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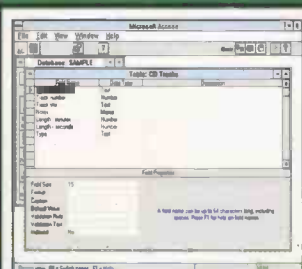
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COVER FEATURE



304

Group Test: Personal Digital Assistants

Catherine Eade and Gordon Laing

The PCW team got itself organised with the eleven top PDAs and other palmtops. Despite their size they pack a punch, and two can even read your handwriting.

Atari Portfolio	305
Casio SF-9300 Digital Diary	306
Casio SF-R20	308
Hewlett Packard HP 95LX	310
Microwriter Agenda	312
Mitac 1600A	314
Olivetti Quaderno	316
Poqet PC	322
Psion Organiser II LZ-64	324
Psion Series 3	326
Sharp PC-3100	330

GRiD PalmPAD	320
Fujitsu PoqetPad	321
Sony DDI-EX Data DiscMan	334
Portable CD-i	336

Cover photography by David Whyte.
IBM PS/2 and Compaq photography by Bruce Mackie.

HARDWARE BENCHTESTS



244

Compaq LTE Lite 4/25c

Compaq's first 486 colour notebook is well worth the wait, with the brand new Intel 486SL chip, a superb TFT screen and an integrated mouse you can actually use. Simon Rockman doesn't want to give it back.

262

Dan for Windows Pro 66MHz 486

If you want to run Windows you'll also need the hardware to cope. Dan has produced just the job, says Chris Cain. It's got a fast disk, a Windows accelerator, a great screen and, of course, that 66MHz chip.

276

IBM PS/2 56 486SLC2

IBM has come out fighting with an avalanche of new and improved PCs. Nick Edmunds looks at this latest tough and surprisingly fast PS/2 and asks, when is a 486 not a 486?



360

Amiga 1200

Personal computing isn't just about PCs. Jeff Walker tests and falls in love with Commodore's new £400 Amiga. With its 32-bit architecture and Advanced Graphics chipset, he thinks this computer will succeed.

Cover Disk Notes 300

This month's cover disk is a double treat. Not only does it contain a special PCW version of the best-selling 'Global Effect' world simulation strategy game, but it also gives you the chance to win a holiday for two on Crete.

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SOFTWARE BENCHTESTS

A Windowful world

The best hardware in the world is useless without applications, but why limit yourself to off-the-shelf packages? David Gristwood and Adrian Lea take a look at eight Windows application development products.

Visual Basic 2.0

Microsoft's latest version of its popular Windows application language was a hit with Mat Beard. Despite having almost no programming experience, he found its power easy to handle.

Digital Chart of the World



World maps combine with PCs and CD-ROMs to produce great graphics. Unreliable and sluggish it may be, but Nick Edmunds still enthuses about this program.

Microsoft Access

Microsoft's own database has finally arrived, filling that gaping hole in its product range. Guy Swarbrick wonders whether it has too many facilities for the first time user.

PC Tools 8.0

Central Point's latest version of its popular utilities program offers even more facilities, plus virus protection, memory optimising and backup. Paul Begg swears by it.

FoxPro 2.5 for Windows

FoxPro 2.0 for DOS steamrolled the opposition in our relational database Group Test in May 1992. Jon Silver, a FoxPro fan, tries out an early Windows version of this super-fast software.

FEATURES

Keeping score

So you can't program but you fancy having a crack at writing a symphony? Martin Tennant conducts us through some of the best computer-based music learning systems.

Copy right

Once upon a time a photocopier was a photocopier, but no more. Christopher Paine looks at the latest digital copier technologies, ranging from colour to image retention.

For Pete's sake

Peter Horn, Apricot's Managing Director, bares all to inquisitive Wendy M Grossman. He's been at Apricot for ten years, working on projects from 8088s to image analysis systems.

Filling a tool bag

Nick Beard looks at the software tools available (from freeware upwards) to help turn those computation-intensive numbers into meaningful graphics.

REGULARS

9 This Month's PCW

135 Newsprint

168 Letters

174 Sounding Off

178 Straight Talking

182 Short Reviews

Count & Add
and Spellbound! 183

Video Logic Rapier 24 184

PenMagic Numero 186

PowerPrint 2.0 188

Dotlink 486 66MHz 193

SummaScribe 194

Series 3 File Manager,
Paint and Convert 195

WinFax 3.0 196

Sound Producer Pro 198

Atari Turbo 20/25 204

CA-Cricket Image 206

Atari ST Cubase Lite 208

Power Letters 212

359 Speaker's Corner

387 Fax Survey

392 Long Term Tests

DataProducts LZR 960 392

CorelDraw! 3.0 393

395 Inside Out

399 Books

402 Screenplay

404 Leisure Lines

Featuring Christmas 1992
Prize Puzzle!

406 Numbers Count

409 Frontiers

413 Innovations

417 1000 Hours

421 Bluesky

425 Hands On

518 Buyer's Charter

519 Ad Index

520 Product Index

522 ChipChat

Personal Computer World

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Pocket-sized PCs have been around since the earliest days of the micro-processor. Then, as now, they ranged from the most simple organisers to pocket-sized versions of full-sized computers. Now, the full-function pocket PCs are rather more advanced than their equivalents from a decade ago and the organisers no longer require a second mortgage. Whether you want an address book with a search facility or the ability to run WordPerfect there's something for you in this month's Group Test. You may even be in time to hint heavily before Christmas.

The future of portable computing almost certainly has little in common with today's pocket PC technology. The 8086 equivalents that provide the processing power in today's products are so far behind the performance level of desktop machines that it's embarrassing. Help is at hand. Intel will be the first to offer a low-power 486 but others are rumoured to be close behind.

Compaq is the first with a computer based around the new Intel 486SL. It is an active matrix colour notebook, a desktop machine that is every bit as good as... a desktop machine.

Clock-doubling is the latest example of Intel's marketing prowess: it's a technique which chip designers have been using for years but only Intel has sought to make it a sales issue. Anyone but Intel would have called a DX2 a 33MHz chip, so how much difference does a 66MHz processor really make? When Dan sent us its 66MHz 486 PC, it also provided an otherwise identical, undoubled 50MHz version. We think you'll be surprised at the results.

When is a 486 not a 486? When it's an IBM 486SLC2. Despite the monicker, the processor at the heart of IBM's latest PS/2 is a 386SX-compatible chip with an on-board cache and a couple of

lesser tweaks. Even so, with the complementary high-speed hardware in our review computer, it turned in a fair set of results. Combine this with IBM's new, enlightened view of pricing and distribution and you may find that you want to buy IBM for more than the badge.

The two most eagerly awaited pieces of software over the last few months have undoubtedly been Access and FoxPro for Windows, Microsoft's two very different solutions to, essentially, the same problem: the Windows database management program. Despite the fact that both applications 'do the same thing', they're as different as chalk and cheese. Neither is perfect but, as you might expect of Microsoft these days, both are pretty good.

The heart of Access is AccessBasic, an extended version of Microsoft's established Visual Basic programming language. FoxPro emerged a clear winner when we reviewed it in our relational databases Group Test in May 1992, the only problem being the lack of a Windows version. Since then, the company has been bought by Microsoft and the Windows version completed, so it should offer the best of both worlds. But it is still the first Windows program from Fox and everyone's first Windows program is a bit of a learning experience. Jon Silver found it an interesting first.

Also new this month is Visual Basic 2.0, the latest stage in the development of the world's most commonly used language. And the full range of options open to developers is the subject of a mini Group Test this month. From xBase to C++, if it's a sensible choice for applications development, we've looked at it.

As well as the regular features, we've also got Long Term Test reports on

Corel Draw! 3.0 and the Dataproducts LZR 960 laser printer, an interview with Peter Horn, MD of the rejuvenated Apricot, a look at the technology behind digital photocopiers and the third part of Nick Beard's fascinating series on visualisation.

If you bought this copy of *PCW* on the newsstand you may have noticed that you got less change. We feel that at our new price of £1.95 we still represent exceptional value for money; our free disks have always been free and while issue sizes have grown we have maintained both the quality of editorial and the rich ratio of articles to advertisements that you have come to expect from Britain's leading title. We've managed to hold the price of subscriptions, so this may be the excuse you need to ensure your price-capped supply for the next year.

This is my 56th issue on *PCW* and my 25th as Editor. It is also my last. I'd like to take this opportunity to thank all the people who've made the last four years so enjoyable. Few people can be so privileged as to work with such a talented and dedicated team or to be involved in producing a product for such an appreciative audience. A Merry Christmas and a Happy and Prosperous New Year to you all.

Guy Swarbrick
Editor

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with EMS LIM 4.0	1MB	£130	Q15
	2MB	£170	Q16
	4MB	£329	Q17

EVEREX

Ram 3000 w/2MB	£169	A27
Ram 3000 w/3MB	£189	A28

AST

Rampage+286 w/2MB	£349	A35
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Kingston

TECHNOLOGY CORPORATION

System Specific Memory

COMPAQ

D'PRO 386/20	4MB Module	£237	Q24
25/E/S	4MB Exp Board	£289	Q26
D'PRO 386/20S	4MB Exp Board	£437	Q30
D'PRO 386/16	8MB Exp Board	£667	Q31
286N & 386N	2MB Module	£119	Q33
386S/20	4MB Module	£200	Q34
D'PRO 486			
386/33	2MB Module	£156	Q39
SYS'PRO 486	32MB Module	£1920	Q41
SLT/286	1MB	£104	Q43
	4MB	£304	Q44
SLT/386	2MB	£156	Q46
	4MB	£245	Q47
LTE/286	4MB	£237	Q50
LTE/386SX	1MB	£111	Q51
PROLINEA	2MB	£126	Q96
3/25S, 3/25ZS	8MB	£460	Q97
CONTURA	4MB	£215	Q98
3/20, 3/25	8MB	£393	Q99

IBM PS/2 & Portables

PS/1	2MB	£111	Q02
M'50Z/50SX	2MB	£119	Q06
35, 40, 57, 70	4MB	£200	Q07
M'50/50Z/50SX/60/70/80			
	2-14MB Adaptor Cd.	£267	Q13
M'70/80	4-16MB Adaptor Cd.	£334	Q14
L40SX, N33	4MB	£222	Q74

TOSHIBA

T2000SX	2MB	£185	Q58
T3100E	2MB	£126	Q65
T5200, T8500	2MB	£126	Q67
T3200	3MB	£208	Q69
T4400SX/SXC	2MB	£148	A65
	4MB	£252	A66
	8MB	£519	A67

Call for prices of memory upgrades for AMSTRAD, AST, DELL, ELONEX, HP, ICL, NEC, OLIVETTI, TANDON, VIGLEN, ZENITH.

Laser Printer Memory

HEWLETT-PACKARD

LaserJet II, IID, IIM	2MB	£89	T01
IIP, III, IIP, & IID	2MB	£141	T02
4MB	£259	T03	
DeskJet Plus & 500			
256K	£51	T06	

EPSON

EPL4100/4000/4300			
8100	512K	£29	T33
	2MB	£89	T34
EPL7500	4MB	£198	T37

STAR, BROTHER and KYOCERA upgrades also in stock.

IBM 4019

2MB	£141	T19
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CANON

LBP4	1MB	£111	T07
& LBP8 II	2MB	£163	T08

PANASONIC

4420 & 4450i	2MB	£156	T22
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OKI

Laser 400, 800 & 820	2MB	£141	T24
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Math CoProcessors

8087-2 8MHz	£89	H02
8087XL	£69	H04
8087SX 16-25	£58	H40
8087DX 16-33	£58	H07
8087SL 16-25	£58	H45
RapidCAD	£229	H46

WEITEK and CYRIX also available.

MONITORS

MONITORS

14" Mono VGA Monitor	£99	F31
14" Colour VGA (640 x 480)	£229	F32
14" Super VGA (1024 x 768)	£279	F33
14" Non-Interlaced Super VGA	£299	F51
17" Non-Interlaced Super VGA	£680	F35
20" Non-Interlaced Super VGA	£1030	F65

NEC Multisync

3FG 15" Monitor Interlaced	£429	F44
4FG 15" Monitor Non-Interlaced	£549	F47

SONY Trinitron

17" Trinitron Monitor	£749	F61
20" Trinitron Monitor	£1499	F62

VGA Upgrades

(Matched Monitor + Card Combinations)

14" Mono VGA	£139	F37
14" Colour VGA (640x480)	£269	F38
14" Super VGA (1024x768)		
-16 colours (512K Card)	£329	F39
-256 colours (1MB Card)	£349	F40
17" Super VGA (1MB Card)	£749	F64
20" Super VGA (1MB Card)	£1099	F63

WYSE TERMINALS

WYSE 30	£229	E24
WYSE 50	£305	E25
WYSE 60	£320	E26
WYSE 120	£299	E28
WYSE 160	£359	E29
WYSE 185	£275	E30
WYSE 285	£309	E32
WYSE 370	£739	E31

ADD-ON CARDS

Serial & Parallel Ports

Parallel Printer Port-LPT1 or 2	£24	E01
Parallel Printer Port - LPT3	£29	E02
Twin Parallel Printer Card	£49	E44
Twin Parallel/Twin Serial Card	£89	E37
Serial Card - COM1,2,3 or 4	£24	E03
Twin Serial Card - COM1,2,3 or 4	£49	E04
Serial/Parallel Card	£49	E08
Mono Graphics Card-Hercules compat.	£49	E09
Twin Serial/Parallel/Game Card	£69	E11

Some of the above prices apply to PC/XT compatible cards only. Please call for prices of PC/AT compatible versions.

Multi I/O + Clock

PC/XT Clock/Calendar Card	£24	E05
"Multi I/O" Serial/Parallel/Game/Clock + Floppy Controller Card	£69	E14
"Multi I/O" with Twin Serial Ports	£79	E15
"Super I/O" - Twin Serial/Parallel/Game & FDD + HDD IDE Controllers	£89	E16

Multi-serial

4 Port XT/AT Multi-Serial Card	£119	E17
8 Port XT/AT Multi-Serial Card	£219	E18

Microchannel PS/2

PS/2 Parallel Printer Card	£89	E42
PS/2 Twin Serial Card	£89	E45
PS/2 Twin Serial + Parallel Card	£119	E43

DISK DRIVES

HARD DRIVES

Seagate

AT-BUS IDE

ST351A 42MB 28ms	£195	S48
ST3120A 106.9MB 15ms	£319	S51
ST3144A 130MB 16ms	£329	S62
ST1239A 210MB 15ms	£499	S56
ST1480A 426MB 14ms	£931	S59

SCSI

ST3283N 248MB 12ms	£529	S63
ST3283N 338MB 16ms	£828	S35
ST4767N 676MB 11.9ms	£1459	S41

MFM

ST251-1 40MB 28ms	£235	S03
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Xenix/Unix Multi-User

4 Port Xenix/Unix Multi-User Card	£179	E21
8 Port Xenix/Unix Multi-User Card	£299	E22
Specialix 4 Port Intelligent I/O Cdr	£419	E39
Specialix 8 Port Intelligent I/O Cdr	£589	E40
Specialix 16 Port Intelligent I/O Cdr	£909	E41

Graphics Cards

Mono Graphics Card-Hercules compat.	£49	F01
Colour Graphics/Pr Card (CGA)	£49	F02
Mono/Colour Graphics Card	£39	F03

VGA Cards

8 bit VGA Card - 256K (640x480)	£59	F06
16 bit VGA Card - 256K (640x480)	£39	F07
- 512K (1024x768, 16 colours, SVGA)	£49	F08
- 1MB (1024x768, 256 colours, SVGA)	£69	F09
Windows Accelerator (1MB) NCR chip	£99	F58
Windows Accelerator (1MB) S3 chip	£195	F60
ORCHID ProDesigner II VGA (1MB)	£129	F12
ORCHID Fahrenheit 1280 W/1MB	£259	F59

Ethernet Cards

8 bit Ethernet Card	£79	G46
16 bit Ethernet Card	£89	G47
3COM 3C503-16 Etherlink II	£129	G38
3COM 3C509 Etherlink III	£129	G49
3COM 3C507 Etherlink 16	£159	G39
Pocket Ethernet Adapter	£179	G48



FLOPPY DRIVES

INTERNAL

TEAC or CANON 5.25"/3.5" Dual	£99	K45
TEAC 5.25" 360K	£75	K27
TEAC 5.25" 1.2MB	£83	K28
TEAC 3.5" 720K	£69	K29
TEAC 3.5" 1.44MB	£74	K30
5.25" Installation Kit for 3.5" FDD's	£15	K31

EXTERNAL

5.25" 1.2MB External FDD w/cables	£119	K33
3.5" 1.44MB External FDD w/cables	£109	K35

HARD CARDS

20MB Western Digital - (65ms)	£179	K46
40MB Western Digital XT/AT - (40ms)	£269	K47
84MB Seagate XT/AT - (24ms)	£419	K48

PRINTERS



Star

LC-15	£209	R16
LC-20	£129	R68
LC-100	£159	R92
LC-200 Colour	£169	R14
LC24-15	£269	R22
LC24-20	£179	R94
LC24-100	£169	R93
LC24-200	£199	R19
LC24-200 Colour	£249	R20
Sj-48	£199	R73
ZA-200	£279	R69
LA-250	£339	R70
XB24-200 Colour	£329	R66
XB24-250	£399	R67
Laser 4	£589	R24
Laser 4 III	£669	R34
Laser 4 Starscript	£849	R25
Laser 8 III	£959	R26
Laser 8 DB	£1279	R71
Laser 8 R	£1449	R72

Epson

LX100	£139	R91
LX400	£119	R01
LX850	£159	R02
LX1050	£229	R57
FX850	£289	R03
FX1050	£349	R04
LQ100	£179	R82
LQ570	£229	R51
LQ860	£459	R60
LQ870	£389	R52
LQ1070	£339	R59
LQ1060	£599	R61
LQ1170	£459	R53
LQ2550	£699	R62
SO870	£429	R84
SO1170	£589	R83
EPL4000	£499	R85
EPL4300	£599	R86
EPL7500 PS	£1189	R12
DPX5000	£1099	R64

Canon

BJ10EX	£189	R74
BJ20	£279	R82
BJ300	£345	R42
BJ330	£399	R43
BJC800	£1419	R83
LBP4 LITE	£519	R85
LBP4 PLUS-1MB	£679	R86
LBP8 III PLUS	£1039	R49
LBP8 III T	£1399	R46
LBP8 III R	£1499	R47

Panasonic

KX-P1170	£129	R75
KX-P1123	£159	R30
KX-P1124i	£199	R31
KX-P1624	£279	R32
KX-P1654	£359	R33
KX-P1695	£299	R29
KX-P2123 col.	£119	R88
KX-P2180 col.	£169	R89
KX-P2624	£299	R78
KX-P4410	£499	R96
KX-P4420	£649	R34
KX-P4430	£639	R90
KX-P4451	£999	R97
KX-P4455	£1529	R77



HEWLETT - PACKARD

HP DeskJet 500.....£289 R36

HP DeskJet 500C.....£36

PC PARAPHERNALIA

MICE

High Resolution Serial Mouse.....£24 N48
GENIUS GM-F302 Serial Mouse.....£39 N05

SCANNERS

Genius GS-4500 Scanner w/OCR SW.....£109 N07
Genius CHINON DS-3000 A4 Scanner.....£419 N10

DIGITISERS

Genius Hisketch 1212 Digitiser Tablet.....£199 N08

MOTHER BOARDS

80286 12MHz.....£39 H16
80286 16MHz.....£49 H17
80386SX 25MHz.....£79 H19
80386SX 33MHz with 64K cache.....£119 H37
80386DX 40MHz with 128K cache.....£159 H38
80486SX 25MHz w/128K cache QD ready.....£215 H39
80486DX 33MHz with 256K cache (ISA).....£439 H41
80486DX 33MHz with Local Bus and
53 Graphics Card.....£599 H53
80486DX 50MHz with 256K cache (ISA).....£619 H42
80486DX2 66MHz with 256K cache (ISA).....£795 H52
80486DX2 66MHz with Local Bus and
53 Graphics Card.....£949 H54
Please call for EISA prices.

PROCESSOR UPGRADES

"SX NOW" 286 to 386SX (25MHz).....£259 T32
"SX NOW" 286 to 386SX (33MHz).....£289 T38
Intel Overdrive SX (16/20MHz).....£339 H49
Intel Overdrive SX (25MHz).....£439 H50
Intel Overdrive DX (25MHz).....£339 H55
Intel Overdrive DX (33MHz).....£459 H56

COMPUTER CASES

Small footprint XT/AT desktop case
with 200W Power Supply.....£69 H27
LAN Workstation case.....£69 H49
Small footprint slimline case.....£79 H43
Mini Tower case w/200W PSU.....£89 H28
Full Size Tower case w/250W PSU.....£119 H29
19" Rack PC Chassis (12 slots).....£695 P34

POWER SUPPLIES

150W standard XT Power Supply.....£44 H30
200W XT size Power Supply.....£59 H31
200W standard AT Power Supply.....£69 H32

UPS

American Power SMART400va.....£319 U01
American Power SMART600va.....£459 U02
American Power SMART900va.....£669 U03
American Power SMART1250va.....£799 U04

DISK CONTROLLERS

XT 2xDC (360K/720K).....£29 L01
XT/AT 2xDC (all 4 formats).....£49 L02
XT/AT FDC for 3rd & 4th floppy drives.....£69 L03
XT/AT 4xDC (all 4 formats).....£79 L04
AT MFM 2xHDC/2xDC (2:1).....£69 L07
AT MFM 2xHDC/2xDC (1:1).....£79 L08
IDE AT-Bus/2xHDC Controller.....£39 L09
Caching IDE Controller w/512K Cache.....£149 L48
AT SCSI HDD/FDD Controller.....£89 L11
AT ES01 2xHDD/2xHDC Ctrl.....£129 L12
Adaptec SCSI HDD/FDD Ctrl w/drivers.....£349 L13

IBM 5250 CONNECTION

AST 5251/11 Plus or 11A Plus.....£375 G16
Full range of 5250 and 3270 emulation cards available.

CD ROM

Sony 5.25" Int. CD ROM Kit.....£339 C81
Sony 5.25" Ext. CD ROM Kit.....£439 C82
Sony Laser Library.....£469 C83
SCSI versions and High Speed HITACHI
CD ROM also available. Please call.

KEYBOARDS

102 Key XT/AT Keyboard.....£59 F22
CHERRY 102 Key Keyboard.....£79 F50

LAB & INDUSTRIAL

PC based Data Acquisition, Measurement, Control and Instrumentation

Free comprehensive catalogue available on request. Please call.

ANALOG/DIGITAL CONVERSION

8 bit AD/DA + Digital I/O + Timer.....£162 P05
12 bit AD/DA.....£99 P06
12 bit AD/DA w/DIO, Timer & DMA.....£329 P07

CPU CARDS

16MHz 286 "all-in-one" with twin Serial,
Parallel, IDE & Floppy Ctrl.....£295 P36
25MHz 386SX with 32K cache.....£219 P39
40MHz 386DX with 256K cache.....£249 P40
33MHz 486DX with 256K cache.....£589 P32
50MHz 486DX with 256K cache.....£699 P41

DOS/WINDOWS

MS-DOS 5.0 or DR-DOS 6.0.....£69 G44
WINDOWS 3.1 - 3.5* format.....£69 G03

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Authorised Dealer

Netware Lite with DR DOS 6.0.....£49 N50
Netware V2.2 5 user.....£429 N51
Netware V2.2 10 user.....£949 N52
Netware V2.2 50 user.....£1909 N53
Netware V2.2 100 user.....£2869 N54
Netware V3.11 5 user.....£519 N55
Netware V3.11 10 user.....£1189 N56
Netware V3.11 20 user.....£1669 N57
Netware V3.11 50 user.....£2249 N58
Netware V3.11 100 user.....£3139 N59
Netware V3.11 250 user.....£5619 N60

Netware Upgrades -
please call for prices.

BAR CODE READERS

Keyboard Emulator Bar Code Reader.....£179 L38
RS-232/422 Bar Code Reader.....£199 L40
Portable Bar Code Reader.....£349 L41
Bar Code Printing Software.....£179 L42

PRINTER SHARING

2 PCs into 1 printer (S or P, Auto).....£39 F53
2 PCs into 2 printers (S or P, Auto).....£149 F55
4 PCs into 2 printers (S or P, Auto).....£199 F56
4 to 1 "daisychain" sharer (S or P).....£139 F57

INTERFACE CONVERTERS

RS-232/RS-422 bi-directional.....£89 N15
RS-232/RS-485.....£99 N16
RS-232/20MA Current Loop.....£69 N17

PC BASED DEVICE PROGRAMMERS

16K-512K EPROM Programmer.....£99 N20
16K-1024K E(P)ROM Prog.....£169 N22
4-Gang version.....£199 N23
8-Gang version.....£299 N24
Universal Device Programmer for E(P)ROM,
BPROM, PAL, FPL, GAL, S-GAL, PEEL, EPD,
8748 & 8751 Series Devices.....£499 N28

IEEE-488

Elite IEEE-488 Card with DMA
National Instruments PC IIA compatible.....£189 N34

RS-422

RS-422 Card.....£69 L28
Dual Port RS-422 Card.....£79 L29
Dual Port RS-422/RS-485 Card.....£109 L30

MODEMS/FAX MODEMS

Miracom WS3000 with V22bis.....£189 G26
Miracom Courier HST V32bis.....£499 G33
Racal MAXAM IV V21/22/23bis/23.....£319 G35
Racal MAXAM V+ V32.....£599 G45
Dataflex Int PC Comfax II.....£249 G49
Dataflex Ext Portable Comfax II.....£319 G50
Psion Dacom Gold PC4 Int Fax/M.....£269 G51
Psion Dacom PDM40 Ext Fax/M.....£389 G52

TAPE BACK UP

Wangtek 60MB - External.....£599 B43
Wangtek 250MB - Internal.....£595 B35
- External.....£799 B44
Wangtek 525MB - Internal SCSI based
(drive only).....£799 B36
Jumbo DJ10 120MB Int - floppy based.....£239 B60
Jumbo DJ20 250MB Int - floppy based.....£329 B61

MISCELLANEOUS

LOGITECH Trackman Trackerball.....£79 F26
Soundblaster Pro Card V2.0.....£129 F45
Bi-Sync Communications Card.....£89 F42

CHIPSET PC SYSTEMS

PC Systems built to your
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From simple LAN Workstations
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Servers and UNIX boxes

486 EISA

Our EISA systems offer the ultimate in PC performance for file server and multi-user UNIX applications. The standard configurations include 8Mb of RAM expandable to 32Mb, fast SCSI disk drives and Super VGA graphics. Chipset EISA systems can be delivered "Novell Ready" together with any number of workstations. Alternatively we can fit intelligent I/O controllers to improve performance in a multi-user UNIX or PICK environment. A comprehensive range of UPS are available as options.

	240Mb	420Mb	670Mb	1Gb
66MHz 486DX2	£2797	£3237	£3402	£3787
50MHz 486DX	£2657	£3097	£3262	£3647
33MHz 486DX	£2505	£2945	£3110	£3495

486 LOCAL BUS

If your application needs high performance graphics then Local Bus is the answer. Our Local Bus systems also feature the S3 graphics accelerator for enhanced performance under Windows. Standard configurations offer 4Mb of RAM expandable to 32Mb. A low radiation non-interlaced 14" Super VGA monitor is fitted as standard but 17" and 20" Sony Trinitron monitors are available as options. Disk drives may be IDE (105Mb to 420Mb) or SCSI (240Mb to 2Gb) with caching disk controllers optional. MS-DOS 5.0, Windows 3.1 and a high resolution mouse are included as standard.

	105Mb IDE	210Mb IDE	420Mb IDE	670Mb SCSI
66MHz 486DX2	£1699	£1839	£2259	£2785
50MHz 486DX	£1699	£1749	£2169	£2695
33MHz 486DX	£1444	£1584	£2004	£2530

486 BUDGET

486SX and 486DX processing is available at budget prices. Our 486 Budget models come with 4Mb of RAM and Super VGA colour graphics. IDE disk drives from 40Mb to 420Mb are fitted in the standard models and SCSI drives are optionally available. From the 24MIPS 66MHz DX2 model to the 25MHz SX, our 486 Budget range is designed to offer you the best price/performance without compromising quality.

	40Mb	105Mb	210Mb	420Mb
66MHz 486DX2	£1361	£1431	£1571	£1991
50MHz 486DX	£1271	£1341	£1481	£1901
33MHz 486DX	£1106	£1176	£1316	£1736
25MHz 486SX	£859	£929	£1069	£1489

386 ECONOMY

For many PC applications, our 386SX and 386DX Economy models offer adequate performance at the lowest price consistent with the production of a high quality, reliable computer. We do not economise by using the cheapest components! Our Economy models all feature 2Mb of RAM expandable to 16Mb and may be fitted with IDE disk drives ranging from 40Mb to 420Mb. For faster disk accessing, a low cost 512K caching IDE controller is available at a cost of £95. A 14" monochrome VGA monitor is fitted as standard and a 14" Super VGA colour monitor can be included for an additional £130.

	40Mb	105Mb	210Mb	420Mb
40MHz 386DX	£688	£758	£898	£1318
33MHz 386SX	£607	£677	£817	£1237
25MHz 386SX	£585	£655	£795	£1215

MULTI-MEDIA OPTIONS

Multi-Media versions of all models are available with Sony or Hitachi CD-ROM drives and a Soundblaster Pro card fitted. Stereo speakers are also included.

CASE OPTIONS

The prices quoted apply to standard desktop cases. Each system can be supplied in a full size tower case at an additional cost of £75. Mini Tower versions are available for all but the Local Bus models at a premium of £15. The Budget and Economy models can be supplied in slimline cases if required at no extra cost.

STANDARD FEATURES

All models are supplied with a 1.44Mb 3.5" floppy disk drive as standard (a second 1.2Mb 5.25" drive costs £45). Two serial, one parallel and one game port are standard. All systems are shipped with MS-DOS 5.0 pre-loaded on the hard disk and a copy of the PC-CHECK diagnostics software package is included with each machine to help us diagnose any problems over the telephone.

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We can supply complete tailor made Networks based on Novell Netware nationwide including installation, cabling, training and support. Please ask our sales staff for a quotation.

WARRANTY

The prices quoted include a one year return-to-base warranty covering both parts and labour costs. On-site maintenance contracts and extended warranties are available as options. Please ask our sales staff for details.

30 Day Money Back Satisfaction Guarantee

This is a promise. Either you are completely satisfied with your Chipset personal computer after 30 days, or we refund both the purchase price and the delivery cost in full.

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OPTIMUM

WORD PROCESSORS

Ami Pro V3 - Lotus - New! <w>	£269
Grammatik-5 DOS	£89
Grammatik-5 Windows <w>	£89
Justwrite V2 - Symantec <w>	£179
LabelPro - Avery	£99
Lotus Write - New! <w>	£139
Manuscript V2.1	£275
Multimate V4.0	£289
PerFORM V2.1 Forms Processor	£89
PerFORM PRO PLUS (free WinFax Pro) <w>	£229
Prof Write Plus for Windows <w>	£179
Word V5.5 - MS	£259
Word for Windows V2 <w>	£229
Word for Windows with Excel and Powerpoint Bundle (MS Office)	£389
MS Office Trade-up	£289
Word for Windows Licence <w>	£195
Word for Word Professional V5.1	£95
Word for Word Pro Windows V5 <w>	£79
WordPerfect Upgrades	EPOA
WordPerfect Language Modules	EPOA
WordPerfect for Windows V5.2 <w>	£194
WordPerfect for DOS V5.1	£194
WordPerfect Licence (no docs)	£169
WordPerfect LetterPerfect	£95
WordPerfect Office V3.1	£95
WordPerfect Office LAN	EPOA
Wordstar for Windows V1.5 <w>	£99
Wordstar V7	£245
Wordstar Network Products	EPOA

DATABASES

Act! V2.1 - Contact Management	£295
Act! for Windows - New! <w>	£345
Agenda V2	£289
Clipper V5.01	£349
Dataease V4.5	£439
Dataease Network (3 user)	£549
DataPerfect V2.2	£269
dBase-III Plus V1.1	£389
dBase-4 V1.5	£329
dBase-4 V1.5 Development Ed.	£789
dBase-4 V1.5 Lan Pack 1-user	£189
dB-Fast - New! <w>	£295
Delta-V Rel.2 - Comsoft	£439
Filemaker Pro V2 - Claris <w>	£245
FoxPro V2	£395
FoxPro V2/LAN (3 user)	£689
FoxPro Distribution Pack	£279
Object Vision V2 / Pro <w>	£95/£245
Paradox V4 - New!	£289
Paradox Network Node	£149
Professional File V2	£169
Q & A V4 - Symantec	£249
Q & A Network Pack (3 user)	£249
Reflex V2.0	£195
Skylink - Harley <w>	£189
SuperBase-2 <w>	£239
SuperBase-4 V1.3 <w>	£389
SuperBase-4 V1.3 Dev Edition <w>	£795
SuperBase-4 5-user Runtime <w>	£179
SuperBase-4 V1.3 LAN - 5-user <w>	£745

UTILITIES/MISCELLANEOUS

386Max V6	£65
Adobe Type Manager V2	£79
Adobe Type Manager Plus	£139
AutoRoute Express UK/Windows	£74/£99
AutoRoute Plus V5	£345
AutoRoute Products	EPOA
Battery Watch Pro V4	£35
BridgeBatch	£119
Check-It Plus PC Diagnostics - New!	£149
Check-It - Lan	EPOA
Dan Bricklins Demo-II V3	£195
DESCview/X 386 - New!	£169
DESCview V2.4	£85
DESCview 386 V2.4 inc OEMM	£145
DESCview QRAM V2 /Manifest	£65/£39
DESCview OEMM 386 V6	£65
DESCview OEMM 50/60	£65
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 4-Button Fasttext ensures speedy page retrieval
 Standard teletext pages using different font sizes
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In these fast-moving times, access to up-to-date information is everything. Optimum are delighted to announce the launch of a superb totally new Windows product, bringing you information like never before. We have designed OPT-III Teletext for Windows for power with ease of use, bringing you the information that you need, in the way that you need it. Among its advanced features, we have included: Up to 30 simultaneous open Teletext windows, automatic 'keyword' search, a superb DDE (Dynamic Data Exchange) implementation etc etc, all designed to take full advantage of the multitasking power, elegance and convenience of Windows..

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2 WordPerfect	£194	7 MS Office Trade-Up	£289
3 Lotus 1-2-3 for Windows	£239	8 Hayes Optima V32 modem	£389
4 Pace Microlin Fax/Modem	£249	9 CorelDraw! V3 Trade-Up	£169
5 Excel V4 - Microsoft	£229	10 Lotus SmartSuite Trade-Up	£249

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Pegasus Easifacts Payroll	£89
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Pegasus Bus. Manager Payroll	£129
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Sage Sterling Accountant Plus V5	£339
Sage Sterling Financial Controller V5	£449
Sage Sterling Payroll V5	£169
Sage Sterling for Windows <w>	£279

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Logitech ScanMan 32 for Windows	£149
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cc:Mail Windows Platform Pack <w>	£295
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Intel 80387	£69
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WorldPort 2496 Pocket Fax/Data £295
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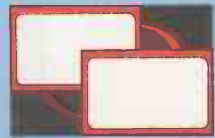
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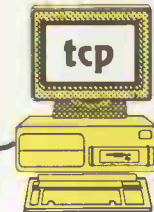


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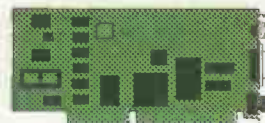
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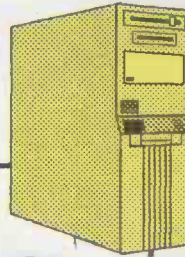
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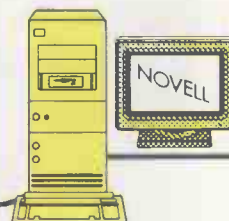
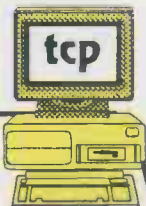
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VGA Card & Mono monitor

- ③ 80386SX 25MHz CPU - 1MB RAM
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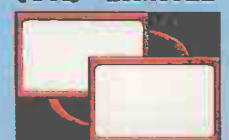
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dan

"Dan Technology has taken the doze out of Windows." PC Plus (Dan for Windows 486/50 - Long Term Test), Nov '92

£2276

For those users who are hungry for power, Dan has built a PC that combines all the advanced features that others offer as extras: a 66MHz 486DX2 processor for fast processing; S3 graphics accelerator for faster Windows updating; 17" Trinitron colour monitor for the ultimate in picture quality; and cacheing for ultra fast disk access.

And we haven't neglected those who want even more. The Dan Multimedia option, supplied ready to use, will help you increase your productivity and make your life easier, as well as give you hours of sheer pleasure.

Multimedia, which integrates text, audio and pictorial features, is suited to all manner of business, educational and entertainment activities. While most experts have predicted that Multimedia will take over the world, Dan has decided that rather than wait, we'll offer it RIGHT NOW.

