be made memory resident is

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prepared by pasting into it the absolute address of the previous interrupt handler. As I've said, the memory occupied by our own environment block is returned to DOS.

We now request a two-paragraph (32-byte) block of memory. DOS will allocate to us the lowest block of spare memory it can find. The block will belong to our install program, and will be reclaimed by DOS when the install program terminates. To prevent this we must change the ownership of the block so that it owns itself.

This is done by patching the Memory Control Block preceding and attached to our small memory block.

MCBs are 16 bytes in size, but only the first five bytes are officially used. From DOS v3.3 the second half of a MCB contains the forename of the program which owns it. To preserve this practice, our TSR copies the name of the TSR into the MCB of the resident code. A single MOVSB instruction copies both this signature and the resident code from the install program to the new memory block. Finally, the interrupt vector is pointed to the start of the memory-resident handler.

The TSR is now installed. We don't

need the Terminate and Stay Resident function of DOS, as is usually the case at this point, since our code is already marked as separate from the usual housecleaning that takes place when the program exits. We simply display a greeting, and quit.

**"Old programs, especially DOS below v5.0, will refuse to die for some time yet, and there are plenty of programmers still struggling with DOS v4.01 and v3.3"**

A word on the installation check (continues John): some writers get themselves very confused over testing whether their routine is already installed. But it really is simple: for simple TSRs, you start at the bottom and search every sector for a string you know to be memory resident.

The only trick is to ensure the signature string does not also exist in the COM file from which the program was loaded, because a copy of that will have been left in the disk buffer which the routine will inspect in passing. So change any byte of the signature string before installing and/or testing. There are cleverer ways to find a TSR, but none as simple.

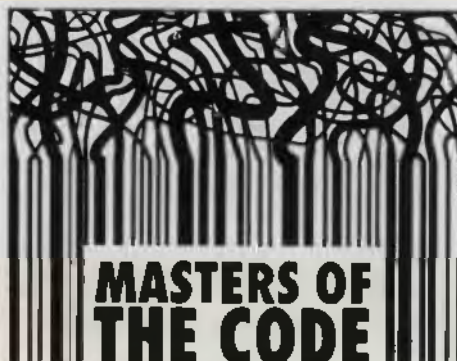
## Simple addition

...and there's nothing quite as simple as the code I've added to John's shell (says Dan O'Brien). It simply hangs off the INT21h interrupt, waiting for the getVersion call (AH=030h); when it sees it, it replaces the return value in

AX with one of your choice.

Just for fun, the listing here provides you with DOS v6.01, but the final hard-wired value should really be something more reasonable to be of any help. To test, assemble the program, convert the compiled program to the COM file using EXE2BIN, run it, and type 'VER'. And just before everyone phones in their droves, yes, I do know that there is a TSR supplied with MSDOS v5.0 that provides this, and much more sophisticated version emulation services (for instance, changing the version number for each application you run).

But, as I said earlier, old programs (especially

## MASTERS OF THE CODE

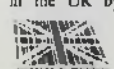
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DOS below v5.0) will refuse to die for some time yet, and there are plenty of programmers, I know, out there still struggling with DOS v4.01 and v3.3.

On the other hand, it's reassuring to know that patches like FAKEDOS don't have an infinite shelf-life.

Clockwork Software is on (0705) 483217. HyperShell is available from shareware

distributors or direct from Text Technology. If you obtain it from Shareware Elite, 25 Cades Parc, Helston, Cornwall TR13 8QS (0326 564164), you will also receive a copy of the company's catalogue, which was developed in conjunction with HyperShell.

Text Technology is on (0625) 431357. Dan O'Brien can be contacted on 081-785 9973.

### Style Corner

Style corner is an occasional series in which 'Low Level' talks to enthusiasts and professional shareware authors about how they code, and why. This month's code excerpt was provided by Nick Taylor, and is based on a portion of his shareware program HyperShell, a popular hypertext development system for the PC.

The whole 56K of HyperShell is written in C. 'I've been programming for twenty-five years now,' Nick writes, 'and I still find C to be better than most programming languages for a wide range of applications. It has by far the widest applicability of 'high-level' languages, and has an elegant simplicity that makes it enjoyable to use. If I have to 'code around' the enforced restrictions of a language, as I find I have to in Pascal, then the language is not doing its job; something I've never found in C.'

### The importance of performance

Hypershell has also allowed Nick to keep a close eye on the performance of his code: 'On a PC and other small machines, performance and efficiency are still important, even if they have gone out of fashion on larger machines. I therefore use many of the coding techniques that are avoided by the modern breed of programmer — sorry, *software engineer* — such as global variables and GOTOs. The C switch statement is one instance where the odd GOTO can be used to advantage, providing a branch into common processing: this is no different from letting code fall through into the next case by omitting a break.'

Nick feels very strongly that the decision to use performance-related techniques should be made at coding time, rather than when the sloth of your application obliges you to. He has some suggestions as to how this could be achieved:

'One thing I try to do is use pointers to step through arrays, rather than subscripts; this has the double advantage of producing smaller and faster code. I also use the Pascal keyword in defining functions in Turbo C, as this form is faster and produces smaller code than the traditional stack handler.'

The fragment is a fairly standard, but complete, implementation of a binary search, adapted to search a sorted text file. The code is used (in a slightly different form) to provide the !B function in HyperShell. Nick chose the code because of the speed it provides for general searches.

### Improved efficiency

'The amazing thing about binary searches is that their efficiency improves with the size of the file — they take only twice as long to sort out a million records as they do to sort a thousand! The routine is a fairly simple variant which returns the position of the record after the search key, if the key is not found. It's a fairly simple exercise to arrange for the routine to do an exact match search and return a result code depending on the success of the search.'

— BEGIN 'STYLE CORNER' INCLUDED CODE —

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#define MAXLINE 256
void
binsrch (bfile, pattern)
FILE *bfile;          /* file to search */
char *pattern;        /* start of line to match
```

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```

*/
{
    long    bottom = 0, top, offset; /* search offsets */
    int     patlen = strlen(pattern); /* length of search
    string */
    char    aline[MAXLINE];          /* input line */
    fseek(bfile, 0L, 2); /* position at end of file */
    top = ftell(bfile);
    while(bottom < top) /* do until the two meet */
    {
        offset = (bottom + top) >> 1; /* calculate mid posi
        tion */
        fseek(bfile, offset, 0); /* go there */
        /* if error or at the top, set at bottom */
        if((fgets(aline, MAXLINE, bfile) == (char *)NULL)
        || ((offset = ftell(bfile)) >= top))
        {
            offset = bottom;
            fseek(bfile, offset, 0);
        }
        /* get next line - if eof, force a null string */
        if(fgets(aline, MAXLINE, bfile) == (char *)NULL)
            aline[0] = 0;
        /* compare case insensitive for length of string */
        if((strnicmp(aline, pattern, patlen)) < 0)
        {
            /* if below search string, bump bottom */
            bottom = ftell(bfile);
        }
        else /* if above or equal, reduce top */
        {
            top = offset;
        }
    } /* while */
    /* fall out with top = seek position */
    fseek(bfile, top, 0);
    return; }
/* TEST PROGRAM */
void
main(argc, argv)
int argc;
char **argv;
{
    FILE *in;
    char aline[MAXLINE];
    if(argc != 2) /* looking for an argument? */
    {
        printf("Usage: binsrch file.ext\n");
        exit(1);
    }
    /* attempt to open file in binary mode */
    if((in = fopen(argv[1], "rb")) == (FILE *)NULL)
    {
        printf("Can't open input file '%s'\n", argv[1]);
        exit(1);
    }
    printf("Enter search strings - end with ^Z\n");
    while(gets(aline))
    {
        binsrch(in, aline);
        fgets(aline, MAXLINE, in);
        puts(aline);
    }
    fclose(in);
    exit(0);
}
--END 'STYLE CORNER'

```



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## Windows in a whirl

There's plenty going in the world of Windows & OS/2, as Ken Morse's recent visit to Comdex revealed that Windows NT has moved into beta form and Pen Windows has gained new features and more supporters. He also offers a personal view of the scene.

Microsoft's Windows NT moved from vapourware to betaware at Comdex as the company began shipping a pre-release version of its Windows 32-bit Developer's Kit to more than 200 developers. Microsoft officials, who were out in force at the show, demonstrated Windows NT running on RISC (the MIPS chips) and multiprocessing hardware, and showed existing Windows applications running under the new environment. Officials also met with about 40 major software developers to urge them to develop for the 32-bit version of Windows.

Microsoft again reversed its decision on OS/2 support in NT. Several months after saying Windows NT won't run OS/2 applications, officials said that the first release of Windows NT will run some character-mode OS/2 applications. Microsoft has not said whether any third-party applications will run, instead announcing support only for its own SQL Server.

Microsoft demonstrated Windows NT running on NCR's 3450, a multiprocessing machine with four Intel processors. NT uses a system scheduler to configure itself to dispatch tasks to different processors. The company also demonstrated Windows NT on three R4000-based machines.

### Excel in public

Also on show were 16-bit Windows 3.0 applications running under Windows NT for the first time and several 32-bit Windows applications ported from Windows 3.0 including the first public demonstration of a 32-bit version of Microsoft Excel.

The first release of the Windows 32-bit Development Kit, available only on CD-ROM, will support only Intel chips; a release for R4000 chips was slated for December at the time of writing. The kit

is currently available only to large developers; a wider beta release is planned for early '92.

An important part of Windows NT is the new Windows 32-bit API. Applications modified for this API can exploit advanced features like support for multiple processors, distributed processing, networking, and security; yet you won't have to adopt the 32-bit API to benefit from the development of Windows NT. 16-bit Windows applications will run alongside applications written to the 32-bit API, sharing data via the Clipboard, Dynamic Data Ex-

***"Windows NT exploits the 32-bit modes of 386 and higher processors. It is designed to be portable to new, more powerful micro-processors as they become available"***

change (DDE), and Object Linking and Embedding (OLE). Visually, you cannot distinguish a 16-bit application from a 32-bit one.

Windows NT and the 32-bit API represent only one extension that Microsoft is making to Windows. Soon Windows 3.1 will be released; Microsoft plans to continue improving the 16-bit versions of its graphical operating system. The newly released Multimedia Extensions for Windows supports sound, animation, and enhanced CD-ROM access; Windows for Pen Computing will bring Windows to clipboard and pen-based systems. Multimedia and Pen extensions will be available on both the 16-bit and 32-bit implementa-

tions of Windows.

Just as standard mode represents optimisations for the 80286 processor and enhanced mode takes advantage of some 80386 capabilities, Windows NT exploits 32-bit RISC processors and the 32-bit modes of 80386 and higher processors. Windows NT is designed to be portable to new, more powerful micro-processors as they become available.

Microsoft is concurrently developing Windows NT on 80x86 and MIPS RISC systems. Both the 386/486 and MIPS RISC platforms will provide binary compatibility with 16-bit Windows and DOS applications. Compatibility for applications written to the 32-bit API will be at the source code level. From a single body of source code, it is possible to create processor-specific executable files.

For the future, Microsoft plans to modify Windows enhanced mode to support the 32-bit API on DOS-based systems. Enhanced mode will continue to run DOS and 16-bit applications, while gaining the capabilities of the Windows 32-bit API.

### Meanwhile, with pens...

Microsoft has packed new features into its pen-based operating system and added a number of independent software vendors to its list of supporters.

New features in Windows for Pen Computing include boxed edit controls, or 'combs' that allow only one letter or number per space. The process helps Microsoft's handwriting recognition engine to translate more accurately. Microsoft has also improved the software's capability to distinguish between letters and numbers.

In addition, the operating system can now rotate easily from portrait to landscape mode for use with spreadsheets, and it can configure pull-



down menus for left or right-handed users.

It can be trained to recognise joined printed letters or simple cursive. Although cursive recognition won't be in Version 1.0 of Windows for Pen Computing, it will appear in subsequent versions. Version 1.0 is scheduled to ship within one week of Windows 3.1, now slated for March.

Those ISVs showing Pen for Computing software at Comdex included HM Hinsch, NewQuest Technologies and Corel Systems.

### C 7.0 requires changes

Microsoft will renege on its promise to support future versions of OS/2 in the forthcoming C and C++ version of its widely used compiler unless major changes are made to the current beta release of C 7.0. The current beta does not support OS/2 2.0 and it is unclear at this time exactly what level of support will be included in the final release of the product, scheduled to be available by the end of 1991.

As C 7.0 currently stands, in the second round of four beta test releases, developers can run the compiler under OS/2 1.x and write C applications that run under OS/2 1.2. What Microsoft appears to have done is neuter OS/2 in a quite blatant manner, and unless this is rectified a lot of developers will become disillusioned. I use C 6.0 for the main reason that it supports all the target platforms I write for: DOS, Windows, and OS/2. However, for OS/2 2.0 development I have to use a separate compiler—something I thought would end with the introduction of C 7.0.

Following on from this, Microsoft has announced it will stop providing technical support to OS/2 developers after IBM ships the commercial release of OS/2 2.0.

In a recent letter to developers, Microsoft offered purchasers of the OS/2 2.0 Software Development Kit (SDK) the option of receiving either a partial cash refund or free copies of Windows 3.1 and NT SDKs.

Microsoft has repeatedly said it will provide OS/2 2.0 to any interested hardware OEMs, but the move to cut support lessens that likelihood.

### MPC group to set second standard

To address criticism by IBM and others that its Multimedia PC (MPC) specification severely limits creative development, the Multimedia PC Marketing Council will define a second, higher-level specification within a year.

Problems with the basic MPC specification were exemplified when the

marketing council distributed its own pre-release sampler disk at the MPC launch in October. The CD-ROM, which provides demonstrations of a handful of multimedia titles, required the use of a 386-based machine with 4Mb of RAM. As such, it could not run on the 10MHz 286 minimum configuration defined by Microsoft and Tandy, among others. Microsoft officials contend that the final version of the disk will run on a 286-based MPC.

To address these concerns, members of the council have formed a sub-committee to design a second-level standard. The group will release a second configuration, to be labelled MPC-2, that will require a 20MHz 386-based machine, 4Mb of RAM, SuperVGA graphics and 16-bit audio. The current spec calls for 2Mb of RAM.

The new spec will also call for enhancements to Microsoft's Multimedia Extensions to Windows including support for video and synchronised sound. Microsoft recently announced that portions of the extensions, which provide sound and device control, will be incorporated into Windows 3.1 when it is released next year. However, Windows 3.1 will not include CD-ROM support.

Some MPC supporters hope IBM will back the logo as a second configuration is defined, because its blessing could give software developers the confidence they need to enter the multimedia market.

### IBM and MPM/2

IBM revealed some of its plans for addressing the multimedia market at Comdex, including OS/2 multimedia extensions with built-in software video compression. IBM demonstrated the unannounced Multimedia Presentation Manager/2 extensions, running a video clip in a window at 16 frames per second on a 20MHz 386SX-based PS/2 Model M57 without a video adaptor. With the software video compression, a 300Mb file can be reduced to 5Mb. Although full-motion video is defined at 30 frames per second, the OS/2 extensions will allow users to gain an adequate level of motion for no additional hardware costs.

The extensions will also include support for Digital Video Interactive (DVI) video-compression hardware and high-quality 16-bit audio, as well as the ability to use two sections of a CD-ROM drive at the same time through interleaving.

The Multimedia Presentation Manager/2 is due to be shipped in the first half of '92. The OS/2 Software Motion Video component is expected to be incorporated in a subsequent release.

While IBM has not finalised how the extensions will be distributed, it is expected that ultimately they will be integrated within OS/2.

### IBM will design version of OLE for OS/2 apps

IBM is developing a version of Object Linking and Embedding (OLE), while Microsoft has stopped work on its own OLE version for OS/2. IBM is evaluating object technology from its new partner, Apple, and from Hewlett-Packard in designing OLE for OS/2.

OLE allows data to be combined from multiple applications into one document and lets users easily update the data within the document at a later time. Developers at Boca Raton and Austin are working on the project. IBM hasn't yet decided whether the first release of OS/2 2.0, due in March, will support Microsoft's OLE for Windows applications, but it is expected that it will. The new OLE is being developed for OS/2 applications and won't be completed until a later release of OS/2.

When Microsoft announced OLE last year, officials said they would also develop a version for OS/2 Presentation Manager. That work has stopped. In designing OLE for OS/2, IBM is looking at Apple's Publish and Subscribe and AppleEvents, which are both in Macintosh System 7. IBM is also looking at Hewlett-Packard's NewWave.

### Of CD-ROMs and CD-ROMs

IBM's inclusion of a CD ROM-XA drive with its first integrated multimedia PS/2 could send supporters of other CD-ROM technologies scrambling to provide compatibility or to find a new target audience. A superset of CD-ROM, CD ROM-XA provides interleaved audio capabilities, allowing audio to be played while data is read. With standard CD-ROM, audio and data files are located on separate tracks, slowing their simultaneous access.

Other incompatible approaches to providing multimedia applications on CD-ROM have caused confusion in the marketplace. These approaches include Philips' Compact Disk Interactive (CD-I), which provides interactive video on a standard television; Commodore's CDTV, which adheres to the CD ROM-XA specification but does not provide seamless interchangeability; and the Multimedia PC (MPC), backed by Microsoft, Tandy and others, which uses a standard CD-ROM. While applications written for the MPC's CD-ROM drive can run in a CD ROM-XA player, the opposite is not true.

IBM's entry into the CD ROM-XA arena has accelerated the need for a



standard multimedia CD. Philips is working on a product that will provide one format for both CD-ROM-XA and CD-I. However, many people see the profusion of formats as only temporary, with all of them being superseded by a new single industry format — watch this space.

### Developing for OS/2 2.0

IBM has formally announced a new set of development tools for OS/2 2.0 that it hopes will spur development for its new operating system. The tools, currently being beta tested, will be shipped when OS/2 2.0 is released in March. They are based on WorkFrame/2 version 1.0, IBM's new OS/2 Presentation Manager development environment.

WorkFrame/2 has an application programming interface that will enable third-party tools to hook into the environment to share data about programs. Both 16-bit and 32-bit tools can be plugged in.

In addition IBM has announced the Developer's Toolkit, a set of utilities for creating and modifying dialog boxes, fonts, icons, bitmaps, and pointers. It also includes on-line reference information and an OS/2 kernel debugger. Both WorkFrame/2 and the Developer's Toolkit are included in a package called the OS/2 2.0 Developer's Workbench.

IBM's C Developer's WorkSet/2 includes all the tools contained in the workbench as well as IBM's new 32-bit C compiler, C Set/2. It also includes a Presentation Manager-based debugger.

C Set/2 includes static and dynamic re-entrant run-time libraries, and allows users to build dynamic link libraries. Developers can integrate the C Set/2 compiler and tools into IBM's WorkFrame/2, allowing them to select run-time libraries via menu-driven compile options.

IBM has also unveiled the Developer's Library, a set of publications providing OS/2 2.0 programming information and which includes a three-volume programming guide.

As part of its effort to promote development for OS/2 2.0, IBM is conducting new support programs for independent software vendors. In addition IBM runs a Porting/Migration Centre in West Palm Beach, Florida, that helps developers convert their 16-bit DOS, Windows and OS/2 applications to 32-bit OS/2 applications.

### The longer lasting laptop

Notebook computer users in 1992 may get as much as a 30% boost in battery life from a power-management interface Microsoft is expected to add to a

new ROM version of DOS. The Advanced Power Management (APM) interface will be used in the ROM version of DOS 5.0 to be announced shortly.

Microsoft's APM interface, designed with help from Intel and Phoenix, lets the operating system tell a portable computer's BIOS when system components are no longer in use and when it can shut off power to them.

Users whose portables have DOS and BIOS versions supporting APM could get between 15 and 30% more battery life. The power savings will depend on how the manufacturer implements APM in the machine's hardware and BIOS. In addition to a ROM version of DOS 5.0, Microsoft will add APM support to future versions of DOS and to a ROM version of Windows, which is expected in 1992.

### Of IBM and Macs

One of the hidden gems in the cross-licensing agreement between Apple and IBM could make elements of the Macintosh interface commonplace in IBM environments, particularly in OS/2.

The wide-ranging pact grants IBM the rights to copy the Macintosh visual displays, commonly referred to as 'look and feel', without the threat of legal action from Apple. Apple has already taken Microsoft and Hewlett-Packard to court, charging that their environments unlawfully duplicate the Mac displays. While IBM officials maintain that Presentation Manager is the current and future interface for OS/2, observers expect more and more Macintosh elements to edge their way into the operating system.

### The 'other' button

Windows developers and users may agree on many things, but what to do with the second or 'other' mouse button is not one of them. Borland has recently started using the second button as a property inspector for objects within its Windows programs such as Paradox for Windows, dBase for Windows, and Quattro Pro for Windows.

IBM's Common User Access (CUA) specification calls for operations such as dragging text or objects using the other button. And, Lotus has used the other button to extend selections on a spreadsheet and allow users to grab parts of a worksheet.

Microsoft is also unsure. Although the company will not discuss any impact the Windows 3.1 style guide might have on the use of the other mouse button, its own applications do a range of things with it. Normally, it is used as a shortcut within applications for launching help enquiries.

### Purely personal

In closing this month I'd like to briefly share my views on the whole Windows versus OS/2 debate. In my work I use DOS, Windows and OS/2 systems, each with their own merits and disadvantages. When compared to Windows, OS/2 falls down on the sheer number of applications available. With over seven million Windows 3.0 users and only 600,000 OS/2 users there is a clear economic reason for the lack of OS/2 applications.

On the downside, Windows can let me down with its infamous UAEs. Trying to place an operating system (Windows) on top of an existing operating system (DOS) was never a good idea, but I must admit at the time it was the most sensible option in a marketplace that can be easily alienated by the idea of throwing away your previous DOS-based software.

It is on this point where OS/2 scores highly. IBM (and Microsoft at the start) had the opportunity to sit down with a blank piece of paper and define a new operating system. From the systems programmer's point of view they did a very good job and built an impressive kernel and front-end (Presentation Manager).

### Perspective

To put things in perspective, the DOS-box in OS/2 is an addition to the operating system, whereas the Windows operating system is an addition to DOS. The fragility experienced by Windows users is totally removed by OS/2. Yes, programs can be made to crash under OS/2 but when they do, the user is presented with the information necessary to understand the problem, and, more importantly, any other applications carry on running unaffected.

With the imminent release of OS/2 2.0 IBM has the chance to put itself in a dominant position. The main moan against OS/2, namely the lack of popular applications, will be removed by the ability to run Windows applications unaltered.

For the diehards, OS/2 allows multiple operating systems to be installed on the hard disk and selectively booted. So, you can keep a DOS or Windows partition if you want.

### The 600,000-user question

As a final thought, remember this. Before the release of Windows 3.0 just over a year ago there were about 600,000 users of Windows 2.0; at present, just before the release of OS/2 2.0, there are 600,000 users of OS/2 1.2. How many users in a year's time?

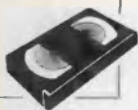




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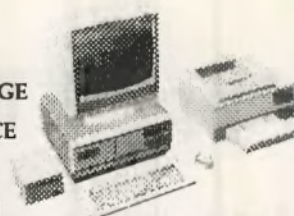
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## Apple II ~~Forever~~ For a Little While Longer

Apple's patching up of the IIGS is just delaying the inevitable. It's a lost cause, says Mick O'Neil, and it's about time Apple US caught up with its UK subsidiary before purchasers are led in the wrong direction. But the seamlessly integrated ClarisWorks impresses.

Apple has taken its share of hits for introducing the IIGS, leading users down the IIGS WIMPs path and then abandoning technical development. In my book, the decision to abandon technical development was the correct one. The IIGS in WIMPS mode is painfully slow and although new versions of the operating system have improved performance, every indication is that computer software will continue to evolve in the direction of heavy graphics and sound usage.

Frankly, the IIGS is not going to make it, and patching in new accelerators and compression software will just delay the inevitable.

Many industry observers expected Apple to bite the bullet and kill off the GS at the same time it announced the PowerBooks, Classic II, and Quadras. But no such announcement was forthcoming. Perhaps the Apple II is still too close to the soul of the company. Or maybe Sculley is too concerned about alienating the millions of Apple II owners. I suspect the new Apple regime just wishes the machine would die from lack of demand.