Dan Multimedia upgrade kit:



Sound Blaster Pro

- Soundblaster & Ad Lib compatible
- Microphone, Stereo Line-in, CD ROM audio Interface & 1 or 2 Joystick ports.
- 4 Watt-per-channel amplifier
- Video effect & Sound controls

CD-ROM Drive - MPC compatible

- 540 / 660MB
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- 64KB RAM Buffer
- 390ms access time

Stereo Speakers

All required cables

Windows 3.1 drivers

Utility Programs

add £375

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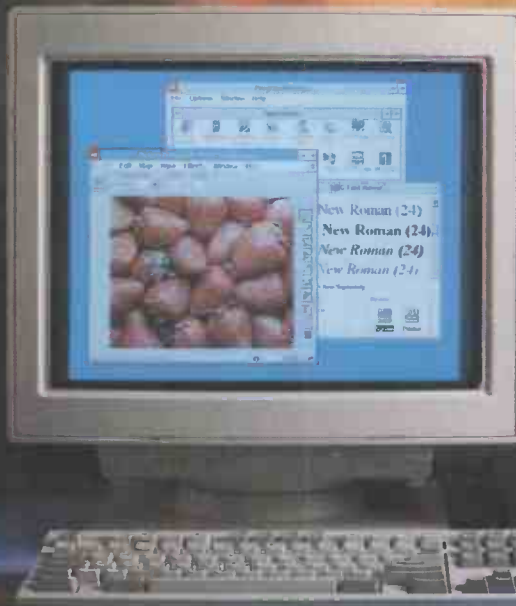
dan for WINDOWS ^{PRO}

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WINDOWS 3.1
Ready-to-run



486DX CPU
Upgradable



Please note that the above configuration shows only one of the cases for the Dan Systems. All prices apply to small footprint desktop case systems only. For other cases P.O.A.

8MB RAM
210 MB HDD
1 MB S3 Video Card
Serial Mouse
Windows 3.1

i486DX2-66 CPU • 64KB Cache Memory • AMI BIOS (with password) • Shadow RAM (System & Video) • 1.44MB FDD • 17" Low Radiation (MPR II) Colour Super VGA Monitor • Desktop Case w/200W PSU • 102 UK Keyboard • 1 Parallel Port • 2 Serial Ports • MS DOS 5.0

S3 1MB Video Graphics Accelerator

2.5MB IDE HDD Cache Controller

17" SONY made TRINITRON Monitor .26

486DX2-66

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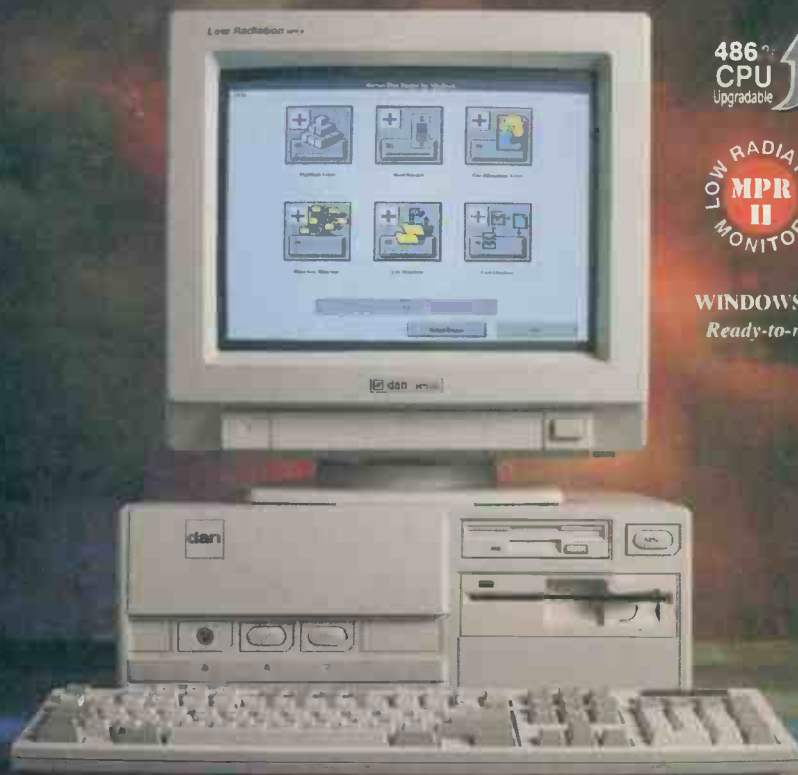
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Finally a PC for the Serious Windows User.



486⁺
CPU
Upgradable

LOW RADIATION
MPR II
MONITOR

WINDOWS 3.1
Ready-to-run

Please note that the above configuration shows only one of the cases for the Dan Systems.
All prices apply to small footprint desktop case systems only. For other cases P.O.A.

8MB RAM
210 MB HDD
1 MB S3 Video Card
Serial Mouse
Windows 3.1
i486DX-33 CPU • 64KB Cache Memory • AMI BIOS (with password) • Shadow RAM (System & Video) • 1.44MB FDD • 14" Low Radiation (MPR II) Colour Super VGA Monitor • Desktop Case w/200W PSU • 102 UK Keyboard • 1 Parallel Port • 2 Serial Ports • MS DOS 5.0

S3 1MB Video
Graphics
Accelerator

The S3 is designed to speed up applications running under Windows, with a 40% increased performance over XGA. This is achieved by directly linking display memory to a dedicated hardware graphics processor, thus eliminating data transfer bottlenecks that exist when sharing the bus with the main CPU and I/O.

"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. But ... you'd be the first to kick yourself if you experienced what the machine is capable of with it." **COMPUTER BUYER, AUG 91**

2.5MB IDE HDD
Cache Controller

This intelligent controller, with its own 80186 microprocessor, considerably speeds up disk transfers, and minimises your computer's CPU waiting time: typically it reduces the average seek time of a hard disk rated at 28ms to a mere **0.3ms** (Core Test).

**COMPUTER
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EDITOR'S
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dan

"The real secret of the Dan's attraction is its remarkable combination of genuinely useful features and low price." **PC User, Oct '92**

£1643

486DX2-50 £1790
486DX-50 £1843
486DX2-66 £1914

During the review period (4 months), the machine coped admirably with a number of foreign components, from the Microsoft Sound System to a complete CompuAdd multimedia kit, including SONY CD-ROM drive, taking in an internal fax/modem on the way and a Dell mouse. the Dan 486/50 uses proven high performance system components to deliver Windows computing at an excellent price, and demonstrates that it's possible to cut costs without cutting corners. **PC USER (dan for Windows 486/DX50), Nov '92**

pc user

Dan Technology has aimed this system at the Windows user who wants the best performance at a realistic price, and it has undoubtedly succeeded.

PC Direct

When running in Windows, the combination of the 486DX 50MHz processor, IDE cache controller and S3 Graphics Adapter proves extremely effective and this system is about the fastest you can get without resorting to non-standard components..... At no time did this system appear taxed and it really did show Windows at its best. **Verdict: In terms of overall performance the combination of the 50MHz 486, the IDE cache controller and the S3 Graphics adapter is superb, and as a result, this machine takes some beating. PC DIRECT (dan for Windows 486/DX50), Nov '92**

Dan are well known for putting together components rather more capably than the average clone builder this is another in a long line of deservedly successful products from Dan. Attention to detail, like the caching controller and accelerated graphics card make it stand out. If you are looking for a fast system at a keen price, you should look at this machine. **OPINION: Blindingly fast, keenly priced and robust. COMPUTER BUYER (dan for Windows 486/DX50), Oct '92**

**COMPUTER
BUYER**

Performance has been Dan's strong suit for some time and this system was no exception. Video performance from the S3 was very fast ... All other aspects are excellent. The supplied 14" non-interlaced monitor was clear and crisp ... the Dan is an all round system with a lot to recommend it. On paper the Dan looks good and the price is indeed competitive. In use it is even more impressive. **PC TODAY, (dan for Windows 486/33) Aug '92**

**PC TODAY
RECOMMENDED**

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The longer anyone uses a computer system, the more likely one is to find its faults. We at Dan Technology believe very much in the quality of our systems and we always encourage magazine reviewers to test the PCs extensively. The following three reviews are part of an on-going long-term test undertaken by the influential PC Plus Magazine on a Dan machine which was delivered in November 1991.

Further reports will follow.

LONG TERM TEST
6-month long test with bi-monthly reports
PC PLUS

1

Long Term Tests 1st report

"The machine's case is excellent; it is solidly constructed and everything inside is easily accessible The keyboard has an impressive feel. It is light, with a definite click action,

and the small footprint saves some desk space I have a 14-inch monitor - the 1 mbyte tseng-based SVGA (Super Video Graphics Array) card can display up to 1,024 by 768 by 256 colours. My monitor gives a clear, sharp picture in all modes The performance is the best I've ever encountered in a PC. The combination of the fast CPU and cached hard disk (0.3ms access time, 1329.3K per second data transfer rate) rips through our applications benchmarks in no time." **PC PLUS** (Long Term Tests 1st report), January 1992

LONG TERM TEST
6-month long test with bi-monthly reports
PC PLUS

2

Long Term Tests 2nd report

"If the ultimate test of a PC is how often you swear at it, the Dan 486 passes with flying colours. There have been no problems at all to date - everything works exactly as intended and this is not as common as you might imagine I have been very pleased with this PC so far, and I would recommend it to anyone who needs high performance at a sensible price." **PC PLUS** (Long Term Tests 2nd report), March 1992

LONG TERM TEST
6-month long test with bi-monthly reports
PC PLUS

3

Long Term Tests 3rd report

"My six months with the Dan 486 have come to an end, and lately I've been desperately looking for something to criticise - the machine continues to do everything I ask of it

The keyboard continues to impress me, and is showing no sign of wear and tear after six months of heavy use. The Dan 486c/33 has been a pleasure to use, and is now even better value than when we started this test. For the next six months the Dan will be doing service in the PC PLUS lab as our OS/2 2.0 test machine." **PC PLUS** (Long Term Tests 3rd report), September 1992

LONG TERM TEST
6-month long test with bi-monthly reports
PC PLUS

4

Watch this space ...

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486 DX2

WINDOWS 3.1
Ready-to-run

LOW RADIATION
MPR II
MONITOR

486 DX2
CPU
Upgradable



Please note that the above configuration shows only one of the cases for the Dan Systems. All prices apply to small footprint desktop case systems only. For other cases see upgrades.

4MB RAM
1 MB Video Card
MS DOS 5.0
Serial Mouse
Windows 3.1

i486DX2-66 or 50MHz CPU • 256K Cache Memory
• AMI BIOS (with password) • Shadow RAM (System & Video) • 1.44MB FDD • 14" Low Radiation (MPR II) Colour Super VGA Monitor
• Desktop Case w/200W PSU • 102 UK Keyboard • 1 Parallel Port • 2 Serial Ports

	dan	486DX2c/66s4	486DX2c/50s4
100MB /15ms (IDE)	£ 1419	£ 1295	
210MB /15ms (IDE)	£ 1580	£ 1456	
420MB /15ms (IDE)	£ 1893	£ 1769	
660MB /15ms (SCSI)	£ 2335	£ 2211	
1.0GB /14ms (SCSI)	£ 2795	£ 2671	
1.6GB /14ms (SCSI)	£ 3167	£ 3043	
Basic System	£ 1353	£ 1277	
(as above with 1MB RAM, 40MB HDD, no mouse and no Windows.)			

IDE Cache Controller w/1MB add £ 126
Additional 1MB RAM upgrade add £ 25
17" TRINITRON monitor upgrade add £ 441

Delivery cost to most of UK for one system is £15.
Prices exclude VAT @ 17.5%

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486DX

dan



486DX
CPU
Upgradable

LOW RADIATION
MPR II
MONITOR

WINDOWS 3.1
Ready-to-run

Please note that the above configuration shows only one of the cases for the Dan Systems. All prices apply to small footprint desktop case systems only. For other cases see upgrades.

4MB RAM
1 MB Video Card
MS DOS 5.0
Serial Mouse
Windows 3.1

i486DX-50 or 33MHz CPU • 256K(50MHz) / 64KB (33MHz) Cache Memory • AMI BIOS (with password)
• Shadow RAM (System & Video) • 1.44MB FDD
• 14" Low Radiation (MPR II) Colour Super VGA Monitor • Desktop Case w/200W PSU • 102 UK Keyboard • 1 Parallel Port • 2 Serial Ports

	dan	486c/50s4	486c/33s4
100MB / 15ms (IDE)		£ 1348	£ 1148
210MB / 15ms (IDE)		£ 1509	£ 1309
420MB / 15ms (IDE)		£ 1822	£ 1622
660MB / 15ms (SCSI)		£ 2264	£ 2064
1.0GB / 14ms (SCSI)		£ 2724	£ 2524
1.6GB / 14ms (SCSI)		£ 3096	£ 2896
Basic System		£ 1220	£ 1060
(as above with 1MB RAM, 40MB HDD, no mouse and no Windows.)			

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17" TRINITRON monitor upgrade add £441

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"When I spoke to Dan Technology I was impressed by their efforts to source the best component possible, and their familiarity with the systems - enabling them to provide good technical support."

PC PLUS, (Long term tests 2nd report)
March 1992

"The Dan Is a winner the Dan monitor is the sharpest of the three, with finely detailed text and graphics my recommendation goes to the Dan machine. The extra care that has obviously been taken in assembling and configuring this machine is an extremely useful pointer to the company's philosophy towards its customers."



"The Dan machine comes in again as the fastest in the group Internally the Dan showed its usual neat and tidy design with all cabling folded and tied out of the way. This shows the kind of attention to detail which inspires confidence. Once again a high value package from a leading direct supplier."



"Where the Dan machine scores over its competitors is in its superior performance. The Dan provided excellent performance at reasonable price, being particularly good value."



"This is the best memory implementation I've seen on a PC yet the monitor itself was sharp the lightweight keyboard is a good example of the mechanical key click variety sheer performance fast hard disk system keen price"



"The Dan-486c/33 uses an IDE cache to improve disk throughput; this boosted it to a joint 4th position (total of 54 systems). If fast disk access is important - as it is for database users, for example - then the disk cached systems are good choices. A very well equipped machine"



"Windows 3 and various applications, ran fine and at a speed beyond anything I've ever seen on a PC before. Real compatibility was tested using PC Tools, display programs and several games. All functioned perfectly and at a dazzling speed It has to be one of the fastest PCs on the market. If performance is the name of your game, this may well be the unit for you".

Personal Computer World

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dan

"Some things in life you can have no regrets about: buying a Dan Technology 486c/33 is one of them." *Personal Computer World*, Aug '92



"Do you know what's wrong with Dan Technology's 486SX/20? Nothing. Absolutely nothing I just can't find fault with it. What makes this beige blue-badged beast so much better than any other similarly shaded system I've ever used? Simply put, it's fast and you will see that it quite happily outperforms everything else on test. In fact it even competes favourably against some of the machines fitted with the clock-doubler. The Dan 486SX/20 is neat, well supported, solidly built, excellent value for money and fast. I want one." *PERSONAL COMPUTER WORLD (PCW)*, July '92 (NOW UPGRADED TO 25MHz)

WHAT PERSONAL COMPUTER



For a start the build quality is impressive. If you take a look at the performance figures, check out the spec and consider the price, it all adds up to make the Dan a very good value machine. The Verdict: Our overall winner has to be the Dan 486SXc/25S4. It's well built, well specified, achieved brilliant results in our performance Tests and what's more, check out that price. *WHAT PERSONAL COMPUTER*, Oct '92

COMPUTER BUYER

Best overall display & if speed is the sole criterion then Dan's your man.

"The machine's preparation was immaculate, with cable runs shipshape and Bristol fashion, ribbon neatly folded and tied, wiring loops clipped and tucked. The best display overall was the Dan's. No messing, the Dan out-performed the rest of the crowd quite handsomely. If speed is the sole criterion, then Dan's your man. Buyer Benchtest Rating: (Max in group) *COMPUTER BUYER*, (Beating the clock) Jan '92



"Dan's 386c/40s4 gives breathtaking hard disk performance, superb graphics and a lifetime warranty. Hard disk performance is spectacular because of the machine's commitment to caching hard disk controllers but even with the controller the price is pleasantly low. If you have the money, invest in the disk cache, as it will save time for database, CAD/CAM and Windows applications. the seductively-priced Dan is worth a very close look. Highly recommended for disk-intensive applications." *PC MAGAZINE* Aug '92



"Dan 386DX/40: This is another of Dan's excellent value systems. In performance terms the Dan did well. The hard drive cache again showed its worth, producing a blistering 1822K/second data throughput. Bearing in mind that the latest version of Windows is also Included, then inevitably this package must lie near the top of any short-list." *PC PLUS* July '92



Dan's 386c/40 is noticeably better made than some of the low cost clones currently available. It is an attractive machine with an excellent choice of motherboard.... the caching controller supplied with the review machine made it a particularly good platform for Windows applications Windows 386 Enhanced mode seemed quicker on the Dan than on the 486/33 in use at the next desk. In fact, this combination of fast processor and the caching disk controller made for a very fast 386-type machine You haven't seen fast until you've seen the Dan 386c/40" *PC DIRECT* Jan '92

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Entry Level

486DX CPU
Upgradable

LOW RADIATION
MPR II
MONITOR

WINDOWS 3.1
Ready-to-run



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4 or 2MB RAM
1MB Video Card
MS DOS 5.0
Serial Mouse
Windows 3.1

i486SX-25 or 386DX-40 or 386SX-33MHz CPU
• Cache Memory • AMI BIOS (with password)
• Shadow RAM (System & Video) • 1.44MB FDD
• 14" Low Radiation (MPR II) Colour Super VGA Monitor • Desktop Case w/200W PSU
• 102 UK Keyboard • 1 Parallel & 2 Serial Ports

dan	486SXc/25s4	386c/40s4	386SX/33s2
main memory / (max)	4MB / (32)	4MB / (32)	2MB / (16)
cache memory / (max)	64KB / (256)	64KB / (256)	-
100MB / 15ms (IDE)	£ 959	£ 929	£ 824
210MB / 15ms (IDE)	£ 1120	£ 1090	£ 985
420MB / 15ms (IDE)	£ 1433	£ 1403	£ 1298
660MB / 15ms (SCSI)	£ 1875	£ 1845	£ 1740
1.0GB / 14ms (SCSI)	£ 2335	£ 2305	£ 2200
Basic System	£ 857	£ 824	£ 763
(as above with 1MB RAM, 40MB HDD, no mouse and no Windows.)			

IDE Cache Controller w/1MB add £ 126
Additional 1MB RAM upgrade add £ .25
17" TRINITRON monitor upgrade add £ 441

Delivery cost to most of UK for one system is £15.
Prices exclude VAT @ 17.5%

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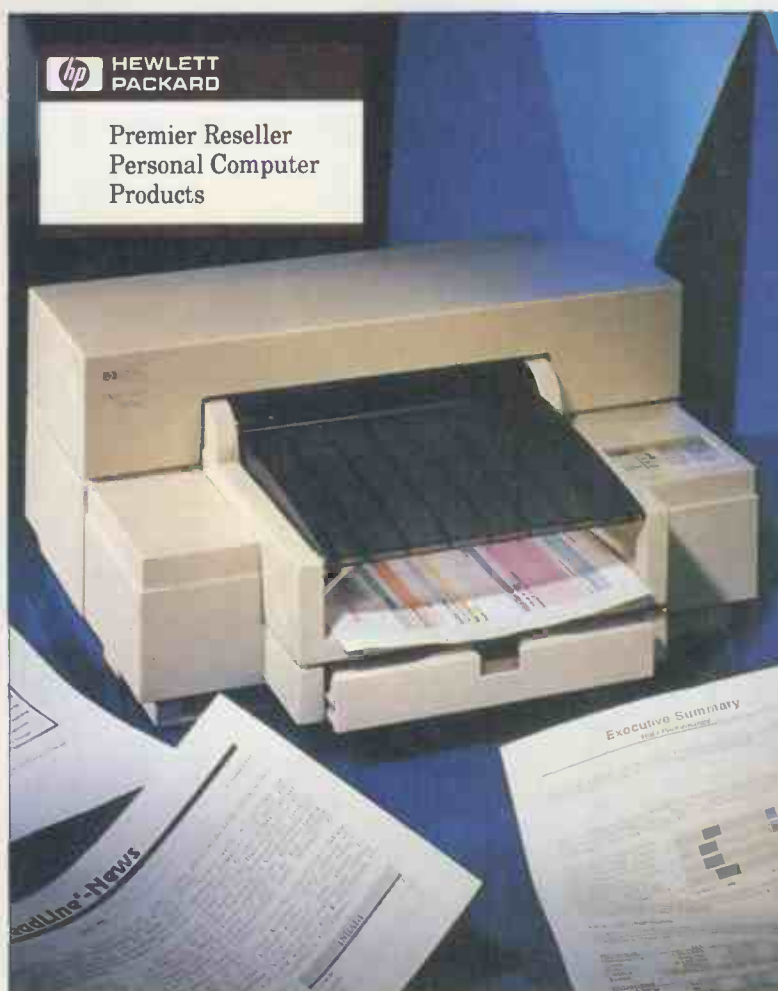


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PS/VP M4A	486DX/33	8Mb/170Mb	£1269
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486slc/33	486slc	33	170Mb	2Mb	£1,079
486dlc/33	486dlc	33	100Mb	4Mb	£1,079
486dlc/33	486dlc	33	170Mb	4Mb	£1,189
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All PC Positive systems include DOS 5.0, Windows 3 and Mouse

Model	CPU	MHz	Hard Disk	RAM	SVGA Mono	Super VGA Colour
MCS Range						
386sx/25	386sx	25	—	2Mb	£628	£764
386slc/50	386slc	25	—	2Mb	£764	£895
486sx/25	486sx	20	—	2Mb	£764	£895
486dx/33	486dx	33	—	2Mb	£988	£1,124

Hard disks:- 40Mb £139 100Mb £229 200Mb £409 400Mb £689
All MCS systems include DOS 5.0, Windows 3 and Mouse

AMSTRAD

Model	CPU	MHz	Hard Disk	RAM	SVGA Colour	Ultra Super VGA Col.
7286	286	16	40Mb	1Mb	£559	£639
7286 Family Pack	286	16	40Mb	1Mb	£599	—
7386sx	386sx	25	40Mb	1Mb	£609	£699
7386sx	386sx	25	80Mb	2Mb	£669	£749
6486sx	486sx	20	105Mb	4Mb	£1,045	£1,125

7286 Includes DOS 5.0, Counterpoint, Lotus Works 3 & 1 year on-site maintenance
7286 Family Pack comes with Joystick, Speakers, DOS 5, Lotus Works 3.0, Adlib compatible soundcard, 6 games, 1 year on-site maintenance
7386sx Includes DOS 5.0, Counterpoint, Lotus Works 3 & 1 year on-site maintenance
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80387-SX 20MHz	£47
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4FG FST Multisync 15" 0.28mm	£452	
5FG FST Multisync 17" 0.28mm	£833	
6FG FST Multisync 21" 0.28mm	£1,492	
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non-interlaced	£339	
2013 20" Multiscan 0.31mm	£1,115	
Philips - (Inc. 1 year OSM)		
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CM8833 II 14" CGA	£169	
7CM3209 14" SVGA 0.28mm	£189	
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3CM9809 14" VGA	£169	
4BM2797 14" FST VGA White		
low rad	£99	
Taxan		
787 14" Supervision 0.28mm	£219	
787LR 14" Supervision 0.28mm	£239	
875 + 17" Multivision 0.28mm	£729	
795 14" FST Multivision 0.25mm	£406	

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Model	CPU	MHz	H/Disk	
AMBRA				
Teka	386sl	20	40Mb	£829
Teka	386sl	25	80Mb	£1,069
COMPAQ				
3/20 Mod 40	386sl	20	40Mb	£869
3/20 Mod 84	386sl	20	84Mb	£1,139
3/25 Mod 60	386sl	25	60Mb	£1,289
3/25 Mod 120	386sl	25	120Mb	£1,649
25c Mod 84 Colour	386sl	25	84Mb	£2,989
25c Mod 120 Colour	386sl	25	120Mb	£3,279
TEXAS INSTRUMENTS				
TM4000sx Win	486sx	16	80Mb	£1,599
TM4000sx Win	486sx	25	120Mb	£1,999
TM4000sx Win	486dx	25	120Mb	£2,339
TOSHIBA - All models include Dos 5				
T1800	386sx	20	43Mb	£795
T1800	386sx	20	64Mb	£929
*T1850C Colour	386sx	25	85Mb	£1,169
*T1850C Colour	386sx	25	85Mb	£1,489
*T1850C Colour	386sx	25	120Mb	£1,269
*T1850C Colour	386sx	25	120Mb	£1,599
T3300sl	386sl	25	80Mb	£1,369
T3300sl	386sl	25	120Mb	£1,499
T3200sxc	386sx	25	120Mb	£1,999
T4400sxd LCD Display	486sx	25	80Mb	£1,495
T4400sxp Gas Plasma	486sx	25	80Mb	£1,495
*T4400sxc Colour	486sx	25	80Mb	£2,519
*T4400sxd LCD Display	486sx	25	120Mb	£1,629
*T4400sxc Colour	486dx	25	200Mb	£2,995
*T4400sxc	486sx	25	80Mb	£2,469
*T4400c	486sx	25	120Mb	£2,649
T6400sx	486sx	25	120Mb	£2,169
T6400sxc Colour	486sx	25	120Mb	£3,369
T6400dx	486dx	33	200Mb	£2,669
T6400dxc colour	486dx	33	200Mb	£3,869
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325S Mod 60	386sx	25	60Mb	£1,289
326S Mod 85	386sx	25	85Mb	£1,399
320L Mod 60	386sl	20	60Mb	£1,649
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326L Mod 120	386sl	25	120Mb	£2,239
420S Mod 85	486sx	20	85Mb	£1,919
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Canon	LBP-4 Lite	4PPM	10	512K	4	9	—	£499
Canon	LBP-4+ (1.5Mb)	4PPM	7/9	1.5Mb	8	9	—	£653
HP	LaserJet IIP Plus	4PPM	—	512K	14	0	—	£549
HP	LaserJet IIIP	4PPM	—	1Mb	14	8	—	£599
M/Tally	MT904	4PPM	2	512K	14	0	—	£535
M/Tally	MT904 Plus	4PPM	5/9/15	1Mb	14	8	—	£598
OKI	Okilaser 400	4PPM	1/9/10	512K	25	0	—	£449
Star	LP-4 III	4PPM	3/4/16	1Mb	14	8	—	£599
IBM	4029-010	5PPM	1/3	1Mb	16	17	—	£669
Panasonic	KX-P4410	5PPM	2/4/9	512K	28	0	—	£469
Panasonic	KX-P4430	5PPM	1/4/9/16	1Mb	28	8	—	£599
Epson	EPL-4000	6PPM	2/4/7	512K	13	0	—	£489
Epson	EPL-4300	6PPM	4/6/7/15	1Mb	14	13	—	£599
IBM	4029-020	6PPM	1/3	1Mb	16	17	—	£825
Brother	HL-8V	8PPM	5/9/10/14/16	1Mb	12	12	—	£835
Canon	LBP-8 III +	8PPM	7/9/10	1.5Mb	7	9	—	£965
Canon	LBP-8 IIIT	8PPM	7/9/10	1.5Mb	7	9	DB	£1349
Canon	LBP-8 IIIR	8PPM	7/9/10	1.5Mb	7	9	DB/DX	£1449
HP	LaserJet 4	8PPM	—	2Mb	0	45	DB	£999
HP	LaserJet IIID	8PPM	—	1Mb	14	8	DB/DX	£1499
Kyocera	F-800T	8PPM	1/4/9/10/11/12/13	512K	79	3	—	£794
Kyocera	FS-850	8PPM	3/8/9/10/13	1Mb	79	13	—	£999
M/Tally	MT908	8PPM	5/9/15	1Mb	14	8	—	£899
OKI	Okilaser 810	8PPM	9/16	1Mb	25	13	—	£849
OKI	Okilaser 810 DB	8PPM	9/16	1Mb	25	13	DB	£1199
Panasonic	KX-P4420	8PPM	1	512K	22	0	—	£619
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Star	LP-8 II DB	8PPM	1/4/9/10	1Mb	8	0	DB	£1179
Star	LP-8 II DB/DX	8PPM	1/4/9/10	1Mb	8	0	DB/DX	£1649
Sharp	JX9500H	9PPM	1/4/9/10	512K	6	0	—	£499
Texas Inst.	Microlaser +	9PPM	1	512K	8	0	—	£599
IBM	4029-030	10PPM	1/3	1Mb	16	17	—	£1065
IBM	4029-040	10PPM	1/3	1Mb	16	17	DB	£1219
Kyocera	F-2200S	10PPM	1/4/9/10/11/12/13	1Mb	79	3	DB	£2059
M/Tally	MT911	10PPM	1	512K	122	0	—	£999
NEC	S102	10PPM	3/16	1Mb	14	8	—	£999
Panasonic	KX-P4451	11PPM	4/9/10/16	1Mb	28	8	DB	£999
Kyocera	F-5000 A3/A4	9/12PPM	1/4/9/10/11/12/13 + 8	3Mb	79	3	—	£3199
HP	LaserJet III Si	16PPM	—	2Mb	14	13	DB	£1999
Kyocera	F-1800	18PPM	1/4/9/10/11/12/13	1Mb	79	3	—	£2059
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HP LaserJet II/IIID IIP/IIIP + IIIP/IIII/IIID IIISi LaserJet 4	£58	£88	—	£182	Panasonic KXP4410/4430, KXP4420/4450, KXP4450 KXP4455	£93	£131	£175	£218
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	£133	£220	—	—	Texas Inst. Microlaser/PS	£66	—	—	—
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W187 Corel Draw 3 Upgrade	E89
W979 Corel Draw Licence	E207
W184a Corel Draw V3.0	E221
193 Designer V2 OS/2	E369
W192 Designer V3.1	E300
W109a Designworks for win	E92
198 DrawPerfect V1.1 5 lic.	E650
197 DrawPerfect V1.1	E209
W217 Harvard Draw	E271
W980 In A Vision	E233
W241 Windows Draw!	E100
W981 Windows Draw! XP-Kit	E406

Graphics-Fonts

835 Adobe Fonts-Various	E10A
831 Adobe LaserTalk	E252
833 Adobe Orator	E91
W838 Adobe Publishing pk 1	E272
W839 Adobe Publishing pk 2	E350
W840 Adobe Publishing pk 3	E350
W837 Adobe Streamline 3	E128
W827 Adobe Type Align	E66
W828 Adobe Type Mgr Bundle	E252
W826 Adobe Type Mgr Plus pk	E120
W825 Adobe Type Manager V2	E66
WC29 Alttype v 2.0	E69
W859 Bitstream Make Up	E129
W865 Facilit for win	E89
866 Facilit for WordPerfect	E89
515 Freedom Of Press Light 2.6	E44
517 Freedom Of Press V2.6	E176
W518 Freedom Of Press Win	E176
W233 Publisher's Type Foundry	E247
W236 Softtype (Win)	E106
WC43 SuperPrint V2.2	E79
W860 True Type 40 Font pk	E79
W861 Type Essentials-Headlines	E89
W863 Type Essentials-brochures	E119
W864 Type Essentials-graphs	E119
W862 Type Essentials-Letters	E119
W834 Adobe Type Set-Fonts 1	E91
W832 Adobe Type Set-Fonts 2	E91
W829 Adobe Type Set-Fonts 3	E91
W830 Adobe Type Set-Fonts 4	E91
875 Typographica Decorative	E59
874 Typographica Newsletter	E59
873 Typographica Standard	E75
242 WP Bitstream Miscellaneous	E21

Graphics-Miscellaneous

176 Business Graphics	E20
177 Calendar Creator Plus	E60
297 Power Panel Multi-User	E58
298 Power Panel Novellnetwork	E125
231 Printing Press	E35
235 Sign Designer	E35
238 Storyboard Live	E287

Graphics-Painting

W858 Aldus PhotoStyle	E407
W965 CA Cricket Image	E178
224 PC PaintBrush 5.0 +	E74
W985 PhotoFinish 2 Win	E91
W232 Publisher's Painter V2.0	E207

Graphics-Presentations

W170 Aldus Persuasion 2.1	E234
173 Applause II V1.5 & Mouse	E241
W190 CA Cricket Presents 1.4	E195
W208 Freelance for win	E282
W986 Freelance for win 20 pk	E4536
W988 Freelance for win upg	E105
W989 Freelance for win upg 20pk	E1677
W207 Freelance Graphics Serv V4	E244
207 Freelance Graphics V4	E244
A01 Freelance Maps	E81
209 Freelance OS/2	E299
274 Freelance OS/2 Ser	E436
W200 Hollywood (presentation)	E257
W886 HVG for win	E254
W406 HVG for win node	E228
W407 HVG for win node upg	E88
W408 HVG for win upg	E88
219 HVG V3	E254
A09 HVG V3 1 node upgrade	E92
210 HVG V3 1 node pk	E219
A10 HVG V3 Upgrade	E88
W883 Multimedia make your point	E59
964 Pixie V2.3	E153
W228 Powerpoint V3	E237
W229 Powerpoint V3 MLP	E236
229 Present It	E60
230 Presentation pk	E346
110 Express Presenter V1	E168
W178 Charisma V2.1	E255
WC36 DeltaPoint DeltaGraph Pro	E10A
W242 Stanford Graphics for win	E307

Statistics & Graphs

W189 CA Cricket Graph for Win	E125
180 Chart V3.0	E172
C20 Grafplot	E307
216 GraphWriter II	E250
WC38 Mathcad 3	E291
234 Quick Charts For HVG	E65
WC40 QuickGraph Plus for win	E69
967 Statgraphics Plus	E637
237 Statgraphics V5	E406
50C Technicurve for Dos	E229
WC51 Technicurve for win	E229
WC44 Unistat for win	E449

INTEGRATED

243 CA Office	E99
244 Framework Executive V1.0	E83
273 Framework IV Network Pk 5	E600
245 Framework IV V1.0	E324
246 Gosworks Ensemble V1.2	E97
W877 Lotus Essentials	E321
W248a Lotus SmartSuite	E10A
W248c Lotus SmartSuite 20pk	E4924
W248b Lotus SmartSuite 5pk	E1407
W895 SmartSuite upg from lotus	E239
W896 SmartSuite upg from other	E269
878 Lotus Symphony V3	E367
248 Lotus Works 3	E93
249 Lotus Works 3 upgrade	E49
W149 Microsoft Office lic	E291
W201 Microsoft Office lic 100pk	E23671
W202 Microsoft Office lic 20pk	E5098
W898 MS Office Upgrade	E299
W257a Microsoft Office	E10A
256 MS Works 2.0	E95
A23 MS Works 2.0 MLP	E78
W257 MS Works For win	E95
249 Office Writer V6.2	E245
W251 PFS Window Works V1.1	E83
252 Smart II System V1.5	E380
326 Smart System User Access	E182
253 Smart System & Speech	E383
255 WordPerfect Executive	E129

LEISURE & GAMES

W899 Casino pk	E39
W747 Chessmaster 3000 win	E25
A25 Flight Sim ACFT&SCN Des	E25
513 Flight Simulator V4.0	E38
433 Games pk v1 win	E28
W746 Mavis Beacon Typing Win.	E25

Graphics-Painting

743 Miracle Piano Teaching	E240
A26 Multi-media Beethoven CD	E40
WC01 Sim City	E39
WA27 MS Win Entertainment pk 1	E21
WA28 MS Win Entertainment pk 2	E21
WA29 MS Win Entertainment pk 3	E21

NETWORKING

A39 Mainlan Easy Ext pk	E63
A40 Mainlan Easy MCA ext pk	E95
A41 Mainlan Easy Start pk	E123
362 Mainlan Gti Ext Pk	E121
361 Mainlan Gti Start Pk	E287
A55 Network 386 3.11 P 5pk	E456
A56 Network 386 3.11 P 10pk	E1056
A57 Network 386 3.11 P 20pk	E1482
A58 Network 386 3.11 P 50pk	E2118
A59 Network 386 3.11 P 100pk	E3000
A60 Network 386 3.11 P 250pk	E5322
A61 Network 386 3.11 (5pk)	E384
384 Network 386 3.11 (5pk)	E882
399 Network 386 3.11 (20pk)	E1236
A62 Network 386 3.11 (50pk)	E1764
400 Network 386 3.11 (100pk)	E2466
401 Network 386 3.11 (250pk)	E4410
394 Network 2.2 (5 User)	E702
396 Network 2.2 (10 User)	E702
395 Network 2.2 (50 User)	E1410
397 Network 2.2 (100 User)	E2118
362 Netprint V2.1	E103
A35 Saber Menu for DOS 25 user	E187
A36 Saber Menu for Win 25 user	E241
380 Software Bridge Server V5.1	E125

OPERATING SYSTEMS

A54 DR DOS Multi-User	E308
390 DR DOS V6.0	E42
391 ms DOS 5.0 Upgrade	E44
392 ms DOS 5.0 Upgrade 10 pk	E346
A45 ms DOS 5.0 Upgrade 100 pk	E2841
A46 ms DOS 5.0 Upgrade 20 pk	E612
W442 New Wave by HP	E482
407a OS/2 V2	E10A
A43 OS/2 V2 (Upgrade from DOS)	E49
WA47 Win multimedia Dev kit CD	E128
W408a Windows 3.1	E10A
WA48 Windows 3.1 DOS 5	E100
WA49 Win 3.1 DOS 5 & mouse	E117
WA50 Win 3.1 MLP 100 pk	E4076
WA51 Windows 3.1 MLP 20 pk	E878
WA52 Windows 3.1 MLP (licence)	E56
WA53 Windows Trans kit	E630

PROGRAMMING

W411 Borland C++ V3.1	E168
WA63 Borland C++ V3.1 Runtime	E62
WA64 Borland C++ V3.1 & Ap/wk	E259
413a Turbo C++ 3.0	E48
412 Turbo C++ & Turbo/Asp/wk	E61
W868 Turbo C++ for win 3.1	E80
414 Turbo Debug & Tools V2	E74
415 Turbo Pascal Pro V6.0	E115
416 Turbo Pascal V6.0	E62
W417 Turbo Pascal (win)	E86
A65 Turbo vision for C++ 3.0	E20

Microsoft

418 Basic Compiler PDS V7.1	E203
419 C & C++ Compiler V7	E203
421 CDBOL 4.5	E395
422 Fortran Compiler 5.1 OS/2	E188
423 Macro Assembler 6.0	E69
424 Pascal Compiler 4.0 OS/2	E127
A66 Profiling Tools kit	E36
429 Quick Basic V4.5	E49
W425 Quick C For win	E84
426 Quick C V2.5	E49
427 Quick C & Assembler V2.5	E179
428 Quick Pascal	E49
667 Source Profiler v	E139
W430 Visual Basic	E91
W468 Visual Basic Prof. Kit	E130

Others

A69 API Toolkit (basic)	E262
A70 API Toolkit (Clipboard)	E262
A71 API Toolkit (C)	E262
A72 API Toolkit (Pascal)	E262
W431 Zortech C++ Developers	E290
433 Zortech C++ & S+E	E456

PROJECT

W476 ABC Flowchart V1.1	E205
439 CA Superproject 2 (DS/2)	E557
441 CA Superproject V2	E469
339 CA Superproject V2 3-User	E821
W440 CA Superproject (win)	E547
W473 CA Superproject (win) 3 user	E821
434 HVG Project Manager III	E446
W435 On Target V1.0	E225
W288 On Target V1.0 1 User	E189
458 PlanPerfect V5.1	E198
461 Professional Plan V1.02	E126
W436 Project For win	E294
WA74 Project For win (MLP)	E251
437 Project V4.0	E219
438 Quick Schedule Plus	E62
W341 Timeline DOS LAN 1 User	E194
W889 Timeline for Win	E394
WA75 Timeline for Win Lan 1 user	E209
442 Timeline V5 DOS	E394

SPREADSHEETS

443 123 Executive	E122
WC28 123 for win M'media CD	E300
879 123 G2	E94
442 123 R2.4	E240
446 123 R2.4 20-pk	E3990
443 123 R2.4 5 Pk	E1124
A78 123 R2.4 5 Pk Upgrade	E470
W288 123 LAN Server	E348
A79 123 R2.4 Server Upg	E105
A80 123 R2.4 Upgrade	E105
447 123 R3.1 Plus	E290
449 123 R3.1 Plus 20-pk	E4714
450 123 R3.1 Plus Add-In Toolkit	E200
259 123 R3.1 Plus Server	E437
A85 123 R3.1 Plus Upg from 123	E105
A86 123 R3.1 Plus Upg from exc.	E200
260 123 R3.1 Plus (OS/2)	E436
454 123 G2 (OS/2)	E346
WA91 123Win Upg. from 123 etc	E105
W452 123Win Upg. from exc.	E200
W453 123Win v1.1 20-pk	E3940
W452 123Win v1.1 5-pk	E1126
WA77 CA Computat	E243
467 CA Supercalc 5.1	E76
468 CA Supercalc V5.1 3-User	E195
W455a Excel 4	E210
A94 Excel 4 licence pk 10	E2036
A96 Excel 4 licence pk 20	E3563
A98 Excel 4 X4 Orind. kit	E1019
456 Excel OS/2 PM V3.0	E250
457 Multiplan V4.0	E96
459 PlanPerfect V5.1 5 pk	E906
302 Professional Plan LAN pk	E550
W877 Quadro Pro for	Ewin
462a Quadro Pro V4.0	E178
388 Quadro Pro V4.0 Lan Node	E120
WA76 Quadro Pro V4.0 Upgrade	E53
465 Smart II Spreadsheet V1.5	E228
466 Spz	E68
469 VP Expert V2.0	E96
W473 Wing V1.1	E245
474 Worksheet Utilities	E72

UTILITIES

W475 386Max V6.0	E51
805 ACT 2.1	E234
WB06 ACT for win	E234
477 Address Book Plus V3	E62
478 Address Book Software	E48
480 Allways For Symphony 1.02	E87
481 Allways V1.2	E75
WC32 Automator for windows	E129
482 Autouroute Express B8	E74
483a Autouroute + V5	E235
485 Back It	E454
486 Battery Watch Pro	E423
WC33 Becker Tools 3	E69
W487 Bluemax V5.1 for PS/2	E64
488 Bridge Batch	E87
489 Bridge Runtime	E43
490 Bridge Toolkit V3	E355
491 Brooklyn Bridge V3.5	E64
WB02 CA-Up to date	E56
493 Checkit Plus	E56
183 Computer Ladder	E62
WB03 CP Antivirus for win	E65
496 CP Antivirus V1.3	E65
497 CP Backup 7.1	E57
W497a CP Backup for win (7.2)	E57
553 CP Tools 7.1	E39
WB04 CP Scrobbler for win	E60
WB01 Daybook Plus (Asymetrix)	E29
WC35 D'compress	E69
498 Desk Link	E76
499 Desquivue 386 V2.4	E112
500 Desquivue Companions V1.1	E58
501 Desquivue V2.4	E63
B31 Desquivue X 386	E134
B32 Desquivue X Net Mgr - TCP/IP	E103
WB33 Desquivue X Open look win	E103
WB34 Desquivue X OS/2/motif win	E127
WB09 Direct Access for win	E51
502 Direct Access V5.1	E51
503 Disk Display V4.05	E44
504 Disklock	E98
195 DOS Director	E43
841 Double DOS V5	E31
800 Fast V4 (HD cache)	E43

WORDPROCESSING

W589 Ami Pro V3	E278
W591 Ami Pro V3 20 pk	E3975
W590 Ami Pro V3 5 pk	E1055
WB52 Ami Pro V3 upgrade	E99
611 CA Textor for DOS	E58
WB51 CA Textor for windows v6	E127
593 DisplayWrite Upgrade To V5	E67
592a DisplayWrite V5	E239
W598 Just Write V2	E162
599 Letterperfect 1.0	E98
W881 Lotus Write	E97
B53 Lotus/Summa One Word Plus	E100

Software Specials

IBM OS/2 V2 E49

Code A43

Central Point PC Tools

New PC Tools v8 E66

PC Tools v7.1 E39

Touchstone Checklist + E49

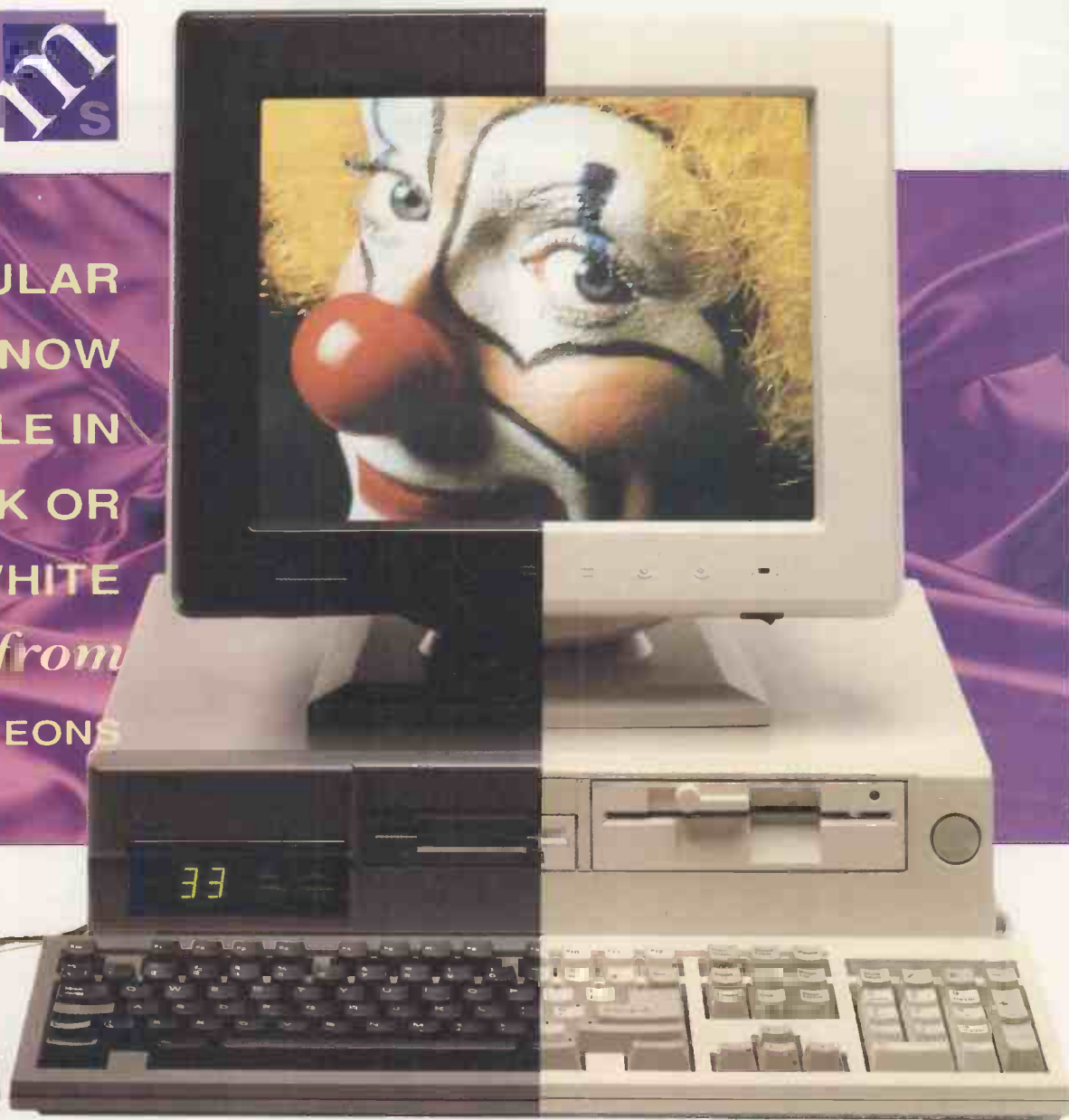
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Dove 386SX-33

- 1MB Ram expandable to 16MB
- 1MB SVGA Card
- 3.5" 1.44MB floppy drive
- 2 serial ports
- 1 parallel port
- 1 games port
- Standard desktop metal case
- 102 key keyboard
- Landmark 48.9Mhz

Example Price with 44MB hard disk
and 14" SVGA low radiation colour
monitor £517.00 plus VAT

Price excluding hard disk and
monitor

£219.00
plus VAT

Swift 386DX-40-C64

- 1MB Ram expandable to 32MB
- 64K on-board cache
- 1MB SVGA Card
- 3.5" 1.44MB floppy drive
- 2 serial ports
- 1 parallel port
- 1 games port
- Standard desktop metal case
- 102 UK keyboard
- Landmark 69.0Mhz

Example Price with 44MB hard disk
and 14" SVGA low radiation colour
monitor £557.00 plus VAT

Price excluding hard disk and
monitor

£259.00
plus VAT

Falcon 486DX-33-C256

- 4MB Ram expandable to 32MB
- 256K on-board cache
- 1MB SVGA Card
- 3.5" 1.44MB floppy drive
- 2 serial ports
- 1 parallel port
- 1 games port
- Standard desktop metal case
- 102 UK keyboard
- Landmark 151.9Mhz

Example Price with 44MB hard disk
and 14" SVGA low radiation colour
monitor £877.00 plus VAT

Price excluding hard disk and
monitor

£579.00
plus VAT

Eagle 486DX-50-C256

- 4MB Ram expandable to 32MB
- 256K on-board cache
- 1MB SVGA Card
- 3.5" 1.44MB floppy drive
- 2 serial ports
- 1 parallel port
- 1 games port
- Small tower metal case
- 102 UK keyboard
- Landmark 234.5Mhz

Example Price with 44MB hard disk
and 14" SVGA low radiation colour
monitor £1047.00 plus VAT

Price excluding hard disk and
monitor

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Options

Select your ideal monitor, hard disk and case from the range listed below and add the cost to the system of your choice opposite.



Case Options

■ Low Profile Desktop Case	£18.00
■ Mini Tower	£18.00
■ Medium Tower	£55.00
■ Large Floor Standing Tower (not shown)	£125.00

Hard Disk Options (not shown)

■ 44MB £109.00	■ 240MB £349.00
■ 102MB £169.00	■ 410MB £649.00
■ 124MB £209.00	



Monitor Options

■ 14" Mono VGA (paper white)	£89.00
■ 14" Colour SVGA Low radiation	£189.00
■ 20" Colour SVGA Non- Interlaced	£699.00

Peripherals

■ Extra 3.5" 1.44MB drive	£42.00
■ Extra 5.25" 1.2MB drive	£50.00
■ MS DOS V.5	£49.95
■ MS DOS V.5 & Windows 3.1	£75.00
■ Additional 1MB Ram	£25.00
■ Canon BJ10ex Printer	£210.00
■ Canon BJ10ex sheet feeder	£48.00
■ MT81 9 pin LQ Printer	£125.00
■ 120MB Colorado Tape Streamer	£155.00
■ 250MB Colorado Tape Streamer	£195.00

Please add £25.00 (Plus VAT) for black finish

Please add £15.00 (Plus VAT) for courier delivery on systems. (mainland UK)
Specifications of systems ordered may differ from those illustrated.

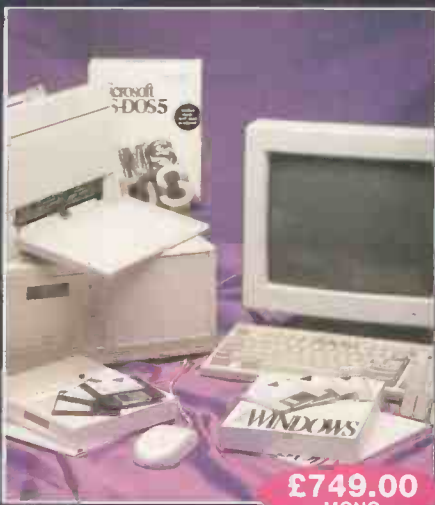
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386 SX-33 Home Starter Pack

Specification as Dove 386SX-33 plus

- 44MB hard disk
 - Choice of 14" SVGA colour or 14" VGA mono monitors
 - MT81 LQ 9 pin dot matrix printer
 - Serial mouse
 - MS DOS v.5
- £525.00 (Mono) £625.00 (Colour) ex VAT



386 DX-40 Office Super Saver

Specification as Swift 386DX-40 plus

- 44MB hard disk
 - 2MB RAM
 - Choice of 14" SVGA colour or 14" VGA mono monitors
 - Canon BJ10ex ink jet printer
 - Canon BJ10ex with cut sheet feeder
 - Serial mouse
 - MS DOS v.5 & MS Windows 3.1
- £749.00 (Mono) £849.00 (Colour) ex VAT

All prices exclude VAT.

14 Day Money Back Guarantee* If Not Satisfied.

* Excludes, printers, software & consumables



386 SX-33 Games Pack

Specification as Dove 386SX-33 plus

- 44MB hard disk
 - 14" SVGA colour monitor
 - Small tower metal case
 - Professional joystick
 - Serial mouse
 - MS DOS v.5
 - MS Flight Simulator
 - Stereo speakers
 - Sound blaster card
 - Black finish
- £695.00 (Colour) ex VAT



486 DX-33 Executive Super Saver

Specification as Falcon 486DX-33 plus

- 44MB hard disk
 - Choice of 14" SVGA colour or 14" VGA mono monitors
 - Canon BJ10ex ink jet printer
 - Canon BJ10ex with cut sheet feeder
 - Serial mouse
 - MS DOS v.5 & MS Windows 3.1
- £999.00 (Mono) £1099.00 (Colour) ex VAT



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4+4

Thanks to massive leaps in recent computer technologies we are proud to present the new addition to our ever popular range of low cost, high specification computer systems, the MICROSURGEONS 4+4.

Unlike most computers that you find within the pages of this magazine the 4+4 is the very leading edge of technology. It has been designed by a team of resident electronics engineers who have called upon years of experience in their field to bring you the first system to have been designed and built solely within the U.K. for many years.

Our objective was to make a 486 system that existing computer users would respect and upgrade to. The heart of the system came from the chip manufacturer VLSI using their latest chip set. Just two chips run the Intel 486 with impressive speed without the need of expensive memory caching.

It is a common mis-conception that cache memory is something to do with built in hard disc caching which does speed up hard disc access. Cache memory found on mother boards is a hardware fudge to speed up access to slow computer memory.

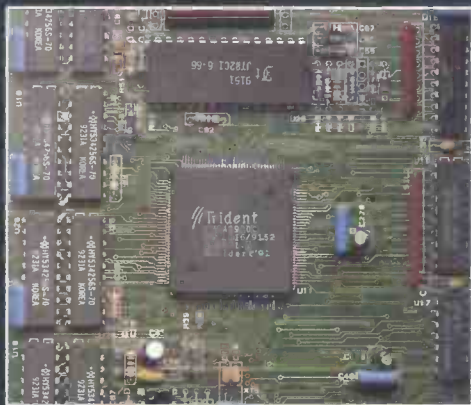
As the Intel 486DX c.p.u. incorporates 8k internal cache we felt it uneconomic in terms of a price and performance trade off to include external c.p.u. cache. A landmark speed of 151.9 Mhz proves this beyond a shadow of a doubt.

The 4+4 motherboard is designed to accept a variety of Intel 486 c.p.u.'s, either the 486SX which does not include internal maths co-processor, 486DX c.p.u. incorporating maths co-processor or 486DX-2 c.p.u. which includes maths co-processor and internal clock doubling to improve performance

still further. As this is the single most expensive component in any 486 based computer care should be taken to choose the c.p.u. that best suits your needs.



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The third chip is the Trident 8900c Super VGA graphics I.C. fitted with 512k (upgradable to 1Mb) on the motherboard. This gives a maximum resolution of 1024 X 768 pixels in 256 colours at any one time. A large selection of software drivers are included for all your applications.

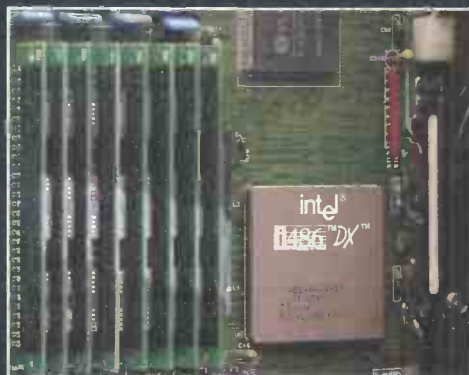


Controlling the 3.5" 1.44Mb drive and optional 5.25" drive is the fourth chip on the mother board (ence 4+4). Simplifying what was once done by many components, its job also entails controlling the 44Mb (upgradable) IDE drive, 2 serial, games and parallel ports. All on the one piece motherboard with full enable / disable for upgraders.

Please add £15.00 (Plus VAT) for courier delivery on systems. (mainland UK) All prices exclude VAT.

14 Day Money Back Guarantee* If Not Satisfied.

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Memory can be expanded up to 32Mb on the motherboard and 1Mb is fitted as standard. Using 4x256Kx9 70ns SIMS or SIPS please state memory required, 4Mb is a realistic size.



The three (upgradeable) 16 Bit expansion slots allow room for your other add-ons and peripherals, although everything is on the motherboard for most users anyway.



At the rear of the case you will find sockets for SVGA monitor, Games, Com 1, Com 2, & printer plugs. Just plug in the supplied keyboard in the front and you're ready to go.



The 4+4 comes with 3.5" Drive, 44Mb Hard disc, 1Mb Ram, 512K SVGA, 102 keyboard, and black low profile case. You will need a monitor.

4+4 SX-25 using Intel 486SX-25

£399.00

4+4 DX-33 using Intel 486DX-33

£499.00

4+4 DX2-66 using Intel 486DX2

£579.00

Note Special Monitor/Hard Disc Options to 4+4 owners. ...Phone/write.

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- 3 Button Mouse
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386 POWERPLEX
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128k Cache, 2Mb Ram, 1.44Mb Floppy, 1Mb Orchid Graphics Card, 14" SVGA Non Interlaced Colour Monitor, 85Mb/12Ms Hard Disk, MS Dos 5.0 and Windows 3.1, Mouse, 5 Year Warranty.

85Mb System
£799

486 POWERPLEX
Sx-25

4Mb Ram, 1.44Mb Floppy, 1Mb Orchid Graphics Card, 14" SVGA Non Interlaced Colour Monitor, 120Mb/12Ms Hard Disk, MS Dos 5.0 and Windows 3.1, Mouse, 5 Year Warranty.

120Mb System
£999

486 POWERPLEX
Sx-25 Cache

128k Cache, 4Mb Ram, 1.44Mb Floppy, 1Mb Orchid Graphics Card, 14" SVGA Non Interlaced Colour Monitor, 120Mb/12Ms Hard Disk, MS Dos 5.0 and Windows 3.1, Mouse, 5 Year Warranty.

120Mb System
£1049

486 POWERPLEX
Dx-33 Cache

256k Cache, 4Mb Ram, 1.44Mb Floppy, 1Mb Orchid Graphics Card, 14" SVGA Non-Interlaced Colour Monitor, 120Mb/12Ms Hard Disk, 120Mb Mag. Tape Storage, MS Dos 5.0 and Windows 3.1, Mouse, 5 Year Warranty.

240Mb System
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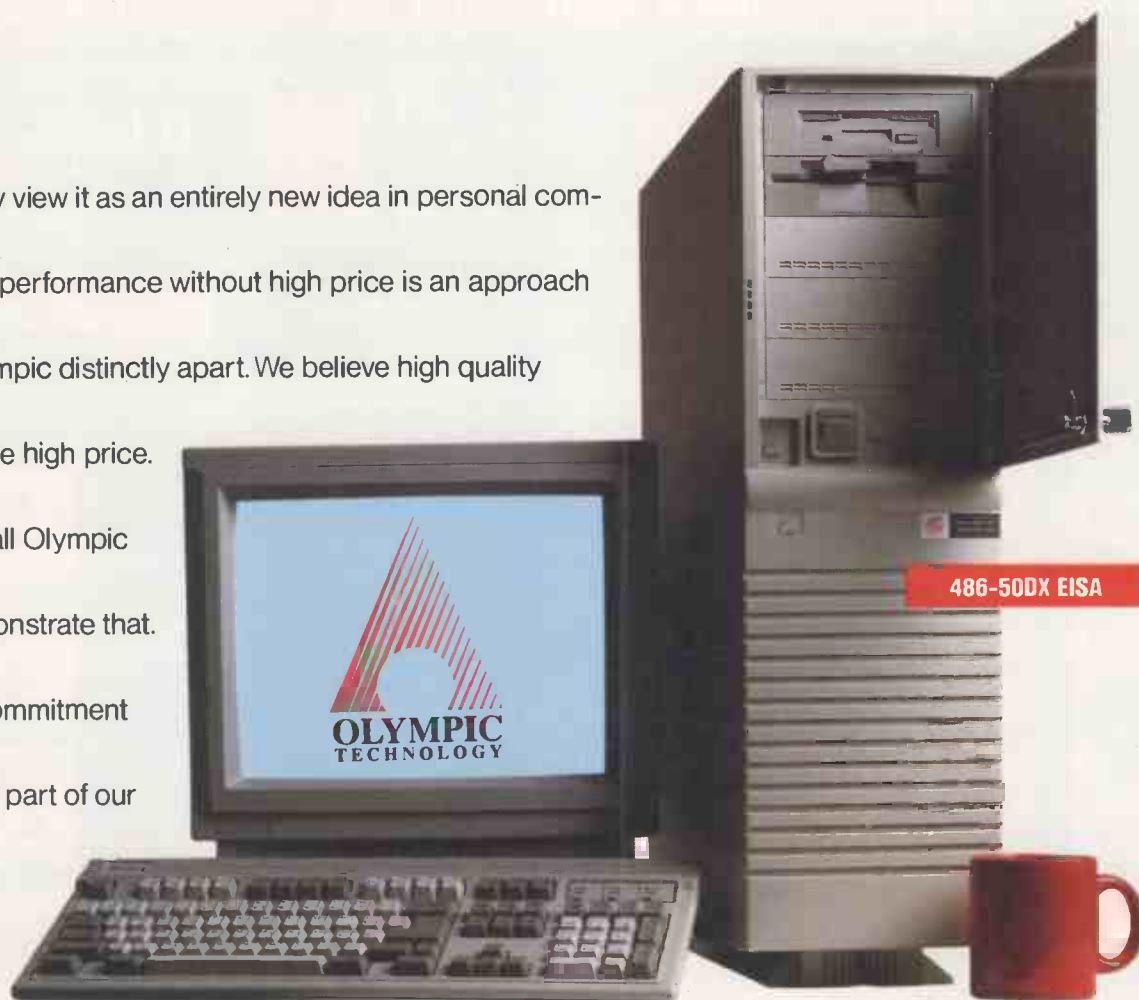
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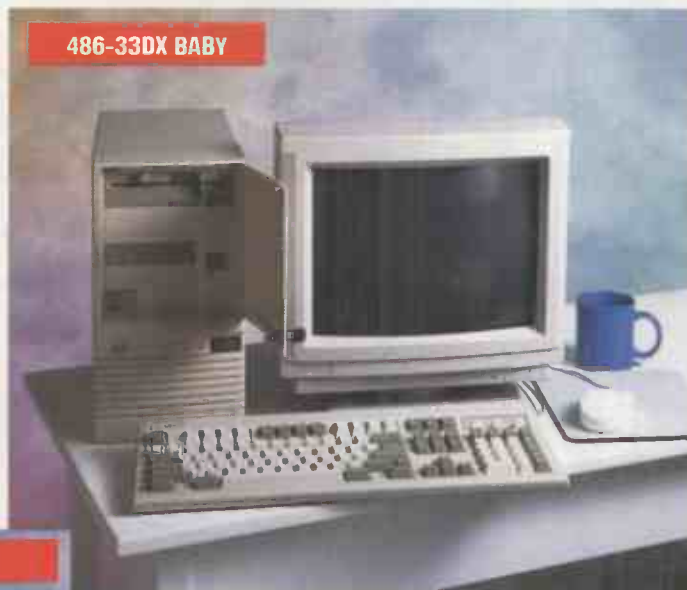
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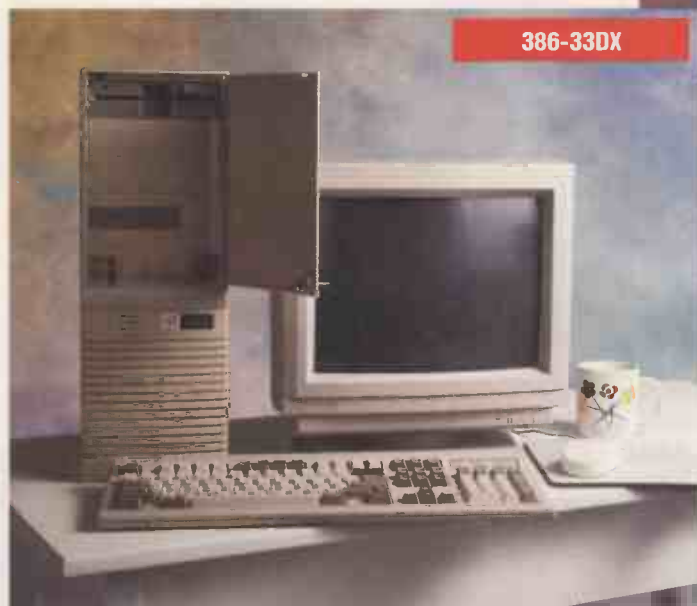
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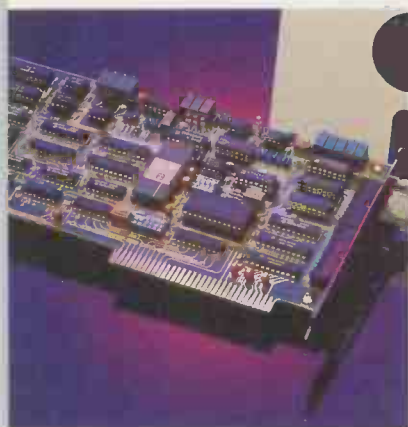
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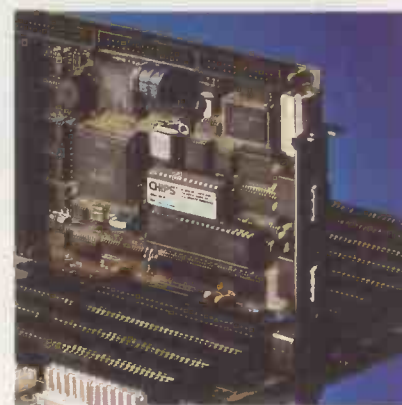
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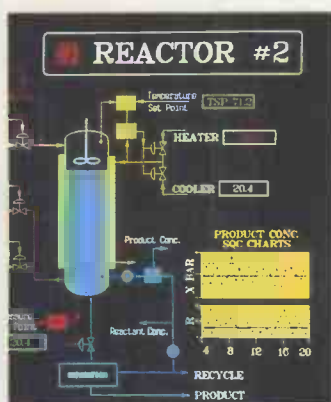
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Its Winputer was hailed by What Personal Computer as

- 1 Deal direct with the manufacturer. Why make the middle man rich?
- 2 Choose an established company. You could be a loser if your supplier disappeared.
- 3 Consider how quality of service and technical support can affect your total outlay.
- 4 The manufacturer, rather than a third party, should provide on-site maintenance. That ensures quicker repairs.
- 5 Computers should be upgradeable – inexpensively.
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- 7 If you have old PCs, consider part-exchange as a cheap way to boost your computing power.
- 8 The manufacturer should have networking expertise – and offer it to customers inexpensively.
- 9 Calculate the value of extras such as cache memory or an additional floppy drive.

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Warning Lights.

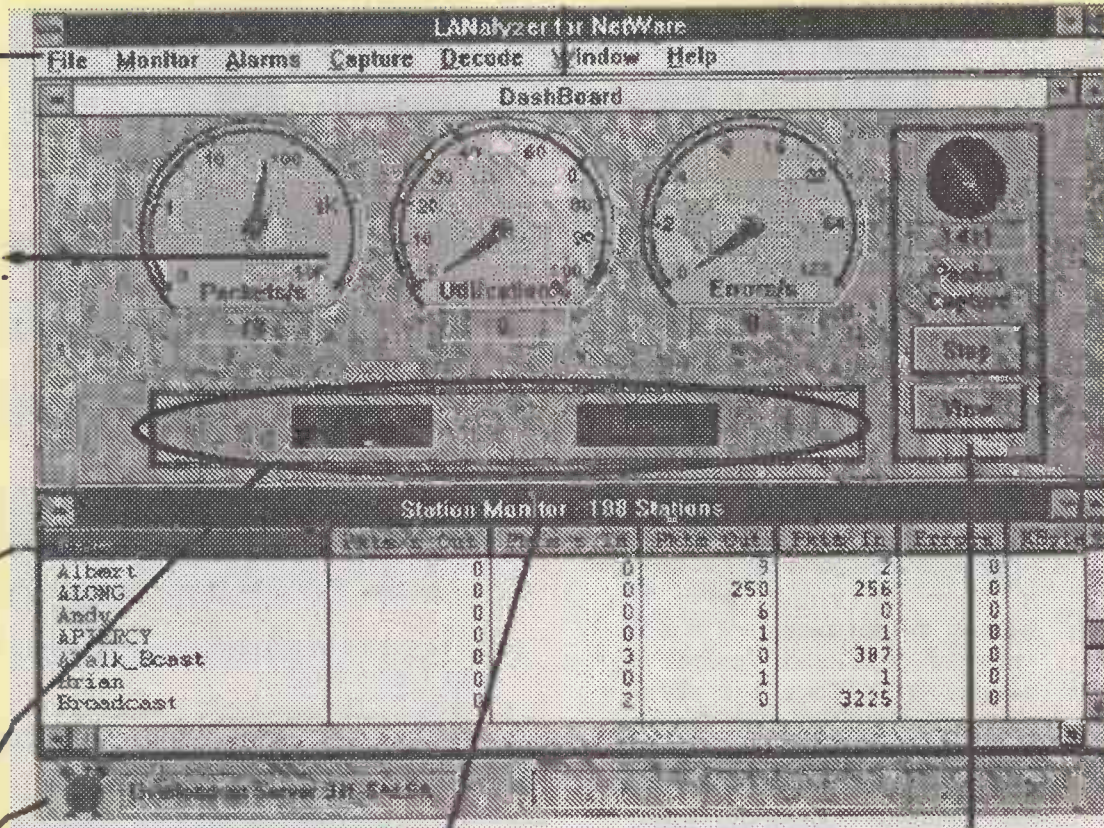
When network or server problems arise, these "lights" turn red and an alarm message appears at the bottom of the screen. Double-click the light for a complete log of alarms.

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42Mb 23ms	85Mb 17ms, 32Kb cache*	170Mb 15ms 32Kb cache*	210Mb 13ms, 64Kb cache*		42Mb 23ms	85Mb 17ms, 32Kb cache*	170Mb 15ms 32Kb cache*	210Mb 13ms, 64Kb cache*	85Mb 17ms, 32Kb cache*	170Mb 15ms 32Kb cache*	210Mb 13ms, 64Kb cache*	85Mb 17ms, 32Kb cache*
14" Colour VGA	685	710	790	860	785	810	890	960	820	900	970	1135
14" Super VGA	735	760	840	910	835	860	940	1010	870	950	1020	1185
17" Hi-res SVGA	1195	1220	1300	1370	1295	1320	1400	1470	1330	1410	1480	1645

WS486DX-33					WS486DX2-50				WS486DX-50			
4Mb (exp 32Mb) 128Kb cache (exp 256Kb)					4Mb RAM (exp 32Mb) 64Kb cache (exp 256Kb)				4Mb RAM (exp 32Mb) 256Kb cache			
85Mb 17ms, 32Kb cache*	170Mb 15ms 32Kb cache*	210Mb 13ms, 64Kb cache*	340Mb 13ms, 64Kb cache*		85Mb 17ms, 32Kb cache*	170Mb 15ms 32Kb cache*	210Mb 13ms, 64Kb cache*	340Mb 13ms, 64Kb cache*	85Mb 17ms, 32Kb cache*	170Mb 15ms 32Kb cache*	210Mb 13ms, 64Kb cache*	340Mb 13ms, 64Kb cache*
14" Colour VGA	1115	1195	1265	1430	1195	1275	1345	1510	1280	1360	1430	1595
14" Super VGA	1165	1245	1315	1480	1245	1325	1395	1560	1330	1410	1480	1645
17" Hi-res SVGA	1625	1705	1775	1940	1705	1785	1855	2020	1790	1870	1940	2105

WS486DX2-66					NOTEBOOK			
4Mb RAM (exp 32Mb) 256Kb cache					<ul style="list-style-type: none"> ▼ 80386SX processor running at 20MHz ▼ Enhanced VGA, 640 x 480 resolution on backlit LCD screen ▼ 1 serial, 1 parallel & 1 external keyboard ports ▼ 2Mb RAM upgradable to 5Mb on the motherboard ▼ Fully LIM 4.0 EMS compatible ▼ 1 x 3.5" 1.44Mb floppy drive ▼ MS-DOS, Windows and Mouse 			
85Mb 17ms, 32Kb cache	170Mb 15ms 32Kb cache*	210Mb 13ms, 64Kb cache*	340Mb 13ms, 64Kb cache*					
14" Colour VGA	1510	1590	1660	1825				
14" Super VGA	1560	1640	1710	1875				
17" Hi-res SVGA	2020	2100	2170	2335				
						40Mb HDD	60Mb HDD	
						745	815	

CVGA = Colour VGA (640 x 480), 39dp, SVGA = Super VGA (1024 x 768), 28dp, 17" HR-SVGA = Ultra VGA (1280 x 1024), 26dp

*Read look ahead Buffer for very fast access



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- ▼ 102 Key enhanced keyboard

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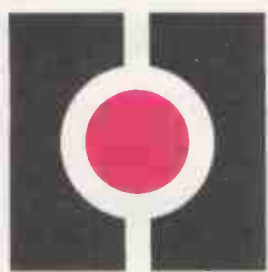
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???????