A fully configured Apple IIGS is now more expensive than a Classic and about the same as a LC. Who in their right mind would buy an Apple IIGS instead of a Mac? Not many individuals, certainly, but perhaps some institutions. School systems, for example, which have invested significantly in Apple IIGS software could opt to stay with the same technology. In fact, one US school system recently purchased so many IIGS's that Apple was rumoured to have re-tooled an old Apple II factory just to meet that order.

Compatibility with the IIGS is a terrible criteria to use for purchasing new hardware, and Apple knows it. Most GS programs have IIGS equivalents, and

the LC with its IIGS emulation board will run the vast majority of them. The new IIGS installation software for the LC lets you partition your hard drive into Mac and IIGS partitions, and it's a relatively simple matter to load unprotected IIGS software on the IIGS partition. Double-clicking a startup icon automatically fires up the IIGS emulation board.

A local talk network, a Mac running under System 7 with file sharing turned on, and the latest GS system software with AppleShare installed, lets you share Macintosh volumes with connected Apple II's. You can load IIGS software on the Mac's hard disk via the GS drives and then boot it directly from the Mac volumes.

Thus if the 'c' word is important there are compatibility solutions that work, and work relatively elegantly. None of them involve a further investment in GS hardware. Apple gets full marks for developing the IIGS emulation board and System 7's sharing capabilities, but as long as the company continues to manufacture the GS, it is in danger of leading purchasers in the wrong direction. Apple UK took a brave stance on this issue long ago. It's time for Apple US to catch up.

### No thanks for the memory

I haven't received the new version of System 7 yet and my PowerBook 170 has yet to arrive. From the looks of things, it may not arrive for some time. It occurred to me, however, as I wrote all those wonderful things about the PowerBook 100 in last month's column, that there's something about the spec that grates slightly.

Apple marketing got a lot of mileage out of the relatively low prices announced for the PowerBook 100 and 140, but the original announcement also indicated that the base models are

fitted with only 2Mb of RAM. You can run System 7 and the odd program in a 2Mb environment, but much of the software that makes the Mac so appealing is going to crash up against the remaining memory. This is particularly true if you employ any of your favourite memory-resident programs like Adobe Type Manager, On Location, and the like.

Anyone who receives a PowerBook 100 or 140 and has to live through the 'limited memory' warning messages is going to wonder what the heck is happening. Recognising this problem, one leading dealer informed us that it refuses to advertise or sell PowerBooks or Mac LCs with less than 4Mb of RAM.

### '...the finest piece of educational software...'

In the February '89 Mac Factor column I wrote: 'With its broad functionality and ease of use, [Microsoft] Works 2.0 could be the finest piece of educational software not specifically written for education.' In fact, Works 2.0 became popular across the whole Macintosh market and consistently maintained its position as one of the five best-selling Macintosh programs. Clearly there's a broad market for reasonably priced, integrated software. For years Microsoft has had this field to itself and has rewarded loyal users with practically no further development.

With the introduction of the low-cost Mac in the Spring of 1990 and the PowerBooks this past Autumn, developers rushed to pack disparate features into integrated bundles. T/Maker released SmartBundle which combined WriteNow 2.2, SuperPaint 2.0, RecordHolderPlus 3.1, and Full Impact 1.1 into a single, low-cost package aimed at first-time Macintosh buyers. SmartBundle included everything but



the kitchen sink. Symantec's GreatWorks, like Works, included a communications module (see 'Macintosh', PCWJan '92), separated draw and paint capabilities into individual components, and threw in a full-featured outliner.

You'll note that Microsoft Works, SmartBundle and GreatWorks are simple collections of separate programs, each tenuously tied together via the clipboard. It's as if the developers got their cue from Switcher or MultiFinder. Although there are overlapping core functions in GreatWorks, the degree of integration is limited. It must take more than a common spell checker or a universal Find and Replace to make a truly integrated package.

## ClarisWorks

ClarisWorks is the most seamlessly integrated software released for the Macintosh since Excel. But where Excel combines spreadsheet, chart, and database functions, ClarisWorks incorporates word processor, draw, spreadsheet, chart, flat-file management, and communications, while maintaining much of the look and feel of the corresponding parent programs: MacWrite, MacDraw, Resolve, and FileMaker.

In designing the program, Claris had to decide which tools to use as a common core, which of the parent's features to keep and which to leave out, and how to blend the different modules to maximise integrated power. Note that there's no corresponding parent for the comms module, and its orphan status is mirrored in its limited level of integration with the other ClarisWorks tools and its separate documentation.

## The Claris Core

A set of MacDraw-like tools along with colour, pattern, and pen palettes is available in all modules except the communications module, as is the familiar Claris zoom tool. There are also a common 100,000 word dictionary and 660,000 word thesaurus and it's useful to be able to access a dictionary or thesaurus while working with a spreadsheet or database. Page formatting features like headers, footers, date, time, and page number are core features, as are customisable rulers, macros, context-sensitive and balloon help, and Claris XTND technology. The latter can be used to translate files to and from other platforms. Several ClarisWorks documents can be opened

simultaneously and the program allows you to tile or stack windows.

But the ClarisWorks core is much more than a set of common features. From within any module you can access a text or spreadsheet tool and create a frame that contains a corresponding sub-document. That is, a frame contains a miniature word processing or spreadsheet document and you can use all the tools and features that would be available to you in a full text or spreadsheet document. Thus, while working on a word processing document you can insert a spreadsheet and in the middle of that you can create a text block. You can even insert a spreadsheet within a spreadsheet! Add the omnipresent draw

the need for a separate 'print preview' and makes document construction fairly simple.

Mailmerge facilities in concert with a database document were easy to use but limited by the lack of a merge-to-file option. In my experience a successful mailmerge takes a couple of trials to get right and it would be convenient to examine merged documents prior to hard copy. Claris has done a good job in figuring out what word processing features are needed and what features might complicate the interface.

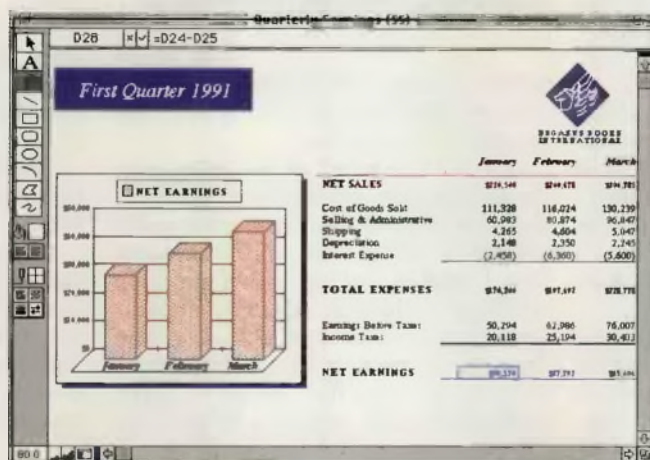
The graphics module has all the standard draw tools including group, align, rotate, scale, and snap-to grids. Text frames are treated as objects and can be aligned and rotated. Scaling a text block affects the size of the block and not the font size. While in graphics mode you can display a graphics ruler or a text ruler. The latter becomes active when you select the text tool and click in a text frame.

Like the word processor, the ClarisWorks spreadsheet and chart generator is likely to meet most of your needs. The spreadsheet includes 100 built-in functions and you can control number type, column widths, row size, character formats, and borders. The chart generator employs seven chart types and some 280 possible formatting combinations and is very comprehensive for an integrated package.

Much database software continues to elude the grasp of the average user. The ClarisWorks database may just change all that. Like FileMaker Pro, the data manager employs both standard and customised layouts. Flexible layouts are the key to the success of this type of software as users see immediate pay-offs for tedious data entry. Built-in layouts include standard data entry, labels, columnar reports, and blank, and you have full access to graphics, text, and spreadsheet tools while in layout mode.

The communications module is full-featured and comprehensive but is only loosely integrated into the ClarisWorks package. The developers may have decided that communications is complicated enough for the average user without the distractions of integrated features. In any event, it's utilitarian and makes the attraction of the program that much more substantial for PowerBook users.

The program requires 900K of RAM and so will run quite happily on a RAM-scant PowerBook. Memory man-



▲ A ClarisWorks spreadsheet can generate some pretty sophisticated charts

graphics and you have a level of integration not found in any other software.

## The Whole is Greater than the Sum of the Parts

Much of the unique power of ClarisWorks derives from these integrated functions. Text frames are objects that can be linked and resized with text automatically adjusting to frame changes. Thus, you have more flexibility in page layout in the graphics environment using text frames than you do in the word processing module with its relatively rigid formatting. Similarly, a spreadsheet frame takes on a new use in the word processing module for creating tables.

With the exception of an outliner which ClarisWorks is sadly missing, the word processor has just about every feature most users will ever need. That includes customised tabs, margins, indents, line spacing, justification, mailmerge, multiple columns, footnotes, and so on. WYSIWYG headers, footers, and footnotes in combination with the ability to zoom out eliminates



agement must be adjudged superb as I tested the software by limiting RAM availability to 700K and opening a variety of documents. I noted no deterioration in program performance and received no error messages.

AppleWorks was one of the best-selling programs of all time because with one piece of software Apple (Claris) provided all the productivity tools most users would ever require for an Apple II. ClarisWorks is more powerful, better integrated and easier to use and simply blows the competition away. It's certainly the perfect companion to the low-cost Macs and the PowerBooks.

### Fractal Design Painter

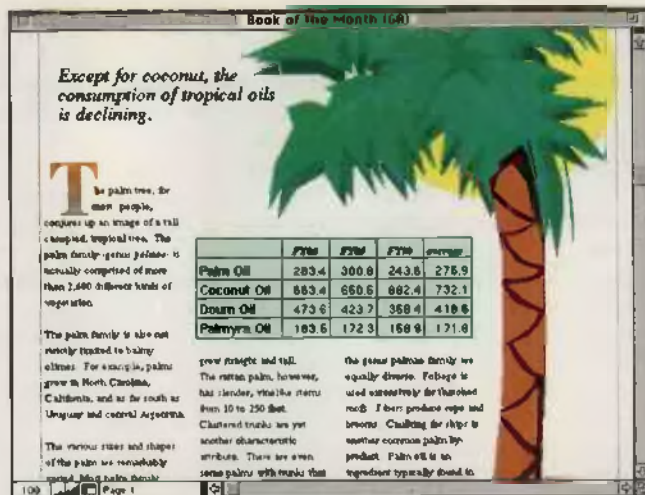
There is nothing on a computer, artists have argued, to compare to the texture of canvas, the variety of drawing tools like thin or thick pencils, soft or gritty charcoal, pastel chalks, and different types of brush. Well, nothing, that is, until Letraset released Fractal Design Painter (full benchtest, page 222).

First the bad news: Letraset recommends a Macintosh II series computer, 4Mb of RAM, a Wacom graphics tablet, and 24-bit colour. You can, however, run the program with less RAM, without a tablet and with 8-bit colour, but you'll lose much of the effect. The good news is that if you follow Letraset's recommendations, Painter will surprise the most anti-technological cynic.

Painter's brush palette has pressure-sensitive thick, thin, sharp and dull-coloured pencils, various types of charcoal, crayons, felt pens, chalk and the like. Editing tools include a flexible eraser that varies how much colour you remove by either how hard you press the stylus or by the number of times you go over the same spot, and water which you can use to blur an image.

'Cloners' are tools used to recreate an image by duplicating it and changing its colour, style, or texture. The program even lets you clone a painting in the style of Van Gogh or Seurat. 'Autocloning' adds dabs of paint to an image on a continuous basis until you turn it off, and you can autoclone in any of several styles. Painter also lets you apply a three-dimensional surface texture to an image and supports Photoshop-compatible filters.

'Friskets' are masks that you place over an area of your painting to shield it during painting or retouching. Special icons in the tool palette allow you to create a frisket, move it, or rotate it.



△ The integration of spreadsheet and graphics in a ClarisWorks text document

Painter comes with 27 friskets already in the Frisket library and you can delete or add to this number.

I'm not sure whether Painter's documentation was poorly organised or it didn't lend itself to the irritating 4.5x8in notebook. I assume the notebook shape was forced by the marketing gimmick of shipping the program in a real paint can. Coupled with the lack of on-line help, the program's powerful but unique tools took some time to get to grips with. One might expect a bit more in the way of hand-holding for £295.

### Gallery Effects Animator

In the November '91 issue we looked at Gallery Effects and I noted that it was time-consuming to apply some special effects to graphic images. Since then, a free Gallery Effects Animator disk has shipped to registered users.

The Animator is a Supercard-based program that applies Gallery Effects filters to some or all the frames of PICS animation files and batches of PICS files. The Animator disk also contains two new versions of the Brightness and Contrast and Colour Balance filters.

After selecting a PICS animation file or a folder containing PICS documents, the Process Setup Window lists the current files. You can select any or all of the frames and assign an effect to them. A special 'Tween' settings button looks at the settings of the first and last file or frame in the range and calculates in-between values and assigns them. The Animator disk also includes a Gallery XCMD that allows experienced users to access Supercard plug-in tools from within Hypercard or Supercard.

### Personal Press 1.01

If you're interested in desktop publishing and don't have four or five hundred

pounds to purchase Page-Maker or Quark XPress, Personal Press is worth a look. Version 1.01 is System 7 compatible and supports TrueType fonts but does not include balloon help or Publish and Subscribe.

Personal Press features an AutoCreate mode for automating document construction, proxies for previewing how changes will affect a document, posted notes that add a kind of hypertext dimension to a document, grey-scale and image control tools for scanning a graphic directly into a

document, and an Equals tool for applying attributes from one object to another (see the Macintosh column, PCW March '91 for a detailed run-down). The new version expands the function of the Equals tool to line styles, line and fill patterns, colour, shadow, and text wrap and can be used to make two objects the same size or change the shape of one object to another.

Other improvements in version 1.01 include keyboard control over font size and line spacing, object resizing to fit text fills, and new templates for the AutoCreate Folder. In addition, the overall speed and responsiveness of the program is noticeably improved.

#### Details

##### ClarisWorks

Price: £195  
FrontLine Distribution  
Intec 1  
Wade Rd, Basingstoke  
Hants RG24 0NE  
Tel: (0256) 463344

##### Personal Press

Price: £195  
Aldus UK  
39 Palmerston Place  
Edinburgh EH12 5AU  
Tel: 031-220 4747

##### Fractal Design Painter

Price: £295  
Recommended: Mac II with 4Mb of RAM, graphics tablet, 24-bit colour  
Fractal Design Corporation  
101 Madeline Drive, Suite 204  
Aptos, CA 95003, USA  
Tel: 0101-408 688 8800

##### Gallery Effects Animator

Price: Sent free to registered users of Gallery Effects  
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## Open up them Perly gates....

Perl is a program that embraces wholeheartedly the spirit of author Larry Wall's 'feeping creaturism' — and it's free. DJ Walker-Morgan thinks he's found a pearl of a language.

I'd like to introduce you to a program that may or may not be on your Unix machine, but which you may well want when you hear what it can do. That program is Perl. Perl is a language, a system administrator's tool, a database handler, and umpteen other things all rolled into one. Perl is also free.

Unix has always been known as an operating system with a large library of tools and utilities. It has been built up from a simple philosophy, 'Small is beautiful'. The idea was that as you could join commands together quite easily using pipes, so a few small commands could be put together to create a larger command. These small commands are the possessors of those cryptic names people associate with Unix, like Grep, Awk, Sed and Find. These commands are often tied together with shell scripts, and allow a great deal to be done without having to write new programs.

Although Unix has this selection of tools, it has not stopped the creation of new tools which are not part of Unix but distributed either through the public domain, just 'freely redistributable', or CopyLeft (the Free Software Foundation licence which lets you use their code, as long as you make your work available to others).

### Emacs

Some of these tools are enhancements of existing programs, others are new. Most famous of the 'other' tools is GNU-Emacs, the editor. Calling Emacs an editor is understating what it can do. With its built-in Lisp interpreter and library of Lisp code, it's better described as a user environment in its own right disguised as an editor. Emacs is not a standard part of any Unix, but comes distributed under the CopyLeft with many systems as part of the supplied but not directly supported software.

I know people who never leave Emacs when they're doing their day-to-day work. If they want a shell, they just open an Emacs shell window. If they want to read mail, they use an Emacs mail reader. If they want a cup of coffee, black, two sugars, there is quite probably an Emacs user out there who has

the code to do it.

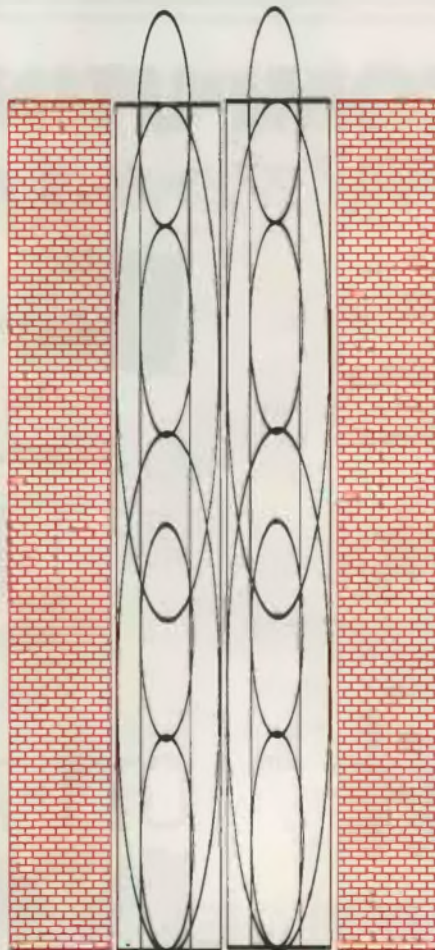
This versatility doesn't come cheap. Emacs is a large program, in terms of memory and disk space. My favourite interpretation of the Emacs acronym is 'Eight Megabytes and Constantly Swapping'. It isn't as bad as that, unless you have loaded every bit of Emacs Lisp into memory. Most Emacs users don't mind this use of resources, countering that they have all the facilities they need at their fingertips.

Larry Wall, the author of Perl, wanted to get all the best facilities of the tools available under Unix under one roof. He's the chap responsible for the creation of 'rn', the news reader, the 'patch' program and metaconfig, a program to write configuration scripts for other programs. He also coined the phrase 'feeping creaturism' to explain what can best be described as the organic growth that occurs in programs like Perl.

He created Perl with a specific task in mind originally, while maintaining a system at Jet Propulsion Labs (JPL), part of the US space effort. He found that Awk, the text file processing language, ran out of steam when he needed to maintain a whole set of multiple files and so set about creating Perl to supplant Awk and Sed. This grew as Wall went from job to job in JPL, acquiring new features and acquiring new users who in turn asked for new features. My local Perl binary is over 400K (on a SPARCbox) but in the same way Emacs is larger than Vi, so the increase in functionality helps explain why Perl is larger than one would expect for a 'lower-powered' utility like Awk.

### Fluffy soufflé

Language purists will probably squeal with horror looking at Perl syntax, but it has grown up that way and people like it. I could describe it as a fluffy





soufflé of shell languages, Awk, Sed and a large dollop of C-styled functionality, but I suspect you are turning white at that thought already.

Alongside is an example of some Perl code. This program searches all the text files in the current directory and any directories below it for words you specify in the command line. You'd run it with a command like:

```
$ wordsearch <words to
search for>
```

The '#' line is a Unix mechanism that allows scripts to be run with a particular shell or program. It feeds the rest of the file to the specified command, in this case `/usr/local/bin/perl`, which is where I keep my copy of Perl. On System V3 Unix and some others, you have to call Perl manually because '#' isn't supported.

The first open command opens not a file but a process, and pipes in the output from that command as if it were a file, a line at a time. Here, we run the find command. If the command fails, the `||` (an or statement) allows the program to handle the error.

The FILE: is a label, which we will return to. Following that is a while statement which reads off filenames from the find 'file', one at a time. The chop command is a classic example of 'feeping creaturism'. It just removes the newline from the end of the variable it's given, always very useful, but in most other tools you have to write it yourself.

Now we see some what I like to call backwards Perl. The 'next' keyword is used for breaking out of loops. It's been made so it can leap out of a loop-to-label statement. Here, it is destined to go to the FILE label, thus moving the program onto the next file to search. Following it is an Unless statement, though. This is called a statement modifier, changing the action. You can have 'If', 'Unless', 'While' and 'Until' as statement modifiers. The expression following is evaluated first to decide if and how the preceding statement should be executed. In the case of unless, the statement is only executed if the expression evaluates as true.

The '-T \$filename' is a Perl expression which returns true if the file named is a text file. So, line can be thought of as reading 'move to next file unless this file is a text file', rather than the more classical 'if the next file is not a text file move to next file'. It is a simple change in emphasis, but I find it does make Perl code easier to read. It also makes up for the fact that you can't have dangling If statements like

```
if (a=b) d=e;
You must use
if (a=b) {
```

### Example Perl code

```
#!/usr/local/bin/perl

open(FIND, "find . -print !") || die "Couldn't run find:
$!\n";

FILE:
while ($filename = <FIND>) {
    chop $filename;
    next FILE unless -T $filename;
    if(!open(TEXTFILE, $filename)) {
        print STDERR "Can't open $filename-
continuing...\n";
        next FILE;
    }
    while(<TEXTFILE>) {
        foreach $word (@ARGV) {
            if ( m/\b$word\b/ ) {
                print $filename, "\n";
                next FILE;
            }
        }
    }
}
```

```
d=e;
}
```

The next line is such an If statement, within which it tries to open the file. If it cannot, it prints an error message and moves on to the next file.

Once the file is open, it is read a line at a time by the following while() loop into a default input and pattern-matching variable very much like Awk handles undirected input. Think of it as just automatically using the variable \$\_ (which is its actual Perl name) if it isn't told otherwise.

Next, there is a 'foreach' loop, which simply steps through the arguments given to the program (that's the (@ARGV)) one at a time placing them in the variable \$word. Inside this loop is an If statement with an apparently odd condition. This is actually Perl's match command. It uses the string within the slashes as a regular expression on the default string space \$\_ and returns true or false if there is a match.

In this case it's a word we are searching for in \$word. The '\b' marks that we only want matches for complete words. If there is a match, the program prints the filename and then leaps out of both the while loops and the foreach loop to start on the next file. Otherwise it will search to the end of the file and naturally move on.

### The beauty of Perl

This is a relatively simple example program, and no hard and fast example of Perl style: your Perl programs could

be simple one-liners or modular masterpieces. The Perl slogan is said to be There's More Than One Way To Do It. You could construct something similar with shell scripts and Grep, but the beauty of Perl is that all this functionality is incorporated in one language. The Perl syntax is loose enough to accommodate most programmers' structuring styles, making Perl ideal for 'quick hacks' to do a quick fix, to more organised projects where code must be maintained over time.

Perl incorporates functions to handle everything from printing easily formatted tables to handling interprocess communications, from easy access to password files to accessing network information, and from dbm database access to handling floating point numbers. You don't need to know all these functions, and some are only appropriate to Perl on certain operating systems, but the core of the language is fairly consistent. Like Emacs, you don't require an encyclopedic knowledge of the entire syntax and library calls. You can start using it purely as a super-Awk clone, using the new functions when you need them. There is plenty of 'growing room' within Perl.

The big advantages of Perl over other tools is its lack of limits, the way it handles errors, debugging and support for reusable code. A lot of Unix utilities have undocumented and documented limitations. They may not be able to handle lines longer than some arbitrary length. There may be limits or perform-



ance degradation on memory allocation. They may break on binary data or not allow recursion. Worst of all is when an arbitrary limit varies between two ports of the same utility. Perl has been written to avoid those limitations, so you can worry less about the tools and get down to solving the problem.

Perl gives detailed error messages, more akin to those of a traditional compiler rather than the terse Awk/Sed-style 'bailing out' messages, and they are usable by other programs. It has a debugging mode which you can customise yourself as it is written in Perl too. There is support for local variables, subroutines and recursion for more (or less) structured code, and you can separate code out into independent packages, so you can re-use code more easily than other tools at this level.