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- 2 Who was the original comedian on Crackerjack?
- 3 Who manufactured the floppy drives for the BBC Computer?
- 4 What was the name of the first IBM PC clone?

Answers in next issue

Last issue's answers:

- 1) Rank Xerox's Parc Laboratory
- 2) Non-Volatile Random Access Memory
- 3) 1962
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- Landmark speed of 112MHz

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- 2 year guarantee

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386SX25 Board with 2MB £199

386SX33 Board with 2MB £239

120MB, 19ms Hard Disk £252

OPUS

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386SX33 Board with 2MB £239

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ALL OUR MEMORY PRODUCTS ARE 100% COMPATIBLE AND COME WITH FULL 5 YEAR NO-QUIBBLE GUARANTEE

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£49

- Extremely cost effective
- Double the capacity of your hard disk

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2MB Upgrade	£158
8MB Upgrade	£467
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1MB Board	£139
4MB Board	£369

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T1000/E/XE/LE, T1800, T1850C, T2000SX, T2000SXE, T2200SXE	
2MB Card	POWERCUT! £94
4MB Card	POWERCUT! £155
8MB Card	POWERCUT! £289

T1200XE

- 2MB Card £87

T1600/T5100

- 2MB Card £88

T3100

- 2MB Card £168

T3100E

- 512K Card £39
- 2MB Card £85

T3100SX

- 2MB Card **POWERCUT! £84**
- 4MB Card **POWERCUT! £162**
- 8MB Kit **POWERCUT! £298**

T3200SX/C

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- 4MB Module **POWERCUT! £179**
- 8MB Kit **POWERCUT! £348**

T3200

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- 4MB Card £125
- 8MB Card £345

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- 2MB Module **POWERCUT! £79**
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- 12MB Kit £367

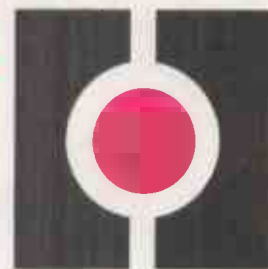
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Call our Corporate Account Division for a free feasibility study on the upgradability of your older PC's. Costings can include Hard Disk, Memory and Processor upgrades.

PUP OF THE MONTH
XT/AT GAMES CARD £4.00

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MS WINDOWS V.3.1 £58
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UPGRADE £38
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• Includes full fitting instructions

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4MB Kit £118

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B/33

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4MB Kit £114
8MB Kit £199

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8MB Kit **POWERCUT!** £188
16MB Kit **POWERCUT!** £345

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4MB Kit **POWERCUT!** £99
8MB Kit **POWERCUT!** £190
32MB Kit **POWERCUT!** £710

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8MB Kit £190
16MB Kit £372

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8MB Kit £196
16MB Kit £388

LT386SX/P

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4MB Kit £102

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Full range of memory and fixed disks available for Classic, SE, LC, CX, CI, FX, SI, Quadra, Portable and PowerBook.

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£2.50**



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Full page high resolution graphics
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EPSON EPL6000

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EPSON EPL7100

512K £55

EPSON EPL8100

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KYOCERA F1200S/3000/3300

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2MB £140
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MANNESMAN TALLY MT905

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PANASONIC 4430

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• PostScript emulation cartridge for HP Series II and III
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• 100% CPI & Pacific Page compatible

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(each) £65

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Forms • Bar Codes • Global
• Worksheet • Equations •
Presentations

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• Speeds up output by 800%
• Incorporates Intel RISC Processor and 4MB RAM

EUROTURBO **POWERCUT!**
CARTRIDGE

£129

PACIFIC PAGE PE £217

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POSTSCRIPT

£275

HP ADOBE POSTSCRIPT +
• PostScript Level 2

£395

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• 25 Font Cartridge for HP Deskjet

HP PAINTJET XL500 £829

• PostScript level 2

• Includes 4MB RAM

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• Full range of individually tested memory and mass storage upgrades available.
• Guaranteed 100% memory matched
• Memory for Sun is SPARC approved

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4MB Kit £124

SUN 4/40 & 60, 65 & SPARC I

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16MB Kit £480

SUN SPARC SLC

4MB Kit £130

SUN 4/110, 4/75, SPARC II

16MB Kit £484

IBM RISC 6000

64MB Kit £3510
448MB Kit £20104

IBM X STATION

6MB Kit £236

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INDIGO 4D/RPC

88MB Kit £6876

HP APOLLO 9000, 433s, 425s, 380, 375

24MB Kit £1897
102MB Kit £8014

HP APOLLO 900, 400di

4MB Kit £245

DEC SYSTEM 5100

16MB Kit £1299

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• Complete range for Micro, Executive, Professional and Tower

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4MB Kit £98

VIG II ELITE

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4MB Kit £104

VIG III LS

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8MB Kit £196

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16MB Kit **POWERCUT!** £396

VIG 3DX40

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8MB Kit £201
16MB Kit £390
24MB Kit £487

VIG 4SX25, 4DX33, 4DX50, 4DX2-50, 4DX2-66

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8MB Kit £204
16MB Kit £392
24MB Kit £491

ALL ABOUT POWERMARK

• Powermark plc is the United Kingdom's largest direct supplier of memory and other upgrades.

• The Powermark Promise has been published and is freely available on request.

• Powermark supply the majority of the UK's top 1000 companies.



CALL 081-951 3355 IF THE UPGRADE YOU REQUIRE IS NOT LISTED HERE



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• Check compatibility with your system before ordering
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1.2MB £43

3.5" DISK DRIVE

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4MB Kit £220

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1MB - 2MB £67

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2MB Kit £115

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...8 Track

...The VIC20

...Chopper Bikes



Memory Bank

MEMORY FOR NOTEBOOKS

• More memory can increase battery life up to 18%

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2MB **POWERCUT!** £87

4MB **POWERCUT!** £162

SHARP 6200/6220

1MB **POWERCUT!** £83

2MB £164

SHARP 6641/8500

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PANASONIC CF170, 270, 370

1MB £55

2MB £99

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1MB £99

APPLE POWERBOOK

£Call

ACER NB

2MB £118

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• Includes full instructions

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2MB Kit £62

4MB Kit £112

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4MB Kit £112

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2MB → 10MB £258

2MB → 16MB £391

325/333

4MB Kit £134

16MB Kit £524

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4MB → 8MB £133

4MB → 16MB £389

8MB → 32MB £780

212N/320N NOTEBOOK

1MB £104

2MB £176

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PRODUCTS ARE 100%
COMPATIBLE AND
COME WITH FULL
5 YEAR NO-QUIBBLE
GUARANTEE**

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• Call for configurations not shown here.

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1MB add-on Module £56

4MB add-on Module £186

1MB Expansion Board £94

4MB Expansion Board £207

DESKPRO 386/16

1MB Kit £101

8MB Expansion Board £768

1MB Expansion Board £168

4MB Expansion Board £310

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DESKPRO 286N, 386N & 386S/20

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2MB Module **POWERCUT!** £82

4MB Module **POWERCUT!** £149

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64MB Board with 4MB £292

64MB Board with 8MB £444

PRO LINEA

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4MB £191

8MB £302

PORTABLE III

2MB Kit £99

PORTABLE 486M/COLOUR

2MB Kit £87

8MB Kit £323

SLT/286

1MB Board **POWERCUT!** £69

4MB Board **POWERCUT!** £235

SLT386

1MB Board £82

2MB Board £148

4MB Board £242

LTE/286

1MB Board **POWERCUT!** £62

2MB Board £96

4MB Board **POWERCUT!** £163

LTE386s/20

1MB Board £80

4MB Board £225

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4MB Board **POWERCUT!** £225

8MB Board **POWERCUT!** £524

CONTURA

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• 12 month warranty

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120MB £294

210MB £501

386L, 486/25, 486L

330MB £959

660MB £1497

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• Essential when handling electrostatic devices. £8.50

IC EXTRACTOR TOOL

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SIMM TESTER

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1MB → 4MB £118

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1MB → 4MB £120

1MB → 6MB £174

1MB → 8MB £222

M290S

2MB Kit £56

PRO SX

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M486/CP386

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4MB Kit £225



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• Upgrade your 80486 Computer with the new Intel OverDrive

• Doubles clock speed

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20/40 40MHz £275

25/50 50MHz £338

33/66 66MHz £385

MEMORY EXPANSION BOARDS

• For PC's with non-upgradable motherboards, expansion boards are the ideal way to add memory to your system.

• All boards support LIM 4.0 standard, Windows 3.1 and are completely user expandable.

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3MB Board with 2MB £127

3MB Board with 3MB £161

BOCA AT

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8MB Board with 4MB £165

8MB Board with 6MB £212

8MB Board with 8MB £245

KINGSTON ATA BOARD

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16MB Board with 8MB £295

16MB Board with 16MB £495

POWERBOARD

32MB Board with 16MB £442

32MB Board with 32MB £736

KINGSTON MCA 64

• 32 Bit MCA Card

64MB Board with 2MB £Call

MEMORY FOR PACKARD BELL

• Includes full fitting instructions

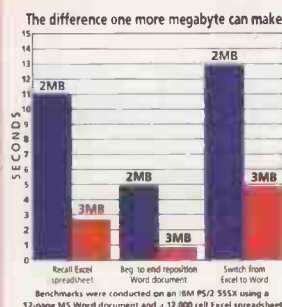
LEGEND 200/316SX

2MB Kit £68

4MB Kit £126

MEMORY UPGRADES - AN EXPLANATION

Most major new software packages, particularly MS Windows, demand large amounts of memory to work effectively. Upgrading from the standard 640K/1MB/2MB enables you to work efficiently AND allows you to run more than one application at a time. Memory upgrades from Powermark are easy to install with little or no software setup - with most upgrades just plug in and go. If however you are unsure our technical support team will happily talk you through the upgrade procedure.



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• Beware of low grade economy modules with slow refresh cycles and low input capacitance. Powermark only supply total specification SIMMs from leading manufacturers.

• Call for configurations not shown here.

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1M x 8 - 80ns £27

1M x 9 - 100ns £27

1M x 9 - 80ns £26

1M x 9 - 70ns £27

1M x 9 (9cs) - 70ns £34

1M x 9 - 60ns £36

4M x 9 - 80ns £123

4M x 9 - 70ns £127

GOLD EDGED SIMMS

• Specified by many PC manufacturers

• Lower MTBF.

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1M x 9 - 70 £37

1M x 9 - 60 £39

SIPS

• Call for configurations not shown here.

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1M x 9 - 60ns £41

4M x 9 - 70ns £154

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27256 - 20 £3.42

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• Full range of PROMs, SRAMs & ZIPs available.

Memory Bank

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Installation of a Co-Processor results in a significant speed increase in maths intensive applications eg: spreadsheets, databases, CAD and graphics packages. • IIT, ULSI & Cyrix Co-Processors can run at twice the speed of Intel equivalents, representing real value for money.

• ULSI feature lifetime warranty, fewer clock cycles for maximum performance, Auto Sleep mode saves battery life.

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8087-2 (8 MHz)	£68	-	-
8087-10 (10 MHz)	£88	-	-
80287 XL (12MHz)	£45	£34	-
80387-16SX (16 MHz)	£57	£43	-
80387-20SX (20 MHz)	£57	£43	-
80387-25SX (25 MHz)	£57	£44	-
80387-33SX (33 MHz)	-	£59	-
80387-25SL (25 MHz)	£57	-	-
80387-16 (16 MHz)	£57	£55	-
80387-20 (20MHz)	£57	£55	£95
80387-25 (25 MHz)	£57	£56	£99
80387-33 (33 MHz)	£57	£57	£139
80387-40 (40 MHz)	-	£61	£199
80487-25SX (25MHz)	£296	-	-
80386 RapidCAD	£199	-	-

PRICES MUGGED!

MEMORY FOR ICL

DRS 40, 45	
2MB Kit	POWERCUT! £61
4MB Kit	POWERCUT! £118
DRS 50, 55	
4MB Kit	£126
DRS 75	
4MB Kit	£142
16MB Kit	£505
DRC Range	£Call
DRS M95	
4MB Kit	£145
64MB Kit	£1880

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• Completely user expandable.

PS/2 50, 50Z, 60 & 65	
14MB Board with 2MB	£199
16MB Board with 4MB	£245
16MB Board with 8MB	£375
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16MB Board with 4MB	£245
16MB Board with 8MB	£375

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• Fully compatible Internal Hard Disks for IBM PS/2

PS/2 50 & 50Z	
52MB	£342
80MB	£438
105MB	£498
PS/2 60, 65, 80, 90 & 95	
113MB	£580
159MB	£690
426MB	£1340

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Acorn, ALR, AST, Austin, Canon, Commodore, Dan, Goldstar, Hotpoint, Hyundai, Locland, MJN, Multiplex, NeXT, Opus, Philips, QMS, Sharp, Tandy, TI, Ti'ko, Unisys, Wyse, Zanussi and many, many more.

Don't forget - if you do not see the upgrade you require then please call 081-951 3355.

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All prices exclude VAT.

15% restocking for returned non-defective goods.

MEMORY FOR IBM PS/1 & PS/2

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- Call for configurations not shown here.
- Includes full fitting instructions

PS/1	
512K	£42
2MB	£89
PS/1 - 386	
2MB	£86
4MB	£148
PS/2 25-286, 30-286	
2MB	£89
4MB	£168
PS/2 35LS, 35SX, 40SX	
2MB	£80
4MB	£154
8MB	£298
PS/2 50Z	
1MB → 2MB	£80
PS/2 55SX	
2MB	£80
4MB	£135
PS/2 57SX, M57 SLC	
2MB	£82
4MB	POWERCUT! £157
PS/2 60, 65SX	
1MB	£45
2MB	£82
4MB	£135
PS/2 70, Portable 70/75	
2MB	£82
4MB	£139
8MB	£260
PS/2 80	
2MB	£82
4MB	£185
PS/2 L40SX, N335SX	
2MB Card	POWERCUT! £91
4MB Card	POWERCUT! £199
PS/2 90 & 95	
2MB Module	POWERCUT! £99
4MB Module	POWERCUT! £156
HURDLA, SPRINTA	
4MB Kit	£102



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MEMORY FOR TANDON

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512K Kit	£18
PCA SL386SX, SL286-12, SL486	
2MB Kits	£74
PAC Range	£Call
PC 386/20	
4MB Kit	£128
8MB Kit	£256
PC386sx/20	
2MB Kit	£64
4MB Kit	£124
6MB Kit	£168
PC286/N, 386/N	
2MB Module	£69
4MB Module	£134
8MB Module	£258
386SX NOTEBOOK	
1MB → 2MB	£74
2MB → 10MB	£198
POSITIVE 386SX25, 386DX40, 486SX25, 486DX33	
4MB Kit	£136
8MB Kit	£270
16MB Kit	£480

MEMORY FOR AMSTRAD

• Includes full instructions	
PC1512/1640/2086/3086	
1MB Board	POWERCUT! £79
2MB Board	POWERCUT! £109
PC1286	
1MB → 4MB	£112
PC1386	
4MB Kit	£114
ALT286/386SX	
1MB → 4MB	£118
1MB → 4MB (Zero-wait state)	£136
PC3286/3386	
1MB → 4MB	£118
1MB → 16MB	£482
PC5286	
4MB Kit	POWERCUT! £114
NC100	
256K Card	£58
512K Card	POWERCUT! £94
1MB Card	£159

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Max. Planer Memory	2.5Mb	6Mb	16Mb
Fixed Disk	40Mb	40Mb	80Mb
Adaptor Slots	—	2	3
Preloaded IBM DOS	4.01	4.01	5.0
MS Works	Yes	Yes	Yes
Works Tutorial	Yes	Yes	Yes
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STD Memory	2Mb	4Mb	4Mb	4Mb
Max. Planer Memory	14Mb	16Mb	20Mb	20Mb
Fixed Disk	85Mb	170Mb	170Mb	170Mb
Adaptor Slots	3	3	3	3
Preloaded IBM DOS	5.0	5.0	5.0	5.0
MS Works	Yes	Yes	Yes	Yes
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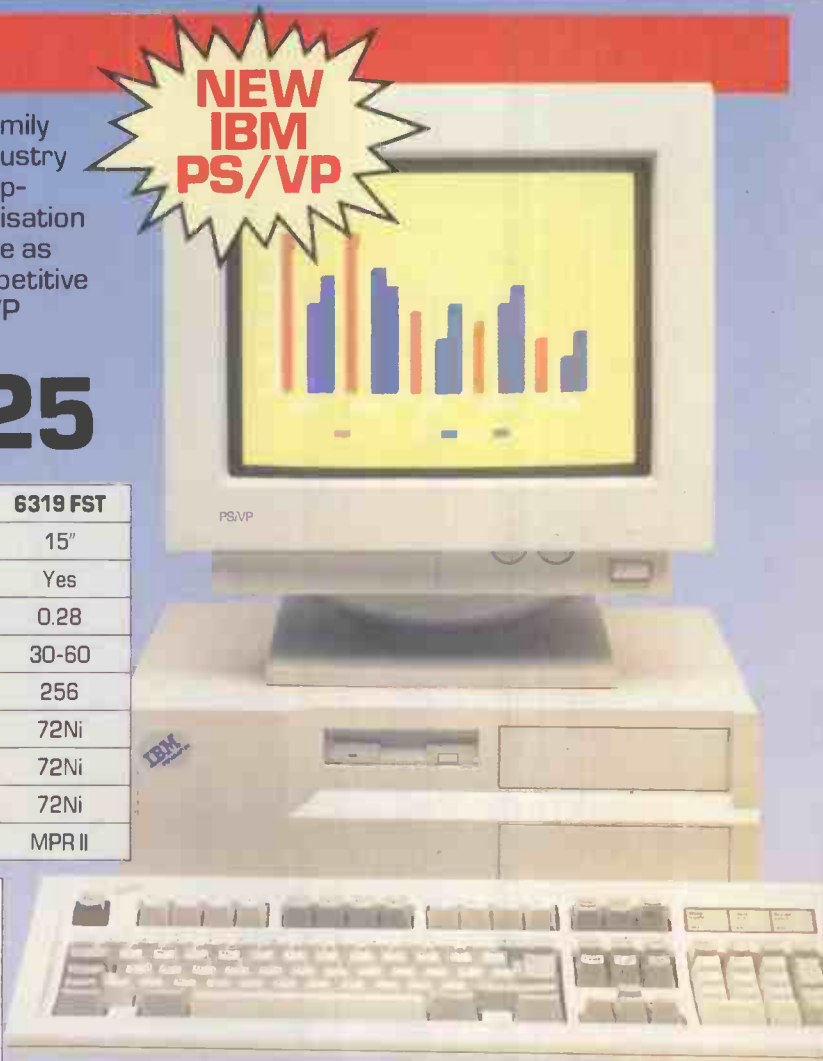
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Horizontal Scan Rate KHz	35.5	30-52	30-60	30-60
Max. Colours	256	256	256	256
Resolution 640 x 480	60i	72Ni	72Ni	72Ni
Resolution 800 x 600	—	72Ni	72Ni	72Ni
Resolution 1024 x 768	43.5i	60Ni	72Ni	72Ni
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Fixed Disk	80Mb	80Mb	170Mb	80Mb	170Mb	170Mb	80Mb	80Mb	170Mb
Expansion Full/Half	4/1	4/1	4/1	4/1	4/1	4/1	4/1	4/1	4/1
Operating System	DOS 5.01	DOS 5.01	DOS 5.01	DOS 5.01	DOS 5.01	DOS 5.01	OS/2.01	OS/2.01	OS/2.01
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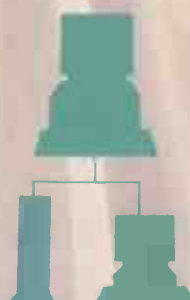
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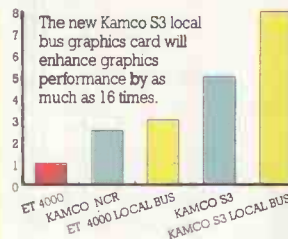
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210 Freelance Graphics Serv V4	£346
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A09 HVG V3 1 node upgrade	£92
275 HVG V3 1 Node pk	£219
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984 Plide V2.3	£153
W228 Powerpoint V3	£237
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230 Presentation pk	£346
110 Express Presenter V1	£168
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W236 DeltaPoint DeltaGraph Pro	£POA
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Statistics & Graphs

W189 CA Cricket Graph for win	£125
180 Chart V3.0	£172
C20 Graftool	£307
216 Graphwriter II	£250
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234 Quick Charts For HVG	£65
W240 QuickGraph Pro for win	£69
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644 Framework Executive V1.0	£83
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A60 Netware 386 3.11 P 250pk	£5322
A61 Netware 386 3.11 (5pk)	£384
398 Netware 386 3.11 (10pk)	£882
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A46 ms DOS 5.0 Upgrade 20 pk	£612
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407a OS/2 V2	£POA
A53 OS/2 V2 (Upgrade from DOS)	£49
W447 Win multimedia Dev kit CD	£218
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W868 Turbo C++ for win 3.1	£80
414 Turbo Debug & Tools V2	£74
415 Turbo Pascal Pro V6.0	£115
465 Smart II Spreadsheet V1.5	£62
W417 Turbo Pascal (win)	£86
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A78 123 R2.4 5 Pk Upgrade	£470
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447 123 R3.1 Plus 20-pk	£714
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386SX-33 Cache	48MHz	£590	£605	£615
386-25	36MHz	£595	£610	£620
386-40 Cache	75MHz	£650	£665	£675
486SX-25	85MHz	£675	£690	£700
486-33 Cache	155MHz	£840	£855	£865
486-50 Cache	210MHz	£995	£1010	£1020
486-33 EISA	155MHz	£1395	£1410	£1420
486-50 EISA	210MHz	£1475	£1490	£1510

All systems complete with:

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- 1Mb RAM
- 2 serial, 1 parallel and 1 games port
- 102 key UK keyboard
- Baby AT style steel case with speed LED, keylock turbo and reset buttons



UPGRADES

120MB 16ms hard disk drive	add £110
210MB 15ms hard disk drive	add £225
Additional floppy disk drive	add £45
Additional RAM per MB	add £25
Mini tower case	add £10
Full tower case	add £60
DOS V5	add £45
Windows V3	add £45
MS compatible mouse	add £15
1 year on site warranty	add £50
(NB: any of the drivers/controllers listed below may be added)	

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Goldstar 14" colour XGA (1024x768) 28"	£190
Sampo 14" colour multi-sync (1024x768)	£245
Sampo 17" XGA multi-sync monitor	£695
VGA card 16-Bit 256KB	£35
VGA card 16-Bit 512KB (Trident)	£45
VGA card 16-Bit 1024 (Trident)	£65
Orchid Pro-Designer MCA 1024KB	£265
Orchid Pro-Designer IIx 1024KB	£190
TSENG chipset VGA card 1024KB	£125
Multi I/O 25, 1P, 1G port	£18
102 Key UK extended keyboard	£28
AT style case with 200W PSU, LED etc	£70
Baby tower case with 200W PSU, LED etc	£80
Full tower case with 250W PSU, LED etc	£125

MOTHERBOARDS

80386SX-25	£90
80386SX-25 Cache	£110
80386-25	£115
80386-33 Cache	£145
80386-40 Cache	£155
80486-33 Cache	£375
80486-50 Cache	£525

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80387SX	CX82587-16KP	£80
	CX82587-20KP	£80
80387DX	CX83D87-16GP	£80
	CX83D87-20GP	£90
	CX83D87-25GP	£90
	CX83D87-33GP	£90

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M2613ET	IDE	135MB	19ms	H/Hx3.5"	£279
M2614ET	IDE	180MB	19ms	H/Hx3.5"	£350
M2622ET	IDE	330MB	12ms	H/Hx3.5"	£650
M2623ET	IDE	425MB	12ms	H/Hx3.5"	£749
M26-24ET	IDE	520MB	12ms	H/Hx3.5"	£849
M2616SA	SCSI	105MB	19ms	1x3.5"	£220
M2613SA	SCSI	135MB	19ms	H/Hx3.5"	£279
M2614SA	SCSI	180MB	19ms	H/Hx3.5"	£369
M2622SA	SCSI	330MB	12ms	H/Hx3.5"	£649
M2623SA	SCSI	425MB	12ms	H/Hx3.5"	£775
M2624SA	SCSI	520MB	12ms	H/Hx3.5"	£850
M2263SA	SCSI	672MB	16ms	F/Hx5.25"	£950
M2266A	SCSI	1079MB	15ms	F/Hx5.25"	£1295

CONNER

MODEL	TYPE	SIZE	SPEED	FORM	PRICE
CP2044	IDE	42MB	28ms	1x2.5"	£205
CP3000	IDE	42MB	19ms	1x3.5"	£120
CP2064	IDE	64MB	19ms	1x2.5"	£220
CP30064	IDE	64MB	19ms	1x3.5"	£145
CP2084	IDE	84MB	19ms	1x2.5"	£275
CP30084	IDE	84MB	19ms	1x3.5"	£179
CP30104	IDE	120MB	19ms	1x3.5"	£235
CP3204	IDE	212MB	16ms	H/Hx3.5"	£360
CP30100	SCSI	120MB	19ms	1x3.5"	£239
CP3200	SCSI	212MB	16ms	H/Hx3.5"	£375

SEAGATE

MODEL	TYPE	SIZE	SPEED	FORM	PRICE
ST351A/X	IDE	42MB	28ms	1x3.5"	£115
ST3096A	IDE	89MB	15ms	1x3.5"	£175
ST3120A	IDE	107MB	15ms	1x3.5"	£195
ST3144A	IDE	130MB	15ms	1x3.5"	£225
ST3283A	IDE	245MB	12ms	1x3.5"	£445
ST2383A	IDE	338MB	16ms	H/Hx5.25"	£455
ST1480A	IDE	426MB	14ms	H/Hx3.5"	£840
ST2383N	SCSI	338MB	16ms	F/Hx5.25"	£745
ST1480N	SCSI	426MB	14ms	H/Hx3.5"	£825
ST4766N	SCSI	676MB	16ms	F/Hx5.25"	£995
ST4767N	SCSI	676MB	12ms	F/Hx5.25"	£1115
ST4120N	SCSI	1.05GB	16ms	F/Hx5.25"	£1295
ST1460N	SCSI	1.42GB	16ms	F/Hx5.25"	£1740

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MODEL	TYPE	SIZE	SPEED	FORM	PRICE
7120A	IDE	130MB	15ms	1x3.5"	£239
7213A	IDE	213MB	15ms	H/Hx3.5"	£340
LXT340A	IDE	340MB	15ms	H/Hx3.5"	£645
LXT535A	IDE	535MB	12ms	H/Hx3.5"	£869
7120S	SCSI	130MB	15ms	1x3.5"	£249
7213S	SCSI	213MB	15ms	H/Hx3.5"	£389
LXT340S	SCSI	340MB	15ms	H/Hx3.5"	£659
LXT535S	SCSI	535MB	12ms	H/Hx3.5"	£879
XT8760S	SCSI	760MB	16ms	F/Hx5.25"	£1079
PO12S	SCSI	1.2GB	13ms	F/Hx5.25"	£1575
PO17S	SCSI	1.7GB	13ms	F/Hx5.25"	£1925

QUANTUM

MODEL	TYPE	SIZE	SPEED	FORM	PRICE
IMP52AT	IDE	52MB	17ms	1x3.5"	£139
IMP120AT	IDE	120MB	17ms	1x3.5"	£239
IMP240AT	IDE	240MB	15ms	1x3.5"	£435
IMP425AT	IDE	425MB	14ms	H/Hx3.5"	£795
IMP52S	SCSI	52MB	17ms	1x3.5"	£155
IMP120S	SCSI	120MB	17ms	1x3.5"	£245
IMP240S	SCSI	240MB	15ms	1x3.5"	£445
IMP425S	SCSI	425MB	14ms	H/Hx3.5"	£785

DISK CONTROLLERS

IDE 16-Bit HDD/FDD with 25, 1P	£25
ST018-Bit SCSI HDD 1:1	£40
ST028-Bit SCSI HDD/FDD 1:1	£55
Adaptec 1542B 16-Bit SCSI Kit 1:1 all drivers	£199
16-bit ESDI	£145
Adaptec 1640 16-Bit MSA	£285
Adaptec 1740 EISA	£385
IDE Cache	£150
DPTEISA SCSI Cached Controller	£375

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PLUS 52MB AT HARDCARD 9ms	£215
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GRAPHICS CARDS

		Max res / cols		Max cols / res	WinTach rating* 1024x768	Price
Orchid Farenheit 1280	1Mb	1280 x 1024	16 I	32K 640 x 480 NI	11.36	199
Orchid Prodesigner IIs	1Mb	1024 x 768	256 NI	32K 640 x 480 NI	5.60	139
VI-900 ET4000 S3	1Mb	1280 x 1024	16 I	256 1024 x 768 NI	11.06	169
Boca X2	1Mb	1280 x 1024	16 I	16mIII 640 x 480 NI	8.92	129
Ahead Wizard	1Mb	1024 x 768	256 I	256 1024 x 768 I		129
COLORImage 6	1Mb	1280 x 1024	16	32K 640 x 480	5.58	109
Trident	1Mb	1024 x 768	256 NI	256 1024 x 768 NI	3.95	59
Trident	512k	1024 x 768	16 NI	256 1024 x 768 NI		39
Oak	256k	800 x 600	16 I	256 320 x 200 NI		29

I = Interlaced NI = Non-interlaced

*WinTach is a Windows-based benchmark program from TI where Compaq 386-20 with standard VGA=1.0

MONITORS

		Max res	Dot pitch	Refresh V (Hz)	H (KHz)	
Kimtron	12" Hercules Mono with FREE mono graphics card					79
AOC 413	14" VGA Mono					99
AOC CM335	14" SuperVGA	SVGA	.28	43-70	30-35	189
Sampo KDM1466	14" MultiFreq - LoRad - Non-interlaced	SVGA	.28	50-90	30-60	259
Interquad AC1495	14" Trinitron FST	SVGA	.28	50-120	30-60	399
Panasonic C1381 *	14" Panasync	SVGA	.28	50-62	30-38	229
Panasonic C13811*	14" Panasync - Non-interlaced	SVGA	.28	50-90	30-70	295
AOC CM735	17" Non-interlaced FST	XVGA	.26	50-90	30-70	649
Panasonic TX1713 *	17" Panasync - LoRad - Digital NI screen	XVGA	.28	50-90	30-64	699
Sampo KDX20	20" Alphascan	SVGA	.31	50-90	30-67	999

* 2 years on-site warranty

SVGA=1024x768 XVGA=1280x1024

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Desktop	3 2		
Mini Tower	2 2	SOFTWARE	
Baby Tower	3 2	Microsoft Windows 3.1	49
Baby Tower with door	3 2	MS-DOS v5.0	59
Midi Tower	3 3	DR-DOS v6.0 with Novell Lite	49
Full Tower	6 0		
Full Tower Deluxe	10 0		

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Full manufacturers warranty

DRIVES *plus...*

smc
computers

From value-for-money SEAGATE drives, through FUJITSU, CONNER, MAXTOR and MICROPOLIS to super-fast QUANTUM drives and PLUS hardcards, we carry comprehensive stocks ready for rapid despatch. Our tape backup drives offer a combination of good performance, easy installation and proven reliability to give you the best solution on the market. Floppy drives are available for all standard PC formats and all carry full manufacturers' warranty. Don't forget that at all times technical support is just a phone call away.

HARD DRIVES & CONTROLLERS

We are your ONE-STOP solution: any of our drives is compatible with any of our controllers with the same interface

IDE INTERFACE

This is now the industry standard for small and medium hard disk sizes. Prices are kept low due to high sales volumes and simple controller technology.

PLEASE NOTE:

You must NEVER low-level format an IDE drive. We do not recommend IDE drives for XT machines. IDE drives from different manufacturers are often incompatible.

IDE HARD DRIVES

SEAGATE

ST351A	3.5"	LP	42Mb	28ms	119
ST3096A	3.5"	LP	89Mb	15ms	179
ST3120A	3.5"	LP	107Mb	16ms	199
ST3144A	3.5"	LP	130Mb	15ms	229
ST1239A	3.5"	HH	211Mb	15ms	349
ST3283A	3.5"	LP	245Mb	12ms	429
ST1400A	3.5"	HH	331Mb	14ms	629
ST1480A	3.5"	HH	426Mb	14ms	729

QUANTUM

ELS85AT	3.5"	LP	85Mb	17ms	179
ELS127AT	3.5"	LP	127Mb	17ms	229
ELS170AT	3.5"	LP	170Mb	17ms	299
with cache effective 9ms					
IMP52AT	3.5"	LP	52Mb	17ms	159
IMP105AT	3.5"	LP	105Mb	17ms	249
IMP120AT	3.5"	LP	120Mb	17ms	269
IMP240AT	3.5"	LP	240Mb	15ms	449
IMP425AT	3.5"	HH	425Mb	14ms	749

CONNER

CP3000	3.5"	LP	40Mb	19ms	119
CP30084	3.5"	LP	84Mb	25ms	179
CP30104	3.5"	LP	120Mb	19ms	229
CP3204	3.5"	HH	212Mb	16ms	399

FUJITSU

M2611T	3.5"	HH	40Mb	19ms	115
M2614ET	3.5"	HH	180Mb	19ms	329
M2622ET	3.5"	HH	330Mb	12ms	599
M2623ET	3.5"	HH	425Mb	12ms	729
M2624ET	3.5"	HH	520Mb	12ms	799

MAXTOR

7120A	3.5"	LP	120Mb	15ms	229
7213A	3.5"	LP	213Mb	15ms	429
LXT340A	3.5"	HH	340Mb	15ms	659
LXT535A	3.5"	HH	535Mb	12ms	849

IDE CONTROLLER CARDS

16-bit Non-cache cards

Seagate ST07A	2HD	25
Seagate ST08A	2HD/2FD	35
IDESPC	2HD/2FD/SPG	29
BOCA Multi-I/O		

+ cables 2HD/2FD/SP 45

Promise 16-bit Cache cards

RAM inst'd		Max Mb
DC - 99	512k	8.5 2HD/2FD
DC-2031	None	16 2HD/2FD
DC-2032	None	16 4HD/2FD/SP

RAM upgrades: £29 per Mb

IDE CABLES

CABIDE	Single drive	8
CABIDE2	Dual drive	10

Universal bracket for 3.5" drives 10

SCSI INTERFACE

The SCSI interface is necessary for very large drives, or when several devices are to use the same controller. Some multi-user operating systems need this interface.

SCSI HARD DRIVES

SEAGATE

SCSI/SCSI-2

ST1480N	3.5"	HH	426Mb	14ms	749
ST41200N	5.25"	FH	1.0Gb	17ms	1249
ST41600N	5.25"	FH	1.3Gb	12ms	1499
ST41650N	5.25"	FH	1.4Gb	15ms	1449
ST42400N	5.25"	FH	2.1Gb	11ms	2199

Fast SCSI-2

ST3283N	3.5"	LP	248Mb	12ms	449
ST1481N	3.5"	HH	426Mb	14ms	799
ST1581N	3.5"	HH	525Mb	12ms	849
ST41651N	5.25"	FH	1.4Gb	15ms	1499
ST42100N	5.25"	FH	1.9Gb	13ms	1999

QUANTUM

with cache effective 9ms

IMP105S	3.5"	LP	105Mb	17ms	269
IMP120S	3.5"	LP	120Mb	17ms	289
IMP240S	3.5"	LP	240Mb	15ms	499
IMP425S	3.5"	HH	425Mb	14ms	799

FUJITSU

M2622SA	3.5"	HH	330Mb	12ms	649
M2623SA	3.5"	HH	425Mb	12ms	799
M2624SA	3.5"	HH	520Mb	12ms	849
M2263SA	5.25"	FH	676Mb	16ms	999
M2266SA	5.25"	FH	1.0Gb	16ms	1249

MAXTOR

7120S	3.5"	LP	120Mb	15ms	259
7213S	3.5"	LP	213Mb	15ms	389
LXT340S	3.5"	HH	340Mb	15ms	649
LXT535S	3.5"	HH	535Mb	12ms	879
XT8380S	5.25"	HH	380Mb	15ms	949
XT8760S	5.25"	HH	760Mb	17ms	1099
PO-12S	5.25"	FH	1.2Gb	13ms	1299
P1-17S	5.25"	FH	1.7Gb	13ms	1699

MICROPOLIS with 5 year warranty

SCSI-2

MIC1598	5.25"	FH	1.0Gb	15ms	1249
MIC1528	5.25"	FH	1.3Gb	15ms	1399
MIC1548	5.25"	FH	1.7Gb	14ms	1849

Fast SCSI-2

MIC1908	5.25"	FH	1.4Gb	11ms	1749
MIC1924	5.25"	FH	2.0Gb	11ms	2299
MIC2112	3.5"	HH	1.0Gb	10ms	1499

SCSI CONTROLLER CARDS

DTC3250	Board	8bit	HD/2FD	69
DTC3180	Kit	16bit	HD	95
DTC3280	Kit	16bit	HD/2FD	115
Adaptek 1542	Kit	16bit	HD/2FD	189
Adaptek 1640	Kit	MCA	HD	279
Adaptek 1742	Kit	EISA	HD/2FD	369
F/Domain 1680	Kit	16bit	HD/2FD	195
Allways IN2000	Kit	16bit	HD/2FD	169

SCSI CABLES

CABSCSI	Single drive	8
CABSCSI2	Dual drive	10

MFM INTERFACE

This is the original hard drive technology, now obsolete. Prices listed are only while stocks last.

MFM HARD DRIVES

SEAGATE

ST251	5.25"	HH	42Mb	28ms	199
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MFM CONTROLLER CARDS

Seagate ST11M	8bit	2HD	39
Seagate ST21M	16bit	2HD	39
Seagate ST22M	16bit	2HD/2FD	49

RLL INTERFACE

Essentially an upgrade of the MFM interface, this is obsolete and stocks will only last for a limited period.

Please note that RLL hard drives are now unavailable

RLL CONTROLLER CARDS

Seagate ST11R	8bit	2HD	39
Seagate ST21R	16bit	2HD	39
Seagate ST22R	16bit	2HD/2FD	49

ESDI INTERFACE

ESDI was the high performance extension of MFM/RLL and stocks will last for a limited period only.

Please note that ESDI hard drives are now unavailable

ESDI CONTROLLER CARDS

DTC6282	AT	16bit	2HD/4FD	145
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MFM / RLL / ESDI CABLES

CABHD	Single drive	10
CABHD2	Dual drive	12

16-BIT HARDCARDS

Just 1" thick, these cards take up one motherboard slot. They use cached Quantum drives giving very fast access. In most cases installation is automatic.

Plus 52 Card	52Mb	9ms	229
Plus 105 card	105Mb	9ms	329

FLOPPY DRIVES

INTERNAL

3.5"	1.44Mb	39
3.5"	frame kit for 5.25" bay	8
5.25"	1.2Mb	42
5.25/3.5"	Canon Dual drive (2 in 1)	99

FLOPPY DRIVE CABLES

2 Drives	Edge connectors	8
2 Drives	Pin & edge connectors	10

Diskettes 3.5" 1.44Mb Box of 10	8
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TAPE DRIVES

COLORADO JUMBO

with software

DJ10 Internal	120Mb	159
DJ10 External	120Mb	239
DJ20 Internal	240Mb	199
DJ20 External	240Mb	279
Ext. port XT/AT for additional PCs		29
Controller XT/AT	8bit	75
Controller AT	16bit	159
3-way connector for use with two floppy drives		12

3M PRE-FORMATTED TAPES

DC34M	120Mb	QIC-40	22
DC38M	250Mb	QIC-80	22

PARALLEL PORT DEVICES

Complete with all necessary documentation, software and fittings for quick, easy installation on your system. Simple to configure for use on a number of systems.

HARD DRIVES

BPHD40	40Mb	299
BPHD100	100Mb	469
Universal Case c/w PSU and carry case		
IDE interface drives		179
SCSI interface drives		199

FLOPPY DRIVES

3.5"	connects to parallel port	189
5.25"	connects to parallel port	189

TAPE DRIVES

BPTD120	120Mb	379
BPTD240	240Mb	459

For tapes see under Colorado Jumbo



Turn the page for more low prices

All motherboards we supply come with Intel/AMD processor, AMI BIOS, 6/8 expansion slots and carry a no-quibble 12-month warranty. Fuller specifications are listed and all lines are held in stock ready for despatch

Unpopulated motherboards.

Please add £29 per Mb of SIMM memory

		Expansion slots:			Size (mm) WxD	Price	
	Cache	8-bit	16-bit	Max RAM			
386sx	33Mhz		2	6	16	220x220	99
386	40Mhz	128k	1	7	32	220x330	189
486sx	20Mhz	128k	1	7	32	220x330	219
486sx	25Mhz		0	6	32	220x220	199
486	33Mhz	256k	1	7	32	220x330	399
486	50Mhz	256k	1	7	32	220x330	549

Local Bus products:

Motherboards with one extended 32-bit bus

		Expansion slots:			Size (mm) W x D	Price
Cache	8-bit	16-bit	Max RAM			
486LB 33Mhz	128k	1	7	32	220 x 330	429
486LB 50Mhz	256k	1	7	32	220 x 330	579

32-bit graphics cards for use with above motherboards

RAM	Chipset	Max res/col	Max cols/res	Price
VI-833 1Mb	ET4000	1280 x 1024 / 16	16mil 640 x 480	149
VI-911 (33Mhz only) 1Mb	ET4000 S3	1280 x 1024 / 16	32K 640 x 480	199

MEMORY *plus...*

From standard SIMM modules to specific boards, we supply your needs at the lowest prices. All memory modules and kits carry a full 5-year warranty and are guaranteed to slot into your computer or printer with a minimum of fuss.

Please phone for prices of memory not listed here.

SIMMS / SIPPS

SIMM	1Mb x 9	60ns	35
SIMM	1Mb x 9	70ns	32
SIMM	1Mb x 9	80ns *	29
SIMM	4Mb x 9	60ns	129
SIMM	4Mb x 9	70ns	109
SIP	1Mb x 9	80ns	35

* Please note :80ns SIMMS are only available while stocks last.



LASER PRINTERS

Apple Laserwriter II NTX	4Mb kit	APW04Mb	129
Brother HL-4	1Mb board	BR100	79
	2Mb board	BR200	109
	3Mb board	BR300	139
	4Mb board	BR400	169
Brother HL-8D,8E,8V	1Mb board	BR101	89
	2Mb board	BR201	109
Canon LPB-811	2Mb board	CA200	99
	4Mb board	CA400	159
Epson EPL-6000	2Mb board	EP202	99
	4Mb board	EP402	159
Epson EPL-7000,7100	1Mb board	EP103	79
	2Mb board	EP203	109
	3Mb board	EP303	139
HP LaserJet II/IIID	2Mb board	HPL200	99
	4Mb board	HPL400	149
HP LaserJet IIP,III,D,P	1Mb board	HPL101	59
	2Mb board	HPL201	89
	3Mb board	HPL301	119
	4Mb board	HPL401	149
HP LaserJet IIIsi	1Mb board	HPL102	49
	4Mb board	HPL402	129
HP DeskJet	512k module	HPD512	99
NEC Silentwriter 90,290	2Mb module	NE200	139
Panasonic	1Mb board	PA100	69
KX-P4420,44501	2Mb board	PA200	99
	3Mb board	PA300	129
	4Mb board	PA400	159
Panasonic KX-P4450	1Mb module	PA102	99
Panasonic KX-P4455	2Mb module	PA203	129

PERSONAL COMPUTERS

COMPAQ

LTE 386S/20	1Mb module	CQ124	69
	4Mb module	CQ125	149
LTE 286	1Mb module	CQ108	59
	2Mb module	CQ200	89
	4Mb module	CQ408	179
SLT 386S/20	1Mb module	CQ303	69
	2Mb module	CQ304	109
	4Mb module	CQ305	169
SLT 286	1Mb module	CQ106	69
	4Mb module	CQ406	179
PORTABLE III *	2Mb kit	CQ205	89
DESKPRO 286/386N *	1Mb module	CQ688	49
	2Mb module	CQ689	69
	4Mb module	CQ690	129
DESKPRO 386S/16	1Mb kit	CQ113	89
	1Mb module	CQ110	59
	4Mb module	CQ410	149
DESKPRO 386S/20	1Mb module	CQ688	49
	2Mb module	CQ689	79
	4Mb module	CQ690	129
DESKPRO 386/20,25	1Mb module	CQ110	59
	4Mb module	CQ410	149
DESKPRO 386E 20/25	1-9Mb board	CQ102	89
	4-12Mb board	CQ402	209
	1Mb module	CQ110	59
	4Mb module	CQ410	149
SYSTEMPRO	2Mb module	CQ204	89
	8Mb module	CQ801	259
DESKPRO 386/33	2Mb module	CQ204	89
D'PRO 386,486/33L	2Mb module	CQ204	89
..... 486/25 *	8Mb module	CQ801	259
DESKPRO 486/33M *	1Mb module	CQ688	49
	2Mb module	CQ689	69
	4Mb module	CQ690	129
	8Mb module	CQ691	279

* May need Compaq memory expansion board

DELL

80-320SX	2Mb module	DL202	59
	4Mb module	DL402	119
	8Mb module	DL802	289
325D,325P,333D,433P	1Mb module	DL100	49
	4Mb module	DL400	129
425TE,443TE	2Mb kit	DL201	79
	4Mb kit	DL401	139
	8Mb kit	DL801	259
	16Mb kit	DL161	569

HP VECTRA

OS/16S	1Mb kit	HPV100	49
	2Mb kit	HPV200	69
OS/20PC	1Mb kit	HPV100	49
	4Mb kit	HPV400	119
	1Mb kit	HPV100	49
RS/20PC,RS/25PC	4Mb kit	HPV400	119
	2Mb module	HPV202	79
386/25PC	8Mb module	HPV160	269
486/PC	2Mb kit	HPV201x2	89
	8Mb kit	HPV800x2	259
	16Mb kit	HPV160x2	559
	4Mb kit	HPV202x2	159
486/25,486/33T	16Mb kit	HPV160x2	559

IBM

N33SX,L40SX Notebook	2Mb module	IBL02	79
	4Mb module	IBL04	139
	8Mb module	IBL08	279
PS/2 35SX, 35LX, 40SX	1Mb module	IB603	49
	2Mb module	IB902	69
	4Mb module	IB904	129
	8Mb module	IB130	259
PS/2 50Z-021	2-8Mb board	IB609	179
	2Mb kit	IB201	69
PS/2 50,50Z	2-8Mb board	IB609	179
	2Mb kit	IB201	69
PS/2 55SX,55LS,60,65SX	2-8Mb board	IB609	179
	2Mb kit	IB201	69
PS/2 P70 Portable	2Mb module	IB604	79
PS/2 P75 Portable	2Mb module	IB902	79
	4Mb module	IB904	129
PS/2 70	2Mb module	IB608	69
PS/2 80-041	1Mb module	IB375	49
PS/2 70,80 (All)	2-14Mb board	IB077	179
	2Mb module	IB604	79
	4-16Mb board	IB011	249
	4Mb module	IB977	129
PS/2 90XP, 95XP	4Mb kit	IB902x2	159
	8Mb kit	IB904x2	259
	16Mb kit	IB130x2	549

TOSHIBA

T1000LE,SE,XE	1Mb module	TMC01	79
	2Mb module	TMC02	99
	4Mb module	TMC04	159
	8Mb module	TMC08	289
T1000LE	2Mb module	TM306	79
	2Mb module	TM302	89
T1200XE	1Mb module	TMC01	79
T1600	2Mb module	TMC02	99
T2000SX	4Mb module	TMC04	159
T2000SX,T2200SX,T3300	8Mb module	TMC08	289
	2Mb kit	TM341	79
T3100e	2Mb module	TM308	79
T3100SX	4Mb module	TM310	139
	3Mb module	TM137	119
T3200	2Mb kit	TM322	79
T3200SX,SXC	4Mb kit	TM324	139
	2Mb module	TM301	79
T5100	2Mb kit	TM304	89
T5200,T8500	8Mb kit	TM800	279

ZENITH

Z386/20,25,33,33e	1Mb module	ZH101	49
	4Mb module	ZH401	129
Z386SX	2Mb kit	ZH202	69
Z248,Z286LP	2Mb kit	ZH202	69
	4Mb kit	ZH202x2	129
SUPERSPORT 286,286e	1Mb module	ZH103	89
SUPERSPORT 286e	2Mb module	ZH203	119
SUPERSPORT SX	2Mb module A	ZH204	99
	2Mb module B	ZH205	99
MASTERSPORT 286	1Mb module	ZHM01	49
MASTERSPORT 386SX	2Mb module	ZHM02	89
MASTERSPORT 386SL	2Mb module	ZHM03	79
	4Mb module	ZHM03x2	159

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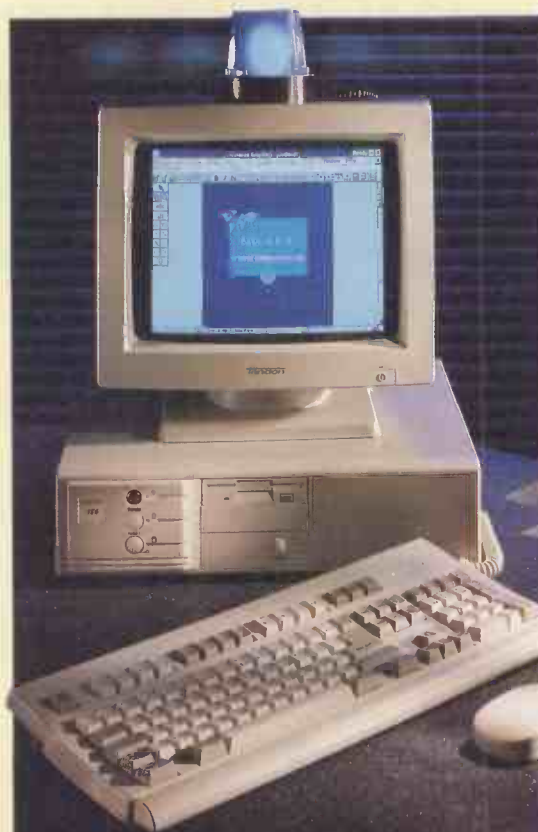
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*excluding the 33 & 40 MHz 386SX'S

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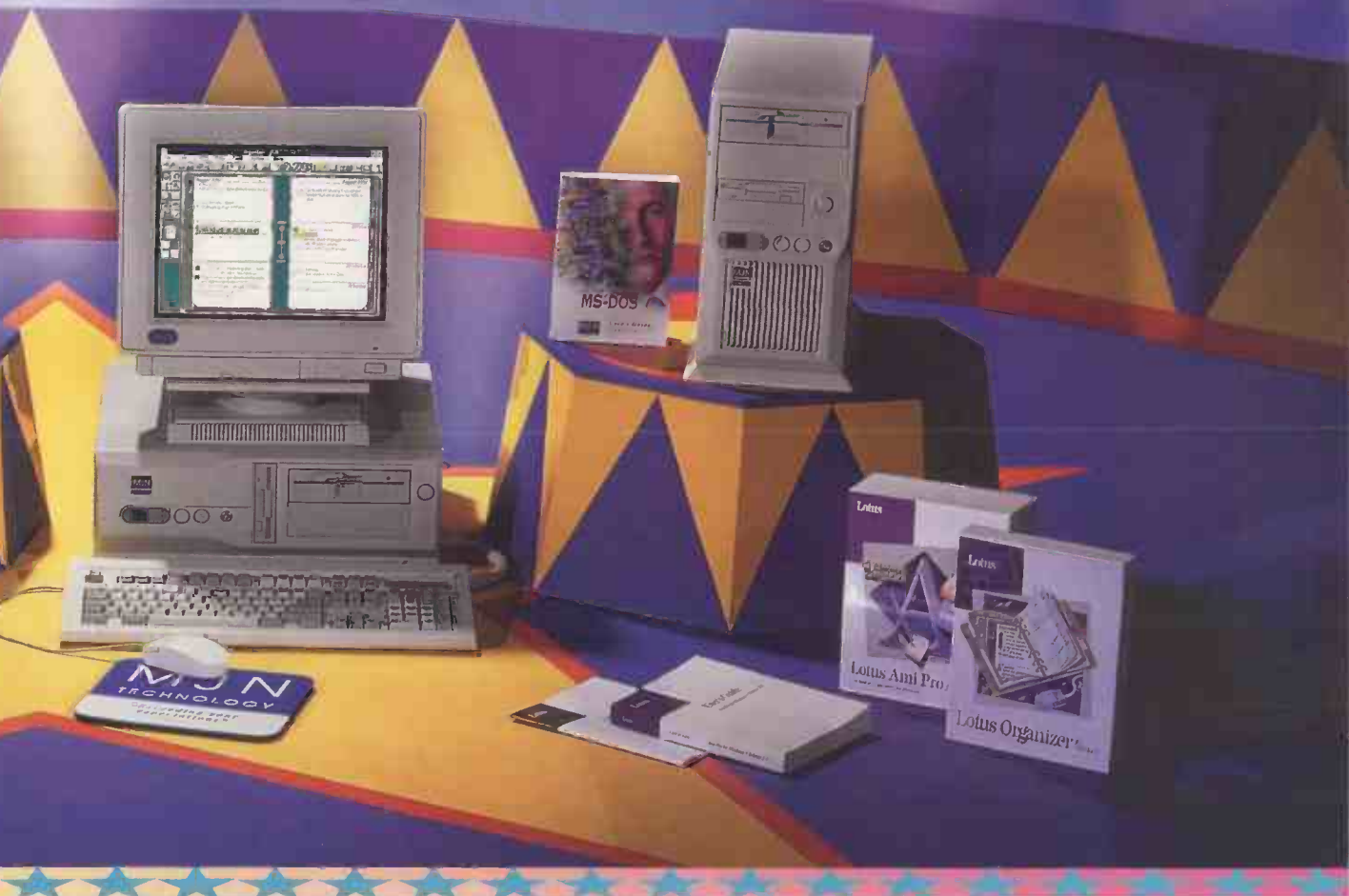
in the PC industry is to cut prices by clowning around,
stripping down systems and replacing quality components with
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never needed to. We never will. We'll never sacrifice features
or quality to make the price competitive. Our winning
performance has been to offer the best price, quality and
service in the market. It always has. It always will.

MJN's price advantage is simple. We have huge volume
buying power. The little guys don't. We operate at sensible and

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starvation diet for some of our competitors. Whenever we
achieve a saving we pass it on to you, and that's what we've
done right from day one.

PC Direct recently wrote "sales of MJN's products are
rocketing, and with machines as impressively made and priced
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it, PC User surveyed some of our customers and concluded "MJN customers we contacted spoke highly of the equipment and service". What Personal Computer simply wrote "Unbeatable Support!".

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MJN5

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YOU GET THE BEST seat in the house when you're performing with MJN's new Windows station. A powerful MJN 25Mhz i486/SX equipped with the latest local bus innovations and full 32 bit technology delivering a lightning fast response to your commands.

An impressive 120MB hard disk with a caching controller giving rapid disk access and high speed read/write facilities. No more looking at the egg timer with this machine. You get to see the whole show on a superb 15" SVGA colour monitor, and the VGA local bus dramatically increases video performance to enable you to blaze through your work and enjoy the show.

The Window Station comes complete with the latest Lotus software pre-loaded and configured ready for use, a Microsoft Mouse and a luxury MJN mouse pad.

And at £1449.00 the MJN Windows Station has a power to price ratio that's a tough act to follow.

THE MJN OFFICE STATION BRINGS THE HOUSE DOWN FOR JUST £1,299!



THE NEW MJN OFFICE STATION - an incredible breakthrough in price and quality, it is a flexible package offering integrated software based around a high-performance processor.

Starting at just £1,299 the package includes a powerful MJN 25 MHz i486/SX personal computer with a Super VGA non-interlaced colour monitor and an 85 MB hard disk.

All the software is pre-loaded and configured ready for use and includes MS DOS v5.0, Microsoft Windows v3.1 and a choice of Microsoft Works for Windows or the Lotus software package. We've included a Hewlett Packard Deskjet 500, a Microsoft mouse and an MJN mouse pad for that professional touch.

Remember, you're investing in a computer system that's supported by a unique free 3 year On-site Service Plan* and unlimited telephone technical support 7 days a week for the life of your system.

*The HP Deskjet 500 comes with a 3 Year warranty

START A DOUBLE ACT WITH MJN'S WORKGROUP STATION

NOW YOU CAN ENJOY the benefits of networking with MJN's Workgroup Station without the large expense normally associated with the setup costs.

We've taken our MJN 25 MHz 486/SX, added Microsoft Windows for Workgroup and Intel's Ethernet Adaptor and cables, and given you a network station ready to go. You'll need at least two.

Windows for Workgroups combines the familiar Windows operating system with easy-to-use networking, making it easy to share information and work together. You can share applications, file and printers, send electronic mail and schedule group meetings.

So, if you've often wished of having a network, now's the time to invest in the MJN Workgroup Station.



OUR NEW 66MHz 486 DX2 LIFTS US ABOVE THE COMPETITION



OUR NEW 66 MHz 486 DX2, at £1479 represents incredible heights in price and performance. It incorporates Intels new 66MHz clock - doubler chip, the fastest

"Unbeatable Support"

WHAT PERSONAL COMPUTER

processor available, packed into a feature rich machine with amazing video and disk performance.

"Exceeding your expectations"

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MJN7



NEW POWERLITE NOTEBOOKS FROM MJN - STEAL THE SHOW



NOTEBOOKS ARE FAST becoming the most popular type of portable computer. In fact, they're the future of personal computing.

It will come as no surprise then, to learn that the new MJN Powerlite's are setting the standard for others to follow. They're the hottest thing in the industry. In price, specification, quality, design, size, weight, expandability and screen clarity MJN still offers the greatest value.

We have three models topping the bill, the NB5500 with its intelligent low power consuming processor giving up to 10 hours of battery life, the powerful NB8600 with its mighty 25 MHz 486 processor or the NB6600C with its new crystal clear colour screen. And, as our Powerlites weigh in at less than 6lbs, they'll never hold you down. Once again, when it comes to offering the best performers at the best price, MJN comes through as the winner.

As PC Plus wrote whilst reviewing our colour notebook against offerings from Dell, Toshiba and AST, "The colour screen of the MJN is considerably brighter than the Dell's...The key board has subjectively the best feel of the four machines...The display is one of the best passive-matrix colour displays we've seen...The keyboard is good with the kind of travel that isn't going to cause repetitive strain injury - that can't be said for all notebooks...For many people contemplating a notebook this machine will be the only candidate". Need we say more?



STAR PERFORMING EXTRAS



OUR STAR PERFORMERS can be upgraded to an even higher specification for those of you who desire that little bit

extra. Our cast now includes local bus, local bus video, local bus and ISA caching disk controllers (ideal for intensive Windows or database users) and high specification large screen monitors.

LOCAL BUS

For blazing Windows performance we offer you our brand new local bus design, delivering dynamic graphics performance and increased disk transfer speeds. Simply put, video signals run over a full 32-bit-wide CPU bus, operating at the processors clock speed (anywhere between 25MHz and 66MHz), rather than at the speed of the system bus (8MHz). Our local bus system design includes three 32-bit local bus expansion slots, very important for future expansion, and five 16-bit expansion slots. We include our local bus VGA graphics controller, based on the Tseng Labs ET4000 chipset with 1MB of video RAM, offering resolutions right upto 1280 x 1024, colours to 64,000 and delivering blistering performance up to an incredible 20 times faster than ordinary SVGA. Our high performance local bus system is an available upgrade to all our 486 systems for an additional £149.

CACHE CONTROLLERS

Our local bus IDE cache controller comes as standard with a 1MB cache, upgradable right upto 16MB. It delivers average seek times of less than 0.3ms and offers rapid data transfer rates upto 20MB/second. It is an upgrade option for our local bus based 486 models for an additional £229.

Our ISA IDE cache controller is available for all our models (including our local bus based 486's). It comes supplied with a 1MB cache, upgradable to 16MB. Performance is also crisp with seek times averaging less than 0.3ms and data transfer rates upto 16.5MB/second, for an additional £129.

MONITORS

You'll enjoy your new MJN computer even more with our new 15" Proscan Colour Monitor. It has a flat, square, non-glare screen that will give you a flicker free non-interlaced resolution right upto 1024 x 768. As standard it also comes equipped with digital controls. The 15" Proscan is an available upgrade option for any MJN system, for an additional £129.

Our 17" Proscan Colour Monitor which provides about 50% more viewing area than our standard 14" Proscan, has all the features of the 15" model, but can offer a resolution right up to 1280 x 1024. It is an upgrade option for any MJN system for an additional £399.



14" Proscan



15" Proscan



17" Proscan

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MJN9

THE GRAND FINALE

STAR ATTRACTIONS

33/40 MHz 386SX

- AMD 80386SX Processor
- 2MB RAM exp. to 16MB
- 1.44MB 3.5" Floppy Drive
- 85MB 16ms IDE Drive with 32K Cache, 16Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan Super VGA 1024 x 768 Colour Monitor

PRICE £829

- MJN 40 MHz 386/SX

PRICE £879

40 MHz 386

- AMD 80386 Processor
- 4MB RAM exp. to 32MB
- 1.44MB 3.5" Floppy Drive
- 85MB 16ms IDE Drive with 32K Cache, 16Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software

PRICE £959

25/33 MHz 486SX

- Intel 80486SX Processor
- 4MB RAM exp. to 32MB
- 1.44MB 3.5" Floppy Drive
- 85MB 16ms IDE Drive with 32K Cache, 16Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan NI MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software
- Support for Intel OverDrive™

PRICE £999

- MJN 33 MHz 486/SX

PRICE £1129

33 MHz 486 Cache

- Intel 80486 Processor
- 256K Cache RAM
- 4MB RAM exp. to 32MB
- 1.44MB 3.5" Floppy Drive
- 120MB 17ms IDE Drive with 32K Cache, 12Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan NI MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software

PRICE £1259

33 MHz 486E Cache

- Intel 80486 Processor (EISA)
- 256K Cache RAM
- 8MB RAM exp. to 64MB
- 1.44MB 3.5" Floppy Drive
- 210MB 12ms SCSI Drive with 256K Cache, 32Mbits DTR, High Performance SCSI Controller
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan NI MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software

PRICE £1929

50 MHz DX2 486 Cache

- Intel 80486 Processor
- 256K Cache RAM
- 4MB RAM exp. to 32MB
- 1.44MB 3.5" Floppy Drive
- 120MB 17ms IDE Drive with 32K Cache, 12Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan NI MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software

PRICE £1329

50 MHz 486 Cache

- Intel 80486 Processor
- 256K Cache RAM
- 4MB RAM exp. to 32MB
- 1.44MB 3.5" Floppy Drive
- 120MB 17ms IDE Drive with 32K Cache, 12Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan NI MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software

PRICE £1429

66 MHz DX2 486 Cache

- Intel 80486 Processor
- 256K Cache RAM
- 4MB RAM exp. to 32MB
- 1.44MB 3.5" Floppy Drive
- 120MB 17ms IDE Drive with 32K Cache, 12Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Proscan NI MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software

PRICE £1479

Office Station

- MJN 25 MHz i486/SX
- 4MB RAM exp to 32MB
- 1.44MB 3.5" Floppy Disk Drive
- 85MB 16ms IDE Drive with 32K Cache, 12Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Non-interlaced MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Microsoft Works for Windows or Lotus Application Software
- HP Deskjet 500 Printer

PRICE £1299

Windows Station

- Intel 25MHz 80486SX processor
- Local Bus with 3 32-bit local bus slots
- 128K Cache RAM
- 4MB RAM exp to 32MB
- 1.44MB 3.5" Floppy Drive
- 120MB 17ms IDE Drive with 32K Cache, high performance 1MB Disk Cache controller, giving up to 16.5MB DTR & effective access less than 0.3ms
- 15" Non-interlaced Super VGA 1024 x 768 Colour Monitor
- 32 Bit Tseng Labs 1MB Local Bus Graphics
- Lotus Application Software

PRICE £1449

Workgroup Station

- MJN 25 MHz i486/SX
- 4MB RAM exp to 32MB
- 1.44MB 3.5" Floppy Disk Drive
- 85MB 16ms IDE Drive with 32K Cache, 12Mbits DTR
- 16-Bit Accelerated Paradise SVGA Graphics Adaptor with 1MB Video RAM
- 14" Non-interlaced MPRII Low Radiation Super VGA 1024 x 768 Colour Monitor
- Lotus Application Software
- Microsoft Windows for Workgroups
- Intel 16-bit Ethernet Adaptor and cables

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Extra's included with all MJN Desktop Systems

- Enhanced UK 102 Key Tactile Keyboard with Positive Response
- Microsoft Mouse, MSDOS v5.0, Microsoft Windows v3.1 & Luxury MJN Mouse Pad
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- AMD 25 MHz 386/SXL
- 2MB RAM exp.to 8MB
- 60MB 19ms IDE Drive
- 64 gray scale LCD Screen
- Advanced Power Management giving 10 Hour Battery Life

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Powerlite NB8600

- Cyrix 25 MHz 486/SLC
- 2MB RAM exp.to 8MB
- 60MB 19ms IDE Drive
- 64 gray scale LCD Screen
- Advanced Power Management giving 10 Hour Battery Life

PRICE £1329

Powerlite NB6600C

- Intel 25 MHz 386/SL
- 2MB RAM exp.to 8MB
- 60MB 19ms IDE Drive
- VGA Colour LCD Screen
- Advanced Power Management giving 10 Hour Battery Life

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THE POWER....

386SX 33 *Advantage*

- AMD 386SX 33MHz Processor
- 2Mb RAM Exp to 16Mb
- 1.44Mb 3.5" Floppy Drive
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- 16 Bit 1Mb SVGA Card
- Philips 14" SVGA Low Rad Colour Monitor 1024x768
- 5Year 24 Carat Gold Warranty

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386DX 40 *Advantage*

- AMD 386SX 40MHz Processor
- 2Mb RAM Exp to 32Mb
- 1.44Mb 3.5" Floppy Drive
- 42Mb 15ms IDE Hard Drive
- 16 Bit 1Mb SVGA Card
- Philips 14" SVGA Low Rad Colour Monitor 1024x768
- 5Year 24 Carat Gold Warranty

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486SX 25 *Advantage*

- Intel 486SX 25MHz Processor
- 2Mb RAM Exp to 32Mb
- 1.44Mb 3.5" Floppy Drive
- 105Mb 15ms IDE Hard Drive
- 16 Bit 1Mb SVGA Card
- Philips 14" SVGA Low Rad Colour Monitor 1024x768
- 5Year 24 Carat Gold Warranty

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486DX 33 *Advantage*

- Intel 486DX 33MHz Processor
- 4Mb RAM Exp to 32Mb
- 1.44Mb 3.5" Floppy Drive
- 105Mb 15ms IDE Hard Drive
- 16 Bit 1Mb SVGA Card
- Philips 14" SVGA Low Rad Colour Monitor 1024x768
- 5Year 24 Carat Gold Warranty

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The Advantage

The lowest prices available for PC's of this specification, while still offering performance levels of machines at twice the price. Supplied as standard with Philips Low Radiation SVGA colour monitors, 1Mb Video cards and our 24 Carat Gold Warranty.

The Revere

All the machines are supplied as standard with local bus ET4000 Graphics cards allowing the Video card to communicate directly with the processor, running up to 2000% faster than normal AT bus machines. This makes graphical applications such as Windows perform like a dream. To make the performance even faster we use an IDE Cache Controller giving a 5000% increase in disk access times*. Philips Low Radiation monitors are included with all machines.

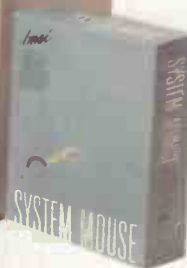
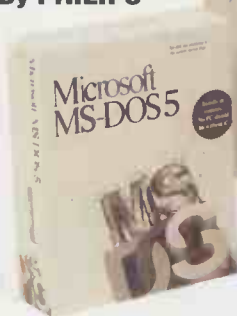
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486SX 25 *Revere*

- Intel 486SX 25MHz Processor
- 2Mb RAM Exp to 32Mb
- 1.44Mb 3.5" Floppy Drive
- 105Mb 15ms IDE Hard Drive
- IDE Cache Controller
- 32 Bit Local Bus SVGA Card
- Philips 14" SVGA Low Radiation Colour Monitor 1024x768
- MS DOS v5.0
- MS Compatible Mouse
- 5Year 24 Carat Gold Warranty

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486DX 33 *Revere*

- Intel 486DX 33MHz Processor
- 4Mb RAM Exp to 32Mb
- 1.44Mb 3.5" Floppy Drive
- 105Mb 15ms IDE Hard Drive
- IDE Cache Controller
- 32 Bit Local Bus SVGA Card
- Philips 14" SVGA Low Radiation Colour Monitor 1024x768
- MS DOS v5.0
- MS Compatible Mouse
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486DX 66 *Revere*

- Intel 486DX2 66MHz Processor
- 4Mb RAM Exp to 32Mb
- 1.44Mb 3.5" Floppy Drive
- 105Mb 15ms IDE Hard Drive
- IDE Cache Controller
- 32 Bit Local Bus SVGA Card
- Philips 14" SVGA Low Radiation Colour Monitor 1024x768
- MS DOS v5.0
- MS Compatible Mouse
- 5Year 24 Carat Gold Warranty

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Options *Advantage*

- | | |
|----------------------------|------|
| ● 1Mb RAM Upgrade | £25 |
| ● 42 to 105Mb Hard Disk | £60 |
| ● 105 - 210Mb Hard Disk | £120 |
| ● IDE Cache Controller | £99 |
| ● Local Bus SVGA Card | £99 |
| ● Local Bus S3 Video Card | £199 |
| ● Windows Accelerator card | £50 |
| ● Windows & Mouse | £50 |

Options *Revere*

- | | |
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| ● 1Mb Cache Cont. Upgrade | £25 |
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| ● 105 - 210Mb Hard Disk | £120 |
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- 386SXL 25MHz Processor
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- 1.44Mb 3.5" Floppy Drive
- 60Mb IDE Hard Drive
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- Ser, Par, PS2 & VGA Ports
- Weight 2.8kg (inc battery)

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- 486SX 25MHz Processor
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 - Ser, Par, PS2 & VGA Ports
 - Weight 3.2kg (inc battery)
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NP305 ProLite

- 486DX 33MHz Processor
 - 4Mb RAM Exp to 8Mb
 - 1.44Mb 3.5" Floppy Drive
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 - 10" VGA Backlit Screen
 - Ser, Par, PS2 & VGA Ports
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- Colour VGA Backlit Screen
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- 1.44Mb 3.5" Floppy Drive
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- Colour VGA Backlit Screen
- 1 x Ser, Par, PS2 & VGA Ports
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- POWER STATION - External High Capacity Battery £149
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STN Colour
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High res. TFT colour screen.
3.2 kg



T6400DXC/200

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16-bit expansion slot.
5.9 kg



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pi 486 DLC	33MHz	64k	£775.00
pi 486 DX	33MHz	256k	£895.00
pi 486 DXII	50MHz	256k	£975.00
pi 486 DX	50MHz	256k	£1025.00
pi 486 DXII	66MHz	256k	£1195.00

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RAM	4Mb 70 ns SIMMS (2Mb - 386 SX25/33)
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FLOPPY DRIVE	Citizen 3.5" 1.44Mb
MONITOR	14" Low Radiation SVGA
GRAPHICS CARD	Trident 512k SVGA
CONTROLLER	IDE High performance
PORTS	2 Ser./1 Par./1 games
KEYBOARD	Tactile 102 Key UK
CASE	Desktop/Slimline/Mini Tower
WARRANTY	12 months - Comprehensive

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2.2	5 USER	£365.00	386 SX	25MHz	£495.00	EMERSON	30I	£295.00
3.11	5 USER	£399.00	386 DX	40MHz	£556.00	EMERSON	40I	£475.00
3.11	10 USER	£825.00	486 SX	25MHz	£595.00	APC BACKUP	400I	£225.00
3.11	20 USER	£1175.00				APC SMART	600I	£425.00
NETWORK CARDS			ARCHIVING			OPTICAL DRIVES		
NE 1000 COMPAT.		£59.00	WANGTEK	3000 120Mb	£225.00	PANASONIC/BERNOULLI		£895.00
NE 2000 COMPAT.		£63.00		3000 250Mb	£295.00	256Mb to 1Gb	from	
NOVELL BOOT ROM		£10.00		5000 120Mb	£365.00	CAD/CAM		
POCKET LAN		£120.00		5000 500Mb	£495.00	PHILIPS Monitors		P.O.A.
4 PORT REPEATER		£495.00	COLORADO	120Mb	£165.00	SPEA/MATROX Graphics card		P.O.A.
TOKEN RING 16Mbps		£325.00		250Mb	£245.00	OTHER PRODUCTS ON APPLICATION		

pi-MULTIMEDIA PRODUCTS

SOUND CARDS AD LIB/SOUNDBLASTER COMPATIBLE	
MUSIC MASTER SOUND CARD	£32.95
SOUND FANTASY CARD	£63.00
SOUND BLASTER 2.0	£76.00
SOUND BLASTER PRO	£119.00
VIDEO CARDS	
VIDEO IMAGE GRABBER	£265.00
VIDEO PC TO TV CARD	£225.00
VIDEO TV TO PC CARD	£295.00
CD ROM DRIVES	
INTERNAL CD ROM KIT	£195.00
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105mm COLOUR SCANNER	£225.00
GREY SCALE SCANNER OCR	£97.00
DELUXE MOUSE	£15.25

TRY THE DIFFERENCE

We measure our success in the number of satisfied customers - not in the number of 'boxes' shifted.

We can offer the technical help and experience to advise on the most demanding of computer requirements: from full network installations by qualified technicians to specialised graphics or data acquisition systems. Call the sales line to discover the difference.