### Associative arrays

For data types and structures, Perl handles numbers and strings, converting between the two as appropriate, and these can be contained within lists, arrays or associative arrays. An associative array is a sparse array which can take any data type as its key, rather than a simple integer. For example, I can have an associative array of CD titles and catalogue numbers:

```
%cdcollection = (
    'GOCDB', 'Billy Bragg -          Back to Basics',
    'LC7309', 'Andy Summers -      Mysterious Barricades',
    'CDrx6301', 'PSB - Dj Culture Mix,
);
```

And if I want to access that data in the associative array:

```
print $cdcollection{ 'CDrx6301' }
```

would return

```
PSB - Dj Culture Mix
```

And this simple piece of Perl prints out the CD collection sorted in catalogue order:

```
foreach ( sort keys %cdcollection ) {
    print "$_ $cdcollection{$_}\n"
}
```

Perl's associative arrays are descended from those in Awk, and are the foundation for more complex structures, such as trees. If you have a dbm database, you can access it as an associative array, making manipulation of that database more transparent.

You may want to write Perl programs that are to be run as super-user—that is, with the super-user flags set, to

do special jobs. You must be sure, though, that these scripts don't contain security holes. Perl is implicitly more secure than shell scripts which rely on substitution to evaluate lines; you can often trick a shell script by giving an argument to a script designed to terminate the command early and run something else. Perl doesn't do this; it evaluates its program expressions in a C-like way, so there are less booby traps.

Perl will trace variables that come from outside the program, whether they are command line arguments, environment variables or user input. It can be set to forbid these sources to be used directly or indirectly in statements which will modify a file, directory or process. This includes tracing across variable assignments and expressions. It doesn't stop you from not thinking about the security aspect, but it does help in blocking off one potential path of abuse.

### Swiss Army Chainsaw

Perl has been described by some as a 'Swiss Army Chainsaw', but it does fulfil a need for an all-purpose system language. Philosophically, it does run against the grain in much the same way as Emacs does, but this doesn't stop it

Perl programmers.

If you already use Awk or Sed, you'll find your transition to Perl eased by the use of a2p, an Awk to Perl translator, and s2p, a Sed to Perl translator. The former is written in C, the latter in Perl itself.

The book that set me off using Perl is *Programming Perl* by the program's author Larry Wall and Randel L Schwartz, and it can be regarded as the Kernighan and Ritchie of Perl. There's an overview, a tutorial (entitled 'The Gory Details'), a generic reference manual, a cookbook of commonly used techniques and an example workbook.

It is one of the O'Reilly & Associates Nutshell Handbooks, and is up to their usual excellent standard: an easy read with occasional humour, and with good example code and plenty of detailed explanations. There are chapters covering the 'Do's and Don'ts' of Perl programming, and how to get hold of Perl if you have access to Anonymous FTP or a fast modem like a Telebit Trailblazer and can brace yourself for the cost of a call to the States.

The book's example programs are all based on real problems and tasks rather than hypotheticals. It includes programming utilities, system administration programs, database handling and network and interprocess communications. If you want to get into Perl, this is the book to have.

### Posted Perl

If you can't afford a call to the States or can't get at Anonymous FTP, you should be able to find Perl posted across Usenet on new releases, on any good Unix-supporting BBS, and available on a number of mail servers. It is also on Cix in the Perl conference there, along with versions of Perl for MSDOS, OS/2, the Amiga and the Archimedes.

I've taken a liking to Perl. It builds on the existing Unix tool base and produces an all-purpose tool. You do have to take into consideration that it is quite large. I already have, and I still have the feeling that I won't be hacking around Unix machines without it in future.

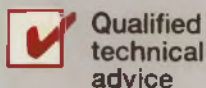
*Programming Perl*, by Larry Wall and Randel L Schwartz, is published by O'Reilly & Associates, ISBN 0-937175-64-1, and costs around £20.

Perl can be obtained by Anonymous FTP from [jpl-devvax.jpl.nasa.gov](ftp://jpl-devvax.jpl.nasa.gov) and other sites.

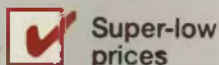
Cix is on 081-399 5252 (most baud rates 8N1).

DJ Walker-Morgan spends his days programming for Unix and X and can be contacted on Cix as [dj@cix](mailto:dj@cix) or via email as [dj@micromuse.co.uk](mailto:dj@micromuse.co.uk).





Qualified technical advice



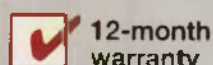
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## Clash of the titans

Giants like DEC and IBM once ruled self-contained worlds, using proprietary protocols like DLC and DECNet. As networks mushroomed, these worlds clashed in an explosion of acronyms. Ralph Bancroft reports on the struggle for peace and understanding.

Last month we looked at Microsoft's LAN Manager 2.1 and the NetWare Connectivity that comes in the box. This lets a PC log on to LAN Manager and NetWare at the same time, by loading into memory both NetBEUI and IPX transport protocols. The need to run more than one transport protocol across a network is an increasingly common requirement as networks become more complex, so this month we will take a more detailed look at transport protocols and the ways they can be installed on both the workstation and the server.

What is a transport protocol, or protocol stack as it is sometimes called? One analogy is with the post. To send a letter, you put it in an envelope, writing the destination address on the front and your address on the back. The front address is used to route the envelope through the postal system. The back address lets the recipient know where the envelope came from — and ensures the letter gets delivered back to you if the postal system is unable to deliver to the correct destination.

### Transport service

On a network, the transport protocol offers the same kind of service. It puts the data you want to send into a packet (sometimes called a datagram) along with a 'header' that contains both the source and destination address. The packet then travels across the network to the destination address, the header information is removed, and the data is passed to the receiving application.

If the data is a request for information, the source address in the header ensures that an acknowledgement is sent back to you, as is eventually the information you requested. If the packet fails to find the destination address, you will not receive the acknowledgement; this is detected by the

workstation, which 'times-out' and puts an error message on your screen.

As you would expect, different computer manufacturers had different ideas on how a network packet should be formed and each came up with its own transport protocols. The IBM mainframe world came up with SNA (Systems Network Architecture), at the core of which was DLC (Data Link Control). The world of DEC minicomputers had the eponymous DECNet. The nearest the industry got to a standard was the Xerox Networking System. Developed by Xerox for use on Ethernet networks, this was adopted by a number of mini-computer manufacturers.

It was also adopted by PC networking companies. 3Com, for example, used XNS in its 3+ networking software. Novell, however, took the view that memory was at a premium in the typical PC. So it stripped out what it thought was the excess baggage in XNS and built a leaner, faster protocol it called IPX/SPX (Internet Package Exchange/Sequence Packet Exchange).

RAM-cram problems also led the big computer manufacturers to produce cut-down protocols for local area networks. IBM, in conjunction with Microsoft, came up with NetBIOS, while DEC came out with LAT (Local Area Transport). Strictly speaking, NetBIOS is an interface layer that sits between an application and the underlying transport protocol (DLC in IBM's case) but Microsoft used a combined NetBIOS interface and transport protocol in its MS-Net, which was licensed by a number of computer manufacturers. LAT, while satisfying the memory requirement, turned out to be cut down too much and is useful only if all you need is terminal emulation to talk to a VAX host.

Initially, this jumble of incompat-

ible protocols was not the great hindrance that it sounds. If you were a DEC site you only had VAX systems. If you were an IBM site you only had true-blue mainframes and/or mid-range systems. Local area networks were only for small workgroups of a dozen or less PCs and at most the only access that these PCs could possibly want to the host systems was terminal emulation.

### Trends in networking

This proprietary view of the world did not prevail for long (if it prevailed at all). The explosion of networking over the past few years has seen a number of trends. Firstly, PC networks have just grown and grown: a single local area network might connect hundreds of PCs. Secondly, the standalone LAN is likely to be connected to similar networks in the same building or elsewhere in the country — even elsewhere in the world. Thirdly, PCs are no longer content to be treated as dumb terminals to a mainframe. They are intelligent machines and want a less patronising form of access. Finally, just as LANs are being connected together, so are host systems: the corporate mainframe with its massive databases is now linked with the VAX system in engineering and the Unix systems in R&D.

These trends put the transport protocols on collision course. The NetWare server (for the PC networks) insists on talking IPX/SPX, the VAX system will only recognise a PC if it talks LAT or DECNet, and the IBM mainframe will only take notice of DLC packets.

Research carried out for 3Com by Benchmark Research shows the scale of the problem. A staggering 82% of Times 500 companies said they were using three or more protocols, and 60% said they would be implementing addi-



tional wide-area protocols in the next year.

The solution comes in two parts. The first is a common protocol that every system can speak. The second is to allow two or more protocols to exist on the PCs, servers and host systems.

The quest for a common protocol led to the development of the International Standards Organisation's Open Systems Interconnect (OSI) seven-layer reference model. I shall spare you all the details of this, and focus instead on the internationally agreed standard for the transport protocol that is known as TP4 (and, no, I don't know what happened to TPs 1, 2 and 3). Every computer manufacturer the world over has pledged allegiance (primarily out of commercial necessity) to the OSI cause. So one day, TP4 will emerge as the *lingua franca* of the networking world.

### TP4 vs TCP/IP

There are two kinds of standards in this world. Those agreed by committees and those that are *de facto*, widely adopted because a sufficient number of people use them. There are people, like my colleague DJ Walker-Morgan on the neighbouring Unix pages, who would suggest TP4 fits into the first category, while in the second category is the totally acceptable TCP/IP.

TCP/IP (Transmission Control Protocol/Internet Protocol) had its humble beginnings in the US Department of Defense, or more precisely the Defense Advanced Research Project Agency (DARPA). The agency wanted a way of linking up the various projects that it was funding so that they could share the results of their research and cross-pollinate with ideas and information. This led to the establishment of ARPAnet which later evolved into Internet, a worldwide internetwork with thousands of nodes. DARPA defined TCP/IP, a suite of protocols allowing dissimilar computer systems to talk to one another.

Given its vendor independence (and the need to connect to Internet), TCP/IP protocol suites have been developed for every host system imaginable, and it is without a doubt the transport protocol of choice in Unix environments. Such is its popularity that even the big computer manufacturers now offer TCP/IP as an alternative means of talking to their host systems and not just those running a variant of Unix.

If TCP/IP is so widely implemented, why not use it as the sole protocol for both local and wide-area networking? Oh, that life were so simple.

TCP/IP is a raw transport protocol. To communicate with it an application

needs an additional layer of software to provide an interface. A mainframe or minicomputer may run TCP/IP, but any *application* you may want to run on the host machine is not necessarily going to have an interface with the transport protocol. So in the host environment, the implementation of TCP/IP can best be described as incomplete.

### The easy PC life

At the PC end, life is a little easier. As remarked last month, Microsoft is shipping TCP/IP as part of the LAN Manager 2.1 bundle, allowing you, should you want, to use TCP/IP as the native protocol on your LAN Manager network. This is made possible by the fact that the LAN Manager Redirector on both the workstation and the server expects to talk to a NetBIOS interface. By happy chance there is a NetBIOS



interface available for TCP/IP (called RFCNETBIOS), so it is a relatively trivial matter to install TCP/IP on both workstations and servers.

The downside for the workstations is that TCP/IP is a chunky protocol. When I tested LAN Manager 2.1, TCP/IP took up 23K more memory on my PC than NetBEUI (the latest incarnation of Microsoft's NetBIOS interface/protocol). This may not sound a lot, but on top of LAN Manager's high memory overhead this might be a problem.

The upside is that workstations gain access to a clutch of tools that come with TCP/IP. These include TELNET (for terminal emulation to a host), FTP (which allows you to transfer files to and from a host), RCP (an alternative file-copying program for use with Unix systems) and RSH (a remote shell program for Unix systems that lets you type in commands and run programs as though you were sitting at that machine's screen and keyboard).

The other benefit of running TCP/IP as the native protocol under LAN Man-

ager is that it was designed from the outset to work across internetworks and wide-area networks. This opens up the possibility of using LAN Manager servers on the other side of the world as though they were just down the corridor (in practice, the bandwidths of your wide-area links are a restricting factor).

This is all good news for LAN Manager users and prospective users. But what about the 70% or so of PC users connected to NetWare networks?

I have good news and bad news. The good news is that you can install TCP/IP on the server (providing it is running NetWare 3.11) and on the workstation (providing you buy LAN Workplace for DOS). The bad news is that you will still need to use IPX if you want the workstation and the server to talk to one another.

The rationale behind running TCP/IP on the server is twofold. It allows Unix boxes to access files on the server, if you also install the optional NFS name space. It also lets NetWare servers communicate over an internet more efficiently than if they were using IPX. It achieves the latter by encapsulating IPX packets within TCP/IP packets (to use the mail analogy, the IPX envelope is put in a TCP/IP envelope at the sending end and removed at the receiving end). This is called tunnelling, and providing the IPTUNNEL.NLM is installed on both servers, a workstation can access a remote server transparently, with the local server automatically performing the encapsulation of the IPX packets.

### Concurrent access

The rationale behind LAN Workplace for DOS, meanwhile, is that a workstation may require concurrent access to NetWare servers and Unix, or other hosts that can talk TCP/IP but not IPX. This product works in a similar way to LAN Manager 2.1's NetWare Connectivity; the difference is that LAN Workplace for DOS has to be bought separately from NetWare. One-off it costs £390, which sounds steep if you want to install it on a number of machines. However, a 10-user licence is available for £1730 and a 100-user licence for £11,280.

Whereas LAN Manager works with adaptors that have Network Device Interface Specification (NDIS) drivers, LAN Workplace for DOS uses Novell's alternative specification called Open Data-link Interface (ODI).

Boards with ODI drivers are not as common as those that come with NDIS drivers, but the expected Novell/Eagle boards are supported as are cards from 3Com and IBM.



Installation is straightforward. The software comes on four 3.5in disks and you simply put the first disk in a drive and type INSTALL. The install program prompts you for the information it needs and proceeds to copy the required files to your hard disk and reconfigure your system files (Config.sys, Autoexec.bat, etc.).

I experienced only two problems. First time, the install program got snippy about the lack of hard disk space (it requires 2.7Mb if you install the full suite). The second time it got through copying over the files before falling over with a very unhelpful error message saying the installation had failed, but giving absolutely no indication why (it transpired that the install program manipulates files in main memory and requires 480K free in order to complete the system reconfiguration).

The reason LAN Workplace for DOS requires so much disk space is that you get more than just the TCP/IP protocol stack and network board drivers. Bundled in the package are a rich collection of TCP/IP utilities including FTP (for file transfer) and a terminal emulator. The main plus point is that you also get two Windows applications that provide the same functions: File Express and Host Director.

### Memory problems

A basic TCP/IP configuration under LAN Workplace for DOS seems straightforward. You first load LSL.COM (the Link Support Layer) followed by the ODI driver for your adaptor card. This is followed by TCP/IP and TELAPI.EXE (which provides a TELNET programming interface). This uses up around 66K of memory compared with 60K for a bare bones installation of IPX and NETX, NetWare's workstation shell. But this minimal configuration supplies you solely with the means to talk to a Unix or other TCP/IP host.

If you want to run IPX and TCP/IP concurrently you will have to add a further 57K to your memory requirement because you will need to load IPXODI, a version of IPX tailored to work with ODI, and NETX. With MS-DOS 5.0 or another memory manager you should be able to load a fair amount of this network software into upper or high memory, so easing the memory

burden. But, at 123K in total, it is still a hefty chunk of software to have resident in your PC at the same time.

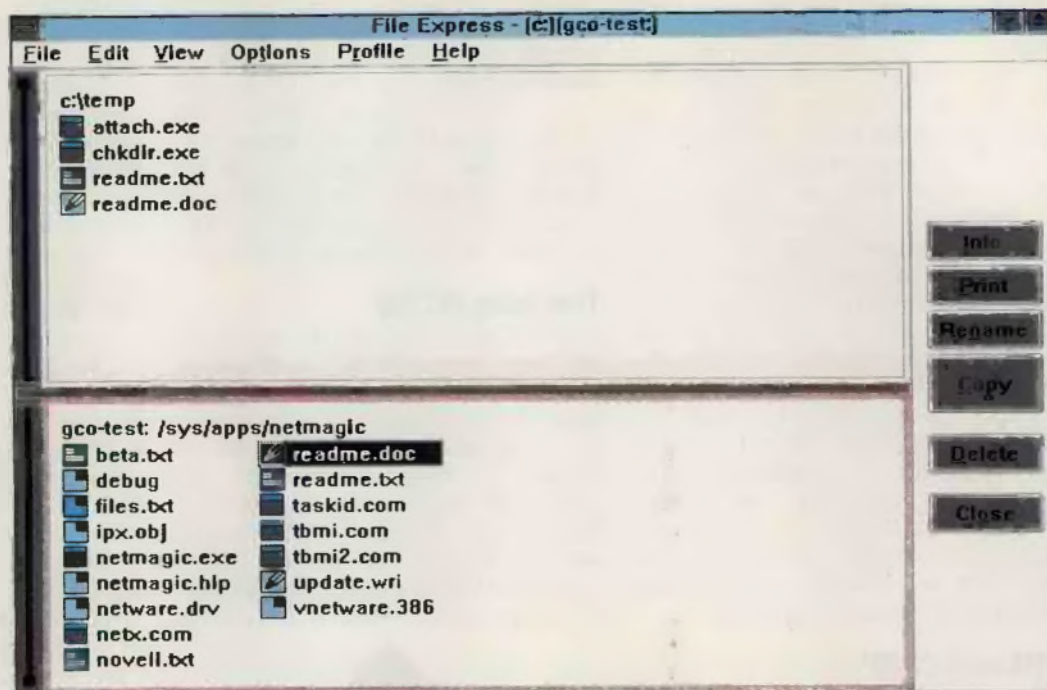
The reason for the burden is that NETX comprises two components: a redirector that traps DOS calls from an application and sends them across the network where appropriate; and SPX which takes the redirected data and chops it up into manageable chunks, putting a sequence number on each chunk. The problem is that SPX is the top half of the IPX/SPX protocol stack and therefore you need to load IPX too.

There may still be circumstances where you need to talk to a remote server across an internet and want to use TCP/IP. One solution is to rely on the IP tunnelling provided by a local NetWare 3.11 server. An alternative is to do the tunnelling from the PC, by loading a DOS version of IPTUNNEL — after loading TCP/IP and before IPXODI. This will add a further 2.4K to your memory overhead.

Novell does not recommend tunnelling as a means of talking to a local server, because the encapsulation process slows down communications. In practice, the performance hit seems quite small. I transferred the entire contents of the PUBLIC directory from a NetWare 3.11 server to my PC. Using TCP/IP and IP tunnelling it took 43 seconds and using just IPX and NETX it took 42 seconds.

There are ways of communicating with a NetWare 3.11 server without using NETX and IPX, although the functionality gained is limited or has other workstation implications. You can install another product on the server called

△ File Express gives Windows a quick way to manipulate files across a network



NetWare NFS, which is a NetWare version of Sun Microsystems' Network File System and includes a FTP (File Transfer Program) server program. On the PC you either use the FTP program that comes with LAN Workplace for DOS, or for real point-and-click copying of files you use the Windows-based File Express (see above). NetWare NFS also allows you to print via a NetWare print queue from a PC using the RPR utility in LAN Workplace for DOS.

To go the whole hog and map logical drive letters to NetWare directories you will additionally need PC NFS running on the PC. This does not come with the LAN Workplace for DOS package and has to be bought from a third-party.

### In an ideal world...

This, of course, is something of a kludge. In an ideal world, Novell would wake up to the fact that a lot of people want to cut through the protocol proliferation by running just one protocol across their networks, and currently TCP/IP seems to be the leading candidate. The ways of doing this at the moment involve additional cost and a memory burden on the PC workstation.

All of a sudden, LAN Manager has become an attractive proposition with TCP/IP shipped in the LAN Manager 2.1 box ready to use as an alternative transport protocol.

Ralph Bancroft can be contacted on 071 895 9765 or on CIX as ralphb and Telecom Gold as JNL522.



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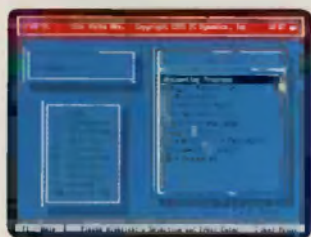


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## Start your apps on the right footing

After reading Phil Rotsky's article on changing the default directory in Word for Windows ('Readers' Tips', November), I would like to show a trick that I use for all Windows applications which insist on using the startup directory as their default.

Provided that Word is in the DOS search path, you can change the application's 'Properties', within Program Manager's File menu, to:

`C:\PERSONAL\DATA\WINWORD.EXE`  
The directory DATA need not contain WINWORD.EXE. Windows will complain that the specified path is invalid but you can click on 'OK' to continue.

After this, the icon changes to an empty window but Word runs fine and defaults its open/save directory to the one specified.

To get back to the nice Word icon, just return to 'Properties' and choose 'Change Icon'. 'WINWORD.EXE' can be typed in the 'FileName' to get Word's icon back. It works for Excel, Write, Paintbrush and others.

If you cannot fit all paths in your DOS path because of limited environment variable space, you can put the following line into your CONFIG.SYS file:

`SHELL=C:\COMMAND.COM/p/e:512`  
which boosts the space to 512 bytes instead of the default 160.

Henry Chang  
Bioengineering Department  
The Rayne Institute

## DOS rescues a WordStar file

Using WordStar 6.0, you may discover that you can't save a file because your CONFIG.SYS does not contain 'FILES=30'. WordStar will explain the problem, but not how to avoid losing the work you have on screen.

All is not lost, however. Type ^KF, which puts you temporarily in DOS — normally so that you can run a DOS command. Then return to WordStar. This appears to free up some file han-

dles, allowing the document to be saved. Guess how I just found this out!

David Leer  
Cheshire

## Cutting the cost of inkjet cartridges

Inkjet printers are becoming more popular, with several manufacturers now producing reasonably priced models. Inkjet print quality is close to laser quality, and certainly good enough for general purposes.

The only snag is the cost of the ink cartridge. At about £16 for most models, it pushes up the cost per page even higher than that of lasers, in some cases approaching 5p per page. This is because the ink cartridge and precision print head are combined in a single unit and both are replaced.

The ink used is simply a dark water-based ink, similar to that used in Rotring drawing pens, absorbed on a sponge inside the cartridge to stop it running out of the jets. If you inject Rotring ink through the air breather hole on the top of the cartridge, using a syringe with a wide-bore needle, you can cut the cost of refills dramatically.

If you have several old cartridges, you can inject clean water, then inject air (take off the needle and press the syringe against the hole) to flush out the last of the original ink, and then refill with a coloured ink. Now you can produce colour letter-headed paper cheaply as well, or send final demands in red ink if you want to.

Dr John G Wright  
Oxford

*I am normally a bit suspicious of recycling components designed to be used only once. Re-inking ribbons may eventually disintegrate the fabric, endangering a very expensive print head and giving the maker a good excuse to tear up any service contract or warranty.*

*This scheme seems unlikely to do any actual damage, should it fail, with the possible exception of spraying some particularly permanent ink around the place. Wear old clothes and try it out of doors first! Obviously, re-filling solid*

*ink cartridges using this method is doomed from the start.*

Frank Leonhardt

## More tips on using SoftPC

As promised, here are a few more tips for Insignia's SoftPC 1.3 for Mac users.

• **Freeing up memory** Often, if memory is tight, I want to be able to run a minimum SoftPC without altering my Mac setup. To do this, I run the basic SoftPC without the EGA module rather than cutting the memory available to the module.

However, the EGA module and the original SoftPC interpret the 'SoftPC Prefs' file, kept in the System Folder, in different ways. So switching from one to the other, or changing the setup in any way, involves the time-consuming process of resetting all the drives and then rebooting the PC.

To avoid doing this, run the EGA module and set the drives correctly. Make a copy of the Prefs file under another name, say 'EGA Prefs', and keep it outside the System Folder. Do the same with SoftPC, so that you create a file called 'PC Prefs'.