CUSTOM BUILDING

We will custom build your computer system - any architecture - any specification! CALL US TO DISCUSS REQUIREMENTS

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pi-COMPUTERS

A DIVISION OF MOZAIC INFORMATION SCIENCE (Europe) LTD
RYCOTE LANE · THAME OX9 2NZ

FAX: 0844 279806

TELEPHONE:

0844 278009

14 DAY MONEY BACK GUARANTEE ON ALL COMPUTER SYSTEMS



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TECHNOMATIC

Technomatic Limited
Techno House,
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London NW9 8UF

**PROVIDING
CONSISTENT AND
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TO CUSTOMERS
SINCE 1971**

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Christmas and
a Prosperous
New Year

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Prices correct at the time of
going to press

TELEPHONE

081-205 9558

FACSIMILE

081-205 0190

LASER PRINTERS

All Laser printers carry one year's on-site maintenance contract

HEWLETT-PACKARD

HP Laserjet IIIP £599(a)
4ppm 1Mb RAM Scaleable fonts/Res Enhancement

HP Laserjet 4 Offers True 600 dpi resolution £975(a)
8ppm/2Mb RAM i/p trays, enhanced PCL5, 45 scalable typefaces

HP Laserjet 4M Postscript £1379(a)
HP Laserjet IIID £1485(2xa)
Duplex printers and as LJIII but with two trays

HP Laserjet IIISi 2Mb (exp to 17Mb) RAM £1959(2xa)
16ppm; two trays, HP's workhorse

Diamond Edge Support for extended on site warranty available

NEC

S62P 6ppm/2Mb PostScript Level 2/PCL5 Emul. 57 fonts £1029(a)
Par/Ser/AppleTalk interfaces. PC & MAC can operate together.

SI02 10ppm/1Mb PCL5/HPGL Emul. 300 sht tray, £999(b)
Par/Ser interfaces can be operated simultaneously. NEW

EPSON

EPL4000 NEW 6ppm £465(a)
LQ/FX/HP Emulation. Price includes special training offer on Windows.

EPL4300 NEW 6ppm £569(a)
HP Laserjet IIISi Emulation

EPL7500 6ppm PostScript £1,139(a)
Par/Ser/Apple ports

EPL8100 10ppm, 1MB RAM £929(a)
PCL 5 compatibility

PANASONIC 2yr OSM

KXP4410 £479(a)
5ppm, HP/II emulation, 512Kb, Par i/f

KXP4430 NEW £585(a)
KXP 4450i £919(a)
11ppm, twin tray

KXP4455 £1,329(2xa)
11ppm PostScript twin tray, HP/II emulation

LOW COST POSTSCRIPT SOLUTIONS

HP Postscript Module for Laserjet 4 £259(b)

HP Adobe PostScript PLUS Cartridge: for HP II/IIIP/IIID £399(b)

HP Adobe PostScript Cartridge: for HP II/IIIP/IIID/IIID £279(b)

PACIFICPAGE XL: + 4Mb RAM, for HP/II/IIID New Version £469(b)
Built in Intel RISC Processor increases data processing by up to 8 times - making Page XL the fastest PS upgrade. No extra RAM required.

PACIFICPAGE PostScript Emulator for HP II/IIIP/IIID £225(b)

Adobe PostScript Cartridge + 2Mb Ram for HP II £299(b)

PACIFICPAGE PostScript Emulator + 2Mb RAM for HP II £325(b)

HP PAINTJET XL 300 PostScript Level 2 2Mb RAM £759(a)

EPSON: PostScript Cartridge for EPL8100/EPL4300 £399(b)

LASER/INKJET ACCESSORIES/CONSUMABLES

HP LASER FONTS

HP Master Type Font Cartridge for MicroSoft, WordPerfect, Presentations, Bar Codes.

Global Forms Each: £99(b)

HP Print Cache (speeds up output) £49(b)

HP PrintPlot (Emulates HP Plotter) £179(b)

JetFont ZIA TmS RMN/Helv £109(b)

HP II/IIIP Lower Cassette Tray £99(b)

JET DIRECT Network Cards

These cards plug into printers I/O Port and provide a direct connection to Ethernet LAN.

For II/IIID/IIID £409(b)

For IIISi £409(b)

Technomatic is an authorised reseller of HP accessories and consumables. Please phone with your requirements.

INKJET ACCESSORIES: Carr(b)

For HP Deskjet Plus/500/500C

HP FX80 Emulation Cartridge £45

JetRAM 256K RAM Cartridge £75

Pacific 25 in 1 Font Cartridge £69

CANON Sheet Feeders:

BJ10 £43 BJ300/330 £94(a)/£129(a)

INK CARTRIDGES: Carr (d)

HP Deskjet Family:

Standard Black £12.50

Double Capacity Black £17.50

500C Colour £20

Paintjet: Colour £22 Black £13

XL/300 (Cyan/M/Y/Blk) each £21

Canon BJ10/20 £15 BJ300/330 £11

A4 Jet Server paper (500c) £17

A4 Transparencies (500c) £39

LASER RAM UPGRADES (b)

HP **IIIP/IIIP/II/IIID** **II/IIID** **IIISi**

1Mb £50 - £55

2Mb £80 £89

4Mb £135 £145 £149

LJ4/4M 2Mb: £95 4Mb: £159 8Mb: £279

Panasonic 4420 4450i 4455

1Mb £59 £59 -

2Mb £89 £99 £129

4Mb £149 £160 -

4430 1Mb £109 -

Epson **EPL4000/4100/4300** **EPL8100**

1Mb £55 £49

2Mb £95 £104

3Mb £149 £149

4Mb £199 £199

INKJET PRINTERS

HP Deskjet 500 80 columns, 300dpi, 16K RAM, B/W £265(a)
Price includes 3 year parts & labour warranty.

Canon BJ10ex 80 col portable, high quality 360x360 resolution, 37K buffer, LQ/Proprietary emulations £169(a)

Canon BJ20 New desktop printer £275(a)

Canon BJ300 80 column 360 dpi resolution 300cps in high speed mode Proprietary/LQ850 emulations £279(a)

Canon BJ330 132 column as BJ300 but 132 columns £380(a)

COLOUR INKJET

HP Deskjet 550C NEW colour with Real Black £425(a)

HP Deskjet 500C A4 Colour printer £335(a)

HP Paintjet XL300 A3 Colour printer £1559(2xa)

HP Paintjet 80 col, 180 x 180 res Parallel or Serial i/face £497(a)

HP Paintjet XL 132 columns. As Paintjet but wider £1199(a)

Canon BJ800C Colour Printer £1375(a)

DesignWorks for Windows only £59

when purchased with any printer

**Limited stocks*

DOT MATRIX PRINTERS

EPSON

LX100 £139(a) LX850 £138(a)

LQ100 £159(a) FX1050 £329(a)

LX400 £99(a) LQ870 £359(a)

FX850 £260(a) LQ1070 £315(a)

LQ570 £205(a) LQ1060 £549(a)

LQ1170 £439(a) SQ870 £412(a)

LQ2550 £679(a) SQ1170 £569(a)

LX1050 £205(a)

PANASONIC

KXP1123 £134(a) **KXP1124i** £175(a)

KXP1624 £270(a) **KXP1695** £275(a)

KXP2123 £205(a) **KXP2180** £155(a)

KXP1654 £339(a) **KXP2624** £280(a)

NEC 24 PIN

P20 £170(a) **P30** £236(a)

P60 £319(a) **P70** £395(a)

P90 £589(a)

STAR

LC20 £109(a) **LC200** £159(a)

LC24-200 £255(a) **Starjet SJ48** £199(a)

We welcome orders from Govt Depts, Universities, Hospitals, Colleges, Local Authorities, National plcs, etc. No VAT on export orders - carriage costs on request.

For fast delivery phone 081-205 9558 or fax 081-205 1090 with your VISA/ACCESS card. Orders for stock items received before 2pm dispatched the same day.

Personal Callers welcome - ample parking space

TONER CARTRIDGES Carr (b)

HP LASERJET **EPSON EPL** **PANASONIC Toner:**

LJ4/4M £79 7100/7500/8100 £119 4420/500/55 £19(c)

II/IIID/II/IIID £48 4000/4100/4300 £55 **NEC**

II/IIIP/IIIP £43 S60/S60P/62P £89

IIISi £99

TECHNOMATIC

TELEPHONE 0812 059 558 FAX 0812 059 550

A4 FLAT BED SCANNERS

HP SCANJET IIP £639(a)
256 grey level, 300 dpi scanner. Includes interface for either PC/AT or PS/2, DeskScan IIP and PhotoFinish software, OMNIPAGE Test Disc. HP's AccuPage Technology third party OCR performance. Printer Path calibration optimises the quality of final printout of a scanned image. 1 year OSM.

HP SCANJET IIC £1069(a)
400 dpi 256 grey scale levels and 24 bit colour recognition of over 16 million colours. Interface for PC/AT or PS/2. DeskScan II and Photo Finish packages included. Other features as Scanjet IIP.

Auto Document Feeders:
For Scanjet: IIP £259(a) IIC £369(a)
HP Diamond Edge Support for extended warranty available.

PANASONIC FX-RS 506U £579(a)
400dpi 16 grey scales

PANASONIC FX-RS 307U £779(a)
600dpi 16-256 grey scales, high speed scanner

PC/AT Interface for 506/307 £125(c)
Software Package included is SCAN-DO.

Auto Document Feeder for 506/307 £335(a)

GENIUS GS-FC30 £589(a)
A4 300 dpi Colour Scanner offers best value for scanning colour/grey and black and white images. Offers 256 grey level 24 bit colour recognition with 16.7 million colours. Includes SCSI Interface for PC/AT + two powerful software packages. Ideal for DTP/Graphics applications under DOS or Windows.

OCR SOFTWARE

OmniPage Ver 3.1 £387(a)
OmniPage Direct £335(a)
OmniPage Professional £585(a)
Calera Wordscan Plus £475(a)

PLOTTERS

HEWLETT PACKARD

(1 yr on site warranty included)
7440A A4/8 pen Desktop RS232 £665(a)
7440B A4/8 pen Desktop HP-IB £740(a)
7475AU A3/6 pen Desktop RS232 £909(a)
7550B A3/8 pen HiSpeed Ser/Par £2125*
7570A A1/8 pen DraftPro RS232 £1999*
7575A A1/8 pen DraftPro DXL RS232 £2525*
7576A A0/8 pen DraftPro EXL RS232 £3429*
7595A A0/pen Draft Master SX+ £4709*
7596C A0/8 pen Draft Master MX+ £5675*
7599B A0 Draft Master MX+ £6349*
Designjet 600 A0 Inkjet Plotter £5351*
Designjet 600 A1 Inkjet Plotter £4999*
Diamond Edge extended On Site Warranty Available

STiKA Image Scanning/Cutting £345(a)
SketchMate A4 Flatbed Plotter £309(a)
SketchMate A3 Flatbed Plotter £499(a)
DXYI100 A3 8 pen Flatbed Plotter £469(a)
DXYI200 A3 Flatbed Plotter £609(a)
DXYI300 A3 Flatbed Plotter £825(a)
DPX2600 A2 Flatbed Plotter **NEW POA**
DPX3600 A1 Flatbed Plotter **NEW POA**
DPX4600 A0 Flatbed Plotter **NEW £5149***
Paper Moving Plotters
GRX300-AG A1 £2549*
GRX400-AG A0 £3349*
DPX & GRX plotters include 3 yr OSM

*Carriage charges on request. Accessories and consumables for above plotters available.

PRINTER SHARERS & BUFFERS

AUTO DATA SWITCHES:

BothWay Switch: A two way switch for 2 PCs to 1 Printer or 1 PC to 2 printers Par/Ser. £42(b)

4:1 Auto Switch: 4 PCs to share 1 printer. Parallel or serial. £57(b)

8:1 Auto Switch: 8 PCs to share 1 printer. Parallel or serial. £99(b)

BUFFERS:

256K Parallel Buffer £139(b)
1Mb Parallel Buffer £199(b)

AUTO SHARER/BUFFER

PBS4/I/256K 4 PCs share one parallel printer £199(b)

256K (exp to 1Mb) buffer

PBS8/I/256K 8 PCs share one parallel printer £249(b)

256K (exp to 1Mb) buffer. (Text only.)

PRINTER CABLES (carr d)

	2m	3m	5m
Parallel PC Printer Lead	£6	£8	£10
Centronics/Centronics	£7	£9	£12
25way Male/25way Male	£6	£8	£10

Other cables available on request

AUTO CROSS-OVER SWITCH

Four PCs can share two printers. Once a data path has been set it can be switched by use of software. Par or Ser £85(b)

Par/Ser or Ser/Par Converter £35(d)

EXTERNAL DRIVES

Tired of backing your portable to multiple floppies? Do you suffer from the NO FREE SLOT syndrome?

Technomatic have the solution for you.

This range of external drives (TAPE, HARD & FLOPPY) have a compact and attractive design, and come complete with everything you need for **EASY** installation. They plug into your parallel printer port. There are no interface cards to install, so you don't have to open the case of your computer, also an ideal solution for portables. And you don't loose the printer, simply plug it into the back of the unit. With their unique printer port interface these drives will work with any computer that has an IBM compatible parallel port, regardless of CPU speed. Now you can add drives even if you don't have any expansion slots free or are restricted by your portable design. All external drives are completely shareable. They can be moved from one computer to another. All units are fully compatible with DOS 3.0 and above and come complete with a one year warranty.

JUMBO TRAKKER TAPE DRIVES : 40/120Mb & 80/250Mb

- DC2000 cartridges
- Easy-to-use backup s/w included
- Transfer rate per min 4.8Mb for JTTS120, 8Mb for JTTS250
- Fast data compression facility in software
- QIC-40 and QIC-80 industry standard formats
- Novell and LANtastic certified
- Unattended backups
- DOS and Windows compatible

JTTS120 40/120Mb £269 JTTS250 80/250Mb £349

BACKPACK HARD DRIVES : 40Mb & 100Mb

- Fastest parallel port disk on the market
- 3.5" size
- No partition size limitation under DOS 3
- Ready-to-use, no formatting required
- Password protection
- 5Kb device driver included

BPHD40 40Mb £294 BPHD100 100Mb £449

BACKPACK DISKETTE DRIVES

- Works like other diskette drives
- 3.5" 14 model accepts both 1.44Mb and 720Kb diskettes
- 3.5" 28 model accepts 2.8Mb, 1.55Mb and 720Kb diskettes
- 5.25" model accepts both 1.2Mb and 360Kb diskettes
- Background format s/w included

BPDF14 3.5" 1.44Mb £155 BPDF28 3.5" 2.8Mb £185
BPDF12 5.25" 1.2Mb £155

MANUAL SHARERS

Reversible, inexpensive manual data switches

	Parallel	Serial
2 in 1 out	£10(c)	£10(c)
3 in 1 out	£16(c)	£16(c)
4 in 1 out	£20(c)	£20(c)
2 way cross over switch	£24(c)	£24(c)

Please check connector types when ordering.

MANUAL COMPACT SWITCH

(Serial/Parallel)
Two way reversible compact switch for 2 PCs to one printer or one PC to two printers. £18(c)

LEASING FINANCE

Technomatic is now able to offer leasing finance to local councils, government departments, universities, polytechnics, schools, hospitals and private businesses (subject to status) at attractive rates for periods of between 1 and 5 years. The approval procedure is very simple and normally does not take more than a day or two. The minimum order has to be £999 before VAT. Typical quarterly repayments per £1000 are (based on rates at 9th October 1992):

	2yrs	3yrs	4yrs	5yrs
Quarterly Repayments/£1000	£140	£105	£88	£77

Exact quotations can be given once we have the details of your requirements.

At the end of the leasing period, equipment can be purchased at a token value.

PRICE WARNING

The prices in this advertisement were correct at the time of submission. However, due to the fluctuating exchange rates, readers are requested to confirm prices when ordering.



TECHNOMATIC

BUSINESS SOFTWARE

Order - best by Fax

ACCOUNTING

SAGE AUTHORISED DEALER

Sterling for Windows	£195(a)
4 in 1 Business Pack	£99(a)
Accountant v5	£165(a)
Accountant Lan	£232(a)
Accountant Plus v5	£246(a)
Accountant Plus Lan	£406(a)
Accountant Plus +2 (win)	£282(a)
Bookkeeper v5	£55(b)
Cash Trader	£57(b)
Financial Controller v5	£328(a)
Financial Controller Lan	£517(a)
Financial Controller +2 (win)	£369(a)
Job Costing	£112(b)
Job Costing Lan	£145(b)
Payroll II	£110(b)
Payroll II Lan	£145(b)
Learn Accounts Beg/Adv	£19(c)
MainLan Starter GTI	£237(a)
MainLan GTI extension	£117(a)
MainLan 386 4/8 Users	POA
MainLan for Windows	£237(a)
MainLan Easy	£125(b)
MainLan Easy Extn	£65(b)
CA Simply Accounting -	£130(a)

DataEase v4.5 3 user	£449(a)
DataEase developers ed	£1225(a)
DataPerfect	£206(a)
dBASE IV v1.5 NEW	£275(a)
dBASE III Plus v1.1	£347(a)
dBASE IV Lan 1 user	£155(a)
dBASE IV Lan 10 user	£1350(a)
DBfast for WIN by CA	£199(a)
Delta 5	£335(a)
Filemaker Pro for Windows	£210(a)
MS FoxPro v2 Single User	£355(a)
MS FoxPro v2 Multi User	£495(a)
MS FoxPro Dist Kit	£215(b)
MS FoxBase Plus	£199(a)
Formbase	£225(a)
IZE Text Database	£145(a)
Omnis 7 Windows	£699(a)
Omnis 7+ Windows	£1415(a)
Paradox V4.0	£277(a)
Paradox 4.0 comp upgrade	£149(a)
Personal RBASE	£54(b)
Q+A Symantec	£174(a)
Rbase v4 NEW	£315(a)
Rapidfile v1.2	£166(a)
Reflex 2 Borland	£149(a)
Retrieve III	£85(a)
Retrieve IV	£176(a)
SuperBase 2 Windows	£183(a)
SuperBase 4 Windows	£337(a)
Superbase 4 dev Edition	£670(a)
SPI WindowBASE	£189(a)

INTEGRATED PACKAGES

CA Office (SCS.I, SDB, Txt)	£94(a)
MS Office V3.0 NEW	£354(a)
Framework IV	£313(a)
Framework XE	£77(b)
Geoworks Ensemble	£115(a)
Lotus Works v3.0 NEW	£83(b)
Lotus Smartsuite	£375(a)
MS Works for Windows	£84(b)
MS Works v2.0	£84(b)
Open Access III	£349(a)
PFS First Choice	£95(b)
PFS Window Works	£79(b)
Smartware II v1.5	£368(a)
Symphony v3.0	£365(a)
Wordperfect Works	£99(a)

DATABASES

Approach for Windows	£182(a)
Cardbox Plus v4.1	£183(a)
Clipper v5.01	£280(a)
DataEase v4.5 NEW	£378(a)

SPREADSHEET

Lotus 123 for Windows	£275(a)
Lotus 123 for Win 5 pk	£1285(a)
Lotus 123 Rel 3.1 PLUS	£287(a)
Lotus 123 v3.1 + 5 pk	£1322(a)
Lotus 123 v2.4 NEW	£239(a)
Lotus 123 v2.4 5 pk	£1105(a)
Lotus 123 GO	£98(a)
Lotus 123 Exec + Filofax	£149(a)
Lotus 123 GO	£98(a)
All Lotus Upgrades	POA
MS Excel for Win v4.0	£227(a)
PlanPerfect v5.1	£203(a)
Quattro Pro v4 Win/DOS	£168(a)
SuperCalc 5.5	£67(a)
SuperCalc 5.5 3U LAN	£174(a)
CA Compete for Win	£250(a)
VP Planner v1.38	£59(a)
Wingz v1.1	£265(a)

WORD PROCESSORS

WordPerfect for Windows	£194(a)
WordPerfect v5.1	£194(a)
WordPerfect v5.1 5 pk	£615(a)
WordPerfect v5.1 20 pk	£2389(a)
WP Office server + 5U	£239(a)
WordPerfect Office PC	£59(a)
WordPerfect Office 5U	£150(a)
LetterPerfect	£95(a)
CA Textor for Win	£132(a)
Displaywrite v5	£239(a)
Gem 1st Word Plus	£66(a)
IBM Storyboard Live NEW	£269(a)
Locolink PCW/IBM	£23(c)
File Transfer	
Locoscript Pro NEW	£62(b)
Lotus AMI (Samna)	£69(a)
Lotus AMI Prof V3	£268(a)
Lotus Write v2.0	£95(a)
MS Word for Windows v2	£229(a)
MS Word v5.5	£229(a)
Multimate IV	£234(b)
Prof Write v2.2	£135(a)
Prof Write Plus Win	£155(a)
Sprint Borland WP	£114(b)
Symantec Justwrite	£145(a)
Top Copy Professional	£99(a)
Wordcraft v6.0	£240(a)
WordStar 2000 + R3.5	£254(a)
WordStar v6	£69(a)
WordStar 7	£222(a)
WordStar 7 Upgrade	£98(a)
WordStar for Windows NEW	£95(a)
WordStar for Windows upg	£95(a)
WordStar Laptop Collection	£152(a)
WordStar Legacy	£149(a)
Borland Brief v3.1 Editor NEW	£157(a)
dbrief	£85(a)
Correct Grammer DOS/Win	£75(b)
Correct Grammer/Letter/Quotes + foc	
Hutchinson Enyc.	£105(b)
Grammatik v5 for DOS/Win	£60(b)
Word for Word Prof	£55(b)
DOS/Win	

BORLAND

Borland C++ v3.1	£167(a)
Borland C++ v3.1 + App Fmwk	£248(a)
Turbo C++ v3.0 NEW	£41(b)

TurboVision	£21(b)
Turbo C++ for Win V3.1	£70(b)
Turbo Pascal for Windows V1.5	£69(b)
Turbo Pascal v6	£57(b)
Turbo Pascal v6 Prof	£115(b)
Turbo Assembler Debugger	£75(b)
Object Vision Win v2.1 NEW	£82(a)
Sidekick V2.0	£46(b)

PROFESSIONAL CAD

AutoSketch v3.0	£61(b)
Autosketch for Win	£90(b)
Symbols library (specify)	£65(b)
Animator Pro NEW	£307(a)
AutoCad Level 10	POA
AutoCad Level 11 386	POA
AutoCad Level 12	POA
Autodesk 3D Studio	£1945(a)
DesignCad 2D v5 NEW	£139(a)
DesignCad 3D v4	£182(a)
Drafix Cad Ultra	£225(a)
DrafixWindowsCADv2	£435(a)
Generic CADD Level 6	£328(a)
Generic CADD 3D Drafting	£179(a)
TurboCad v2	£67(a)

COMMUNICATIONS

Ascom IV	£83(a)
Carbon Copy Plus v6.0	£83(b)
Carbon Copy for Windows	£99(b)
Centra Point Commute	£59(b)
Crosstalk for Windows NEW	£58(b)
Crosstalk Mk4 NEW	£120(b)
Datataalk v4.0	£82(b)
Mirror III UK	£112(a)
PC Anywhere v4.5	£92(b)
Procomm Plus EC version	£65(b)
Procomm Plus for Windows	£68(b)
Reflection 4/Plus	£195/225(a)
Sage Chit Chat	£57(b)
Smartterm 340/320	£127/79(a)
Talking Windows	£185(a)
Winfax Pro for Win	£68(b)

**All software for
IBM PCs &
100% compatibles.**

Please specify disk size 3.5" or 5.25"

AUTHORISED DEALER DIGITAL RESEARCH DR DOS 6

Compatible Operating System
with Advanced features:

- Memory Mangement up to 627K available
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PS/2 50 50Z 55SX 60	2-14Mb	6450609	£208(b)
NOTEBOOK L40SX	2Mb	79F0999	£109(b)
NOTEBOOK L40SX	4Mb	79F1000	£219(b)
PS/2 M57SX	2Mb	6450902	£109(b)
PS/2 M57SX	4Mb	6450128	£149(b)
PS/2 P76/90/95	2Mb	6450902	£109(b)
PS/2 P76/90/95	4Mb	6450128	£149(b)
386 Memory Exp Option	2-8Mb	6450605	£219(b)
386 Enh Memory Opt 85ns	2-14Mb	34F3077	£208(b)
386 Enh Memory Opt 85ns	4-16Mb	34F3011	£296(b)

SANYO/COMMODORE

17NB/18NB - COMM	2Mb	£94(b)
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HP 95LX - POQET

HP95LX/POQET	128K F1002A	£105(b)
HP95LX/POQET	512K F1003A	£131(b)
HP95LX/POQET	IMB	£193(b)
HP95LX/POQET	2MB	£384(b)

PANASONIC

CF170	IMb	£61(b)
CF270	2Mb/4Mb	£116/£226(b)
CF370	4Mb	£226(b)

SHARP

PC 6220/PC 6240	1/2Mb	£94/£187(b)
PC 3000	1/2Mb	£209/£413(b)

CO-PROCESSORS (b)

TYPE	INTEL	IIT
8087 - 8MHz	£80	-
8087 - 10MHz	£89	-
80287 - 8/10/12MHz	£52	£46
80287 - XL/XLT	£52/£56	-
80387SX-16/20/25MHz	£60	£55
80387SX-33MHz	-	£75
80387SL	£60	-
80387-DX-16/20/25/33MHz	£65	£60
80387-40MHz	-	£90
80487SX	£299	-
RAPIDCAD	£199	-
INTEL OVERDRIVE PROCESSOR -		
See below		

MEMORY PART NUMBERS LISTED ABOVE ARE FOR REFERENCE ONLY. WE SUPPLY COMPATIBLE PARTS FROM REPUTABLE MANUFACTURERS.

PRINTER MEMORY UPGRADES

	IMb	2Mb	3Mb	4Mb		IMb	2Mb	3Mb	4Mb
BROTHER					KYOCERA				
HL4W/PS	£87	£131	£164	£197	F-800/Arr	£99	£143	-	£229
HL-8V/D/PS	£87	£142	-	-	F1200S/3000/A/3300	£99	£143	£229	-
					F820/1800/A/5000	£98	-	-	-
STAR					IBM				
LP4	£119	£175	-	£293	4019/4019E	£83	£120	£175	-
LP8	£119	£175	-	£285	4029 NEW	£87	£142	-	£274
	IMb	2Mb	3Mb	4Mb					
CANON					SHARP				
LBP-4	£94	£142	-	-	JX-9500 PS	IMb	£71	-	-
LBP-8.2	£59	£92	-	£153	JX-9500E/H	1.5Mb	£131	-	-
LBP-8.3+/T/R	£94	£142	£186	-					

INTEL OVERDRIVE PROCESSORS

(Doubles the speed and provides Co-Pro Functions)

486SX16/SX20 to 32/40MHz	£249
486SX25/DX25 to 50MHz	£329
486DX33 to 66MHz	£429
486DX50 suggest 66MHz	£429
RAPIDCAD-upgrades to 386DX	£199

(Suitable for upgrading Intel CPUs only)

SIMMS & SIPS (b)

SIMMS SIPS

1 Mb x 9-60ns	£36	-
1 Mb x 9-70ns	£32	£36
1 Mb x 9-80ns	£32	£36
1 Mb x 9-100ns	£34	£39
4Mb x 9-70ns	£109	-
4Mb x 9-80ns	£109	-
256K x 9-80ns	£10	£14

TECHNOMATIC

MONITORS (MULTISYNC COLOUR)

NEC Low Radiation

2AN 14" 800 x 600	£279(a)
3FG 15" 1024x768(i)	£343(a)
4FG 15" 1024x768(ni)	£437(a)
5FG 17" 1280x1024(ni)	£799(2xa)
6FG 21" 1280x1024(ni)	£1460(2xa)

TAXAN

787 14" 1024x768 (i)	£229(a)
795 14" 1024x768 (ni)	£395(a)
875+ 17" FST 1600x1200 (ni)	£719(2xa)
1075 20" 1280x1024 (ni)	£1029(2xa)
1095LR 20" FST 1600x1200	£1499(2xa)

PANASONIC

2 years on-site maintenance	
C1381 14" SVGA MultiScan	£199(a)
C1381 Low Radiation	£275(a)
TX1703MAB 17" FST MultiScan	£759(2xa)
TX2013 20" MultiScan	£1015(2xa)

NEC GBM-70: 27" MultiSync Monitor TTL/Analog & Video Signals input

NEC Graphics Smart Projection System: Image sizes from 100" to 300" (diagonal). RGB/TTL Analog, S-Video, PAL etc inputs

Laser Pointer: An indispensable tool for any presentation

£POA

£POA

£89(b)

GRAPHICS ADAPTORS (Carr b)

MENTOR 9406AF SVGA ET4000 (G Version) based, 1Mb, 16 bit card offering 16.7 million Colours, zero wait states, VESA modes, Windows Accelerator, 1280 x 1024 (i), 1024 x 768 (256 col NI), 800 x 600 (NI 32k cols), 640 x 480 (16.7m cols) **£99(b)**

ORCHID FAHRENHEIT 1280 1Mb VRAM, 16 bit New version offering up to 1280 x 1024 resolution and up to 16.8 million colours. **£249(b)**

ORCHID PRODESIGNER SERIES

Series II 1Mb **£99(b)** Series II S 1Mb **£129(b)**

TAXAN TURBO SERIES (GTS) ADAPTORS

8514A/SVGA Cards with ATI Wonder+ and ATI Mach CPUs. Professional graphics with flicker free displays. Up to 24 times faster than std SVGA. 256 cols in 1024 x 768 non interlaced modes with very fast memory response. Windows accelerator and most popular applications drivers included. Resolutions up to 1280 x 1024 (i).

GTS595+ 1.5Mb DRAM (VGA/SVGA/8514A) **£175(b)**

GTS695+ 1.5Mb VRAM **£219(b)**

GTS690+ As GTS695+ but for MCA bus **£229(b)**

TRIDENT 512K 16bit Card 1024 x 768 Res **£36(b)**

DATA STORAGE DEVICES

HARD DISKS (Carr a)

CONNOR IDE 3.5" Half Height

C2088	85MB	21ms 2.5"	£199
CP3000	42MB	28ms	£119
CP30084E	85MB	18ms	£175
CP30104	121MB	19ms	£229
CP30174	170MB	18ms	£259
CP3204F	212MB	16ms	£359
CP3364	340MB	15ms	£649
CP3544	510MB	15ms	£899

CONNOR SCSI

CP3040	42MB	25ms	£169
CP30080E	85MB	18ms	£209
CP30100	121MB	19ms	£229
CP30170E	170MB	18ms	£329
CP3200P	212MB	12ms	£375
CP3360	362MB		£759
CP3540	543MB		£899

5.25" Adaptor kit for 3.5" Drive **£12**

QUANTUM IDE with 256K cache RAM

LPS240AT 245Mb	16ms	3.5" LP	£429
LPS425AT 426Mb	13ms	3.5" x 1"	£699

PLUS HARD CARDS

Plus Hard Card IIAT 50MB 9ms	£219(a)
Plus Hard Card IIAT 105MB 9ms	£329(a)

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

FUJITSU HARD DRIVES 5 yrs Warr.

M2617T	IDE	104Mb	19ms	£199
M2618T	IDE	210Mb	19ms	£219
M2622T	IDE	330Mb	12ms	£599
M2624T	IDE	520Mb	12ms	£729
M2617SA	SCSI	105Mb		£199
M2618SA	SCSI	210Mb		£219
M2622SA	SCSI	330Mb	12ms	£599
M2624SA	SCSI	520Mb	12ms	£749

CACHING CONTROLLERS

Promise Technology - IDE and SCSI

- Effective access time of 0.3ms average
- 80186 CPU • ISA Bus up to 16Mhz

IDE controller DC2032 (c) with

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- 386sx CPU • Drivers for Novell, UNIX
- with 4Mb **£675** with 16Mb **£965**

Phone for full specifications on all above cards

BARE FLOPPY DRIVES

360K 5.25"	£45(b)	1.2Mb 5.25"	£45(b)
720K 3.5" + 5.25" adaptor kit	£42(b)		
1.44Mb 3.5" + 5.25" adaptor kit	£42(b)		

Two In One Floppy Drive:

5.25" + 3.5" Drives in one frame. **£89(b)**

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DJ10 120Mb Internal tape drive	£135(a)
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KE-10 Ext Kit for above drives	£86(b)
TC-15 Tap Cont + Compression PCS	£149(b)

700Mb Models/Jumbo Accessories also available

3M DATA CARTRIDGES Carr(d)

DC2000	£13	DC2120	£15
DC6250	£20	DC6150	£17

10 x DC2120 **£135(b)**

FLOPPY DISKS Carr (d)/pk

3M SONY TDK

3.5" DD 720K	£6.00	HD 1.44Mb	£9.90
5.25" DD 360K	£5.00	HD 1.2Mb	£6.90

10 pks TDK 3.5" HD formatted **£79(b)**

DRIVE CONTROLLERS

ST01 SCSI HD Adaptor XT/AT	£34(c)
ST02 SCSI HD/FD Adaptor XT/AT	£37(c)
IDE HD Adaptor AT	£19(c)
IDE HD Adap/FDC/AT Multi I/O AT	£29(c)

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Parallel Port Card (2 ports)	£12(d)
AT 2 Serial/I Parallel Ports	£16(d)
Cherry 102 key k/bd (XT/AT)	£45(a)

MODEMS (Carr a)

APPROVE for Connection to telecommunication systems specified in the instruction for use subject to the Conditions set out in them.

COMMUNICATIONS STANDARDS

	V21	V22	V22bis	V32	V32bis	V32bis	V42	V42bis	V42bis	FAX	Int.	Ext.
MULTITECH - Authorised Dealer, 2 yr. manuf. warr., Free Hot Line Support inc Free Software												
Multi Micro 1432MK	•	•	•	•	•	•	•	•	•	•	---	599
Multi II 1432BLK	•	•	•	•	•	•	•	•	•	•	---	626
Multi II 932BK	•	•	•	•	•	•	•	•	•	•	---	529
Multi 932ECK	•	•	•	•	•	•	•	•	•	•	---	499
Multi 224EK7	•	•	•	•	•	•	•	•	•	•	---	379
Multi 224EK5	•	•	•	•	•	•	•	•	•	•	---	369
DATAFLEX - Authorised Dealer, 2 yr. manuf. warr., Free Hot Line Support, Transend Pro software available on request												
Gem NEW	•	•	•	•	•	•	•	•	•	•	109	109
Gem + FAX NEW	•	•	•	•	•	•	•	•	•	•	149	149
Stardcom	•	•	•	•	•	•	•	•	•	•	---	149
Biscom II	•	•	•	•	•	•	•	•	•	•	129	159
Quadcom II	•	•	•	•	•	•	•	•	•	•	189	232
Comfax II	•	•	•	•	•	•	•	•	•	•	225	265
Sapphire	•	•	•	•	•	•	•	•	•	•	---	375

COMMUNICATIONS STANDARDS

	V21	V22	V22bis	V32	V32bis	V32bis	V42	V42bis	V42bis	FAX	Int.	Ext.
Rapier - Authorised Dealer, 5 yr. Manuf. warr., Free Hot Line Support												
PCM/IA 2400+ credit card size	•	•	•	•	•	•	•	•	•	•	329	359
US Robotica (Microm) - Authorised Dealer, 5 yr. Manuf. warr., Free Hot Line Support												
WS3000	•	•	•	•	•	•	•	•	•	•	125	125
WS3000 Mk II	•	•	•	•	•	•	•	•	•	•	219	225
Courier 2400e Quad	•	•	•	•	•	•	•	•	•	•	---	239
Courier V32	•	•	•	•	•	•	•	•	•	•	385	375
Courier HST	•	•	•	•	•	•	•	•	•	•	364	369
Courier HST Dual Std	•	•	•	•	•	•	•	•	•	•	575	565
HAYES - Authorised Dealer, 5 yr. manuf. warr., Free Hot Line Support, including Smartcom EZ software												
Optima 24 NEW	•	•	•	•	•	•	•	•	•	•	---	235
Optima 96 NEW	•	•	•	•	•	•	•	•	•	•	---	370
Optima 144 NEW	•	•	•	•	•	•	•	•	•	•	---	430
PACE - Authorised Dealer, 5 yr. manuf. warr., Free Hot Line Support												
Microlin FX	•	•	•	•	•	•	•	•	•	•	189	189

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AKHTER PCs

Affordable Computer Solutions

Model	Std (Max) RAM	Free Exp slots	Land Mark Speed	14" Monitor Type	No HD	40Mb £	105Mb £	210Mb £	420Mb £
LC386SX-25	2(4)Mb	4	24	Mono	627	764	846	1021	1361
LC386-40C	4(32)Mb	6	52	Colour	765	902	984	1159	1499
64K cache RAM				Mono	682	819	902	1076	1417
LC486-33C	4(32)Mb	6	152	Colour	820	957	1040	1214	1555
64K cache RAM				Mono	1050	1187	1269	1444	1784
LC486-50C	4(32)Mb	6	-	Colour	1188	1325	1407	1582	1922
265K cache RAM				Mono	1280	1417	1499	1674	2014
LC486-50ET	8(64)Mb	6	-	Colour	1418	1555	1637	1812	2152
256K cache RAM				Mono	1934	2029	2080	2272	2522
				Colour	2015	2110	2161	2353	2603

*Mini-Tower Case at no extra cost; *£30/Mb for additional RAM; £45 for a 5.25" floppy drive; Carriage £12/system

*Educational/Student prices available - *Extended warranty at 6% per annum for up to 4 years

All systems include:

◆ MS DOS 5.0

◆ Windows 3.1

◆ Fast IDE drives from 40Mb to 1400Mb

◆ 1 x 3.5" 1.44Mb FD

◆ 102 key keyboard

◆ 2 Serial/1 Parallel/1 games port

◆ SVGA Graphics Adaptor 512K *

◆ 14" Mono VGA/Colour SVGA Monitor

◆ MS compatible Mouse

◆ MS Works for Windows **

◆ Norton Anti-Virus

◆ 1 year on site maintenance

* All 486 systems include 1Mb RAM

** Included ONLY with all 386SX systems

AMBRA

GOOD PRICES

1 year on site maintenance, extension of up to 3 years available
Hotline support on free phone number

SPRINTA 386

Friendly Styling
Fast IDE HD Controller
16 bit Video Controller
Max. res. of 1024 x 768 at
16 cols. on SVGA systems
3 expansion slots (ISA/AT)

SPRINTA 486

As SPRINTA 386 plus:
64Kb High speed cache
16 bit video display, 1MB RAM
Max. res. of 1024 x 768 at 256 cols.