When you want to switch from one version of SoftPC to the other, make a copy of the right preferences file, rename it to 'SoftPC Prefs', and drop it into the System Folder. You can then run your chosen version of SoftPC.

• **EGA video modes** The EGA/AT module does not give perfect EGA emulation: 43-line displays do not appear correctly on the 9in window, but do appear on the 13in window. If you need these EGA modes make sure that your monitor is at least 13in.

While the EGA module is running it creates a temporary file called 'EGAFONTS' in the System Folder. This file is updated whenever the screen mode is changed. If 43-line displays do not look right in the 13in window, or the normal display text appears compressed, the 'EGAFONTS' file has been accidentally locked. Unlock it to restore text displays to normal.

Lloyd Wood  
Peterborough



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## 486 upgrade: where is it AT?

I am thinking about pepping up an old AT-style PC by replacing the motherboard with a 40MHz 486. Boards advertised in your magazine for around £700 look like quite a bargain. How practical is this, and what sort of support can I expect from the motherboard vendors?

I have heard that the BIOS which comes with some motherboards can be less than compatible with IBM's.

Arthur Sponge

A complete 486-based machine with colour SVGA, large hard disk and so on can be bought for between £1500 and £2000, so £700 for a 486 motherboard is not particularly cheap. However, if you have the case, power supply, video and drive sub-systems already it could make sense to buy one.

You first problem may be that the motherboard does not fit in your case, or mounting holes and I/O connectors may be in the wrong place. Of course, size permitting, you can always drill appropriate holes in your case, but you might still have problems with expansion-card siting.

There is some standardisation of motherboard dimensions, especially among the Far Eastern clone makers who supply components to Western back-street 'manufacturers'. You are more likely to have size problems if your old machine was from a large manufacturer.

I'd be inclined to order a board and a new case from the same supplier at the same time. Cases are normally imported with a PSU (with mains switch) already fitted and the extra cost could save a lot of hassle.

Once you have the new motherboard in, there should be few problems plugging in everything else from your old machine and getting the system running. You may experience some conflicts with disk controllers and serial/parallel ports if the new motherboard has them built in — this would be a good time to remember exactly what you did with the manual supplied with

your multi-function expansion card!

Most board-level dealers tend to have fairly poor technical backup — they assume you know what you want. Generally, if you get a faulty board they will give you a refund with no arguments, and there is normally someone in the company who can help. However, I'd hesitate buying mail-order from the other side of the country.

You are unlikely to find a BIOS with serious compatibility problems, at least not one fitted to a 'standard' motherboard. They vary in facilities offered, like support for different types of hard drive (especially built-in IDE controllers) and security features.

Those types of BIOS which have been hacked for special purposes, such as power management for notebooks or for handling removable hard disks, can be less than 100% compatible.

Finally, I would avoid unusually specified components such as a 40MHz i486. If something isn't going to work it is probably going to be a new-fangled bit. The 33MHz i486s is tried and trusted. A go-faster i486 may be fine in a complete machine, where if it fails you can send the whole thing back and say 'fix it'. But with a component you may find you have an argument on your hands.

Frank Leonhardt

## J-walking in Hayes

Can anyone tell me what the command '&J1' and its numeric variants does? I've just discovered that my modem has this command in its default config but the command itself is not listed in the modem manuals.

Robert at Imagineering

Some modems use the extended &J options for setting up flow control, using the syntax:

```
&J0 Flow control OFF
&J1 XON/XOFF flow control
&J2 RTS flow control
&J3 XON/XOFF flow control ON
      with pass thru to remote
      station
```

Other modems use &J to select the

type of jack used to connect to the telephone line. The auxiliary relay, which connects the A lead to the A1 lead, is normally open on single-line systems and closed on multi-line systems. The options normally take the form:

```
&J0 = Relay never closed.
      Suitable for RJ-11, RJ-
      41s or RJ-45s jacks
&J1 = closed when off hook.
      Suitable for RJ-12 and
      RJ-13.
```

Don't select the &J1 option unless you are sure you know what you are doing. It could cause serious problems if it is selected in error. In any case, check with your modem manual because this is not a standard option and is used for different purposes by different manufacturers.

Geoff Mather,  
Jonathan Hurwitt and Mik Griffin

## Mac-ICL link

Is it possible to connect a Mac to an ICL mini using some VT-100 terminal emulation software? A simple RS232 serial link is available from the mini.

Richard Moore

There is no reason why a Macintosh cannot be used for this purpose. Most comms products support VT-100 emulation modes, including Microphone II, Vicom, Smartcom, Red Ryder, Versaterm Pro and Dynacomm. You might also consider one of the many integrated packages with comms facilities, as these tend to be in the same price range as the comms products alone. There is a Group Test of various comms packages in this issue.

Frank Leonhardt

## LaserJet repairs

Does anybody know a company that fixes faulty LaserJet IIs (cheaply!)?

Mark Sharpe

Hewlett-Packard. The company does a return-to-base service facility so you don't need to pay a fortune on call-out.

Doug Taylor





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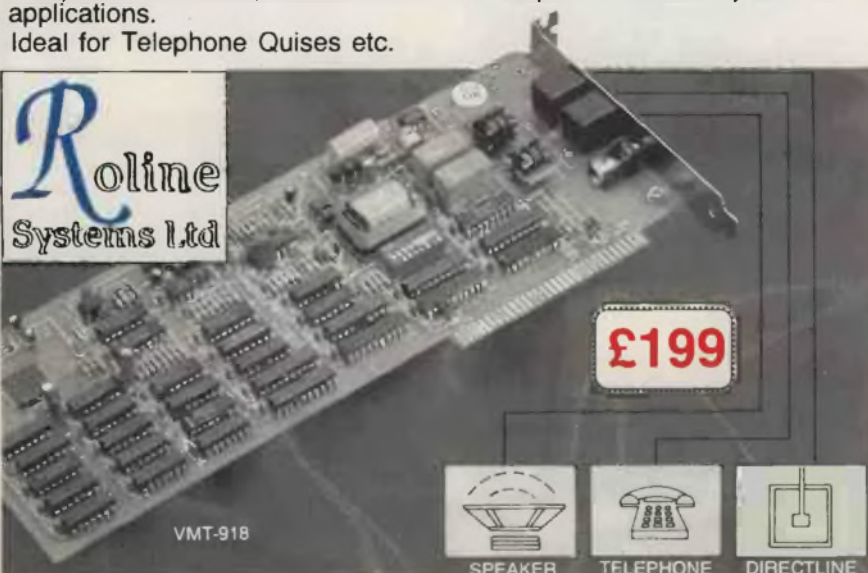
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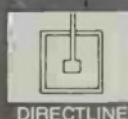
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# NOT ALL ACTS OF VANDALISM ARE THIS EASY TO SPOT



Virus infections and vandalism have a lot in common. The damage can be minor or major, and the perpetrator gains no material advantage from the act.

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**Dr. SOLOMON'S**

**ANTI-  
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Everyone needs the benefits of high speed and processing power simply to take advantage of the latest software developments.

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**T**he Aries brand Notebook PCs from Watford Electronics are, to say the least, inexpensive. Yet they have earned rich praise from the independent, professional reviewers who take performance into account as much as a good price.

Check the specifications for the surprisingly sophisticated features of the range, and see how they will benefit you...

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### Special package offer:

We will include the excellent Canon BJ-10ex Bubblejet Printer with your Aries Notebook for just an extra £180 plus VAT) when you buy from this advertisement. So compact, it gives near laser quality print for a fraction of the cost and is the ideal companion for your notebook.



Choosing your supplier takes guile and wisdom. Start by asking about the company: how long has it been trading...? Some careful questions and an astute assessment can save thousands of pounds and

land you a very good machine. All round this is a superb machine and would still have come out best even if it had cost an extra £300. Certainly this machine deserves Best Buy...  
*Computer Shopper, September 1991*

On the face of it, Watford Electronics NBL 16 is just another notebook computer, albeit one with a decent specification.

... The unusual feature is the price. ... The keys are large enough to use comfortably... ENTER and BACKSPACE are commendably large...

VERDICT - Compact, effective... and a great price. Value for money: ■■■■■  
*PC User, September 1991*



An impressive specification at a sizzling price  
*PC Magazine*

		Price	Price inc. BJ-10e
<b>NB36X20/20</b>	20MHZ & 20MB HD	<b>£975</b>	<b>£1155</b>
<b>NB36X20/40</b>	20MHZ & 40MB HD	<b>£1095</b>	<b>£1275</b>
<b>NB36X20/60</b>	20MHZ & 60MB HD	<b>£1199</b>	<b>£1379</b>
<b>NB36X20/80</b>	20MHZ & 80MB HD	<b>£T.B.A.</b>	<b>£T.B.A.</b>

### NOTEBOOK OPTIONS:

Ram Upgrade Additional 1MB	£89	Car Charger	TBA
Additional 2MB	£149	External 5.2 (1.2MB)	£89
Additional 4MB	£245	Drive Spare Battery Pack	£29
Carry Case	£28	12 months ON-SITE	
Carry Case for Notebook & BJ-10e	£49	Maintenance Warranty	£45



The Canon BJ-10ex weighs just 4.6lbs and is about the size of an A4 sheet of paper. 83cps letter quality. 360 x 360 dpi resolution.



# not premium price.

## ARIES DESKTOP PCs

**F**rom entry-level XT and AT to the top-of-the-range 486, Aries PCs offer exceptional value for money whatever application you have in mind.

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These are standard, popular configurations. We are always willing to quote for special systems pre-configured to your precise instructions.

### XT88

•10 bit NEC V20 processor •10MHz or 4.77MHz clock speed •640KB on board memory •Co-processor socket •360KB 5.25" floppy drive •Real time clock & calendar •6 expansion slots •Parallel printer port •2 serial ports •Games port •Legitimate BIOS •102-key enhanced keyboard  
Options: 3.5" 720KB floppy disk drive £51 •20MB hard disk drive & controller £184 •Hercules mono monitor and adapter £50 •Mono VGA monitor + SVGA card £100 •Colour SuperVGA monitor and SVGA card £200

**£375**

### AT286

As XT88 except for the following:  
•80286 processor •8/12MHz switchable •Landmark speed 16MHz •1MB on board memory expandable to 4MB •Co-processor socket •1.2MB 5.25" floppy drive •Serial port •Parallel printer port  
Options: as XT88 plus •3.5" 1.44MB floppy disk drive £58 •20MB hard disk & controller £110 •40MB hard disk & controller £174

**£465**

Official orders accepted from government and educational establishments. Trade and export enquiries welcomed.



### All Aries PC 386/486 systems include:

•1.2MB 5.25" and 1.44MB 3.5" floppy disk drives •40 MB hard disk drive (1:1 Interleave) •28ms average access time •Combined FDD/HDD controller •8 expansion slots

•Parallel printer port •2 serial ports •Enhanced 102-key keyboard •Legitimate BIOS with built-in set-up routines •Co-processor socket •OS/2 and Xenix optimisation

### 386SX-25

•80386SX-25 processor •25MHz clock speed •16KB Cache expandable to 128KB •Landmark rating 36MHz •1MB on board memory expandable to 32MB

**£799**

### 386DX-33 Cache

•80386DX-33 processor •33MHz clock speed •64KB Cache RAM •Landmark rating 59MHz •2MB on board memory expandable to 16MB

**£1095**

### SYSTEM OPTIONS:

<b>RAM</b>	
• Per 2MB extra	<b>£72</b>
<b>Hard Disk Upgrades</b>	
• 100MB, 18ms	<b>£100</b>
• 200MB, 18ms	<b>£200</b>
• 330MB, 18ms	<b>£700</b>
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• Mono Herc + adapter	<b>£50</b>
• Mono VGA + SVGA 512K adapter	<b>£100</b>
• Colour SVGA + SVGA 512K adapter	<b>£200</b>
• Colour XGA + SVGA 1MB adapter	<b>£300</b>
• Colour XGA-20" + SVGA 1MB adapter	<b>£950</b>

### 486SX-20

•80486SX-20MHz processor •Landmark rating 40MHz •4MB RAM on board expandable to 16MB  
Options available: 128KB Cache, POA

**£1245**

### 486DX-33 Cache

80486DX-33MHz processor •256K Cache RAM •Landmark rating 152MHz •4MB RAM on board expandable to 32MB

**£1499**

### HOW TO ORDER

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Please quote Dept. PCD

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**250 Lower High St.  
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**£7** NO HIDDEN EXTRAS  
+VAT CARRIAGE

### All these extras... at no extra cost!

There are no hidden extra costs - but all our systems come with many unseen extras.

**Extra 1...** Bundles of software. All Aries PCs are supplied with free software - MS-DOS 3.3 MS-DOS 4 or MS-DOS 5. What's more, all desktops come with either Windows 3 and a mouse OR Multiwriter 2, PC Organiser, GEM 3, Logitech Finesse DTP and a mouse.

**Extra 2...** As much support as you need. We want you to get the best from your machine, so we offer a comprehensive support package over the phone. Our experienced and qualified staff can tell you everything you want to know about using your system.

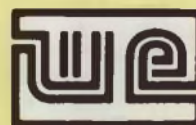
**Extra 3...** Security. The hardware we supply is of the very best quality and backed by a free 12 months parts and maintenance warranty. Every machine is rigorously tested before it leaves us and fully configured so you can get up and running straight away. Our desktop PCs are covered by 12 months on-site service in mainland UK.

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We are able to deliver such price/performance value because, over twenty years, we have grown big enough to enable us to negotiate the best deals from our suppliers and develop the technical excellence to afford to provide an unrivalled support service. The sort of service which keeps our customers coming back to us time and again.

Buying Aries direct from Watford Electronics, you are secure in the knowledge that you are dealing with one of the longest established computer specialists in the UK. We have been in business for 20 years and are reliable.

Our Aries range and the other products we supply are often the first choice of local government, educational and corporate specifiers. Special prices are available to these groups and anyone buying in large quantities.



**Watford Electronics**

A member of the Jessa group of companies.

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VAT: UK customers, please add 17.5% to value of order and carriage.

## Watford Electronics

### YOUR ONE STOP COMPUTER SHOP

Offers and all items are subject to availability. Prices may have to change for reasons beyond our control. Specifications of all products are correct at time of going to press and given in good faith, but may change without notice. Phone for the very latest prices and the quickest delivery options.



# Despite appearances, we offer you very little choice.



At Watford Electronics, we will only offer any product when we are convinced that we can sell it at the best price with the right level of support. It's an approach that our thousands of customers appreciate, for we are now celebrating twenty years in the business. So as you look through all the lists of items that follow and discover how competitive we are, you'll discover just how little choice you have. You simply must call us.

## Aries 14" Mono Monitor

This State of the Art monitor has a chemically etched, non-glare flat screen, IBM, MDA & Hercules graphics compatible, high resolution (720 x 350 lines).

• ArM1000A - High Resolution Amber £68

## Aries 14" VGA Monitor

Monochrome; 14" Flat Screen, Non-Glare, High Resolution paper white, VGA Monitor. Caters for CGA, EGA, VGA. Supplied complete with Swivel base.

• VGA Mono Monitor £85  
Colour Super VGA: The state of the art, flat screen, colour monitor supporting a high resolution of up to 1024 x 768. Complete with Swivel base.  
• Super VGA Colour Monitor £239  
• Super VGA Card (8/16 Bit) £59  
• Super VGA Monitor + Card £279

## Aries Multiscan Monitors

...provides unquestionable picture quality at VGA...it supports VGA in 1024 x 768 in non-interlaced mode."

"The huge bandwidth of the monitor means that it should be able to support display modes not even invented yet, certainly XGA."

"In the not too distant future, monitors with this level of sophistication are going to become commonplace for PC users. But for the moment, the Aries MC3000 is state-of-the-art."

Computer Shopper Nov 1991

## Alphascan Plus

This new 14" colour monitor provides automatic adjustment for horizontal frequencies between 50 and 90 Hz. This, combined with its 0.28mm dot pitch tube and anti-glare treatment, gives sharper text and graphics resolution up to 1024 x 768 on a non-interlaced flicker free display (XGA standard). Operation is made simply by use of the front mounted controls for comfortable and easy setup. Supplied with tilt and swivel base.

Aries Alphascan Plus £325

## Aries MC3000

Watford Electronics' new microprocessor controlled 14" colour monitor brings a new concept in display technology to the PC world. Now you can set up to 8 different optimum screen displays using push-button controls for vertical and horizontal size and position. The monitor will then select your ideal settings when displayed screen resolutions are changed.

Flicker free operation at up to 1280 x 1024 resolution is the norm with its support for 30 to 64KHz horizontal frequency and 50 to 120Hz vertical frequency. Its other features include 0.28mm dot pitch tube, push button controls and removable tilt and swivel base.

Aries MC3000 £395

## Multiscan Colour Monitors

• Eizo 9060S	£380	• Taxan 770LR	£362
• Eizo 9070S	£362	• Taxan 775	£366
• NEC 3FG	£370	• Taxan 795-PC	£402
• NEC 4FG	£465	• Taxan 875	£669
• NEC 5FG	£850	• Taxan Viking II	£1179
• NEC 6FG	£1525	• Taxan 1000 20"	£1215

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Type	Ribbons	Dust Covers
IBM PCs pair	-	£7.75
DMP2000/DMP4000	£3.75	£4.85
RX/FX80/85/800/MX80	£2.95	£4.95
RX/FX100/1000	£3.95	-
Kaga/Taxan KP810/815	£3.25	£5.00
EX/LQ500/550/800/850	£3.50	£6.00
EX/LQ1000/LQ2500	£4.00	£5.50
LX80/86/400/800/850	£3.00	£5.00
NEC P2200	£6.00	£5.00
Panasonic KX1080/81	£2.95	£4.75
Star LC 10	£4.00	£5.00
Star LC24-10	£2.95	£6.00

Our attractive dust covers are manufactured from translucent PVC. The seams are stitched and edges are taped to prevent splitting due to continuous use.

## Canon Bubblejet Printers

Printer	CSF	D'ble	Ink	Cart
BJ10EX	£192	£43	-	£16
BJ300	£340	£88	£85	£12
BJ330	£385	£110	£79	£12

• Spare Battery pack for BJ10 £33

## Citizen Printers

• 120D Plus	£100	• Swift 24E colour	£249
• 124D	£145	• Swift 24X	£299
• PN-48	£209	• Swift 9	£129

• Swift 24 Colour Option £32  
• Swift 24 Ribbons: Black £4 Colour £13

## Star Printers

• LC15	£173	• LC20	£103
• LC24-10	£137	• LC24-15	£275
• LC24-200	£168		
• StarJet-48 360 dpi			£179
• XB24 Colour Kit			£29
• LC24-200 Colour			£207
• XB24-200			£306
• LC200 Colour			£146
• XB24-250 Colour			£359
• ZA-200 Colour			£236

**Cut Sheet Feeder**  
• LC10/24-10/200 £65 • LC15/LC24-15 £125  
• XB24-10 £80 • XB24-15 £139

**Serial Interfaces**  
SPC-10 LC10; LC10-11; LC10-Col;  
LC15; LC24-10; LC24-15; LC-200;  
LC24-200 £49  
8K Ser FR10/15; LC-200; LC24-200;  
XB24 £60

**Buffers**  
• 32K Ram Card for LC/XB24-10; 15 & 200 £55

**Ribbons**  
• LC10; LC10-11; LC15 Black £4 Colour £6  
• LC-200; LC24-200 Black £5 Colour £12  
• XB24-10; XB24-15 Black £5 Colour £12

## Hewlett-Packard Printers

• Desk Jet 500	£275	• Quiet Jet Plus	£384
• Paint Jet Colour	£435	• HP Think Jet	£265
• Paintjet XL	£1089		

• Desk Jet 500 Colour £499

# Now 3 years extended Parts & Labour warranty  
# 3 years on-site warranty £50  
• Paintjet Cartridges Black £19 Colour £25

## Desk Jet 500 Accessories

• DJ Ink Cartridge Black	£14
• DJ 500 256K RAM Cartridge	£129
• DJ Epson FX Emulation Cartridge	£59
• DJ IBM Proprinter Emulation Cartridge	£59
• DJ 500 Wordperfect Cartridge	£89
• Desk Jet Unlimited (Book No VAT)	£19.75

## Laser Printers

All laser printers include 12 months on-site maintenance

• Canon LBP-4 4ppm	£575
• Canon LBP-8 IIR 8ppm	£1445
• Canon LBP IIR 8ppm	£1345
• Epson EPL-4100	£575
• Epson EPL-7100 6ppm	£619
• Epson EPL-7500 Postscript 6ppm	£1165
• HP Laserjet III 8ppm	£1015
• HP Laserjet IIR 8ppm	£1720
• HP Laserjet IIR 4ppm	£689
• HP Laserjet III SI 2M RAM 16ppm	£2615
• Panasonic KX-P4420 8ppm*	£629
• Panasonic KX-P4450i 11ppm*	£945
• Panasonic KX-4455 Postscript 11ppm*	£1455
• Star LP-4PS	£779
• Star LP-4 4ppm	£565
• Star LP-8 II (2 Bin) 8ppm	£1195
• Star LP-8 III 8ppm	£915
• Star LP-8 8ppm Star (post)script	£1149
• HP IIP Wordperfect Font Cartridge	£98

\* 2 years on-site warranty

## Laser Toners

• Canon 2, 3 & 4	£46	• KX-P4420/50	£19
• Epson GQ	£12	• HP II, IIR, III, IIR 48	£48
• Epson EPL7100	£82	• HP IIP, IIR	£42
• Star LP-8	£56	• NEC S60/60P	£75
• Qume Crystal (3) £58		• IBM 4019	£142

## Laser RAM Upgrades

• IIP & III 1MB	£56	• EPL7100 512K	£39
• IIP & III 2MB	£88	• GQ5000 512K	£42
• II & IIR 1MB	£64	• KX4420/50 1M	£75
• II & III 4MB	£99	• P4420/50 2M	£115
• II & III 4MB	£146	• P4420/50 4M	£195
• Star LP8 1M	£139	• Star LP8 2M	£275

• Canon LBP-4+1M £105  
• Canon LBP8-2.2M £125

## Jetpage Postscript Cartridge

• HP IIP/III £239 • IIR & III £240

## Various Add-Ons

• Laserjet Appletalk Interface	£139
• HP Adobe Postscript	£399
• Jetpage Postscript for Laserjet 2	£235
• Jetpage Postscript for HP 2P/3	£229
• Pacific Page Postscript	£259
• HP Premier Font Collection	£28
• Laserjet Various Font Cartridges	£45
• Jetfont Superset for II & IIR	£129
• Jetfont Superset International for IIP & III	£145
• Canon LP88 III Adobe Postscript Interface	£579
• HP IIP Wordperfect Font Cartridge	£98

## NEC Pinwriter Printers

• P20	£176	• P70	£403
• P30	£214	• P90	£545
• P60	£324		

## Panasonic Printers

• KX-P1123	£133	• KX-P1624	£278
• KX-P1124	£177	• KX-P1654#	£385
• KX-P1170	£105	• KX-P1695	£278
• KX-P1180	£96	• KX-P2624	£355

#Price includes 12 months on site warranty

## Panasonic Cut Sheet Feeders

P36-1124/24i	£79
P38-P1624/95; P2624	£129
P37-1123/70/80	£69

## Panasonic Printer Buffers

P124K Buffer Board for KX-P1081	£55
32K Buffer Board for P1123/24/70/80	
P1540/92/95; P1624/54/95	£16

## Panasonic Serial Interfaces

• P19 for P1123/24/24i/70/80/1624/54/95/2624	£54
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## Original Panasonic Ribbons

Guaranteed to last 3 million characters

• P110 for KX-P1081, 1592, 1595 & 1695	£6
• P115 for KX-P1180	£6
• P145 for KX-P1123/24	£6
• P140 for KX-P1540	£6
• P155 for KX-P1624	£8

• Colour Ribbons for KX-P1081, 1592, 1595 & 1695 Brown, Blue or Red £9 each

## Epson Printers

• DFX5000	£1069	• LQ1050+	£459
• DFX 8000	£1949	• LQ1060 Colour	£599
• EX1000 Colour	£428	• LQ1070	£322
• Fx850	£268	• LQ1170	£438
• FX1050	£342	• LQ2550+	£679
• FX1060	£595	• LX400	£104
• LQ200	£155	• LX850	£144
• LQ450	£172	• LX1050	£219
• LQ570	£210	• SQ850	£432
• LQ860 Colour	£449	• SQ2550	£628
• LQ870 Colour	£369		

## Cut Sheet Feeders for

• LX400/800/850/LQ400/500/550	£69
• EX800/FX800/850/LQ800/850	£130
• FX/LQ1000/1050/SQ850	£159
• LQ2550	£176
• SQ2550	£390

## Tractor Feed for

• LQ800	£44	• LQ850/FX850	£69
• LQ1050/FX1050	£85	• LQ2550	£90
• LQ2550	£90		

## Accessories

• EX800/1000 Colour Option	£55
• EX800/1000 Colour Ribbon	£18
• LQ2500 Colour Option	£65

## Epson Printer Interfaces

All these interfaces fit inside the printer

• RS232	£32
• RS232 + 2k Buffer	£52
• IEEE 488	£95
• RS232 + 8k Buffer	£75

## Printer Leads

• IBM Parallel Lead 2 metres	£4
• IBM Parallel Lead 5 metres	£10
• IBM Parallel Lead 10 metres	£15
• Double ended 36 way Centronics lead 4' £7	
• Double ended 36 way Centronics lead 6' £9	
• RS232 lead (various) PDA	
• IBM Keyboard extension	

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**Watford Electronics**  
YOUR ONE STOP COMPUTER SHOP



## Universal Printer Sharers

Connect up to 5 micros to 1 printer or 5 printers to 1 micro with our combined Sharer/Changerswitch boxes.