TREKA NOTEBOOK

VGA 9.5", LCD screen, 3.5" FDD

The HURDLA 486 features:

As SPRINTA 486 plus
Video system has Ramdac + graphics
accelerator
256KB cache
6 ISA AT expansion slots
1 extra drive bay (3.5")

Accessories & Upgrades

8Mb RAM Upg. for SPRINTA + HURDLA £218
64Kb cache RAM for HURDLA 386 £45
80Mb Hard Disk upgrade £199
2Mb RAM for Treka £95
Treka Fax Modem £279
Treka Carry Case £87

Model	CPU	RAM(Mb)	Max (Mb)	Cache (Kb)	HD	Price
SPRINTA	386SX-25	4	16	none	80Mb	£629
	486SX-25	4	32	64Kb	100Mb	£849
	486DX-33	4	32	64Kb	100Mb	£1089
	486DX-50	4	32	64Kb	213Mb	£1485
HURDLA	386SX-25	4	32	16Kb	80Mb	£679
	486SX-25	4	32	256Kb	100Mb	£899
	486DX-33	4	32	256Kb	100Mb	£1139
	486DX-50	4	32	256Kb	213Mb	£1555
TREKA MAX	386SL25	2	8	64Kb	80Mb	£1089

MS DOS v5.0 + Windows v3.1 installed on all machines.

Diskettes are not supplied by manufacturer.

Carriage cost per system: £12.00 except Treka at £8.00.

COMPAQ Performance at LOW PRICES

Desktops & Notebooks

Contura3/20	386SL-20	2MB (Exp 10Mb)	40Mb	£899(a)
Contura3/25 (W)	386SL-25	4MB (Exp 12Mb)	120Mb	£1499(a)
Contura3/25 Colour (W)	386SL-25	4Mb (Exp 12Mb)	84Mb	£1699(a)
Contura3/25 Colour (W)	386SL-25	4Mb (Exp 12Mb)	120Mb	£1799(a)
Prolinea 3/25zs	386SX-25	2Mb (Exp 16Mb)	40Mb	£539(a)
Prolinea 3/25zs (W)	386SX-25	4Mb (Exp 16Mb)	84Mb	£575(a)
Prolinea 3/25s (W)	386SX-25	4Mb (Exp 16Mb)	120Mb	£759(a)
Prolinea 4/33 (W)	486DX-33	4Mb (Exp 16Mb)	120Mb	£1169(a)
Prolinea 4/50 (W)	486DX-50	4Mb (Exp 16Mb)	240Mb	£1445(a)

VGA Colour Monitor (14")

£210(a)

QVision Controller

£235(b)

SVGA Colour Monitor (14")

£259(a)

QVision 150 Monitor

£499(a)

Compaq Monitors for Prolineas

NEW - LEADING EDGE DEBUTS

LTE LITE/25E 386SL-25 4Mb STD, 64Kb cache, Max 20Mb, 120Mb HD
World first active matrix B&W screen, superb clarity and response. Model includes DOS v5.0, Windows v3.1 and integrated trackball. **£2599(a)**

LTE LITE 4/25C Colour 486SL-25 4Mb STD, 8Kb int. cache, Max 20Mb
120Mb HD, highly compact, lightweight Notebook with Intel's latest SL CPU
and active matrix colour screen. Model includes DOS v5.0, Windows 3.1
and integrated trackball. **£3229(a)**

SPECIAL OFFER

Selected Prolinea + Deskpro/i models available with MS OFFICE pre-installed FREE OF CHARGE if ordered by 31st December 1992. This offer applies to all PROLINEA 486 models with HDs installed, to all DESKPRO/i 486 models with HDs installed and to DESKPRO/m 486/33 & higher models with HDs installed.

HP VECTRA PCs

1 year on site maintenance

Model	CPU	RAM(Mb)	Max (Mb)	Cache (Kb)	Video Adapter (512Kb)	I/O Slots	HD	PRICE	Trouble Free Personal Computing
486/33U	486DX-33	4	64	128Kb	Local-Bus Ultra VGA+	5 EISA	240Mb IDE	£2069(a)	All HP machines conform to TFPC ie they are reliable, secure, easy to use, upgradeable, quieter and ergonomic in design.
486/66ST	486DX2-66	16	64	128Kb	Local Bus Ultra VGA+	8 EISA	430Mb SCSI-2	£4299(a)	
U = Upgradeable PCs - 50MHz & 66MHz CPUs available					HP Accessories				
ST = Server - has 6 half height storage slots					HP SVGA 14" colour monitor.				£259
HP Vectra PCs do not include monitors.					512Kb VRAM upgrade for Ultra VGA+				£110
INDUSTRY LEADING RELIABILITY					HP Mini-DIN Mouse				£62

SANYO NOTEBOOKS

MBC-18NC 386SXL COLOUR

25MHz 80386SXL CPU, 4Mb RAM expandable to 12Mb, 1.44Mb
3 1/2" FDD, 2nd Generation STN Colour LCD screen, power saving
LCD status panel, MS-DOS 5.0 installed. NiMH batteries. 3 year EC
wide warranty.

With removable 90Mb Hard Disk

£1749(a)

With removable 120Mb Hard Disk

£1899(a)

LAN/SCSI Interface Module

£299(b)

MBC 18NB6h 486SX Version

NEW LOW PRICE

486SX-20 CPU, 60Mb HD, MS DOS 5, 3Mb RAM

£899(a)

UPGRADED FROM 386SX

Above System with internal modem

£1019(a)

Above System with internal fax/modem

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3 year EC wide warranty

Sanyo Ball Mouse

£49(b)

AMSTRAD FAMILY PACK: 386SX-20, 4Mb RAM, 80Mb HD, 3.5" FDD, 10" Trinitron screen, DOS + Windows, Games, Speakers + Mouse.

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TECHNOMATIC

TECHNO MULTIMEDIA CD-RAMA

£299 MPC MULTIMEDIA UPGRADE KIT

An unbeatable value multimedia upgrade kit, that is fully compatible with Microsoft MPC Level 1. Complete with windows 3.1 drivers.

Hardware:

Fast Panasonic internal CD-ROM drive, Sound Galaxy NX PRO Sound card, Speakers & Microphone. The amazing Sound Galaxy NX PRO Sound card is fully Sound Blaster V2.00 and Sound Blaster Pro II compatible. It has additional programmable bass and treble controls, with software adjustment of IRQ, DMA and address settings.

Entry level kit with no bundled CD-ROMS
GALAXY MULTIMEDIA UPGRADE KIT ENTRY

£299(a)

CD-ROM Software bundled:

Grolier 1992 MPC encyclopedia (Toolworks label), MPC Mavis Beacon Teaches Typing, Wing Commander II & Ultima Underworld.

GALAXY MULTIMEDIA UPGRADE KIT

£329(a)

TECHNO MULTIMEDIA MPC SYSTEM

This superior MPC level one system comprises:

*386DX 40MHz 4Mb RAM, 40Mb HD, SVGA Monitor, *Wharfedale Diamond V Speakers, *Windows 3.1, Sound Blaster Pro, CDROM Diamond V drive. See left border for multimedia CD-ROM bundle included with this system.

£1405(2xa)

*Other configurations on request, educational discounts available

Creative Technology (labs) Professional Multimedia Upgrade

A superb multimedia upgrade including:- Sound Blaster Pro v2.0 and Panasonic CDROM drive (390ms av access time). See left border for details of multimedia CD-ROM bundle included in this kit.

Full Internal

£465(a)

Full External

£529(a)

Also entry level kits with no CD-ROMS

Entry Internal

£380(a)

Entry External

£415(a)

16BIT MULTIMEDIA SOUNDCARDS

Microsoft Windows Sound System

This high performance 16bit stereo 44KHz sound card, comes fitted with the Yamaha OPL3 synthesizer chip. Easy installation and powerful bundled software.

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Soundblaster Pro 16

Latest Soundblaster sound card with 16bit audio sampling comes fitted with the Yamaha OPL3 synthesizer chip. Stereo digital/analogue mixer. Includes bundled software library.

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High Performance 21bit colour video digitiser, the incoming video is scaled and overlaid over a window. Images can be captured and edited with the powerful Temptra software supplied. Video images can be manipulated in real-time and sound can be mixed. Requires VGA feature connector (for video overlay) and Windows 3.0 or Windows 3.1.

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SOUND BLASTER SOUND CARDS

The SoundBlaster cards are fully Windows 3.1 Sound compatible.

Sound Blaster Card V2.0

£77(b)

NEW Sound Blaster Pro PLUS

(Windows Midi+Mic)

£157(b)

NEW Port Blaster

£127(b)

Sound Blaster Pro Card MCA

£178(b)

Sound Blaster MSDOS Developers Kit

£49(b)

Sound Blaster Windows Developers Kit

£49(b)

Sound Blaster V2.0 CMS CHIPS

£19(c)

Wharfedale Diamond V Speakers (for SB Pro)

£98(a)

NEW Techno Beat Speakers (10w Active)

£25(b)

Techno-Beat Mains Adaptor

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Sony Laser Library, 340ms av access, 8K cache, external drive, interface and driving software supplied, six great CDROMS included

£409(a)

NEW! NEC, 280ms average access time, 64Kb cache, SCSI.

NEC CDR-84 (Internal drive)

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NEC CDR-74 (External drive)

£449(a)

NEW Toshiba PHOTO-CD multi-session

CD-ROM drive with viewing/translation software.

Int drive 330IBAK £550(a) Ext drive 330ISAK £650(a)

Panasonic Lasermate MPC upgradable

CD-ROM drive 390ms av access time, 64K look

ahead cache (complete with controller card).

Internal

£199(a)

High quality CD-ROM caddy

£9.50(b)

CD ROM SPECIAL OFFER

MPC GROLIER ELECTRONIC ENCYCLOPAEDIA 1992 BUNDLE

(RRP £320) This unbeatable bundle also includes Mavis Beacon Teaches Typing and Wing Commander II+ ULTIMA Underworld CD-ROMS. The MPC Grolier Encyclopedia 1992 CD-ROM, contains 21 Volumes of a true multimedia encyclopedia including pictures and sounds, when purchased with hardware. £89(a)

OTHER CD TITLES (b)

MULTIMEDIA PC TITLES (b)

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TECHNOMATIC

GENIUS: Hand Held Scanners

GS-B105: Grey Scale

£109(a)

- 400 dpi resolution, 256 grey levels
- 105mm width, auto switch for A4

GS-C105+: Colour

£225(a)

- 400 dpi 4096 colours
- 105mm width, auto switch

GS-4500: for Windows

£69(b)

- 100-400 dpi resolution
- 105mm width, auto switch

iPhotoDeluxe

An image capture and process package capable of enhancing and editing. Using Windows, it has a user friendly interface that will allow you to start using your scanner without having to purchase other software. Output can be in various popular file formats allowing easy import and export to DTP, Word Processor etc packages. It can handle monochrome, greyscale (256) and 24 bit colour images allowing you total flexibility in getting professional results.

GO-CR

GO-CR is Europe's most popular Optical Character Recognition software. Why? It can recognise up to 80 different roman character-based languages! GO-CR can recognise text in point sizes from 6 to 24. It can scan mixed text and graphics, reversed text and outputs the recognised text in ASCII, allowing easy import into any word processor or DTP package. Most of all, it is very easy to use, being Windows based.

All scanners come with iPhotoDeluxe and GO-CR O.C.R. software and a PCIAT interface card.

These scanners are not suitable for AMSTRAD systems.

Minimum system for 105: 386SX/VGA/HD/Windows3+ 5Mb Free on HD/4Mb RAM (2Mb on GS4500)

GENIUS MICE (serial with full Microsoft compatibility)



HiMouse Serial - the Advanced mouse

This is the most ergonomically designed mouse in the Genius range. From the finely textured surface to the sculpted body, the HiMouse will hold your hand! Supplied with Zsoft's PC Paintbrush IV, Genius driver, Mouse mat & 9-25 pin adaptor. **£25(b)**

HiPoint Mouse

A portable trackball mouse for desktop, notebook or laptop. Attaches to keyboard. Easy thumb movement of the ball and finger operation of the buttons makes HiPoint a pleasure to use. Includes 3 keyboard clamps, leather carrying case, 9/25pin and PS/2 adaptors, 3.5"/5.25" disks and driver software. **£45(b)**

HiMouse Lite

Most advanced optical mouse with Mouse Systems engine, ideal for accuracy sensitive applications. No moving parts to wear out. ZSoft Paintbrush IV, PS/2 adaptor, 9/25 adaptor, Optical Mouse Mat. **£48(b)**

GM-F303

£21(b)

An ergonomically styled 2/3 button mouse. 350-1050 dpi dynamic resolution, precise x-y movements. Includes PS2, 9/25 pin adaptor, CasCAD software.

GM-F302

£18(b)

As F303 but without CasCAD I and PS/2 adaptor.

MouseOne

£15(c)

Low cost 2 button mouse (Please specify Serial or PS/2)

HiTrak Tracker Ball

£39(b)

Ideal tool that also saves space. Buttons can be locked to free the fingers to roll the ball. PS/2 adap. 9/25 adapt, ZSoft Paintbrush IV.

All GM-F 'mouses' include Dr Genius paint/slide show software, Genius MenuMaker with library and mouse mat.

GM-D220P

£15(d)

Mouse for PS/2s & Notebooks + driver on 3.5" disk.

All Genius Software on 5.25" disks. £5 extra for 3.25" disks.

LOGITECH PRODUCTS

Logitech Scanman 256

£169(b)

Logitech Scanman 256 PS/2

£195(b)

Logitech Scanman 256 col

£299(b)

Logitech Catchword

£89(b)

Logitech Mouseman

£49(b)

Logitech Photoman

£329(b)

GENIUS TABLETS

A range of tablets for PC/XT/AT/PS2 systems interfacing through the RS232 port. They are fully compatible with most of the popular CAD and Paint packages. Windows 3.0 driver is available as an option.

GT1212 & GT1812 include Dr Genius, MenuMaker program, utilities including ADI drivers for AutoCAD/AutoShade/AutoSketch, a template for AutoCAD 10. GT1812 also includes CasCAD 11 CAD package.

GT906 has now been enhanced to HiSketch 906. It includes GeniSketch CAD program, Windows and ADI Drivers, AutoCAD R10 & GeniSketch Templates.

Computer Shopper on GT1212B said:

"The value for money of this digitiser is amazing"

All tablets include a UK standard power supply with 13A plug.

Options: GT1212B stylus £15. Windows 3.0 driver £7 when purchased with the tablet: £15 if purchased separately.

GT1812D is like GT1812 but with a LCD co-ordinate display.

Model	GT1212B	GT1812/GT1812D	HiSketch 906
Working Area	12"x12"	18"x12"	9"x6"
Data Rate	150 to 19,200 BAUD		
Sampling Rate	20 to 100 pairs/sec		
Resolution	1000 lines/inch. Accuracy +0.01		
Pointing Device	4 button	Multi directional 4 button puck + stylus	3 button stylus
Price	£139(a)	£209/£235(a)	£89(a)

GENIUS HIPEN



Genius HiPen - an affordable & elegant entry product to the world of Pen Based Computing.

Tired of trying to type? Aren't computers meant to be productivity aids? You need Pen Based Computing - the exciting new step forward in the man/machine interface. Use your natural pen-&-paper skills to control your PC. HiPen is also fully compatible with the MS Pen Extension for Windows. Connects to a 9 pin serial (RS232C) port. Supplied with the following hardware and software:

Stylus pen, Puck, Control unit with status LEDs, Power adaptor, Zsoft's PC Paintbrush IV, PenPal software, Windows 3.x and ADI drivers.

PenPal software converts your handwriting into text, recognises gestures and works with all your DOS programs. PC Paintbrush IV is sold separately at over fifty pounds.

Genius HiPen **£179(a)**

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TELEPHONE LINE - FAX SYSTEMS AND SWITCHES

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£79(b)

Latest launch from FAX LINK, can be connected to any telephone extension, and can be connected to a telephone, a fax and an answering machine. Priority is given to voice calls avoiding delays and unnecessary recorded messages.

FAXMAN 400

£115(b)

As FAXMAN 350 but capable of connection to a fax system and/or a modem.

STORACALL FS100

£119(b)

Automatic fax switch which enables a fax machine, upto 3 telephone and an answering machine on one telephone line.

JT FAX + CARD

£225(b)

A half card system for XT/ATs offers: Groups III compatibility, A/VAD, AutoPrint, CallScheduling etc. Support for popular WPs, Printers & Scanners. Comprehensive Text/Graphics editing facilities. Supports CGA & Hercules Graphics. Now with enhanced software.

AMSTRAD FX6000AT DESKTOP FACSIMILE

£355(A)

FX6000AT offers total communications on your desk. Comprises of fax, telephone, answer machine and a copier. Voice & Fax calls discriminated automatically and can be set for automatic message reception for fax or answer machine. Answer machine can be accessed remotely. Speed dial. 1 year on site warranty.

THE AMSTRAD BUSINESS COMPUTER YOUR KIDS CAN TOY WITH... FOR LESS THAN £600



Now there's a neat, small and simple to use home computer package that everyone will want to open at Christmas; the Amstrad 4386 Family Pack. It's exclusive from Crown at just £599 (plus VAT + Carriage) and inclusive of a high specification for business and pleasure.

The Amstrad 4386 features Counterpoint menu-driven front end, specifically designed for the novice user, which makes it so simple to access both games and business software.

As a business tool in its own right, it includes Amstrad Manager Software incorporating the Windows 3 version of Write (wordprocessing), File (card index system) and Excel (Spreadsheet), plus DOS, 4Mb RAM, 80Mb Hard Disk, 3.5" Floppy Disk and a high resolution Sony Trinitron colour monitor.

As a games centre it includes F15 Strike Eagle, Links Golf and Prince of Persia, plus twin speakers and joystick. Three surefire ways to keep the family amused for hours.

In short this is a computer package that packs everything you need to get down to some

serious business and some serious fun. There's even a free 12 months on-site warranty to put your mind at rest.

Why buy an ordinary games machine when you can now buy a real computer that works as hard as it plays? At just £599 it also comes with a price that will keep you just as happy as the children.

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1MB X 9 - 3 CHIP	20
1MB X 9 - 9 CHIP	25
4MB X 8 - 8 CHIP	70
4MB X 9 - 9 CHIP	75
16MB X 8 - 8 CHIP	325
16MB X 9 - 9 CHIP	375
256K X 36	35
512K X 36	60
1MB X 36	100
2MB X 36	245
4MB X 36	350

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80287XL	45
80287XLT	60
80387SX (16/20/25)	50
80387DX (16/20/25)	60
80387DX33	80
80387DX40	110

Expansion Boards

PC XT/AT		
ORCHID		
RAMQUEST 8/16	2MB	140
4MB	190	8MB 280
16MB	450	32MB 780
PC AT		
EVEREX RAM	1MB	90
3000 DELUXE	2MB	120
	3MB	150
EVEREX RAM	4MB	215
10K DELUXE	10MB	390
PS/2 (50,60,70,80)		
ORCHID		
RAMQUEST 16/32	2MB	210
4MB	270	8MB 360

Amstrad Memory

PCW 8256	256K	10
PC 1512 - VER.1	128K	18
- VER.2	128K	10
PC1286/1386/2286;	2MB	50
/3286/3386SX/5286	4MB	95
8MB	205	16MB 350
PC2386/4386	16MB	350

Apple Memory

MAC Classic	1-3M	45
	2MB	46
MAC Classic IIL/C	2MB	46
4MB	90	8MB 160
(Video Module)	512K	30
QUADRA 700/900	4MB	90
16MB	320	64MB 1300
(Video Ram Kit)	512K	45
MAC Ilei	1MB	27
2MB	46	4MB 90
8MB	160	16MB 320
	64MB	1300
MAC Iifx	4MB	100
16MB	320	64MB 1500
MAC Ilsi	2MB	46
4MB	90	8MB 160
MAC Ili/x; SE30	1MB	27
2MB	46	4MB 90

AST Memory

Premium II 486/	8MB	200
/SX20/386/33;		
Premium 486/25/E/		
/33		
BRAVO 486/25	2MB	60
	8MB	200
Premium 386/25/33	1MB	35
Premium II 386SX/	1MB	35
/20;Premium 386SX/	4MB	100
/16; 386/33/T/TE		
Premium 386/C	1MB	35
	4MB	100
BRAVO 286/386SX	2MB	60

Compaq Memory

PRO LINEA	2MB	75
3/25/SZ/S	8MB	190
	16MB	375
SYSTEMPRO;	2MB	70
DESKPRO'S	8MB	220
386/33/L;486/	32MB	1250
/25/33/50/L		
EXP.BOARD	2MB	195
386/20/25/e/s		
MODULE	1MB	48
MODULE	4MB	110
EXP.BOARD	1MB	80
EXP.BOARD	4MB	160
386/16	1MB	35
EXP.BOARD	1-2MB	135
EXP.BOARD	4-8MB	260
386S		
MODULE	1MB	48
MODULE	4MB	110
EXP.BOARD	1MB	80
EXP.BOARD	4MB	160
286/386/N/S20/	1MB	35
/25M;486/S/16/25/	2MB	60
/33/M	4MB	100
EXP.BOARD	2MB	220
EXP.BOARD	4MB	260
286E	1MB	48
	4MB	110

Commodore

PC286-16/40	2MB	55
	4MB	100
SSL386SX-20	1MB	32
4MB	100	8MB 175
16MB	320	

Dell Memory

420/425/433;	2MB	60
450/de/se/te	4MB	100
8MB	220.00	16MB 360
	32MB	670
425/433/E	2MB	60
	4MB	100
320SX/325P;	1MB	35
325D/333D	4MB	100
310/316/325;	1MB	35
320LX	4MB	100

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ES/12PC;386/16/	2MB	50
20/N		
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2MB	50	4MB 95
QS/RS/20/25/C	1MB	30
	4MB	95
386/25PC;	1MB	40
486/PC/25/33/T	2MB	65
4MB	100	8MB 200
APOLLO 9000	4MB	190
SERIES	8MB	325
16MB	570	32MB 1120
APOLLO X	1MB	50
STATION 700/RX	2MB	90
4MB	130	8MB 250

IBM Memory

PS/1/386SX	512K	30
2MB	50	4MB 100
PS/1 PRO 386SX	2MB	65
4MB	100	8MB 200
PS/2 25/30-286	512K	20
	2MB	60
PS/2 35/40/L5/SX	1MB	35
2MB	60	4MB 110
8MB	195	
PS/2 50Z	1MB	35
	2MB	60
PS/2 55/65/L5/SX	2MB	60
	4MB	110
PS/2 70	1MB	35
2MB	60	4MB 110
PS/2 80	1MB	60
2MB	90	4MB 150
PS/2 90/95 &	2MB	60
56/57/SLC/SX	4MB	120
	8MB	250
RISC SYSTEM	16MB	600
6000 SERIES	32MB	1100
	64MB	2150

Olivetti Memory

PCS 286 &	2MB	55
PCS 386SX	4MB	100
6MB	150	8MB 180

Sun Micro Memory

ELC & IPX	4MB	100
	16MB	320
MODEL 4/110	4MB	100
SLC 386/250; 4/20	16MB	320
3/60/80;4/40/60/65/75	4MB	100
& SPARC 1 & 2	16MB	320
SPARC 330/370/390	8MB	200
	32MB	650

Zenith Memory

Z-386/20/25/33/33E	1MB	35
2MB	65	4MB 110
Z-386SX/20	2MB	55
Z-486/33ET	4MB	125
	16MB	360

Laptop, Notebook, Palmtop & Portable Memory

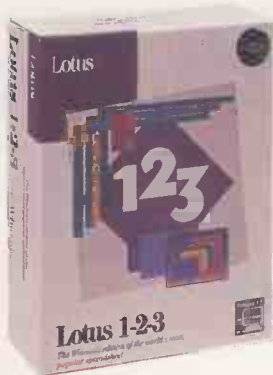
APPLE		
POWERBOOK	2MB	65
100/140/170	4MB	125
	6MB	220
MAC Portable	1MB	85
2MB	145	3MB 330
		4MB 460
AST		
Premium Executive	1MB	40
286/12;386SX/20/25C	4MB	100
AMSTRAD		
AL T286/386SX	2MB	55
(0 WAIT STATE)	4MB	105
NC 100	512K	100
1MB	155	2MB 360
COMMODORE		
C286/386SXLT	2MB	75
COMPAQ		
CONTURA 3/20/25	2MB	90
4MB	160	8MB 290
LITE 20 & 25	2MB	105
4MB	150	8MB 330
LTE/286	1MB	45
2MB	60	4MB 150
LTE/386s20	1MB	100
	4MB	160
SLT/286	1MB	50
	4MB	170
SLT/386s20	1MB	60
2MB	80	4MB 135
DELL		
212/320/N	1MB	40
	2MB	60
EPSON		
LT 286E	1MB	60
LT 386SX	2MB	100
NB SL/20/25/25C	2MB	120
	4MB	230
NB 3S	1MB	55
	4MB	120
EVEREX		
TEMPO CARRIER	2MB	80
TEMPO LX/20	2MB	75
Hewlett Packard		
PALMTOP 95LX	512K	100
1MB	155	2MB 360
IBM		
PS/2 N51/SX/SLC	2MB	80
4MB	120	8MB 200
L40SX & N33/SX	2MB	70
4MB	110	8MB 220
OLIVETTI		
QUADERNO	512K	100
1MB	155	2MB 360
PACKARD BELL		
286 NB	1MB	75
	4MB	195
386SX NB	1MB	50
	4MB	100
PANASONIC		
CF 270/370 NB	1MB	40
CFL 280/380/480	2MB	70
4MB	125	6MB 190
PHILIPS		
PCL 203	1MB	80
	4MB	250
PCL 304	2MB	80
	4MB	160
POQET		
PALMTOP PC	512K	100
1MB	155	2MB 360
REEVES		
PC 1000	512K	100
1MB	155	2MB 360

Laptop, Notebook, Palmtop & Portable Memory (...cont)

SANYO		
17/18/NB/6	2MB	75
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TANDON		
NB/386SX	2MB	60
	8MB	220
TANDY		
1500/2810	1MB	35
Texas Instruments		
Travelmate 2000	1MB	65
Travelmate 3000sx	2MB	55
& 3000 WinSX		
TOSHIBA		
T1000LE/SE/XE	1MB	75
& T2000/SX/E	2MB	80
& T2200	4MB	150
	8MB	275
T1200XE	2MB	75
T1600	2MB	75
T3100	2MB	120
T3100E	2MB	65
T3100SX	2MB	75
	4MB	100
T3200	3MB	110
T3200SX/C	2MB	70
	4MB	100
T3300SL	2MB	80
4MB	140	6MB 195
T4400SX/C	2MB	100
& T6400/DX/SX/C	4MB	195
	8MB	380
T5100	2MB	70
T5200/C/8500	2MB	70
	8MB	230
WALTERS		
NOTEBOOK	4MB	125
ZENITH		
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SLIMSPORT	1MB	50
& Supersport 286/e	2MB	65
	4MB	120
SUPERSPORT SX	2MB	65
Turbosport 386/e	1MB	50
	4MB	280
Z-NOTE 320/325/L/C	2MB	75
	8MB	250

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AT & T		
593	2MB	100
	4MB	140
BROTHER		
HL-8/e/D	1MB	85
	2MB	115
HL-8V	1MB	85
2MB 115	4MB	155
HL-4/PS	1MB	100
2MB 125	4MB	180
CANON		
LBP-4/PLUS	1MB	85
	2MB	115
LBP-8 II/T/R	2MB	65
	4MB	110
LBP-8III/PLUS	1MB	95
2MB 120	3MB	145
CITOH		
CI-4/4 PLUS/8E	1MB	70
EPSON		
EPL 4100/8000 &	1MB	70
ACTIONLASER II	2MB	120
	4MB	200
EPL 6000	2MB	100
	4MB	140
EPL 7000	2MB	100
	4MB	135
EPL 7100 / GQ 5000	512K	15
EACIT		
P6060	2MB	100
	4MB	140
Hewlett Packard		
Deskjet 500/C/PLUS	256K	50



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At only a fraction of the cost of a laptop PC, the
HP 95LX has genuine PC capabilities

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One-key access lets you move among any of the seven built-in HP 95LX applications.

Lotus
1-2-3



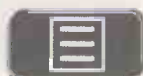
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24-Hour Answerphone Line 0923 233383



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Microsoft Windows v.3.1.



MS-DOS 5.0



The Norton
AntiVirus

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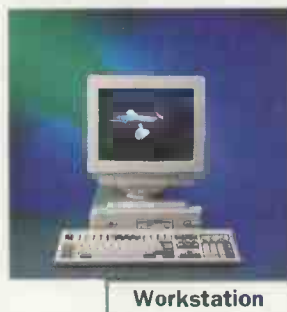


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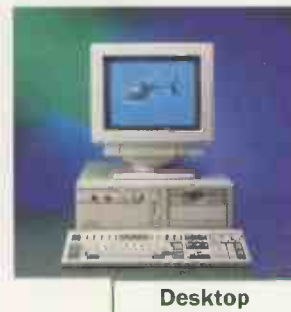
Introducing The New ARIES



Workstation



Slimline



Desktop

The Aries *Perfecta* PC range is even by our own high standards a breathtaking addition to the Watford portfolio. Designed without compromise for today's PC professional, *Perfecta* PCs incorporate a host of advanced features. Our state-of-the-art casings are engineered to incorporate a conductive coating to eliminate electrical interference which is fully FCC approved and are zinc plated for added durability. An *Intel approved zero insertion socket* ensures easy installation of an upgrade processor chip, and with our S3 graphics accelerator card you can now unleash the full power of Windows.



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At prices you've come to expect from Watford you could say the new *Perfecta* range is quite simply - *perfect*.



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All *Perfecta* Systems Include:

- ◆ 3.5" 1.44Mb FDD ◆ Optional Co-processor Socket ◆ Two Serial, One Parallel and One Games Port
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Perfecta

HIGH SPEC
COMPLETE
SYSTEMS AT
UNBEATABLE
INTRODUCTORY
PRICES ➤

32bit
COMPUTING
EISA OR
LOCAL BUS

CKA 0500 386SX-25

- ◆ 386SX-25MHz Processor
- ◆ 2Mb RAM expandable to 16Mb
- ◆ 44Mb HDD - 16ms
- ◆ Landmark speed of 34MHz
- ◆ SVGA Card with 512K RAM
- ◆ Low Radiation Monitor
- ◆ Slimline case
- ◆ Software Bundle

£685



CKA 0510 486SX-25C

Advance

- ◆ 486SX-25MHz Processor
- ◆ Internal Cache RAM
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- ◆ 105Mb HDD - 13ms (32K Cache)
- ◆ Landmark speed of 85MHz
- ◆ SVGA Card with 512K RAM
- ◆ Low Radiation Monitor
- ◆ Slimline case
- ◆ Software Bundle

£895



CKA 0570 386SX-33C

- ◆ 386SX-33MHz Processor with 16K Cache RAM
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- ◆ 44Mb HDD - 16ms (16K Cache) RAM
- ◆ Landmark speed of 45MHz
- ◆ SVGA Card with 512K RAM
- ◆ Low Radiation Monitor
- ◆ Slimline case
- ◆ Software Bundle

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CKA 0520 386DX-40C

Advance

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- ◆ 105Mb HDD - 13ms (32K Cache)
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- ◆ SVGA Card with 512K RAM
- ◆ Low Radiation Monitor
- ◆ Mini Tower case
- ◆ Software Bundle

£889

CKA 0530 486DX-33C

Advance

- ◆ 486DX-33MHz Processor with 64K Cache RAM expandable to 256K
- ◆ 4Mb RAM expandable to 32Mb
- ◆ 105Mb HDD - 13ms (32K Cache)
- ◆ Landmark speed of 115MHz
- ◆ S3 Windows Accelerator Card with 1Mb RAM and 33K Hi-Colour RAM-DAC
- ◆ Low Radiation Monitor
- ◆ Mini Tower case
- ◆ Software Bundle

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CKA 0540 486DX2-50C

Advance

- ◆ 486DX2-50MHz Processor with 64K Cache RAM expandable to 256K
- ◆ 4Mb RAM expandable to 32Mb
- ◆ 105Mb HDD - 13ms (32K Cache)
- ◆ S3 Windows Accelerator Card with 1Mb RAM and 33K Hi-Colour RAM-DAC
- ◆ Low Radiation Monitor
- ◆ Mini Tower case
- ◆ Software Bundle

£1335



CKA 0550 486DX2-66C

Advance

- ◆ 486DX2-66MHz Processor with 64K Cache RAM expandable to 256K
- ◆ 8Mb RAM expandable to 32Mb
- ◆ 210Mb HDD - 13ms (32K Cache)
- ◆ Landmark speed of 225MHz
- ◆ S3 Windows Accelerator Card with 1Mb RAM and 33K Hi-Colour RAM-DAC
- ◆ Low Radiation Monitor
- ◆ Mini Tower case
- ◆ Software Bundle

£1695



CKA 0560 486DX-50EISA

- ◆ 486DX-50MHz Processor with 64K Cache RAM expandable to 256K
- ◆ 16Mb RAM expandable to 32Mb
- ◆ 210Mb HDD - 13ms (32K Cache)
- ◆ Landmark speed of 225MHz
- ◆ S3 Windows Accelerator Card with 1Mb RAM and 33K Hi-Colour RAM-DAC
- ◆ Low Radiation Monitor
- ◆ Tower case
- ◆ Software Bundle

£2345



Perfecta® Range



Mini Tower



Midi Tower



Tower

All these extras at no extra cost!



SOFTWARE
All Aries PCs are supplied with **FREE** software. MS-DOS 5.0, Windows 3.1 and Norton Anti-Virus Pre-Installed.



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All Aries PCs are covered by **Unlimited Lifetime Support**. We want you to get the best from your machine, so

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All our Perfecta PCs are covered by a **FREE 12 Month On-site Service Warranty** in the mainland UK.



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680MB storage and access speed of 390ms

£239

CPA 0110

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Upgrade Options

Code	Description	Additional Cost
RAM UPGRADES		
CRA 0500	2 to 4Mb RAM Upgrade	£50
CRA 0510	4 to 8Mb RAM Upgrade	£100
CRA 0520	8 to 16Mb RAM Upgrade	£200
CEA 0530	Additional 32Mb RAM Upgrade Card (64Mb) for 386DX/486DX systems	£95
CACHE RAM UPGRADES		
CRA 0540	Upgrade to 128K Cache RAM	£45
CRA 0550	Upgrade to 256K Cache RAM	£95
HARD DISK UPGRADES		
CDA 0260	44 to 105Mb Upgrade	£115
CDA 0270	105 to 210 Mb Upgrade	£169
CDA 0280	210 to 330Mb Upgrade	£469
VGA CARD UPGRADES		
CEA 0260	Upgrade 512K Card to 1Mb	£25
CEA 0350	Upgrade 512K Card to S3 Win Accelerator	£105
ADDITIONAL DRIVE		
CDA 0470	Additional 1.2Mb Drive	£35
SOFTWARE BUNDLE OFFER		
Code	Description	Additional Cost
CSA 3100	Lotus Works, Borland Quattro Pro for Windows, Games Pack	£59
CSA 6000	Lotus Works, Borland Quattro Pro for Windows, Harvard Graphics	£95
CSA 3110	Lotus Works, Super Stor (Disk Doubler), Games Pack	£39

Perfecta®

Monitor Options

Code	Description	Additional Cost
MKA 0460	14" Aries Alphascan Plus Monitor 1024 x 768 non-interlaced	£95
MKA 0480	17" Aries 7000 1280 x 1024 non-interlaced	£445

Best Buy Computer Shopper 1992

Perfecta®

PC Case Options

Code	Description	Additional Cost
CAA 1100	Workstation Case	£5
CAA 1110	Slimline Case	£5
CAA 1120	Desktop Case	£10
CAA 1130	Mini Tower Case	£15
CAA 1140	Midi Tower Case	£25
CAA 1150	Tower Case	£35



Watford Electronics Ltd

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Fax: (0923) 233642

Advance



The New Aries Perfecta range (except 386SX) allows you to upgrade your CPU in an instant with Advance. It's the ideal upgrade path from a 386DX to a 486SX, 486DX, 486DX2 or even an Intel OverDrive processor without the need to replace your computer! Our Intel approved zero insertion socket ensures easy installation of an upgrade processor chip.