## Standard Low Cost Sharers

Connects	Serial	Parallel
• 2 to 1	£10	£11
• 3 to 1	£13	£14
• 5 to 1	£16	£17

## Professional Sharer Units

Connects	Serial	Parallel
• 2 to 1	£17	£18
• 3 to 1	£22	£25
• 5 to 1	£34	£38

## Handy Printer Switch

A handy 2 way compact printer switch. Enables one micro to be connected to 2 printers or vice versa.

Centronics £18 Serial £17

## Auto Printer Sharer Switch

Connects	Serial	Parallel
• 2 to 1	£40	£45
• 4 to 1	£62	£59
• 8 to 1		£89

## 256K Multi Spooler

These Auto Centronics Printer Sharers have built-in 256K of Printer Buffers. They can be used as Auto Sharers, Printer Buffers or both.

• 2 in/2 out	£135
• 4 in/2 out	£169
• 8 in/1 out	£199

(Cables for all printer switches are extra @ £5 each. Please specify the type required when ordering.)

## Compact Converter Units

• Serial to Parallel	£36
• Parallel to Serial	£37

## Listing Paper (Perforated)

• 1,000 Sheets 9.5" x 11" Fanfold	£7
• 2,000 Sheets 9.5" x 11" Fanfold	£11
• 1,000 Sheets 9.5" x 11" NCR 2 Part Fanfold	£21
• 1,000 Sheets 15" x 11" Fanfold	£9
• 2,000 Sheets 15" x 11" Fanfold	£16
• 1,000 Sheets true A4 Fanfold Paper 70gms	£11
• 2,000 A4 Fanfold Paper	£19
• Teleprinter Roll (Econo paper)	£4

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached.)

## Printer Labels

(On continuous fanfold backing sheet)

• 1,000 90 x 36mm (Single Row)	£6.00
• 1,000 90 x 36mm (Twin Row)	£6.25
• 1,000 90 x 49mm (Twin Row)	£7.50
• 1,000 102 x 36mm (Twin Row)	£6.75

## Laser Printer Labels on A4 Sheets

• 3750 - 70 x 29mm (3 Rows)	£13.50
• 3000 - 70 x 37mm (3 Rows)	£13.25
• 2625 - 70 x 42mm (3 Rows)	£13.00

## Maths Co-Processors

• 8087-5MHz	£50	• 80387-16	£119
• 8087-8M	£73	• 80387-20	£99
• 8087-10M	£95	• 80387-25	£129
• 80287-6	£45	• 80387-33	£125
• 80287-8	£46	• 80387-40	£169
• 80287-10	£48	• 80387SX-16	£54
• 80287-12	£49	• 80387SX-20	£82

## 3M Diskettes

• 10 x 3.5" D/5ide D/Density 720K	£7
• 10 x 3.5" D/S D/D Formatted 720K	£7
• 10 x 3.5" D/5ide H/Density 1.44	£12
• 10 x 3.5" D/S H/D Formatted 1.44	£13
• 10 x 5.25" D/5ide D/Density 360K	£5
• 10 x 5.25" D/S D/D Formatted 360K	£6
• 10 x 5.25" D/5ide D/Density 1.2M	£8
• 10 x 5.25" D/S D/D Formatted 1.2M	£9

(Lifetime warranty on above Disks)

## BOOKS (No VAT)

Carriage on books varies between £2 to £4.00, depending on their weight

• 1-2-3 Mastering - 2nd Ed	£20.95
• 1-2-3 Quick Ref	£8.45
• 1-2-3 Using - Release 2.2	£25.95
• Accountancy software in Business - Using	£14.95
• Advance C Tech & Application	£19.95
• Aldus Pagemaker	£27.95
• Amstrad 9512 - Using the	£10.95
• Amstrad Basic 2 - User Guide	£9.95
• Amstrad Technical Manual for 1640	£19.95
• Assembly Language Quick Ref	£8.45
• Autocad 4th Ed - Mastering	£31.50
• Autocad - Inside 6th Ed	£32.45
• Autocad - Inside Release 11	£27.95
• Autocad - Mastering Through Rel 11	£28.95
• Business Companion on the 1640	£12.95
• C - Introducing	£12.95
• C - Programming Language 2nd Edition	£26.95
• C - Teach Yourself	£19.95
• Clipper - Using 2nd Ed	£27.95
• Computer Users Dictionary	£9.95
• Coral Draw 2nd Ed - Mastering	£25.50
• Coral Draw made easy	£24.95
• Coral Draw v2 Quick Ref	£8.45
• dBase IV - Handbook	£19.95
• dBase 3/4 Complete Ref	£27.45
• Desk Jet Unlimited	£19.95
• DOS Instant Ref	£9.75
• DOS & BIOS Function - Quick Ref Guide	£7.95
• DOS Power Tools 2nd Ed	£46.45
• Excel for + + + + - Quick Ref	£8.95
• Fax - Management with	£7.95
• Framework III - Mastering	£24.75
• GW BASIC Users Guide & Ref	£12.95
• Hard Disk Instant Ref	£10.95
• IBM PC & PS/2 3rd Ed - Inside the	£21.70
• IBM PC AT - Inside the	£21.70
• IBM PS/2 Handbook	£19.95
• Microsoft GW BASIC	£17.95
• Microsoft Windows - Illustrated	£21.95
• Microsoft WORD 5.0 - Using	£20.45
• MS-DOS Bible 3rd Ed	£24.95
• MS-DOS First Book	£15.50
• MS Windows 3 and Ed - Using	£22.95
• MS-DOS for Beginners	£17.45
• MS-DOS Users Guide 2nd Edition	£17.95
• MS-DOS - ABCs of 2nd Edition	£17.95
• MS-DOS - Running 4th Edition	£19.95
• MS-DOS - Supercharging 2nd Edition	£17.95
• MS-DOS - Tricks and Tips	£16.45
• MS-DOS - Using	£21.95
• MS-DOS 5 - User Handbook	£19.95
• MS-DOS 5 - Upgrading to	£14.95
• MS-DOS 5 - Quick Start	£18.45
• MS-DOS 5 - Using	£29.95
• MS-DOS 5 - Using 2nd Edition	£22.95
• Network User Guide	£23.95
• Networking Personal Computers 3rd Edition	£-
• Norton Utilities - Inside the	£22.95
• Novell Network - Mastering	£27.95
• Novell Network - The ABC of	£21.95
• Novell Network - Using	£27.45
• Pagemaker - Using	£22.95
• PC Crash Course 2.0 2nd Edition	£19.95
• PC Tools - Quick Ref	£8.45
• PC-DOS Using 2nd Edition Ver. 3.3	£20.45
• PC-DOS Using 3rd Ed	£21.95
• PCs and Compatible for Beginners	£17.95
• Programming Guide to EGA & VGA Cards	£25.95
• Quattro - Mastering Pro 3	£21.95
• Quattro Pro Quick Ref	£8.45
• Quattro Pro III - Using	£25.95
• Smart II - Using	£27.45
• Smart, tips, tricks and traps (QUE)	£22.95
• Smartware II - Mastering	£22.95
• Smartware II - Using	£22.95
• Supercalc 5 - Using	£21.45
• Supercalc Professional	£17.95
• Symphony 4th Edition - Mastering	£24.95
• Symphony Made Easy	£16.95
• Symphony - Using Special Ed	£27.45
• Teach Yourself C	£19.95
• Turbo C Bible	£27.95
• Turbo C + + - Using	£22.95
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• Ventura Mastering - 2nd Ed	£22.95
• Ventura - 3rd Edition	£18.95
• Ventura - Instant Reference	£10.95
• Ventura - Tips & Tricks 2nd Ed	£27.95
• Window 3.0 Programming	£27.95
• Window 3.0 Quick Ref	£8.45
• WORD for Windows - Using	£22.95
• WORD for Windows Made Easy	£15.95
• Wordperfect for Beginners	£17.45
• Wordperfect 3rd Ed - Using	£20.45
• Wordperfect 5 - Using	£25.95
• Wordperfect 5.1 Quick Start	£18.45

• Wordperfect 5.1 1st Book of	£15.50
• Wordperfect 5.1 - Mastering	£24.95
• Wordperfect 5.1 - Using Special Ed	£25.95
• Wordperfect Mastering Ver 5	£21.95
• Wordperfect Using Ver 5	£21.95
• Wordperfect - Illustrated	£18.45
• WordStar 6.0 Made Easy	£16.95
• WordStar Release 5.0 - Mastering	£20.45
• WordStar User's Ref. manual	£12.50
• WordStar Using 5.5 & 6 3rd Ed	£25.95
• Xerox Ventura Publishing - Inside	£27.95

## Hard Disk on Cards

3.5" Hard Disk on a controller card. "Simply Plug and Play". For Amstrad 1640 & XT compatibles.

• WD-XT 20MB	£129
• WD-XT 30MB	£149
• WD-XT 40MB#	£159

# Now supplied with ViewMax - the hard disk management program.

## Hard Disk Drives (bare units)

• WEHD20 21 MB Hard Disk	£95
• WEHD30 30MB RLL Hard Disk	£119
• WEHD40/28MS 42MB HD including partitioning software	£179
• WEHD65 65MB HD RLL	£185

## Disk Controller Cards

• WEXT100C XT Hard Disk Controller card and cables	£29
• WEXT200C/RLL XT Hard Disk Controller card and cables	£39
• IDE AT - 2HD/FDC/Parallel/2 Serial Games port for AT	£25
• FDC-Plus PC XT Controller card to interface High/Low Density 3.5" or 5.25" Floppy Drives	£35
• FDC-4 PC XT Controller card to interface up to a 4 High/Low Density 3.5" or 5.25" Floppy Drives	£65
• AT Embedded Drive Adaptor 2 x FDD/HDD only	£15

## Hard Disk Kits

• WEHD20(KIT) 21 MB HD with XT-Amstrad Controller + Cables	£125
• WEHD30(KIT) 32 MB HD with XT-Amstrad Controller and Cables	£179
• WEHD40(KIT) 42 MB HD with XT-Amstrad Controller and Cables	£235

## Floppy Disk Drives

• UC200 5.25" 360K 48tpi Double Sided Disk Drive	£47
• UC600 5.25" 1.2M 96tpi Double Sided High Density, Disk Drive	£57
• UC35/4 3.5" 720K Drive with 5.25" kit	£51
• UC35/6 3.5" 1.44M Drive with 5.25" kit	£59

## Tape Streamers

• WE 5000 - Tape for XT & AT. 60MB external kit with software, short controller, cable and documentation. Backs up 60MB in less than 12 minutes.	£449
• WE 2000 - Low cost internal Tape Streamer. Up to 120MB capacity. Software included	£199
• External Case, PSU & Lead for above	£79

## Add-On Cards

• EGA Card. 256K RAM, compatible with CGA & EGA	£49
• Monochrome Graphics Card (Incl. Parallel printer port)	£19
• CGA Card - RGB Colour and Mono Composite Video (Includes parallel port)	£32
• RS232 Card with 2 ports	£15
• Multi I/O Card includes FDC, Real Time, Clock/Calendar, Serial/Parallel/Games	£25
• Serial/Parallel/Game Card (+ 2nd Serial Optional port)	£9

## Large Capacity Hard Disk Drive

SCSI			
• 91MB	3.5"	20ms	£485
• 180MB	3.5"	20ms	£595
• 330MB	F/H	18ms	£1095
• 670MB	F/H	16ms	£1449

## AT IDE Drives

• 44MB	3.5"	28ms	£125
• 100MB	3.5"	18ms	£225
• 200MB	3.5"	16ms	£370
• 337MB	H/H	16ms	£795

## HD Controller Cards

• SCSI Hard Disk Controller Card	£199
• ESDI Hard Disk Controller Card	£165
• AT IDE Hard Disk Controller	£15

## PC Software

Please specify Disk size required (3.5"/5.25")

• Autoroute Plus v4	£192
• Autoroute Express GB	£47
• Autosketch v3	£64
• Clipper v5	£295
• Coral Draw v2	£230
• D/Base III+	£339
• D/Base IV	£340
• Dataperfect	£233
• Datatalk v4	£82
• Data Ease	£382
• Desk Top for Windows	£57
• Deskpress	£195
• Display Writer v5	£245
• DR DOS v6	£49
• Draw Perfect	£249
• Excel for windows	£10A
• Foxbase	£182
• Grammatik for Wordperfect	£45
• iPhoto for Windows 3	£49
• Laplink Pro	£69
• Lotus 123 v3	£299
• Lotus Freelance	£245
• Lotus Symphony	£360
• Microsoft Basic Compiler	£195
• Microsoft C Compiler v6	£195
• Microsoft DOS v5.0	£49
• Microsoft Excel v2.1	£229
• Microsoft Excel v3	£232
• Microsoft Pascal Compiler	£126
• Microsoft Quick C v2.5	£45
• Microsoft Word v5.5	£230
• Microsoft Works v2	£84
• MS DOS 5 Upgrade	£49
• MS Flight Simulator	£26
• MS Quick Basic v4.5	£45
• MS works for windows	£88
• Norton Anti-Virus	£70
• Norton Backup	£60
• Norton Commander v3	£63
• Norton Desk Top for Windows	£69
• Norton Utilities v6	£44
• Norton Anti-Virus & Utilities	£95
• Norton Utilities & Backup	£96
• Pagemaker v3	£255
• Pagemaker v4	£389
• Paradox 3.5	£349
• PC Tools Deluxe v7.1	£74
• PC Tools v7.1	£70
• Quattro Professional	£189
• QUEEM 386	£37
• Sage Accountant	£169
• Sage Bookkeeper	£55
• Sage Cash Trader	£60
• Sage Job Costing	£112
• Sage Payroll II	£112
• Smartware II system	£398
• Supercalc v5	£79
• Timeworks DTP Publisher 2	£84
• TurboCad v1.8	£90
• Turbo C + + 2nd Ed	£43
• Turbo Pascal for Professional v6	£117
• Turbo Pascal v6	£57
• Ventura Publisher Gold	£467
• Windows v3	£58
• Wordperfect v5.1	£218
• Word for Windows	£252
• Wordstar v6	£209
• XTree Gold	£59



## Scanners

• HP Scanjet+	£719
• Document Feed	£289
• Interface XT/AT	£265
• Interface Mac 2	£266
• Panasonic RS506 Scanner + OCR Software	£589
• XT/AT Interface	£122
• Mac Interface	£195
• Panasonic RS307 Scanner + Software	£805
• XT/AT Interface	£146
• Document feed	£349
• SCSI Interface	£189

## A4 Tech Products

- **AM-5 Plus PC Mouse Package** £15  
High specification 290-1450 dpi resolution mouse with 600mm/s tracking speed, with Image 72 Paint software for EGA & VGA and mouse pad.
- **AG-256 Grey Scale Hand Scanner** £119  
High resolution switch selectable from 100-400 dpi hand held scanner. Selectable scanning of 2, 16 and incredible 256 grey shades with dial adjusted contrast for optimum performance. Supplied with Image 72 and Image 256 paint packages for EGA & VGA. Also supplied with the AG-256 is the incredible OCR Optical Character Recognition software package to convert scanned text images into ASCII text files.
- **AC-4096 Colour Hand Scanner** £215  
As above with 105mm scanning width but with selectable palette for 256 out of 4096 sensed colours. Full software control of colour hue, saturation and value provided with Image 72 mono and Image 256 colour paint packages for EGA & VGA.
- **A4Base II Colour Image Database Software** £39  
Versatile and pictureseque method of storing and retrieving scanned colour images. Combines text and graphics from images on screen. Up to 256 colours images capacity - ideal for slide shows.

## Mains Distribution Socket

- 4 way top quality mains trailing sockets.  
Supplied wired up with mains plug ready for use. Can be screwed to floor or wall if required. Very useful for tidying up all the mains leads from your peripherals. £9.50
- **Aries Spike Cleaner Unit.**  
A 4 way mains distribution unit as above with a built-in Surge Arrester, providing protection for your complete Computer/Hi-Fi Systems. £14.95

## Fax it with Aries Fax-it '89 Card

• 4164-10	£1.55	• 1MB-10 DIL	£4.50
• 4464-10	£3.50	• 1MB ZIP	£4.50
• 41256-10	£1.50	• 256K x 4 ZIP	£4.50
• 4256-8	£2.00		
• 256K x 9-10	£14	• 1MB x 9-10	£36
• 256K x 9-8	£16	• 1MB x 9-8	£39

For 1640, IBM PC & Compatibles. Supplied complete with case, cables & Power Supply Unit. Ready to plug in.

- PCS-3L5 3.5" 720K Drive £75
- PCS-3H5 3.5" 1M44 Drive £85
- PCS-5L2 3.5" 360K Drive £69
- PCS-5H2 3.5" 1M2 Drive £89

N.B. Not all XT compatible micros can accept the high density drives.

The Watford Fax-Line. Enjoy the utility of any phone line by automatically detecting and routing incoming fax to the fax machine, otherwise it routes the call to the telephone after a very brief message. Calls can even be directed to any answering machine. Standard BT connections provide simple plug-in-and-go operation. Fax-Line saves you hundreds of pounds in BT rental. BABT approved. Only £45 (For a live 24 hour demo of Watford Fax-Line, please phone 0923 22 22 21)

APPROVED for connection to telecommunication systems specified in the instructions for use subject to the conditions set out therein.

## P C Spares

- 101 Keys Professional Keyboard for XT/AT £45
- 150W Power Supply (XT size) £42
- 200W Power Supply (AT size) £55
- Main Casing for PC XT £37
- Main Casing for PC AT £44

## TEX Eprom Erasers

EPROMs need careful treatment if they are to survive their expected lifetime. Over erasure of EPROMs very rapidly turns them into ROMs!

The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast.

- **ERASER EB - Standard version** erases up to 16 chips £34 (carr £3)
- **ERASER GT - Deluxe version** erases up to 18 chips. Has automatic safety cut-off to switch off the UV lamp when opened. £36 (carr £3)
- Spare UV tubes £12

## Genius Mouse

- **GM-D220P** New low cost mouse for PS/2 and Notebook PCs. Supplied with Driver software & manual. £15
- **GM-D320** 200-800 dpi. A low cost mouse for XT/AT. Supplied complete with Driver Software and manual. £16
- **GM-6000** 350-1050 dpi. £19
- **GM-F303** 350-1050 dpi X-Y movement, 2-3 button operation. £26
- **GM-F303** 350-1050 dpi as above supplied with PS/2 adaptor and Cas CAD software £33
- **GMW220** State of the art Infra red cordless mouse, ergonomic with a built in charger and 2 rechargeable batteries. £49
- **GM-M330** 30-30,000 dpi another state of the art Optical mouse with Cas CAD 1 software. £59

N.B. Except for GM D220P & GM D320, all other mouse are supplied with mouse mat, mouse holder, DR Halo software, Genius menu maker and operating manuals. Mouse software is supplied on 5.25" disks, software on 3.5" disks, £5 extra.

## Genius Handy Scanner

- **GS-4500** Handy scanner is supplied complete with OCR and Scan edit softwares £79
- **GS-B105G** True 64 Grey level & 256 VGA grey mode. Ideal for 386 system £125

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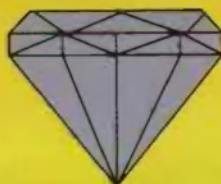
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dot pitch with 1Mb VGA card	ONLY £299

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### NEW 20" High-Resolution Autoscan Colour Monitor

Brilliance 4CM2789 20 inch, 1280 x 1024, 0.31mm dot pitch.  
Supports a wide variety of resolutions for various computers,  
PS/2, PC 386/486 etc, Macintosh II and SPARC workstations.  
It will also support low resolution modes i.e. VGA, SuperVGA,  
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is that Diamond are doing it for only

**£1274 + VAT**

Reviewed by Computer Shopper SEP '91  
"Good performance and quality  
will satisfy bargain hunters."

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2Mb 28ms ST136 M	£158.00	JUMBO Int 40/112Mb	£168
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BRISTOL OFFICE EXPORT

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7595 SX +		£4768 DPX 4600	A0 £5138
7596RX +		£5688 GRX 300AG	A1 £2558
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# IF IT'S OUT THERE IT'S IN HERE

OUT  
NOW

THE PC BUYERS GUIDE FOR BUSINESS FEBRUARY 1992 £1.95

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- ▶ **BUYERS GUIDE ON DISK:**  
Over 400 software packages
- ▶ Windows accounting – Sage  
Sterling vs FCG Winaccs
- ▶ SX on the cheap – Six 386SX  
desktops under £1,000
- ▶ Fax and figures –  
PC-based fax special report
- ▶ Computer Class – Building a  
database application

## TRAILBLAZERS

### Four hot new notebook PCs:

**Exclusive:** Sharp PC-6700-386SL notebook

**Exclusive:** AST Premium Exec 386SX/25C colour

Ti Traveimate 3000 WinSX

Dell 320N+



The UK's most comprehensive buyers tables – over  
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**WIN** one of 30 copies of PC-File – Buttonware's flexible  
flat-file database manager







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- 102 Key Enhanced Keyboard
- Free Technical Support
- AMI BIOS System
- Support for Maths CO-PROCESSOR
- Ample Expansion
- All OMD PC's are constructed with the highest quality components

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H A R D D I S K S	
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QUANTUM 52 MB	£169.00
QUANTUM 105 MB	£269.00
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All monitors and hard disks supplied by OMD are covered by 12 months on site warranty.

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TRIDENT VGA 1MB CARD	£79.00
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- CPU 286
- Speed 16Mhz
- Desktop
- RAM 1Mb
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 256KB
- Floppy Disk: 1.2Mb 5.25"
- Power supply 200W

£299.00

## 386SX/16

- CPU 386SX
- Speed 16Mhz
- Desktop
- RAM 1Mb
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 256KB
- Floppy Disk: 1.2Mb 5.25"
- Power supply 200W

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- CPU 386SX
- Speed 16Mhz
- Minitower
- RAM 1Mb
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 256KB
- Floppy Disk: 1.2Mb 5.25"
- Power supply 200W

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## 386SX/25

- CPU 386SX
- Speed 25Mhz
- Minitower
- RAM 1Mb
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 512KB
- Floppy Disk: 1.2Mb 5.25" 1.44Mb 3.5"
- Power supply 200W

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## 386/25

- CPU 386DX
- Speed 25Mhz
- Minitower
- RAM 2Mb
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 512KB
- Floppy Disk: 1.2Mb 5.25" 1.44Mb 3.5"
- Power supply 220W

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## 386/40

- CPU 386dx
- Speed 40Mhz
- Tower
- RAM 2Mb
- Cache 64KB
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 1Mb
- Floppy Disk: 1.44Mb 3.5"
- Power supply 220W

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## 486SX/20

- CPU 486SX
- Speed 20Mhz
- Tower
- RAM 2Mb
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 1Mb
- Floppy Disk: 1.44Mb 3.5" 1.2Mb 5.25"
- Power supply 220W

£749.00

## 486/33

- CPU 486DX
- Speed 33Mhz
- Big Tower
- RAM 4Mb
- Cache 128KB
- I/O 2x ser, 1x par, 2x FDD, 2x IDE
- Video RAM 1Mb
- Floppy Disk: 1.44Mb 3.5"
- Power supply 220W

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- 60 Mb hard disk
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## COLOUR SCANPLUS

High quality low cost colour scanning is now achievable with the Colour Scanplus supplied with Picture Publisher Plus. Full 300 dpi, 256 true shades of grey and HP Compatibility. With 24 bit Colour processing the Colour Scanplus is Capable of scanning over 16 million colours.

The Colour Scanplus a serious contender when looking for a colour scanner.

**£549**

Includes: Software, User Guides 8 bit Interface Card & Cables

### SCANPLUS 7 DAY MONEY BACK GUARANTEE

Take advantage of our 7 day money back guarantee. You can try our scanner on your computer with your application, and if you are not completely satisfied within seven day, just give us a call and we'll arrange a refund.



## TYPIST

Scan text directly into your software with the aid of Typist, the hand scanner that recognise 500 words-per-minute ! Books



Spreadsheets, magazines, letters all can be placed directly into you word processor, spreadsheet or database - WordPerfect, Lotus 1-2-3, Microsoftword, Word for Windows, Excel, and many more DOS, Windows or Mac software. Supplied with image capture software that support PCX, TIFF and PICT the TYPIST outperforms any other hand held scanner in speed and OCR accuracy.

**£399**

## WORDSCAN OCR

Calera Wordscan has the features that everybody wants but

doesn't want to pay for. Being a windows product Wordscan is easy to install and use. No need to educate as all major fonts and sizes (above 8pt ) are recognised. With features such as scan now recognise later, background processing and user definable dictionary's Calera WordScan is true value for money.

	WordScan	Wordscan Plus
Industry-Leading Recognition	=====	=====
Windows 3.0 Compatibility	=====	=====
286 PC Support	=====	=====
Fax Support	=====	=====
Draft-Quality Doc-Matrix Recognition	=====	=====
Scan Now, Recognise Later	=====	=====
Built-in and User Dictionaries	=====	=====
Pop-Up Verifier for faster Correction	=====	=====
Style Sheets	=====	=====
Multi-Job Processing	=====	=====
Maximum Clipping Zones	1	100
Throughput (average verified words/minute)	200	300
Memory Requirements	2 Mb	2Mb

**WORDSCAN £395**

**WORDSCAN PLUS £595**

## LOGITECH

This quality hand scanner gives amazing results through the 32 true shades of grey it supports. A maximum of 400dpi and comes with 8bit image processing software.

With 256 shades of grey and a maximum resolution of 400dpi the Scanman 256 achieves outstanding results and is supplied with Ansel Image Editing Software,

SCANMAN 32

**£87**

SCANMAN 256

**£159**



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# Honing a Sharp Edge with OMD **SHARP** COLOUR SCANNERS

## JX-100

**A 'HAND HELD' SCANNER THAT THINKS IT'S A FLATBED**

IBM PC AT 286, 386 and 100% compatibles, MAC, AMIGA

200 dpi resolution

100mm x 160mm scanning area

Plugs directly into your 9 pin D serial port

View finder allows perfect positioning

Supplied with Quickscan 100 software for PC's FREE

Supplied with Scanlab for AMIGA £69.00

**£399**



## JX-300

**THE VERSATILE A4 FLATBED COLOUR SCANNER**

IBM PC AT 286, 386 and 100% compatibles, MAC

Full 300 dpi resolution

Use of the new GPIB\* interface

Accurate colour separation - 256 gradations per colour

Supplied with Quickscan 11 FREE

**£999**



## JX-450

**A HIGH RESOLUTION A3 COLOUR SCANNER**

IBM PC AT 286, 386 and 100% compatibles, MAC

300 dpi resolution

GPIB\* interface card connectivity

Scans reflective materials and transparencies with optional mirror unit (CX500T3)

Supplied with Quickscan 11

Software FREE

CX500T £349.00

**£2750**



## JX-600

**AN AFFORDABLE COMMERCIAL QUALITY SCANNER**

IBM PC AT 286, 386 and 100% compatibles

600 dpi resolution

GPIB\* interface card connectivity

Over 16 Million colours reproduced

A3 scanning area

Scans reflective and transparent materials as standard

Precise control over every phase of the scanning process

One pass scanning for efficient use of production time

**£5250**



## JX-730

**A FRICTION FED COLOUR PRINTER THAT BEATS ITS COMPETITION BY 4 INCHES**

Full A3 colour inkjet printer with 48 on demand nozzles using black, magenta, yellow and cyan inks.

A printing resolution of 180 x 180 dpi

Using the TTL (Centronics compatible) interface the end results are second to none.

**£899**



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### INTERFACE CARDS

GPIB Board for PC'S, AT & 100% £325.00 NB-GPIB for Apple Mac £439.00



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# A Panasonic Pedigree from OMD

If you are looking for a pedigree of printers, scanners and computers, OMD and Panasonic are the perfect partnership for you. All our products carry names you'll instantly recognise. Proven brands, designed and engineered with a reliability that can be counted on. At OMD, we're not just direct. You'll find us very straightforward to

## Panasonic

### Notebook Computers



If you want a notebook that is of the highest quality and specification then what you want is a Panasonic. They are by no means the cheapest notebook you can find but when it comes to specification, quality and reliability the

Panasonic range of Notebooks are unbeatable. With OMD's keen pricing structure you may be surprised to learn that you can afford Panasonic. Just take a look.

CF-150E 8088, 8Mhz, 640k RAM, 3.5" 720k drive, CGA	£495
CF-170 8088, 10Mhz, 640k RAM, 3.5" 1.44Mb drive, 20 Mb HD CGA	£785
CF-270 286, 16Mhz, 1Mb RAM, 3.5" 1.44 MD drive, 20Mb HD, VGA	£999
CF-270H6 286, 16Mhz, 1Mb RAM, 3.5" 1.44 MB drive, 60Mb HD VGA	£1355
CF-370 386sx, 20Mhz, 1Mb RAM, 3.5" 1.44 MB drive, 60Mb HD, VGA	£1835

All Panasonic Notebooks weigh around 3.1kg with battery.  
Remember that every Panasonic Notebook is covered by a one year on-site maintenance contract.

### CF-350HD Laptop



True 386 20Mhz Laptop  
2Mb RAM Standard  
3.5" 1.44Mb Drive  
40Mb Hard Disk  
Superb LCD VGA Screen  
Full size Keyboard with  
Numeric Pad  
Full length expansion Slot  
Weights only 8.6kg (with battery)  
12 Months Warranty

**Normal RRP £4195 Our Price £1795**

### Laser Printers

Whatever you want from a laser printer you can be sure that the Panasonic have one available that will suit any budget and application

KX-4420 8ppm, 300dpi 512k Buffer, HP Laserjet compatible	£655
KX-4450i 11ppm, 300dpi, 512k Buffer, Dual Bin Input	£1055
KX-4455 11ppm, 300dpi, Postscript, 2Mb Buffer, Dual Bin Input	£1590

Remember that every Panasonic Laser Printer is covered by a comprehensive two years on-site maintenance contract.

**ORDER TODAY**



### Flatbed Scanners

True Grey Level.  
216 x 356 scanning area  
Detachable cover  
Scan-Do scanning software  
Synergy OCR Software  
TIF, PCX and MSP file formats supported  
Interfaces available for IBM XT/AT, PS/2 and Apple  
12 Months Warranty



FX-RS506 Supports up to 400dpi and 16 Grey Levels	£585
FX-RS307 Supports up to 600 dpi and 256 Grey Levels	£795
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FX-BS182 IBM PS/2 MCA interface for the FX-RS506	£195
FX-IS170 Apple (SCSI) interface for the FX-RS506-307	£195
FX-AF520 30 Page Automatic Document Feeder for the FX-RS506 or FX-RS307	£395
CALERA WordScan Professional OCR Software	£395
CALERAPLUS WordScan/PLUS Professional OCR Software	£595

If you need any assistance in selecting the correct scanner for your requirements then please do not hesitate to call

### Panasonic Dot Matrix Printers

KXP 1081 9pin, 80col, 144cps	£120
KXP 1180 9pin, 80col, 192cps, 2K Buffer	£129
KXP 1124i 24pin 80col, 300cps, 12K Buffer	£230
KXP 1123 24pin, 80col, 192cps, 10K Buffer	£169
KXP 1624 24pin, 132col, 192cps	£330

Free printer cable and box of 11x9.5" 2000 sheet paper.  
Panasonic Printer.



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# Components with Class from OMD

## MONITORS

### SAMSUNG

H3001 ML2611 12" MONO VGA	£89.00
H3002 ML4571 14" MONO VGA	£99.00
H3003 CJK4685 14" COL VGA	£199.00
H3004 CVB4587 14" COL SUPER VGA (0.28)	£329.00
H3005 MP5671 15" A4 PAGE	£549.00
H3006 CSA7571 17" COL MULTISCAN SYNCMASTER'S FLAT SQUARE SCREEN OFFERS ADVANCED COLOUR CAPABILITY AND A SHARP CLEAR DISPLAY.	£749.00



### PHILIPS

H3010 PHILLIPS 78M749 14in FST PAPER WHITE MONO RES 920 X 480 PIXELS PC PS/2 DARK GLASS SCREEN	£95.00
H3011 PHILLIPS 48M7490 VGA STANDARD, LOW RADIATION RES 640 X 480 PIXELS ERGONOMIC DESIGN	£119.00
H3012 PHILLIPS CM8833/11 14" COL	£199.00
H3013 PHILLIPS 14" COL VGA/MCGA RES 850 X 480	£239.00

## DISK DRIVES

<b>INTERNAL</b>	
X1160 3.5" 1.44mb NEC	£49.00
X1161 5.25" 1.2mb NEC	£49.00
X1162 Dual Disk Drive	
A 3.5" and 5.25" drive in one half height slot	
The drive support 360k, 1.2mb and 720k, 1.44mb	
Utilises only one bay and one power supply	£109.00

## LAPTOPS

X1123 AMSTRAD 286LT 5.25" 1.2MB	£99.00
X1151 TOSHIBA, SHARP, PANASONIC 5.25" 1.2MB	£99.00
X1152 ZENITH SUPERSPORT 286 5.25" 1.2MB	£99.00

## GRAPHIC CARDS

OAK 16 BIT 256K RAM	£59.00
TSENG LABS ET4000 16 BIT	
1 MB VGA. INTERLACED/NON INTERLACED	£99.00
Trident 16 BIT SVGA	£79.00

## INTERFACE CARDS

SERIAL CARDS 2PORTS	£15.00
IDE MULTI I/O CONTRDLLR CARD	
2 HD/2FD/2 SERIAL / 2 PARALLEL/1 GAMES	£49.00
MULTI I/O CARD PARALLEL/	
2 SERIAL/GAMES	£29.00
XT/AT GAME CARD	£12.50
PARALLEL CARD	£13.50

## CABLES

A0801 25 pin / 36 pin male	£5.50
A0804 25 pin / 36 pin male	£6.50
A0805 25 pin / 25 pin female	£6.50

## DOUBLE DISK

Your Hidden Second Drive is now unveiled by Double Disk. By using a subtle technique of compressing and de-compressing files "on-the-fly" as and when required DoubleDisk can approximately increase your hard disk storage capacity by upto 50%. When installed Double Disk is a logical drive which acts like a normal DOS drive and can be treated as such by all industry standard software. Compatible with, IBM XT, AT, PS/2 & 100% Compatibles. Most versions of DOS. All industry standard software. Disk utilities such as PCTDOLS and NORTON. **ALL HARD DISKS UPTO A MAXIMUM OF 256MB £99**

## THE BACKPACK FAMILY

The external drives with no internal connections. Plugs directly into your parallel port. All members of the backpack family plugs directly into your parallel port without disturbing the printer. With no cards to install into your PC XT, AT and 100% Compatible, LAPTOP and NOTEBOOK, use of any member of the backpack family is almost immediate on delivery. Regardless of processing power or clock speed of your PC, backpack drives can be shared dedicated or daisy chained. All backpacked drives are DOS ver. 3 and above compatible and comes with 12 months back to base warranty.

<b>HARD DRIVES</b>	
B5040 40mb Hard Drive	£329.00
B5080 80mb Hard Drive	£499.00
B5100 100mb Hard Drive	£549.00
<b>TAPE DRIVES</b>	
B1040 40/60mb	£369.00
B1080 80/120mb	£449.00
<b>FLOPPY DRIVES</b>	
B1231 5.25" 1.2mb FDD	£199.00
B1430 3.5" 1.44mb FDD	£199.00
B2830 3.5" 2.8mb FDD	£225.00

## AUTO PRINTER SHARERS

<b>UPTO 8 COMPUTERS SHARING ONE PRINTER</b>	
X0101 Two input / One output Parallel	£35.00
X0102 Four input / One output Parallel	£59.00
X0103 Eight input / One output Parallel	£69.00
X0111 Two input / One output Serial	£39.00
X0112 Four input / One output Serial	£65.00
X0113 Eight input / One output Serial	£79.00
<b>UPTO 8 COMPUTERS SHARING TWO PRINTERS</b>	
X0150 Three input / Two output Parallel	£89.00
X0151 Four input / Two output Parallel	£99.00
X0152 Six input / Two output Parallel	£139.00
X0153 Eight input / Two output Parallel	£159.00

## MANUAL PRINTER SHARERS

X0001 2 way, 36 pin connectors	£9.00
X0003 4 way, 36 pin connectors	£15.50
X0004 x way, 36 pin connectors	£17.50
X0011 2 way, 25 pin connectors	£8.50
X0013 4 way, 25 pin connectors	£14.50
X0014 x way, 25 pin connectors	£16.50

## LOGITECH MICE

X1999 PILOT MOUSE	£29.00
X1991 MOUSEMAN SERIAL	£49.00
X1992 MOUSEMAN CORDLESS	£79.00
X1993 TRACKMAN TRACKBALL	£59.00
X1994 Trackman Trackball PS/2, BUS	£59.00

## KEYBOARDS

X1000 IBM XT / AT 102 KEY	£39.00
X1001 AMSTRAD 1512 /1640 101 KEY	£63.00

## UNISCREENS

fits all 12 and 14 in screen  
NEW EEC DIRECTIVE LAYS DOWN MINIMUM SAFETY AND HEALTH REQUIREMENT FOR WORK WITH VDU.  
Q WHY USE AN ANTI-GLARE FILTER ON YOUR MONITOR



A By using a filter, troublesome glare and annoying reflections which are the cause of headaches, eyestrain and user fatigue, are removed. By using an anti glare filter which is conductive, the harmful electro-static field and radiation (vlf and elf) are drained to earth, thus protecting the user from eye and skin complaints.  
Conductive anti reflective glass £89.00  
Conductive anti glare micromesh £39.00  
**ORDER TODAY AND GIVE YOUR EYES THE COMFORT.**

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**STURDY CONSTRUCTION**  
**BUILT IN COPPY HOLDER**  
**LARGE SLIDING KEYBOARD SHELF**  
**PAPER FEED SHELF AND CATCH BASKET**  
**REMOVABLE SHELF FOR SHEET FEED PRINTERS**  
**HEAVY DUTY CASTORS**

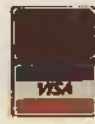


AVAILABLE IN GREY ASH OR BLACK ASH FINISH £99.00  
DELIVERY £10.00

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# Essential Accessories from OMD

## BULK DISKS

HIGH QUALITY, 100% CERTIFIED, LIFETIME WARRANTY, ERROR FREE.

CODE		50	100	200	500
D0010	3.5" DSDD	£22.50	£39.00	£69.00	£150.00
D0211	3.5" DSHD	£35.00	£60.00	£115.00	£250.00
D2120	5.25" DSDD	£15.00	£24.00	£45.00	£99.00
D2121	5.25" DSHD	£26.00	£49.00	£89.00	£199.00

: DISK BOX 100 CAPACITY

ONLY £2.90 WHEN PURCHASING WITH BULK DISKS

DISK CLEANING KITS A1102 3.5 OR A1103 5.25 £2.50



## BRANDED DISKS

SONY, VERBATIM, 3M

	1BDX	5 BOXES	10 BOXES
3.5" DSDD	£9.90	£8.90	£6.90
3.5" DSHD	£16.90	£14.90	£12.90
5.25" DSDD	£6.90	£5.90	£4.90
5.25" DSHD	£11.90	£10.90	£7.90

SONY AVAILABLE IN 3.5"

PRICE PER BOX OF 10 DISKETTES

## LOCKABLE DISK STORAGE SYSTEMS

CODE		
A0023	3.5" 50 CAPACITY	£4.90
A0053	3.5" 100CAPACITY	£5.90
A0123	5.25" 50 CAPACITY	£4.90
A0153	5.25" 100 CAPACITY	£5.90



## STACKABLE DISK STORAGE SYSTEMS

STACKABLE, LOCKABLE, IMPACT RESISTANT

CODE		
A0084	3.5" 150 CAPACITY	£22.50
A0194	5.25" 180 CAPACITY	£22.50

## DESK TOP

CODE		
A0301	DESKTOP COPY HOLDER	£9.00



## LISTING PAPER

CODE		
P0101	112 x 9.5" 60GSM BOX OF 2000	£14.50
P0201	11 x 14.5" 60GSM BOX OF 2000	£22.50

AVAILABLE PLAIN OR MUSIC RULE  
P0301 PERFECT A4 85GSM, BOX OF 1000 £12.50

## PRINTER STANDS

UNIVERSAL

CODE		
A0201		£7.50

SECURELY HOLDS ANY PRINTERS WIDE OR SMALL. MADE OF MOULDED PLASTIC



SPACE SAVER

CODE	DESCRIPTION	
A0203	YUS-25A FOR 80 COL.	£22.50

MADE OF SAFETY PLASTIC. FEEDS AND REFOLDS PAPER UNDERNEATH THE PRINTER. TAKES UP HARDLY MORE SPACE THAN THE PRINTER ITSELF.



WIRE

CODE		
A0202		£10.50

MADE OF SAFETY PLASTIC COATED STEEL WIRE



MOBILE

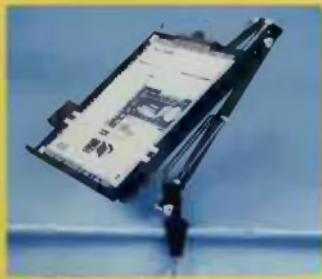
CODE		
A0205	80 COL	£49.00
A0206	132 COL	£59.00

RUGGED STEEL FRAME. WEIGHT ADJUSTABLE BASKET FOR OUTPUT PAPER. SELF ASSEMBLY - INCLUDES CASTORS.



## COPY HOLDER ANGLE POISE

CODE		
A0302	ANGLE POISE COPY HOLDER 80 COL	£14.00
A0303	ANGLE POISE COPY HOLDER 132 COL	£19.00



## MONITOR STAND

CODE		
A0701	MONITOR STAND	£14.50

HOLDS 14" MONITOR

## MOUSE PRODUCTS

CODE		
A0603	MOUSE PADS	£3.90
A0604	MOUSE POCKET	£2.90
A1105	MOUSE CLEANER	£4.90

## KEYBOARD STORAGE DRAWER

CODE		
A0501	KEYBOARD STORAGE DRAWER	£29.00

STORES KEYBOARD UNDER THE CPU OR MONITOR SAFELY OUT OF THE WAY OF DUST AND DIRT.



## LASER PRINTER TONER CARTRIDGES

CANNON / HEWLETT PACKARD / APPLE

REF		
T0000	LASER JET MARK1	£55.00
T0001	LASER JET MARK11	£55.00
T0002	HP 11 PP	£49.00

ALL OTHER MAKE OF TONER CARTRIDGES AVAILABLE, PLEASE CALL FOR PRICES

## PRINTER RIBBONS

CODE		
R7410	AMSTRAD 8256	£3.90
R4820	AMSTRAD DMP 2000/3000	£2.75
R4260	AMSTRAD DMP 4000	£4.50
R7461	AMSTRAD 9512	£3.40
R2230	CANON PW1080	£4.25
R4880	CITIZEN 1200	£4.25
R2730	EPSON MX80	£2.90
R3200	EPSON MX100	£4.50
R4540	EPSON LX80	£2.90
R4770	EPSON LD 500/800	£3.90
R8440	NEC P2200	£4.50
R2280	PANASONIC KXP 1081	£4.50
R9040	PANASONIC KXP 1124	£4.90
R8610	STAR LC 10	£3.90
R8696	STAR LC10 COLOUR RIG	£7.90
R7610	STAR NL10	£3.90
R8680	STAR LC24-10	£4.50
R8706	STAR LC200 BLACK	£5.50
R8716	StarLC200 COLOUR	£11.00
R8726	STAR LC24/200 COLOUR	£12.50

## INKJET CARTRIDGE

REF		
T0101	HP THINKJET / QUITEJET	£8.50
T0100	HP DESKJET	£13.90
T0102	HP PAINTJET (BLACK)	£21.00
T0103	HP PAINTJET (COLOUR)	£25.00
T0120	CANNON BUBBLEJET BJ 130	£12.75

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## WORD PROCESSING

PC WRITE LITE (2) Beginner's w/p, includes tutorial.  
PC TYPE 4 (4) (HD) Latest version from Buttonware.  
WORD FUGUE (2) Many features, including WordStar commands.  
GALAXY LITE (1) Latest version, improved printing.  
SIMON (1) Excellent pop-up memory resident editor.  
MULTIWORD (1) Memory resident thesaurus.  
THESAUR PLUS (1) (HD) Good pop-up, use with your w/p.  
STYLE CHECKERS (1) Checks the readability of text.  
READABILITY PLUS (1) Ex-commercial writing analysis.  
IMAGEPRINT (2) High quality printing on a dot matrix.  
SIGNSMITH (1) Create letterheads/posters/logos/pics.  
LQ (1) Print enhancer, fonts, print-spools & more.  
FONTASTIC (1) Good font collection & font editor.  
BRADFORD/CITYDESK (1) High quality typesetting/fonts.  
HYPERHELL v4 (3) UK Hypertext system.

## DATABASE MANAGEMENT

PC FILE 5 (3) (HD) Powerful D/Base III compatible.  
FILE EXPRESS v5 (4) New version, powerful but easy to use.  
FREEFILE (1) Easy to learn menu-driven database.  
ZEPHYR (2) (HD) Easy to use, fully relational D/Base.  
WAMPUM v4.2 (1) Fast, fully-relational. Great value!  
SR-INFO (2) Shareware upgrade of VP-Info.  
CLUB (1) UK Club membership program.

## SPREADSHEETS

PC CALC+ v2 (3) Popular spreadsheet from Buttonware  
AS-EASY-AS (1) Famous 123-style spreadsheet.  
PIVOT (1) Prints 123 s/sheets in landscape/portrait.  
TUTOR 1-2-3 (1) Interactive tutorial for 123 beginners.

## INTERACTIVE PROGRAMS

DESK COMMANDO (1) Notepad, calc, calendar, DOS shell  
ALT (1) Editor / calculator / address book / calendar etc.  
GDAY MATE (1) Diary, Calendar, notepad etc.  
FRIDAY (1) (HD) Super pop-up Organizer/diary/notebook.

## PAINTING/DRAWING

FRACTAL GRAPHICS (1). PCX Drawing using Fractals.  
VGA PAINT (1) Excellent VGA graphics/drawing program  
FINGERPAINT (1) Accurate mouse/keyboard paint program  
DESKTOP PAINT (1) (HD) (EGA or Hercules) Superb B/W  
painting.  
DESKTOP PAINT 256 (1) (HD) [640K & Super VGA] Full  
256 Colour.

## DESIGN

PC KEYDRAW (4) Powerful drawing & design package.  
EASYDRAW (1) Technical drawing, flowcharts, diagrams  
DANCAD 3D (5) (HD) 3D wire-frame drawing tool.  
DRAFT CHOICE (1) Accurate, easy to use CAD program.  
CHARTS UNLIMITED (1) Flowcharts/electrical/Gantt etc.  
T SQUARE (4) (HD) Superb affordable CAD package.

## GRAPHICS UTILITIES

GRAPHIC WORKSHOP (2) Converts/scales/dithers: many  
picture formats.  
ICONVERT (1) Converts many formats + screen preview.

## CLIP ART

OFFICE IMAGES (1) State format: PCX/MAC  
DECORATIVE DROP CAP (1) Decorative capitals in PCX and IMG  
COOPER SET (2) 1700 pictures. Choose: PCX/IMG/MAC

## BUSINESS

LEADMASTER (1) (HD) Complete sales office system.  
OPTIMA (1) (HD) very good project management.  
MANAGEMENT TRAINING (1) Thorough training program.  
BUSINESS LETTERS (3) 600+ letters in ASCII format.  
ULTIMATE DIARY (1) (HD) Diary/addresses/appointments.  
FORMGEN (1) Create & fill out customised forms.

## FINANCE

PAGE FINANCE CONTROL (2) (HD) Leading finance  
package.  
FREEWAY PAYROLL (3) Latest version. UK tax/NI rules.  
FREEWAY CASHBOOK (3) Profit & loss/VAT/bank rec... etc.  
FREEWAY LEDGERMASTER (4) Major new integrated system  
ULTIMATE SALES (2) (HD) Integrated sales/invoice/stock.

## DOS UTILITIES

DAZZLE (1) EGA/VGA colour kaleidoscope - AMAZING!  
SPARKS (1) EGA/VGA "fireworks" when keyboard is idle.  
TREEVIEW (1) Highly rated file management utility.  
4DOS (1) Improves on DOS commands & adds 35 more.  
4DOS UTILS (1) including 4EDIT, 4ZIP, 4UNZIP.  
ARCMaster (1) Menu system for archiving/unarchiving.  
PKZIP (1) Fast and efficient archiving program.  
POWERBATCH (1) Powerful extension to batch files.  
MICRO-MACRO-BAT (1) Additional batch file commands.  
QUICK TITLES (1) Rapidly creates title screens.  
POWERMENU (1) (HD) Friendly menus, easier than DOS.  
AUTOMENU (1) (HD) Run programs with single keystrokes.  
MCAFFEE VIRUS TOOLS (2) Anti-virus programs.  
PC PROMPT (1) Mem.res. screen prompt/help screens.  
PC DOS HELP (1) Highly rated DOS tutor/detailed refs.  
FLEXIBAK (1) (HD) UK hard disk back-up program.  
BACK & FORTH (2) (HD) Fantastic task manager.

## PROGRAMMING

WINDOW BOSS (2) C tools for windows/menus/help.  
C TUTOR (2) Excellent tutorial with examples.  
PERSONAL C COMPILER (1) Best Shareware C compiler?  
A86/DB6 (1) Fast Assembler/debugger.  
8086 TUTOR (1) Intro to assembly language programming.  
TURBO PASCAL TUTOR (2) Very good tutorial.

## HOBBIES & INTERESTS

FAMILY TREE (1) Prints charts or book with index.  
BROTHER'S KEEPER (4) Friendly. Prints sideways charts.  
CROSSWORD CREATOR (1) Design your own crosswords.  
SOLVER (1) Crossword, anagram, & word square solver.  
NIGHT SKY (4) UK-Pgm: planets/stars/eclipses/comets.  
WEATHER (1) Use barometer + thermometer + PC to forecast.  
FOOTBALL FORECAST (1) Popular pools/fixed odds system.  
PUNTER'S PAL (1) UK horse-racing analysis program.

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AP05 Library System  
AP06 Golf Companion v1.0  
AP07 Jeeps Bibliography Database Management (3)  
AP08 Lotto Challenger NEW!  
AP09 Market Master (Wicked Stock Market Games)  
AP10 Universal Estimator v2.0 (Self Documented) NEW!

#### Accounting & Business

Freeway Cashbook v4.5 Updated! (3)  
Freeway Ledgermaster Updated! (4)  
AC19 Freeway Payroll v8.6 (3)  
AC21 Page Financial Controller v1.11 (2)  
AC28 Noyes Financial Package (2)  
AC30 Cheque It Out v1.1 (1)  
AC31 Cheque Plus (2)  
AC32 Business Letters (1)  
AC35 Formgen v4.1a  
AC37 EZ-Forms (1)  
AC40 Fast Invoice Writer (1)  
AC42 Investment Ledger v6.0 (1)  
AC45 SISPlus (Sales, Invoicing, Stock) (1)  
AC49 Mr Bill  
AC67 Easy Projects v4.02 (1)  
AC55 Home Finance Manager (1)  
AC59 Ultimate Sales Manager v4.00 (2)  
AC60 Corporate Financial Analyst (2)  
AC61 Salesman v2.1 (1)  
AC62 Video Management SYS v3.5 (2)  
AC64 Cassy (1)  
AC65 Dlite v1.0 (1)  
AC66 Prodev Quote v4.0 (1)  
AC67 Market Finder & Minder (1)  
AC69 Marketeer (2)  
AC70 Case Accounting (2)  
AC71 Automotive Accounts v1.4 (1)  
AC72 Simple Book Keeping (1)  
AC73 Capital Gainz (Stock Market) (2)  
AC74 Easy Quote (1)  
AC75 Cashtracker v6.51 (1)  
AC76 Micro Accounting System v1.2 (1)  
AC77 PC Accounting (1)  
AC78 Stock Market Analysis & Tracking (1)  
AC79 The Stock Trader (3)  
AC80 Turbo Financial Assistant v1.12 (1)  
AC81 Total Investor v2.0 (1)  
AC82 AlphaQUOTE v2.0 - Estimating PGM (1)  
AC83 PC-Chart Stock Market PGM (2)  
AC84 Maintenance & Service Call Tracking System (4)  
AC85 PC Mechanic Maintenance System (1)  
AC86 PC Project Manager (1)  
AC87 PC Sell v1.0 Point of Sale System for Retailers! (1)  
AC88 Personal Client Manager  
AC89 Purchase Order System v3.0 (2)  
AC90 Price Search v2.1 for the Sales Manager (2)

AC91 Surveysoft V3.0 (for surveyors) (1)  
AC92 Telesale Program v4.0 (1)

#### Utilities

UT25 Professional Masterkey v3.20 (1)  
UT50 PKZip & PKMenu v1.04 (1)  
UT20 4 Dos v3.03  
UT18 Automenu v4.7 (1)  
UT16 Powermenu v5.3 (1)  
UT17 Menu Direct Gold v3.0 (2)  
UT19 Hard Disc Menu IV v4.00 (1)  
UT21 Menu Commando II (1)  
UT20 Treeview (1)  
UT36 Powerbatch (1)  
UT39 Turbo Copy v2.01 (1)  
UT38 Executive Director v2.10 (1)  
UT42 Virus Scanner (1)  
UT43 Anti Virus Kit (2)  
UT44 Back & Forth v1.71 (1)  
UT49 Dos Toolbox & Menu v2.27 (2)  
UT50 Dos Help  
UT55 Ultra Utilities v4.00 (1)  
UT59 Flexibak Plus (1)  
UT60 PKWares Utility Package (2) Good deal!  
UT61 400K Disk Formats 360K to 400K (1)  
UT62 800K Disk Formats 800K to 1.2Mb drive (1)  
UT63 Easy Format Package v3.10 (2)  
UT64 EZ-Menu v3.36 (1)  
UT65 Fast Menu Plus v5.1 (2)  
UT66 GMenu v3.0 (1) Good  
UT67 Taskmaster v4.72 Very good (1)  
UT68 Ali v1.24 (1)  
UT69 VMix 386 v2.5 (1)  
UT70 DOS Management (80 PGMS) (2)  
UT71 DOS Directory Manager (100 PGMS) (5)  
UT72 PC System Check (2) Not bad!  
UT73 Overview Too v2.21 (hard disk manager) (1)  
UT74 Flu Shot + (1)  
UT75 Dalabeller (1)  
UT76 Christmas Utility Package (200 PGMS) (12)  
UT77 PC World Utilities (1)  
UT78 Batch Utilities Package (100 PGMS) (4)  
UT79 Easy Access Menu System  
UT80 Shareware Menu System  
UT81 GMenu for Hard Disk  
UT82 Mega Menus UK Author  
UT83 Label Maker Pack (2)  
UT84 Banners - Creates Banners on Computer  
UT85 Roladex of Names & Phone Numbers

#### Database

DB04 Wampum v4.00 (2) UK Version  
DB06 PC File v5.01 (3)  
DB07 Zephyr Foxpro Clone v2.0 (2)  
DB08 Catalyst v3.27 (4) List Manager  
DB09 SR-Info v3.41 (2)  
DB10 File Express v5.00 (4)  
DB11 Softbook  
DB12 Information Please v2.07 (1)  
DB13 Data manager (1) Good!  
DB14 Freebase v1.5 (1)  
DB15 Record Card Database (1)  
DB16 Ed's Database for the Novice User (1)

DB17 Freefile Simple to use Database (1)  
DB18 UK Postcode Database. A must for companies! (1)  
DB19 DBSteel Database (powerful) (3)  
DB20 Database PGM for Churches (1)

#### Wordprocessing

WP08 Galaxy-Lite v1.7 (1)  
WP09 PC Outline  
WP10 PC Write Lite v1.03 (2)  
WP11 PC Type+ v4.0 (4)  
WP12 Black Magic v1.51 (3)  
WP13 Mindreader v2.0 (1)  
WP14 Rubicon Publisher v2.2r (2)  
WP22 Hypershell v4.0 (3)  
WP26 New York Word (1)  
WP29 Jorj Dictionary (1)  
WP31 Thesaur Plus (1)  
WP49 Fantastic (1)  
WP55 European Multi Lingual WP (3)  
WP59 HyperPAD v2.2 (5)  
WP75 Word Fugue v2.00c (2)  
WP77 Bradford (1)  
WP90 WP for Kids (1)  
WP91 CV Master  
WP92 Ianed v2.1 (1) Nice  
WP93 Brown Bags v2.0 (1)  
WP94 Freeword v1.0 (1)  
WP95 Pedit v3.0 (V. Good) (1)  
WP96 QEdit v2.1A (1)  
WP97 Ravitz Editor v1.0 (1)  
WP98 Spellcheck Checker (very powerful) v2.0 (1)  
WP99 The Report Writer v1.10 (Brill) (1)  
WP80 Micro EMacs Package (3) Good  
WP81 VDE v1.6 V. Good  
WP82 Anyword v1.06 (1)  
WP83 Alans WP & Spreadsheet & Text Editor (2)  
WP84 Blackboard text Editor (1)  
WP85 Boxer Text Editing v3.00 (1) Brill!!!  
WP86 Wysiwyg Word Processor Very Good (1)  
WP87 Anyword v1.06  
WP88 PC Hypertext  
WP89 Maxi Read A Writing Analyzer

#### Educational

ED02 PC Tutor (1)  
ED03 Tutor Dos (4)  
ED04 GCSE Physics/Computer Science/  
Mathematics/Chemistry (3)  
ED05 German/Spanish/Italian/Japanese  
& French Tutor (4)  
ED06 IQ Builder (1)  
ED07 World Atlas (1)  
ED08 Kids Graphic Prog. (1)  
ED09 Childrens Ed. Games (4-8 Yr Olds) (2)  
ED10 Computer Tutor (1)  
ED11 Amy's First Primer v2.2 (1) For Kids  
ED12 Spelling Tutor (1)  
ED13 Play 'N' Learn (1)  
ED14 Spanish for Travellers (1)  
ED15 Funnels & Buckets v2.00 (1)  
ED20 Algebra Tutor (2)  
ED21 PC Fast Type v3.01 Typing Tutor (1)  
ED22 Quiz Master (1)

ED23 Trigonometry (1)  
ED24 Tutorial Writer v2.1 (1)  
ED25 Chemical Ed. Game for secondary students (1)  
ED26 Hebrew Tutor (1)  
ED27 Lotus 1-2-3 Tutor (1)  
ED28 Games for the Very Young (18mths - 4 yrs)  
ED29 Good Math Educ. Game (For 3-6 yrs)  
ED30 The Co-ordinator v1.03 Learn How to Type  
ED31 Wicked Educational Hangman Game  
ED32 Letterfall - Learn the Alphabet  
ED33 Numberscope Learn Kids Numbers

#### Programming & Languages

PL06 A86 & D86 (1)  
PL09 C Tutorial (1)  
PL11 Pascal (1)  
PL13 Turbo C Tutor (2)  
PL15 Modula 2 Compiler (3) v2.0  
PL17 Power Basic Support ST (5)  
PL19 Chasm (1)  
PL23 Turbo C14 Tutor (2)  
PL24 Help PC v2.1 (2)  
PL25 The Programmers Productivity Pack v2.5 (2) V. Good  
PL26 Cobol v6.0 (1)  
PL27 Jorj v1.4 (2) Brill  
PL28 Snobol4 Compiler (1)  
PL29 Suprapascal v1.0 (1)  
PL30 Turbo Pascal v3.0 (1)  
PL31 B/Window C/Window (1)  
PL32 CP/M Emulator (1)  
PL33 Ladybug Logo (1)  
PL34 Workbase (1)  
PL35 Basic Programmers Kit (4)  
PL36 Programming Assembler Kit (6)

#### Spreadsheets

SS09 As Easy As v4.0s (1)  
SS13 Qubecalc v3.01 (2)  
SS14 PC-Calc v2.0 (3)  
SS16 Istacalc v3.0 (1)  
SS18 Pivot v2.0 (1)  
SS19 Turbo Calc v9.01 (1)  
SS20 Abite v1.0s (1)  
SS21 Express Calc v4.10 (2)  
SS23 Grab Plus v6.0 (2)  
SS25 Free Calc v2.0 (1)  
SS26 Lotus 123 Utilities (1)  
SS30 Abite v1.10 (1)  
SS32 EZ Spreadsheet v1.1 (1)  
SS33 Proque Lite v1.0 (1) Very powerful  
SS34 VP Spreadsheet Planner (1)  
SS35 Symphony Worksheets 1-9 (2)

#### Graphics & Art

GP03 Dancad 3D v2.00 (2)  
GP04 Optiks (1)  
GP05 T-square (4)  
GP06 VGA Paint (1)  
GP07 Clip Art Pack (6)  
GP08 Droege (2)  
GP09 PC-Key Draw (3)  
GP10 PC Draft (1)

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GP11 Desk Top Paint (2)  
 GP12 Fractal Designer v3.08 (1)  
 GP20 ATK Tool Set v1.02. Brilliant (2)  
 GP21 The Draftsman v1.0 (1)  
 GP22 Acrospin v2 CAD Powerful package (1)  
 GP23 Electronic Circuit CAD PGM 1-3 (1)  
 GP24 Easy Case v1.6 Engineering PGM (1)  
 GP25 BFlag EZ Presentation Graphics Pack 1-3 (1)  
 GP26 PC Draft II (2)  
 GP27 Ocrshare v2.2 V. Good (1)  
 GP28 Northcad 3D v4.2 (1)  
 GP29 VGA Computer Assisted Design v1.6. Nice (2)  
 GP30 Autocad Editor (2)  
 GP31 Autocad Starter Pack (5) Good deal!

## Windows

W123 Icon Manager  
 W124 Metz Windows Utilities  
 W125 Almanac for Windows  
 W129 Winedit v1.1 Test Editor  
 W130 Winpost v3.0b  
 W133 85 Games for Windows  
 W134 Paintshop for Win v2.02  
 W135 Command Post v7.0s  
 W136 Wincheck v2.2a  
 W140 Windows Desktop Demo PGM (1)  
 W141 Windows Christmas Utilities Package (100 PGMS) (8)  
 W142 Windows Modern Collection (75 PGMS) (6)  
 W143 Atlas v1.0 (1)  
 W144 Active Life V1.5 for Business People! Excellent (1)  
 W145 Windows Business Package (15 PGMS) (3)  
 W146 Orion SQL (Database for Windows) (1)  
 W147 Power BBS v1.50 Powerful! (2)  
 W148 Run PKZip from Windows (1)  
 W149 100 Games for Windows (7)  
 W150 Fractint v3.0 for Windows (1)  
 W151 Music Collection for Windows (3)

## Communication

CM10 Odyssey v1.42 (1)  
 CM11 PC Comm+ UK Version (1)  
 CM12 Telix v3.15c (3)  
 CM13 Wildcat BBS System (2)  
 CM15 Fido (1)  
 CM16 PC Ham v5.32 (1)  
 CM17 Auto Sig Comserve v6.3a  
 CM18 GT Power v16.00 (4)  
 CM20 Backmail (1)  
 CM21 BCom121 Updated V. Good (1)  
 CM22 Boyan Comm. (2) Brill!  
 CM23 Com and v2.5 (3) Excellent!  
 CM24 Buzzlink UK v3.4 with Bill Calculator (2)  
 CM25 Easycomm v1.2 for novice (1)  
 CM26 Pibterm v4.0 (6) for the Prof.  
 CM27 QModem SST v4.20 (5)  
 CM28 Telemate v2.11 (3)

## Special Interests (Hobbies)

SI42 Crossword Creator v4.3 (1)  
 SI43 Crossword Solver (1)  
 SI44 Crystal Ball v3.0 (1)  
 SI45 Managing your Food v3.61 (1)  
 SI46 Astrology/Horoscopes (1)  
 SI47 Football Forecaster (1)  
 SI48 Handwriting Analyst (1)  
 SI49 Diet Aid (2)

SI50 Bible (7)  
 SI51 Family Ties v1.15 (1)  
 SI52 HAM Radio (4)  
 SI53 Planoman (1)  
 SI54 Stock Options & Trader (1)  
 SI55 Wedding Organiser (1)  
 SI56 Weight Control (1)  
 SI60 PC Astral Windows v6.0 (1)  
 SI61 Harmless Joke PGM (funny) (1)  
 SI62 Golf Card Maker (1)  
 SI63 Poem Creator (1) 2 PGMS!  
 SI64 The Mystical Tarot Cards (1)  
 SI65 Weather Forecaster (1)  
 SI66 Brothers Keepers v4.5 (3) Entertaining!  
 SI67 Dograce v1.0 Betting on Dog Races (1)  
 SI68 Club Membership UK version (1)  
 SI69 PC Contracts Manager. Good! (2)  
 SI70 Gardeners Assistant v1.0 (1)  
 SI71 Incontext v1.0 (2) Organise your work. Very good  
 SI72 Indexing Library (1)  
 SD173 Simple Cataloguing System (1)  
 SI74 Home Insurance Calc. (1)  
 SI75 Constructive Cost Model for Proj. Planning (1)  
 SI76 Creative Cuisine. Brilliant for Christmas! (1)  
 SI77 Meal Master v6.07 (200 recipes) (1)  
 SI78 Freeware KJV Bible Text & Search PGM (6)

## Desk Top Tools

DT01 Early Bird v1.0e (1)  
 DT02 Personal Calendar v2.1 (1)  
 DT03 PC Deskstream v2.01 (1)  
 DT04 The Ultimate Diary (1)  
 DT05 Alt v1.16s (1)  
 DT06 First Publisher (1)  
 DT07 Demo of Atch's Publishers Powerpak (1)  
 DT08 Flowdraw v2.04 (Flowchart drawing PGM) (1)  
 DT09 Jet Setter DTP (2)  
 DT10 Fonts Package (25 PGMS) on (3) Very good deal!

## Music

MS25 Sequencer Plus (2)  
 MS26 Music Maestro (1)  
 MS27 Melody Master v1.6 (1)

MS28 Musicians Toolbox (1)  
 MS30 Soundblaster v4.0 (1)  
 MS31 Drum Master v1.0 1 Connect your PC into drum machine (1)  
 MS32 Juke Box v1.5 (1)  
 MS33 Trakblaster v2.0 (1)

## Science & Engineering

SE02 Bigcalc (1)  
 SE03 Diff (1)  
 SE04 Aciran (1)  
 SE05 RMS Survey Utilities (1)  
 SE06 PC Model (1)  
 SE07 Kinetics (1)  
 SE09 Geocalc Coordinate Geometry v1.21 (1)  
 SE10 Computer Aided Mathematics PGM v1.02 (1)  
 SE11 Derive v1.59 (1)  
 SE12 Electronics Calculations PGM (1)  
 SE13 Collection of Formulas (1)  
 SE14 Graph (Brilliant) (1)  
 SE15 Scientific Calculator (1)  
 SE16 Maths Package II v3.0 (1)  
 SE17 Multi Statistics Package (2)  
 SE18 PC Setat v2.2 (1)  
 SE19 Science & Engineering Package (60 PGMS) (8)  
 SE20 Vichem. Very good chemistry PGM (1)

## Games

GM02 Arcade Games (4)  
 GM03 Black Jack v2.20d (1)  
 GM04 Ford Simulator II (1)  
 GM05 PC Chess (1)  
 GM06 PC Monopoly UK Version (1)  
 GM07 Dracula in London (1)  
 GM08 Captain Comic v3.00 (1)  
 GM09 Jacaranda Jam Adventure v2.23 (1)  
 GM10 Pharaoh's Tomb (1)  
 GM11 The Soccer Game (1)  
 GM12 PC Golf (1)  
 GM13 Sex Monopoly (1)  
 GM14 Block Out (1)  
 GM15 Joystick Games (1)  
 GM16 Shooting Gallery (1)  
 GM17 Scramble v1.00 (1)  
 GM18 VGA Concentration (1)  
 GM19 Power Chess v4.46 (1)  
 GM20 Goal v1.0 (1)  
 GM21 Kung Fu Louis (3)  
 GM22 Business Strategist (1)  
 GM30 688 Sub Attack (1)  
 GM31 Castle Adventure (1)  
 GM32 Dark Ages Adventure (EGA) v1.0 (1)  
 GM33 Political Scandal (2) Very good  
 GM34 PC Hack v3.6 (1)  
 GM35 Hugo II Whodunnit? (2) Amusing Adv. game  
 GM36 Lam v12.2 Dungeon Adv. game (1)  
 GM37 Moraff's World VGA Brill (1)  
 GM38 Net Hack v3.0f (2) Awesome!  
 GM39 20 Board Games (Christmas pack) (5)  
 GM40 Bass Tour Fishing Game v4.0  
 GM41 Computer Football v2.3 EGA req (1)  
 GM12 Centre Fielder Football Game (1)  
 GM43 Storybook for Kids (1)  
 GM44 Dr Ruths Computer Game of Good Sex (1)  
 GM45 Football Manager v1.0 (1)  
 GM46 PC Tennis (1)  
 GM47 Questmaster v2.1 (make your own adventures!)  
 GM18 11 Shareware Games (3)  
 GM49 "Name That Tune" (1) Good  
 GM50 Dice & Card Games Package (10 games) (4)  
 GM50 Beyond the Titanic Adventure  
 GM51 Duke Nukem  
 GM52 Test your IQ (Funny)  
 GM53 Commander Keen  
 GM54 On Line Gladiatorial (Very Good)  
 GM55 Space Conquest Brill!  
 GM56 Blockbuster Game  
 GM57 BGA Baseball  
 GM58 Casino Games  
 GM59 PC Pontoon v3.2  
 GM60 Set Card Games (3)  
 GM61 High Rollers Dice Game Fun for Kids  
 GM62 30,000 Word Dictionary & Anagram Finder  
 GM63 Connect 4  
 GM64 Jigsaw Puzzle Game

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10 Tapes	£17.00	£30.00
50 Tapes	£75.00	£125.00

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ALT 286/40 Laptop with BJ10e

ALT 386 SX/80+2 Laptop

ACL 386 SX/120+4 Colour Laptop

BJ10e Bubble Jet Option

## NOTEBOOKS

ANB 386 SX/20 Notebook

ANB 386 SX/40 Notebook

## 2000 SERIES DESKTOPS

PC 2086

PC 2386 Mono VGA

PC 2386 Colour VGA

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PC 3286 HD40 3" with Lotus 1-2-3 v2.2

PC 3286 HD40 3" & 5.25" FDD's with Lotus 1-2-3 v2.2

PC 3386 SX HD40 with MS Windows & Mouse

PC 3386 SX HD80 +4 with MS Windows & Mouse

## MONITORS FOR 3000 SERIES

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14" Super VGA Monitor

## 5000 SERIES DESKTOPS

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PC 5086 HD40 with Microsoft Works

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PC 5286 HD40 with Lotus 1-2-3 v2.2

PC 5286 Family Pack with Microsoft Works 2

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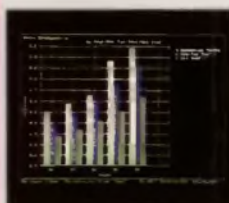
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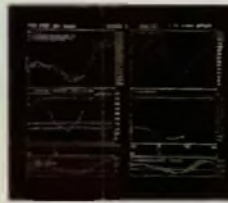
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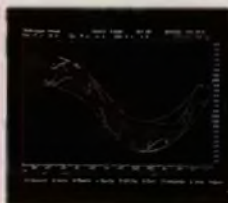
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## SPECIFICATIONS

- 80C86 10MHz PROCESSOR
- BUILT-IN 3½" 1.44Mb DISK DRIVE
- 1Mb RAM
- SOFTWARE - RESIDENT: MS-DOS 3.3 IN ROM
- SOFTWARE - SUPPLIED: GW-BASIC 3.22, MICROSOFT WORKS 2.0
- REAL-TIME BATTERY BACKED CLOCK
- 80 KEYS - EMULATING 101/102 KEY ENHANCED KEYBOARD
- HIGH CONTRAST LCD CGA DISPLAY
- RESOLUTION: 640x200 PIXELS
- SERIAL, PARALLEL & VIDEO PORTS
- LED INDICATORS FOR POWER, FLOPPY DISK & BATTERY LOW
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The easy to read LCD CGA screen measures just 3½" x 7½" and displays crisp, clear characters and sharp graphics at CGA resolution (640x200 pixels). The keyboard has 80 full size, full travel keys with 12 separate function keys, emulating a full-size industry standard keyboard.

Industry standard serial, parallel and external monitor ports, are all included. Power can be supplied from the mains via an auto-sensing, multi-voltage adaptor and charger, or by a Ni-Cad battery pack that snaps flush into the main body case. With its sophisticated power management, the battery lasts for about 3 hours (and takes 4 hours to recharge). The PCL 101 offers automatic audio 'battery low' warnings, to help ensure that you never lose any valuable data.

PHILIPS



## PACKAGE INCLUDES

- MS-DOS 3.3
- GW-Basic 3.22
- Microsoft Works 2.0
- PSU/Battery Charger
- Protective Pouch
- 1 Year On-Site Warranty

# £449

REF: NBC 7101 +VAT = £527.58

# 286 + 386 PC AT NOTEBOOKS

Commodore



- **BUILT-IN VGA DISPLAY**
- **20Mb HARD DRIVE**
- **6 HOUR BATTERY LIFE**
- **1Yr ON-SITE WARRANTY**
- **WINDOWS 3 + MOUSE**
- **TEXTURED CASING**

In stylish grey casing with a non-slip, textured finish and using the very latest technology, Commodore's 286-LT and 386sx-LT Notebooks are available from Silica at incredibly low prices.

Both models have a 20Mb hard disk, 1Mb RAM, expandable to 5Mb RAM using two 2Mb RAM cards, a 3½" 1.44Mb floppy disk drive and industry standard parallel and serial ports to allow connection to a wide range of printers, mice, modems and LAN adaptors.

Bright, backlit LCD screens display VGA graphics at 640x480 resolution, with a port to plug in a colour VGA monitor to show the graphics full potential.

These compact Notebooks weigh just over 5.9 lbs (7 lbs with battery) and measure 12½" x 10" x 2". They can be powered from the mains, via the multi-voltage mains adaptor, or by their own batteries, which can be recharged while in use, or independently in approximately one hour. Commodore's Powersave feature increases battery life to up to 6 hours and, along with optional rechargeable battery packs, gives you continuous PC power on the move!

## SPECIFICATIONS

	286	386
● PROCESSOR	286	386sx
● CLOCK SPEED	12MHz	16MHz
● LANDMARK (MHz)	11.5	21
● 1Mb RAM EXPANDABLE TO 5Mb	•	•
● 2Mb RAM UPGRADE	£299	£299
● 20Mb 23ms HARD DISK DRIVE	•	•
● VGA GRAPHICS - Res: 640x480	•	•
● 3½" 1.44Mb FLOPPY DISK DRIVE	•	•
● PARALLEL, SERIAL & VGA PORTS	•	•
● UP TO 6 HOURS BATTERY LIFE	•	•
● 1 YEAR ON-SITE WARRANTY	•	•
● WINDOWS 3.0 + MOUSE	•	•
● MS-DOS 4.01 + GW-BASIC	•	•
● 80387sx CO-PROCESSOR UPGRADE	•	£279

## 286 WITH 20Mb HDD

# £899

+VAT = £1056.33

40Mb HARD DRIVE VERSION - £1099

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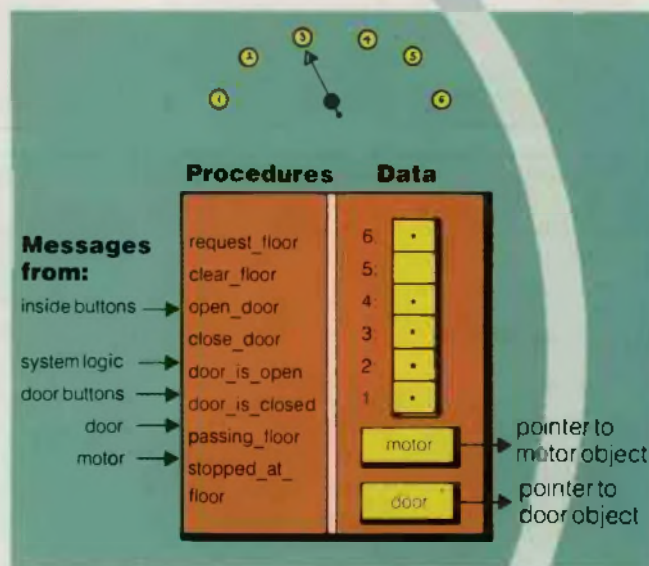


# pc lan



## Lotus notes 24

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## No object 29

Object technology explained. What it can offer the network manager and when.

## Shedding light 41

PC LAN products illuminated. Users join the reviewers and award Lanmarks to the latest PC LAN products.



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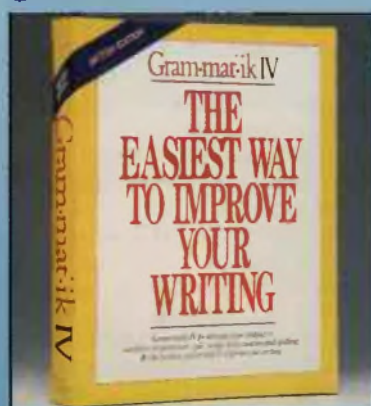
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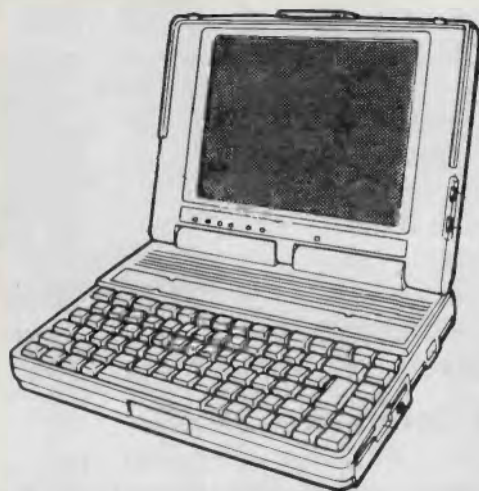
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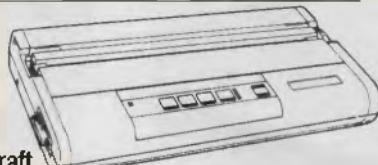
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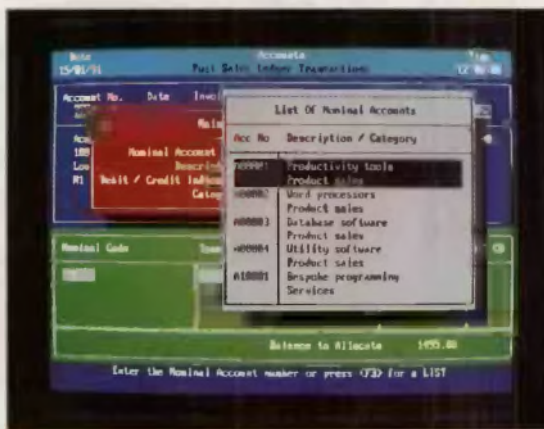
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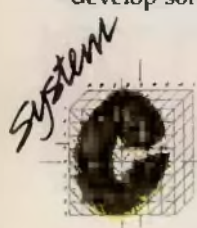
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## 9 PIN PRINTERS



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**FREE! COLOUR KIT**

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- Epson, IBM & NEC P6+ Emulation
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- FREE Silica Printer Starter Kit

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SAVING: £169  
SILICA PRICE: £259

**£259**

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Colour Option Extra - See Accessories

**192 CPS** **80 COLUMN**

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## 24 PIN PRINTER



Colour Option Extra - See Accessories

**192 CPS** **136 COLUMN**

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- 8K Printer Buffer + 4 Fonts
- Parallel Interface
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SILICA PRICE: £349

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## 24 PIN PRINTER

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- 8K Printer Buffer + 2 Fonts
- Parallel Interface
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- Epson and IBM Emulation
- FREE Silica Printer Starter Kit

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SILICA PRICE: £169

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PCYACC Prof	DOS	£435	
Source Print	DOS	£75	
Tree Diagrammer	DOS	£75	



# ADVERTISERS INDEX

A-Mail		Diamond Computer Systems Ltd	403	M	S&S International Ltd	393
AEG Olympia UK Ltd	376	Diamond Computer Systems Ltd	404	Memory Bank	SNMC	381
AEG Olympia UK Ltd	121	Diamond Computer Systems Ltd	405	Memory Bank	Sanyo Manubeni (UK) Ltd	221
AJP Business Computers Ltd	39	Diamond Computer Systems Ltd	406	MD Systems Ltd	Semaphore Systems Ltd	44
AI Downloading Services	235	Digicom	386	MD Systems Ltd	Semaphone Systems Ltd	45
ATI Corporation (UK) plc	4	Digital International Ltd	263	MUN Technical Services Ltd	Sanfil (Europe) Ltd	205
ATI Corporation (UK) plc	4	E		MUN Technical Services Ltd	Signal Technologies Ltd	291
ATI Corporation (UK) plc	5	EQ Consultants	336	Mass Business Systems	Salica Shop Ltd	315
Atterville Computers Ltd	63	ERC Computer Services	235	Matmos Ltd	Salica Shop Ltd	421
Action Computer Supplies	168	Electronics Ltd	323	Maze Technology	Salica Shop Ltd	427
Action Computer Supplies	169	Elite Computer Distribution	320	Mash Computer & Electronics Ltd	Salcon Valley Computer Systems plc	239
Adapt Technology Ltd	35	Elonex	147	Micro Rent	Skyline Systems	386
Applications Systems Design Ltd	36	Elonex	149	Micro System Maintenance Ltd	Software Construction Company Ltd	428
Atom Style Ltd	181	Elonex	150	Microcom Inc	Software Paradise Ltd	74
Azcom Systems Ltd	22	Epson (UK) Ltd	104	Microgram Computer Industries Ltd	Software Paradise Ltd	75
		Epson (UK) Ltd	105	Moretechnics	Sophos Ltd	253
Base Computer Services Ltd	313	Evesham Micro Centre Walltons	302	Minolta (UK)	Suntec Corporation plc	191
Birmingham International Shareware	416	Evesham Micro Centre Walltone	303	Morgan Computer Company	Super Money Savers	340
Birmingham International Shareware	417	F		Morgan Computer Company	Synergy Software	420
Building Blocks	185	First Choice UK	63	Morgan Computer Company	System C Ltd	425
		Frontline Distribution Ltd	111	Moutandere Ltd	System Science (Systematika)	343
C		G		Multiple Computer Systems plc	SpeedModem	301
C.M.O.S.	424	G Com	209	Multiple Computer Systems plc	T	
Cal Abco (UK) Ltd	152	Garbo Systems Ltd	333	Memory Direct	TDK	251
Cal Abco (UK) Ltd	153	Global Microsystems	33	Memory Direct	Technology Research Co Ltd	245
Central Point Software Inc	130	Golestar UK Sales Ltd	109	N	Technomatic Ltd	82
Central Point Software Inc	131	Grimpan Hardware	424	Naga Trading Ltd	Technomatic Ltd	83
Cherry Microschalter GmbH	62	Graymatter	426	Nationwide Computers	Technomatic Ltd	84
Cherry Microschalter GmbH	63	Graymatter	431	Nationwide Computers	Technomatic Ltd	85
Chipboards Ltd	10	H		Ness Computers Ltd	Technomatic Ltd	86
Chipboards Ltd	11	HM Systems	215	Ness Computers Ltd	Technomatic Ltd	87
Chipboards Ltd	12	HQ Computers Ltd	213	Nesland (UK) Ltd	Technomatic Ltd	88
Chipboards Ltd	13	HQ Computers Ltd	95	Nesland (UK) Ltd	Technomatic Ltd	89
Chipboards Ltd	8	Hard Cache	386	Nest Computer UK Ltd	Telesystems Ltd	335
Chipboards Ltd	9	Hayes Microcomputer Products Ltd	225	Nestbase Ltd	Teshware UK Ltd	415
Citizen	155	Hewlett Packard	145	Novatech	Tiko Computer Corporation	278
College Computers	76	Hi Voltage	46	Novatech	Tiko Computer Corporation	279
College Computers	77	Hi Voltage	47	O	Tiko Computer Corporation	280
College Shareware UK	307	Hi Voltage	48	OK Services	Tiko Computer Corporation	281
Comet Data	157	Hi Voltage	49	OPO Computers	Tiko Computer Corporation	282
CompServe Forum	129	Hi Voltage	51	Ocean Office Automation	Tiko Computer Corporation	283
Compuser Center Ltd	64	Hi-Grade Computers Ltd	53	Optimum Technology Ltd	Time Computer Systems Ltd	192
Computer Associates Ltd	159	Hi-Grade Computers Ltd	53	Optimum Technology Ltd	Time Computer Systems Ltd	193
Computer Express Europe Ltd	246	I		Optimum Technology Ltd	Time Computer Systems Ltd	216
Computer Express Europe Ltd	247	IQ Computer Systems	37	Optimum Technology Ltd	Time Computer Systems Ltd	217
Compistand	14	Interlink Communications Ltd	297	Optimum Technology Ltd	Time Computer Systems Ltd	227
Compistand	15	Istein Ltd	40	Overseas Media Distributors	Time Computer Systems Ltd	257
Compistand	26	Istein Ltd	41	Overseas Media Distributors	Time Computer Systems Ltd	264
Compistand	27	Istein Ltd	42	Overseas Media Distributors	Time Computer Systems Ltd	265
Computer Mates Ltd	418	Istein Ltd	43	Overseas Media Distributors	Time Computer Systems Ltd	316
Computers by Post	55	J		Overseas Media Distributors	Time Computer Systems Ltd	317
Computers by Post	67	Javelin Computers	38	P	Time Computer Systems Ltd	57
Computers by Post	68	Jupiter Electronics Ltd	293	P&P Micro Distributors plc	Total Solutions Ltd	93
Computers by Post	69	Just Portables	90	PC World	Triumph-Alder (UK) Ltd	241
Computing Plus	377	Just Portables	91	PC World	Twinkl International Corp	309
Copam Ltd	167	K		Panas Electronics	U	125
Corel	207	K & O Products Ltd	65	Paragon Technology	Ultima Business Systems Ltd	327
		Kaytech Ltd	394	Pegasus Software Ltd	Unimat Computers Ltd	350
D		Kaytech Ltd	395	Polyhedron Software Ltd	Unimat Ltd	336
DNR Electronics	54	Kestech Ltd	377	Portable Computers Ltd	V	
Dako Press	328	Kyocera Electronics (UK) Ltd	OB/C	Power Up	VNU Business Publications bv	407
Dako Press	329	L		Powermark Ltd	VNU Business Publications bv	414
Damson Computing Ltd	82	Lan Research Ltd	66	Powermark Ltd	VNU Business Publications bv	422
Dan Technology	199	Laser Trader	80	Phocus	VNU Business Publications bv	96
Dan Technology	20	Laser Trader	81	Phocus	VP Business Systems Ltd	426
Dan Technology	21	Lexussoft Ltd	117	Quality Computer Services Ltd	Variatic	34
DataTech Systems	245	Leonardo Computer Systems Ltd	385	R	Viglen Computer Supplies	175
DecisionWare Systems	52	Locland Computer Ltd	70	Ribbons Direct Ltd	Viglen Computer Supplies	176
DeL Computer Corporation	1	Locland Computer Ltd	71	Rive Ltd	Viglen Computer Supplies	177
DeL Computer Corporation	435	Locland Computer Ltd	71	Rodenick Manhattan & Associates	Vine Micros Ltd	373
DeL Computer Corporation	436	Logitech SA	233	Roland Digital Group	W	
DeL Computer Corporation	401	Lowndes Exhibition Organisers Ltd	136	Rolme Systems Ltd	Watford Electronics	396
Diamond Computer Systems Ltd	402				Watford Electronics	397
Diamond Computer Systems Ltd					Watford Electronics	368
					Watford Electronics	399
					Watford Electronics	400

# MICROMART ADVERTISERS INDEX

<b>A</b>		<b>E</b>		<b>M</b>		<b>S</b>	
A Plus P Computers	363	Electronics 2100 Ltd	365	Marblewell Ltd	366	SSC Computer Brokers Ltd	344
Adoom	368	Electronics 2100 Ltd	368	Microcosm Limited	357	Semi ICS Ltd	368
Aerial Shareware	355	Escape Technology	366	Micromail	348	Silverwood Electronics Ltd	355
Altek Instruments	344			Microtext	344	Smalltalk Objects	369
				Midland Peripheral Distribution	350	Spitfire (UK) Ltd	354
<b>B</b>		<b>F</b>		Mike Green Consultancy	357	Siratum Technology Ltd	360
B J Print & Graphics	355	Faxback Ltd	359			Swift-Tech	362
Bell & Watson Technology Ltd	344	Formula Business Solutions Ltd	364	<b>O</b>		Symbol Services Ltd	364
British Software Licensing	365			Omicron Systems Ltd	367	System Insight	351
		<b>G</b>				System Science (Systematika)	349
<b>C</b>		Graphic Composition	357	<b>P</b>		System Science (Systematika)	369
Chandi Software	352			PC Microfix Ltd	368		
Oherwell Scientific Ltd	350	<b>I</b>		PC Services	354	<b>T</b>	
Composit Software	349	Ikonworks	369	Pandect Services	359	Talent Computers	369
Computer Music Systems	344			Paradigm Technology	356	Themis (UK)	359
Computrad	352	<b>J</b>		Pathfinder	355		
Copymaster UK Ltd	344	Jacquard Computing Ltd	354	Paul Cook Computer Services Ltd	352	<b>U</b>	
Custom Micro Systems	353			Picture Perfect (UK) Ltd	355	Ultracard Systems Ltd	361
		<b>K</b>		Presenter Systems & Design Ltd	369		
<b>D</b>		Kingsway UK Ltd	369	Product Trade & Services (UK) Ltd	367	<b>V</b>	
Database	355	Kui-Net Systems	369	Professional Computer Services	358	Voltch Computer Systems	344
David Pollard Associates	369						
Discount	368	<b>L</b>		<b>R</b>		<b>W</b>	
		LBL TextScan	356	Rastra Electronics	364	Wight Scientific	358
		Longford Business Services	368	Red Arrow Shareware	367	Worldware Ltd	358



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Topspeed Mod-2 Std	OS2	£110
Topspeed Mod-2 Prof	OS2	£165
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Library source is available with some compilers. Please enquire about other libraries and utilities available.



Last month's issue featured the PCW Awards so this month ChipChat, not wanting to miss out, has decided to announce its own, very special, New Year Awards.

The International Reader Award (runner-up Manuf Haman of Syria — see January's ChipChat) goes to the anonymous Norwegian reader for his perseverance in calling us in sub-zero temperatures from a phone box somewhere in the frozen wastes of Scandinavia for a lengthy and esoteric discussion on disk write pre-compression. They make computer enthusiasts tough in Norway.

The Bizarre Behaviour Award goes to Chris Bakolas, Technical Manager of Dan Technology. If any favourable review of a Dan appears in our pages (and there have been two recently) he is immediately on the phone to complain. OK Chris, we've got the message: only bad reviews from now on.

The Long Face Award goes to Lotus' Jenny Bacon attending our 'real' awards ceremony in London to collect the single Lotus trophy (for Best Groupware). Her neighbouring Microsoft man actually got her to hold his pile of awards while he went up to accept yet another. Final score, Lotus 1, Microsoft 4.

Finally, Trader Systems wins the coveted ChipChat Basketcase Award for its 386SX/20 reviewed in last month's Hardware Group Test. Not only could the machine not run Windows, but the monitor arrived back from the studio (too late to alter the copy) with its box bearing a mark from our photographer: 'MONITOR MADE LOUD BANG AND FIZZED WHEN SWITCHED ON'.

(PS. There are no political pin-ups this month but there is a reward for snaps of any public figures caught in compromising circumstances with computers.)

### Bits & Pieces

All right, we didn't get every single one of the pictures in January's monster Hardware Group Test in exactly the right place, but two out of 45 isn't bad... It won't happen again, honest.

Many readers of December's issue were surprised that we'd secured the services of England's football team manager, Graham Taylor, to write the Framemaker review. So were we. In truth, it was written by Graham Jones. (Sorry Graham, it won't happen again, honest.)

And yes, it was in fact Jon Silver and not Peter Jackson who reviewed Animator Pro in the same issue; but let's face it, their names are similar, aren't they? Sorry Jon, we promise it won't happen again, honest... Oh, never mind.



Unbelievable but true. This 'hold jockey' (who thought of that job title!) is WordPerfect's answer to long telephone support queues. I mean, you don't phone technical support to get technical support, do you? According to WordPerfect, callers waiting for customer support can hear a selection of soft rock, jazz, R&B, advertisements, traffic reports on waiting times, special offers and (what's this?) technical tips! Take ChipChat's advice. Got a problem with WordPerfect? Just switch on the radio, it's a lot cheaper...

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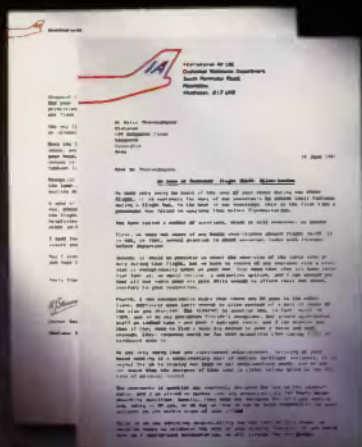
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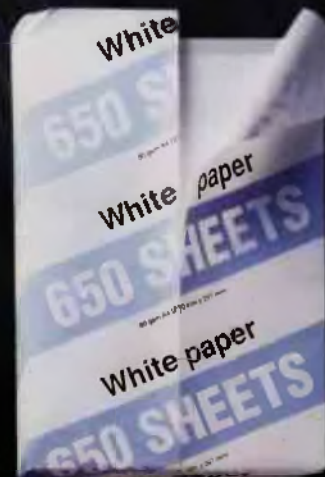
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