All Perfecta systems are supplied with Windows 3.1 and Norton Anti-Virus Pre-installed



CHIP FAN!

Our DX2-66C and DX-50EISA chips have their own heat sink and cooling fan for longer operational life



...the Aries 486EISA-50 would make a superb fileserver... You really do get a lot of power for your pounds.



The presentation it gives and the documentation... are a cut above the rest. The spec of the computer (Aries Perfecta 486SX-25C) is good, it's powerful and it's very cheap.



The Aries 486 (DX33) is exceptional value for money... Watford can claim better performance and a far more capable monitor and video card.



The Watford Electronics Aries 386SX25 is a good all rounder.



A solidly built machine that should provide good service for years.

Technical Hotline:
0582 454455

Continued >>



“The Aries NBL36X20 is the latest addition to the Watford range of portable PCs and like its predecessors, it is both inexpensive, yet surprisingly good. The best of the bunch is easily the Watford Electronics Aries NBL36X20. This offers the best combination of features at the best price.”



“The Aries is an outstanding bargain... All round a superb machine.”



“The Aries is better specified than other machines in its range.”



“The Aries notebook range from Watford Electronics has gained a reputation for quality at low prices.”



“An impressive spec at a sizzling price.”

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Lotus Works A complete professional business package Word processor, Database, Spreadsheet, Graphics, Communication

- ◆ Norton Anti-Virus Pre-Installed
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- ◆ SuperStor Doubles the capacity of hard disks

CSA 3020 **£49**

(With purchase of any Aries Notebook)

Notebook Options

	NB36X20	NB36X25	NBC46X25
RAM Upgrades:			
Additional 1Mb:	£45	£55	£25
Additional 2Mb:	£79	£89	£50
Additional 4Mb:	£109	£139	£105
Carry Case for Notebook & PSU		£28	£28
Carry Case for Notebook & BJ-10ex		£39	£39
Car Charger		£69	£69
External 5.25" 1.2Mb Drive		£89	£89
Spare Battery Pack		£29	£39
Fax/Modem Card, Internal		£129	£99
External Numeric Keypad for NBX25		£49	
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Aries Thumball		£45	£45

Aries Notebooks – “Compact, effective... and a great price” PC USER



NB 36X25

With up to 8 hours continuous use, password protection and a 10" LCD display the NB 36X25 is a truly outstanding Notebook.

- ◆ 80386SX 25MHz Processor
- ◆ 4Mb RAM expandable to 8Mb
- ◆ 10" LCD display with true 32 grey scales
- ◆ Built in 3.5" 1.44Mb Drive
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- ◆ Full travel 81 key keyboard
- ◆ Auto resume mode for user convenience
- ◆ Smaller than A4, only 2.5" thick and weighs just 6lbs
- ◆ External SVGA port for colour monitors
- ◆ Easy access maths co-processor socket
- ◆ Serial/parallel, mouse and external floppy drive ports
- ◆ Optional Hard Disk 60/80/120/180Mb
- ◆ NiCad battery (3.5 hours battery life)
- ◆ Universal AC mains adapter
- ◆ Padded case
- ◆ MS-DOS 5

	MHz	HDD	RAM	£
NB36X25/60	25	60Mb	4Mb	£895
NB36X25/80	25	80Mb	4Mb	£995
NB36X25/120	25	120Mb	4Mb	£1195
NB36X25/180	25	180Mb	4Mb	£1495

FROM ONLY £895
(60MB HDD, 4MB RAM)



NBC 46X25 COLOUR

It's here! The new low cost Aries **COLOUR** notebook that boasts an unrivalled array of features and exceptional Interface flexibility. Marvel at it's unique 'Personality Module' – a detachable cartridge with options including Fax modem, Trackball printing device, Ethernet port and SCSI II port.

- ◆ 80486SLC 25MHz Processor
- ◆ 4Mb RAM expandable to 8Mb
- ◆ 256 Colour LCD display
- ◆ Built in 3.5" 1.44Mb Drive
- ◆ Advance Power Management for power conservation
- ◆ Full travel 81 key keyboard
- ◆ Auto resume mode for user convenience
- ◆ External SVGA port for colour monitors
- ◆ Easy access maths co-processor socket
- ◆ Serial/parallel and mouse ports
- ◆ Optional Hard Disk 60/80/120/180Mb
- ◆ Weighs just 6.2lbs
- ◆ Universal AC mains adapter
- ◆ DR DOS 6
- ◆ Optional leather case

	MHz	HDD	RAM	£
NBC46X25/60	25	60Mb	4Mb	£1495
NBC46X25/80	25	80Mb	4Mb	£1595
NBC46X25/120	25	120Mb	4Mb	£1695
NBC46X25/180	25	180Mb	4Mb	£1995

FROM ONLY £1495
(60MB HDD, 4MB RAM)

NB36X20 Entry level Notebooks

- ◆ 80386SX-20MHz Processor ◆ 1Mb RAM upgradable to 5Mb
- ◆ Co-Processor Socket ◆ 1.44Mb 3.5" Drive ◆ Fast 40/60/80Mb Hard Disk
- ◆ Backlit Supertwist LCD display ◆ 81 Key keyboard ◆ Embedded numeric keypad ◆ Universal AC mains adapter ◆ Serial/Parallel and external floppy drive port ◆ External VGA colour monitor port ◆ Weighs 6.2lbs incl all ancillaries ◆ MS-DOS 5

	MHz	HDD	£
NB36X20/40	20	40Mb	£695
NB36X20/60	20	60Mb	£775
NB36X20/80	20	80Mb	£795

FROM ONLY £695



Smarter Input For Smarter Output



HiMouse

The Advanced Mouse

- ◆ Unique ergonomic styling - fits your hand like a glove
- ◆ Z soft PC Paintbrush IV included free
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- ◆ Own Mouse Pad
- ◆ Storage Pocket Attaches to side of PC

HiMouse - Serial	£28
HiMouse - Serial & PS/2	£32
HiMouse - Cordless	£43

HOW TO ORDER

Call: **0582 487777**



MouseOne & MouseToo

The Starter Mouse

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- ◆ Extra Value: Included Doctor Genius III graphics software, mouse pad & storage pocket (MouseToo)
- ◆ Superb Styling
- ◆ Engineered for durability & Extra long life
- ◆ Fully compatible with all IBM PC & PS/2 compatible systems

MouseOne - PS/2	£18
MouseOne - Serial 3B 350dpi	£19
MouseOne Notebook	£19
MouseToo - 350-1050dpi	£22

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A Stationary Trackball

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- ◆ Ergonomic Design
- ◆ Three Buttons
- ◆ For all IBM & PS/2 compatibles & all software applications including windows

HiPoint

The Smart Mouse

- ◆ Total Freedom - Use from any angle
- ◆ Total Flexibility - easily adjusted for right or left hand users
- ◆ Total compatibility - Tested with all leading notebook PC's
- ◆ Versatile Mouse Replacement - Use it for your desktop PC
- ◆ Supplied complete with 9/25 way adaptor, PS/2 adaptor, 5 foot extension cable and leather carrying case

HiMouse Lite

High performance Optical Mouse

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- ◆ Best optical engine from Mouse Systems
- ◆ Advanced Mouse Pad; In built grid for extra accuracy
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HiSketch digitizers are the perfect solution for small and large scale document tracing & drawings

- ◆ Top CAD/CAM compatibility
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- ◆ Proximity sensing - trace through a stack of blueprints
- ◆ Includes Microsoft Windows Pen Extension and ADI Drives
- ◆ Now supplied FREE with Auto Sketch software, Stylus Pen and Puck*
- *Supplied with 1212 & 1812/D

HiSketch 906 - 9" x 6"	£95
HiSketch 1212 - 12" x 12"	£189
HiSketch 1812 - 18" x 12"	£259
HiSketch 1812D - 18" x 12"	£289*

NEW

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Powerful Greyscale scanning for professional image processing

- ◆ Free Photo deluxe software for exciting visual effects. Works in windows environment as you retouch, cut, paste, resize, & combine vivid colour images
- ◆ GO-CR multilingual/omnifont OCR program included free
- ◆ True greyscale - 256 level greyscale images
- ◆ Convenient design

GS-B105W - 256 grey scales	£119
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GS-C105W - Colour scanner	£245

Sensational scanners at Stunning prices!



Aries RELISYS VM3511 600 dpi COLOUR Scanner

- ◆ **Scanner Type:** Flatbed, colour image scanner
- ◆ **Light Source:** Three fluorescent lamps (RGB) with single CCD sensor
- ◆ **Image Data:** Colour: 24 bits per pixel, Gray Scale: 8 bits per pixel, Bi-tone: 1 bit per pixel
- ◆ **Scanning Speed:** Colour: 120 seconds for A4 size document, Gray Scale: 40 seconds for A4 size document, Bi-tone: 9.9 seconds for A4 size document
- ◆ **Bundled Software**
- ◆ **Unlimited Zoom Out Feature**

£875

Aries RELISYS VM3411 600 dpi 256 GREYSCALE Scanner

- ◆ **Scanner Type:** Flatbed, Gray Scale image scanner
- ◆ **Light Source:** One fluorescent lamp with single CCD sensor
- ◆ **Image Data:** Gray Scale: 8 bits per pixel, Bi-tone: 1 bit per pixel
- ◆ **Scanning Speed:** Gray Scale: 40 seconds for A4 size document, Bi-tone: 9.9 seconds for A4 size document
- ◆ **Bundled Software**
- ◆ **Unlimited Zoom Out Feature**

£575

The Aries RELISYS VM3511 flatbed colour scanner is a sight for sore eyes. The perfect solution for DTP presentation applications, OCR and CAD in both the PC and MAC environments this high performance, high specification scanner opens a colourful world of computing possibilities. The VM3511 enables colour and monochrome images to be captured, enhanced and combined with other files to create truly professional documents. The Aries RELISYS features outstanding resolution of 600 dpi, an unlimited zoom out feature, one pass colour page or line sequence scanning, as well as offering easy set up and a full legal document scanning area. What's more it comes bundled with both Calera's Wordscan OCR Software and Picture Publisher 3 Limited Edition absolutely free of charge.



“Comparing the price of this machine with the others, it is a considerable feat to produce a unit of this quality, but Watford have stolen a march on everyone in so doing. Add the bundled software and it is undoubtedly the best buy.”

PC Today September 1992
Best Buy in independent survey of 9 colour scanners

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Ultimate OCR (Optical Character Recognition) Software Pack worth £535 (normal RRP)

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Ultimate Graphics Image Scanning/Editing Package worth £249 (normal RRP)



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" VGA Monitor

Monochrome: 14" Flat Screen, Non-Glare, Paper White Monitor. 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 **£195**

● Super VGA Monitor and Card **£229**

● Super VGA Low Radiation Monitor **£205**

Aries Multiscan Monitors

Alphascan Plus

These new colour monitors provide automatic adjustment for horizontal frequencies between 50 to 90Hz. 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). Supplied complete with tilt and swivel base.

● Aries Alphascan Plus **£295**

● Aries Alphascan 17 Plus - with 17" Tube **£545**

● Aries 7000 - 17" Flat Screen, 0.28mm Non-Glare tube with max resolution of 1280 x 1024 (non-interlace), Microprocessor Controlled.

(Best Buy - Computer Shopper, Sept. '92) **£649**

Aries MC Range

● Aries MC3000 14" 0.28 dot **£345**

Multiscan Monitors

Eizo 9060S **£389** Taxan 770LR **£335**

Eizo F550i **£725** Taxan 787 **£210**

Eizo T560i **£1319** Taxan 787LR **£230**

Eizo T660i-T20 **£1615** Taxan 970 20" **£1179**

NEC 3FG **£345** Taxan 795-PC **£394**

NEC 4FG **£442** Taxan 875 **£670**

NEC 5FG **£827** Taxan 875+ **£705**

NEC 6FG **£1485**

Panasonic Printers

● KX-P1123 **£126** ● KX-P1695 **£267**

● KX-P1124i **£170** ● KX-P 2123C **£197**

● KX-P1170 **£98** ● KX-P2180C **£146**

● KX-P1624 **£250** ● KX-P2180M **£156**

● KX-P1654# **£330** ● KX-P 2624# **£268**

#Price includes 12 months on site warranty

Panasonic Cut Sheet Feeders

● P36 - 1124/24i **£79**

● P37 - 1123/70/80 **£69**

● P38 - 1624/95; P2624 **£129**

Panasonic Serial Interfaces

● P17 P1081/1592 **£32** ● P13 P1124/1180 **£49**

Original Panasonic Ribbons

Guaranteed to last 3 million characters

● for P1081, 1180, 1123/24/70 **£6**

● for P1624, P1695 **£8**

● Colour Ribbons for KX-P1081, 1592, 1595 & 1695 Brown, Blue or Red **£9** each

Panasonic Printer Buffers

● P12 4K Buffer Board for KX-P1081 **£55**

● P14 32k Buffer for P1123/24/70/80 **£16**

P1540/92/95; P1624/54/95

Canon Bubblejet Printers

Printer CSF D'ble Ink

BJ10EX **£160** **£43** - **£16**

BJ20 **£248** - **£16**

BJ200 **£275** - **£16**

BJ300* **£279** **£88** **£65** **£12**

BJ330* **£373** **£110** **£79** **£12**

BJC800C **£1355** - **£16**

● Spare Battery pack for BJ10EX **£33**

* includes 12 months on site warranty

Hewlett-Packard Printers

Desk Jet 500 **£255** DJ500 colour **£325**

DJ 550 Colour **£415** Deskwriter Mac **£299**

Deskwriter C **£469** Paint Jet XL **£1045**

Paint Jet **£495** PaintJet XL300+ **£1775**

Quiet Jet **£293** QuietJet plus **£379**

+ Includes 12 months on-site warranty

Includes 3 years extended parts & labour

warranty. For additional £50, we will convert

above warranty to 3 years on site warranty.

● Paintjet Cartridge Black **£19**; Colour **£23**

● DJ 500 Cartridge Black **£14**; Colour **£23**

P.S. For an additional £39, we will supply the

sophisticated Designworks software pack worth

£175, with every HP DJ 500 colour printer

purchased from us this month.

Desk Jet 500 Accessories

● DJ 500 256K RAM Cartridge **£69**

● Epson FX Emulation Cartridge **£59**

● IBM Proprinter Emulation Cartridge **£59**

● Wordperfect Cartridge **£89**

● Ink Cartridges Black **£19**; Colour **£23**

● High Capacity Ink Cartridges Black **£21**

● DJ 500 Dust Covers **£6**

● 50 x A4 Transparencies **£32**

Plug In Font Cartridges for DJ 500

22706B - Prestige, Elite, Line Draw **£55**

22706C - Letter Gothic & HP Line Draw **£56**

22707P - Proprint Emulation Cartridges **£57**

NEC Pinwriter Printers

● P20# **£169** ● P70 **£396**

● P30 **£235** ● P90 **£603**

● P60 **£322**

Includes 12 months on site warranty

Star Printers

LC15 **£168** LC200 Colour **£140**

LC20 **£99** Star Jet SJ48 **£165**

LC24-15 **£233** XB24-200 Colr **£288**

LC24-20 **£148** XB24-250 Colr **£350**

LC24-200 **£162** XB24 Colour Kit **£29**

LC24-200C **£205** ZA-200 Colour **£230**

LC100 Colour **£136** ZA-250 **£299**

LC24-100C **£162**

Cut Sheet Feeder

● LC10/24-10/200 **£65** ● XB24-10 **£80**

● LC15/LC24-15 **£125** ● XB24-15 **£139**

Serial Interfaces

8K Serial LC10; LC10-Colour; LC15;

LC24-10/15/200; LC200 **£52**

Buffers

● 32K Ram for LC/XB24-10; 15 & 200 **£55**

Ribbons

● LC10; LC10-II; LC15 Blk **£4** Col **£6**

● LC-200; LC24-200 Blk **£5** Col **£12**

● XB24-10; XB24-15 Blk **£5** Col **£12**

Printer Ribbons & Various Dust Covers

Type Ribbons Dust

IBM PCs pair - **£7.75**

Mini Tower PCs set - **£8.00**

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**

Star LC24-10 **£2.95** **£6.00**

Citizen 120D **£3.25** **£5.00**

Our attractive dust covers are manufactured from translucent PVC. The seams are stitched and edges are taped to prevent splitting due to continuous use.

Epson Printers

● DFX5000 **£1069** ● LQ1170 **£429**

● DFX8000 **£1920** ● LQ2250 **£669**

● EX1000 Col **£428** ● LX100 **£117**

● FX850 **£255** ● LX400 **£90**

● FX1050 **£322** ● LX850+ **£134**

● LQ100 **£144** ● LX1050 **£199**

● LQ570 **£197** ● SQ870 **£409**

● LQ870 **£352** ● SQ1170 **£560**

● LQ1060 **£588** ● SQ2550 **£669**

● LQ1070 **£308**

● Tractor Feed for LQ100 **£29**

● Original Ribbon for LQ100 **£6**

Cut Sheet Feeders for

● FX1050/LQ1060/SQ850 **£155**

● LQ570, LQ870 **£47**

● LX400/850/LQ200/400/450/500/550

LQ1010/1070/1170 **£69**

● LX1050 **£115** ● FX850/LQ860 **£128**

● LQ 2550 **£299** ● SQ2550 **£210**

Tractor Feed for

● LQ800 **£44** ● LQ850/FX850 **£69**

● LQ1050/FX1050 **£85** ● LQ2500 **£90**

● LQ2550 **£90**

Accessories

● EX800/1000 Colour Option **£55**

● EX800/1000 Colour Ribbon **£18**

● LQ2500 Colour Option **£65**

Epson Printer Interfaces

RS232 **£28**; RS232 + 8K Buffer **£75**

Citizen Printers

120D Plus **£98** # Swift 9 **£145**

224 **£174** # Swift 24X **£195**

PN-48 **£199** # 240 Colour **£212**

Free Windows 3.X Driver & 2 years parts and labour warranty.

● Swift 24 Ribbons: Black **£4** Colour **£13**

● 24X Colour Opt **£32**

Printer Leads

● IBM Parallel lead 2m **£5**

● IBM Parallel Lead 5m **£10**

● IBM Parallel Lead 10m **£15**

● Double ended 36 way Centronics

lead 4' **£7**

● As above, but 6' long **£9**

● RS232 lead (various) **POA**

● IBM Keyboard extension lead coiled **£5**

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 **£12** **£13**

● 3 to 1 **£16** **£18**

● 4 to 1 **£23** **£24**

Professional Sharer Units

Connects Serial Parallel

● 2 to 1 **£17** **£18**

● 3 to 1 **£22** **£25**

● 5 to 1 **£34** **£38**

Auto Printer Sharer Switch

Connects Serial Centronics

● 2 to 1 **£38** **£40**

● 4 to 1 **£59** **£59**

● 8 to 1 - **£89**

256K Multi Spooler

These Parallel Auto printer sharer switches have built-in 256K Buffer.

● 2 In / 2 out **£135** ● 4 In / 2 out **£145**

● 8 In / 1 out **£199**

(Cables for all printer switches are extra @ £6 each please specify the type required when ordering.)

Laser Printers

All Laser printers include 12 Months On-Site maintenance

Brother HL-4V 4ppm **£639**

Brother HL4-VE 4ppm **£549**

Brother HL4-PS Postscript 4ppm **£970**

Brother HL8-V 8ppm **£894**

Brother HL8-PS 8ppm **£1330**

Brother HL-10V 10ppm **£1059**

Brother HL10-PS 10ppm **£1329**

Brother HL10-DV 10ppm **£1149**

Brother HL10-DPS 10ppm **£1449**

Canon LBP4 LITE 4ppm **£479**

Canon LBP4+ 1.5M RAM 4ppm **£632**

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 x 10)	£15.50
2400 - 70 x 37mm (3 Rows x 8)	£15.25
2625 - 70 x 42mm (3 Rows x 7)	£15.00

HP Scanners

AT - ScanJet IIP	£615; IIC	£1044
PS/2 - ScanJet IIP	£616; IIC	£1045
Mac - ScanJet IIP	£569; IIC	£975

Sound-Cards

- Aries Sound Booster Card £75
 - Aries Sound Booster Pro Card £119
 - Sound Blaster Card v2.0 £82
 - Sound Blaster Card Pro Card £145
 - Aries Low Cost Speakers £34
- (Write in or call for further information)

Ethernet Cards

8 bit with remote boot ROM, NE 1000 Compatible	£68
16 bit with remote boot ROM, NE2000 Compatible	£78

Hard Disk On Cards

3.5" HD on a controller card. "Simply Plug and Play". For Amstrad 1640 & XT compatibles.

- WD-XT 30MB (60MB)# £149
- WD-XT 40MB (80MB)# £175

Supplied FREE 'SuperStor' - the disc doubler that 'really works'. (Worth £99).

Disk Controller Cards

- IDE AT - 2HD/FDC/Parallel/2 Serial Games port for AT £18
- FDC-4 PC XT Controller card to interface up to 4 High/Low Density 3.5" or 5.25" Floppy Drives £35
- AT IDE Embedded Drive Adaptor 2 x HDD, 2 x FDD £12
- AT IDE Embedded Drive Adaptor 2 x HDD, 2 x FDD up to 2.88M £29
- Aries ISA IDE Cache Controller# £135
- Aries EISA IDE Cache Controller# £245

OK RAM

Maths Co-Processors

8087-8MHz	£69	80387DX-	
8087-10MHz	£88	20/25/33MHz	£48
80287-8/10/12MHz	£42	80387DX-40MHz	£89
80287-20MHz	£49	80487SX-	
80387SX-16/20MHz	£40	16/20/25MHz	£289
80387SX-25MHz	£45	Overdrive 486SX-	
80387SX-33MHz	£64	20MHz	£POA
		25MHz	£POA

Carriage £5 on all co-processors

Motherboards

- 286-20MHz £75
- 386SX-25 £95
- 386SX-33MHz £115
- 386DX-40 £225

Upgradable Motherboard -

- 486SX, 486DX, 486DX2 - (Without Processor) £175

Computer Cases

- Mini Tower Case with 200W PSU £69
- Full Tower Case with 200W PSU £125
- Slim Line Case with 200W PSU £79
- Desk Top Case with 200W PSU £69

Floppy Disk Drives

- UC200 5.25" 360K 48tpi Double Sided Disk Drive £35
- UC600 5.25" 1.2M 96tpi Double Sided High Density, Disk Drive £38
- UC35/4 3.5" 720K Drive £34
- UC35/6 3.5" 1.44M Drive £37
- 5.25" Fixing kit for 3.5" Drives £8
- US35/9 3.5" 4Mb (2.88Mb when formatted) Drive (Capable of reading/writing 720K & 1.44MB) £79

Tape Streamers

- WE 2000 - Low cost internal. Up to 120Mb capacity incl Software £149
- WE 3000 - As above but with capacity of up to 250MB £195
- External Case, PSU & Lead for above £79

PC External Drives

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 5.25" - 360K Drive £69
- PCS-5H2 5.25" - 1M2 Drive £89

N.B. Not all XT compatible micros can accept the high density drives.

Hard Disc Drives

AT IDE Drives			
● 44MB	3.5"	28mS	£115
● 100MB	3.5"	17mS	£215
● 210MB	3.5"	16mS	£365
● 337MB	H/H	16mS	£685

ESDI/SCSI Controllers

- ESDI Hard Disk Controller Card £165
- SCSI Controller Card 8 bit £79
- SCSI Controller Card 16 bit £195

Add-On Cards

- EGA Card, 256K RAM, compatible with CGA & EGA. £49
- AT-Multi I/O Card
- Twin Serial/Parallel/Games £14
- XT/AT - Joystick/Games Card £11
- Dual Serial (RS232) Card £11
- Parallel Printer Port Card £11
- S3 Windows Accelerator Card, 1Mb RAM (Speeds Windows by up to 300%) £149
- VGA Card - 8/16 bit with 256K RAM £29
- Super VGA Card 8/16 bit 512K RAM £39
- Super VGA Card 8/16 bit 1MB RAM £49
- Super VGA Card 1MB TSENG LAB £69

Memories

SIMs and SIPs

- 256K x 9-10 Call ● 1MB x 9-10 Call
- 256K x 9-8 Call ● 1MB x 9-8 Call
- 256K x 9-7 Call ● 1MB x 9-7 Call

PC Spares

- 102 Keys Pro Keyboard for AT £27
- Aries 102 Key Click-Action Keyboard (AT) £39
- 150W Power Supply (XT size) £40
- 200W Power Supply (AT size) £55

Special Bundled Software Offer

(UK version software only)

- Borland Quattro Pro for Windows and Sitback Backup £75
- Borland Paradox SE and Norton Backup v2 £69
- Harvard Graphics v2.3 £75
- Harvard Graphics v3.0 £169
- (includes v2.3 and v3.0 Upgrade)
- Norton Utilities v6.01 & SuperStor £75
- Norton Utilities v6.01 & Backup £75
- Timeworks and Designworks £129
- Norton Antivirus v2 & Utilities v6.01 £79

Fifth Generation 'TRIPLE PACK'
Fastback Plus, Untouchable Antivirus and DiscLock - Protect your Data
(RRP £350) Offer Price £79#
Offer valid until present stocks last

PC Software

Please specify Disk size required (3.5"/5.25")

ADOBE Illustrator for Windows	£429
Adobe Plus Pack	£107
Adobe Streamline	£244
Adobe Type Align	£61
Adobe Type Manager	£52
Adobe TypeSet 1 or 2	£75
Adobe TypeSet 3	£115
Address Book Plus (Power Up)	£47
All Type (Power Up)	£47
Approach for Windows	£169
Arts & Letters Apprentice	£98
Arts & Letters G Ed	£286
AutoRoute MapBase v5	£427
AutoRoute Plus v5	£218
AutoRoute Express GB	£49
AutoRoute Express GB for Windows	£75
Autosketch v3	£61
Autosketch for Windows	£91
Bitstream Facelift WordPerfect	£95
Bitstream Facelift Windows 3.1	£95
Bitstream Makeup for Windows	£95
Bitstream Type Essentials	£85
CA Office	£93
Calendar Creator Plus (Power Up)	£65
Clipper v5.01	£280
Company Ladder (Power Up)	£63
Complex Windows	£250
Corel Draw v3	£219
Corel Draw Upgrade to v3.0	£79
Correct Grammar DOS	£58
Correct Grammar for Windows	£58
Crosstalk for Windows	£58
Dataperfect	£207
Datatalk v4	£82
DBase IV v1.5	£279
DB fast for Windows	£199
dBase IV Developers	£569
db Quick	£63
Delta Five Pro (Compsoft)	£335
Design Works	£88
Desqview 2.4	£58
Deskpress	£165
Data Ease v4.5	£378
Direct Access (5th Gen)	£60
Direct Access Windows	£60
Disklock	£105
DR DOS v6	£38
Dr Solomon's Anti Virus	£65
Draw Perfect v1.1	£206
Express Presenter (Power Up)	£213
Express Publisher (Power Up)	£90
Express Publisher for Windows	£135
Fastback Plus	£85
Fastback Plus Windows	£96
File Director (5th Gen)	£79
FileMaker Pro v2.0 for Windows	£199
Foxbase Plus v2.1	£195
Fox Pro v2.0	£352
Fox Pro v2 Server (multiuser)	£495
Fox Pro Distribution Kit	£210
Floor Plan Plus (Power Up)	£39
Fontware Face Pack 1	£18
Fontware Face Pack 2	£27
Fontware Face Pack 3	£45
Fontware Face Pack 4	£70
FormWox Windows (Power Up)	£129
Framework IV	£314
Framework XE	£77
Free hand for Windows	£245
Grammatik v5 for DOS/Wordperfect	£60
Grammatic for Windows	£61
Harvard Graphics v2.3	£125
Harvard Graphics Upg v2.3-3	£95
Harvard Graphics v3.0	£250
Harvard Graphics for Windows	£258
Informix Wingz v1.1	£245
Intelli Draw	£107
iPhoto for Windows 3	£49
Labels Unlimited (Power Up)	£53
Laplink Pro v4	£67
Lemmings (for PC)	£15
Letter Perfect	£95
Lotus Agenda	£245
Lotus 1-2-3 v3.1	£272
Lotus 1-2-3 for Windows	£273
Lotus 123 v2.4	£239
Lotus 123 GO	£99
Lotus AMI 3.0	£276
Lotus AMI Pro v3	£276
Lotus Freelance	£243
Lotus SmartSuite	£439
Lotus Symphony 2.2	£365
Lotus Symphony v3	£365
Lotus Works 3	£87
Lotus Write	£96
Macro Assembler	£69
Micrographics Windows Draw	£87
Micrographics Charisma	£218
Micrographics Designer v3.1	£308
MS Access	£POA
MS Basic Compiler	£195
MS C++ Compiler v7 & SDK	£192
MS DOS 5 Upgrade	£41
MS Entertainment Pack	£20
MS Entertainment Pack IV	£25
MS Excel v4 Lan	£979
MS Excel for Windows v4	£226
MS Flight Simulator	£25
MS Golf	£POA
MS Learning Windows	£30
MS Office for Windows v3	£355

MS Office for Windows - Trade In	£297
MS Office Upgrade	£295
MS Pascal Compiler	£124
MS Publisher for Windows	£84
MS Quick C for Windows	£83
MS Quick Compiler + Quick Assembler	£79
MS Quick C v2.5	£44
MS Quick Pascal	£45
MS True Type Font Pack	£49
MS Visual BASIC for DOS	£82
MS Windows for Workgroups	£135
MS Windows for Workgroups Upgrade	£49
MS Windows Sound System	£185
MS Windows v3	£49
MS Windows v3.1	£57
MS Windows v3.1 upgrade	£42
MS Word v5.5	£227
MS Word for Windows	£229
MS Works for Windows	£84
MS Works v2	£82
Multimate LAN v4	£50
Name That Disk (Power Up)	£29
Norton Anti-Virus	£89
Norton Backup	£60
Norton Commander v3	£60
Norton Desktop for DOS	£62
Norton Desktop for Windows	£89
Norton Utilities v6.01	£79
Novelle Lite	£42
Object Vision Win v2	£72
Omnipage v3.1	£389
Open Access III	£349
Organiser (THREADZ) - The	£145
Pagemaker v3	£249
Pagemaker v4	£378
Paradox v4	£278
PCopy (transfer software)	£49
PC Planner III	£112
PC Tools v8	£68
PC Tools Deluxe v7.1	£68
Pegasus Easifacts	£190
Pegasus Easifacts Payroll	£95
Pegasus Business Manager S/User	£295
Pegasus Business Manager M/User	£499
Pegasus Business Manager Extra S/User	£445
Pegasus Business Manager Extra M/User	£695
Pegasus Business Manager Payroll	£145
Photostyle (Aldus)	£404
PlanPerfect v5.1	£204
Portex	£36
Portex Professional	£92
Projects for Windows v3	£292
Q+A v4 (Symantec)	£174
Quattro Pro for Windows	£99
Quattro Pro v4	£168
Quick Schedule Plus (Power Up)	£63
Quickwin v6.0	£35
QEMM 386 v6	£45
Rapid File v1.2	£167
Rbase v3.1 (Micromim)	£316
Rbase Personal	£79
Reflex 2 (Borland)	£149
Rooms for Windows Xerox	£39
Sage Accountant	£166
Sage Accountant Plus	£246
Sage Accounts Plus for LAN	£405
Sage Bookkeeper	£54
Sage Financial Controller	£330
Sage Financial Controller for LAN	£515
Sage Job Costing	£110
Sage Payroll II	£110
Sprint	£112
Staker v2	£62
SuperBase 4 Developer Ed	£670
SuperBase 4 for Windows	£344
SuperDB	£69
Super Office	£99
Superbase 2 Windows	£183
Symantec Games Pack	£35
Smartware II v1.5	£368
Stirling for Windows	£198
Supercalc v5.5	£67
Superstore	£74
TAS Books	£97
Text Appeal Windows	£47
Timeworks DTP Publisher 3	£84
Timeworks Publisher for Windows	£89
Top Priority (Power Up)	£63
TurboCad v2	£69
Turbo C++ for DOS	£39
Turbo C++ for Windows v3.0	£68
Turbo Pascal for Professional v6	£115
Turbo Pascal v6	£57
Typographica Decorative	£57
Typographical Newsletter	£55
Untouchable	£95
Up to date (CA)	£69
Ventura Publisher Gold	£399
Window Works (PFS)	£99
Winfax Pro for Windows	£65
Wordperfect Office PC	£58
Wordperfect Office v3	£239
Wordperfect v5.1	£193
Wordperfect 5 User licence	£615
Wordperfect for Windows	£194
Wordperfect for Windows Upgrade	£75
WordStar Laptop Collection	£152
WordStar Legacy	£128
Working Hours (Power Up)	£63
Windows 3D BASE	£197
Windows - Freehand for Windows	£245
Wordstar v7	£215
Wordstar v7 Upgrade	£98
Wordstar for Windows	£210
XTree Gold	£56
XTree Gold for Windows	£28

Books (No VAT)

Carriage on Books varies between £3 to £4, depending on their weight

386/386X Build your Own & Save	£15.50
386/486 PC Power User Guide	£19.95
80486 Build your own IBM	£12.95
AMI Pro 3 - Using Special Ed	£25.95
Amstrad BASIC 2 User Guide	£14.95
Assembly Language Using 3e	£27.45
AutoCAD - Inside 10 & 11 Spec Ed	£32.45
AutoCAD - Mastering Rel II 4e	£31.50
Basic - Do it yourself Visual	£18.50
Build Your Own 386/386SX & Save	£15.50
Build Your Own 80486 IBM Computer	£12.95
C - Programming Language 2e	£26.95
C++ Borland 3 Handbook 2e	£24.95
C Turbo Bible	£27.95
Clipper 5 Developers Guide	£24.95
Clipper 5.01 Using 3e	£27.45
Corel DRAW 2.3e - Mastering	£26.95
Corel DRAW 2.1 3e - Inside+Disc	£32.45
Corel DRAW 2.0 Made Easy	£19.95
Corel DRAW Quick Reference v1.2	£28.90
DOS 5 Programmers Ref Manual 3e	£27.45
DOS Complete Reference 3e	£23.95
DOS for Dummies Through v5.0	£15.45
DOS - Easy (to ver 5)	£18.45
DTP Looking Good In Print 2e	£21.95
DR DOS 5 Quick Reference	£8.95
DR DOS 6 Stepping Up To	£13.95
EGA & VGA Cards Program Guide	£27.95
Excel 4 for Windows Learn Fast	£16.50
Excel 4 for Windows Made Easy 3e	£16.50
Excel 4 for Windows Quick Course	£11.95
Excel 4 for Windows Quickstart	£20.45
Excel 4 for Windows Using 2e	£27.45
FoxPro 2 Made Easy Rev Ed	£20.95
FoxPro 2.2e Mastering	£26.95
FoxPro 2 Using	£27.45
IBM PCs 386 486 Power User Guide	£17.95
IBM PC Crash Course & Survival 3e	£17.95
LAN - Understanding Local Area	
Networks	£23.50
Lotuscript PC v1.5 - Using	£14.95
Lotus 1-2-3 for Windows	£27.45
Lotus 1-2-3 Rel. 2.4 Special Ed - Using	£27.45
MS DOS 5 10 Minute Guide	£9.95
MS DOS Batch Files Quick Reference	£5.95
MS DOS 5 Complete Reference 3e	£23.95
MS DOS Easy to v5	£18.45
MS DOS For Dummies Thru v5.0	£15.45
MS Guide to Manage Memory DOS 5	£9.95
MS GW BASIC User Guide & Ref	£17.95
MS Visual BASIC DIY	£18.50
MS Visual BASIC Workshop	£28.31
Netware Understand Local Area	£24.50
Novell Netware 386 Comp Ref	£29.95
Novell Netware Using 2e	£27.45
Pagemaker 4 IBM (5.25")	£19.98
Pagemaker 4 Using for Windows	£27.45
Paradox 4 Quick Reference	£8.95
PC Complete Upgrade & Maintain	£25.50
PC Configuration Handbook 2e	£26.99
PC Crash Course & Survival 3e	£17.95
PC Fix your Own	£22.50
PC Upgrading & Maintain - Complete	£25.50
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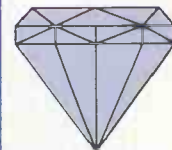
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Taken from comments made in the July issue of PC Direct by the Riggs AP Bank, London

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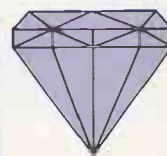
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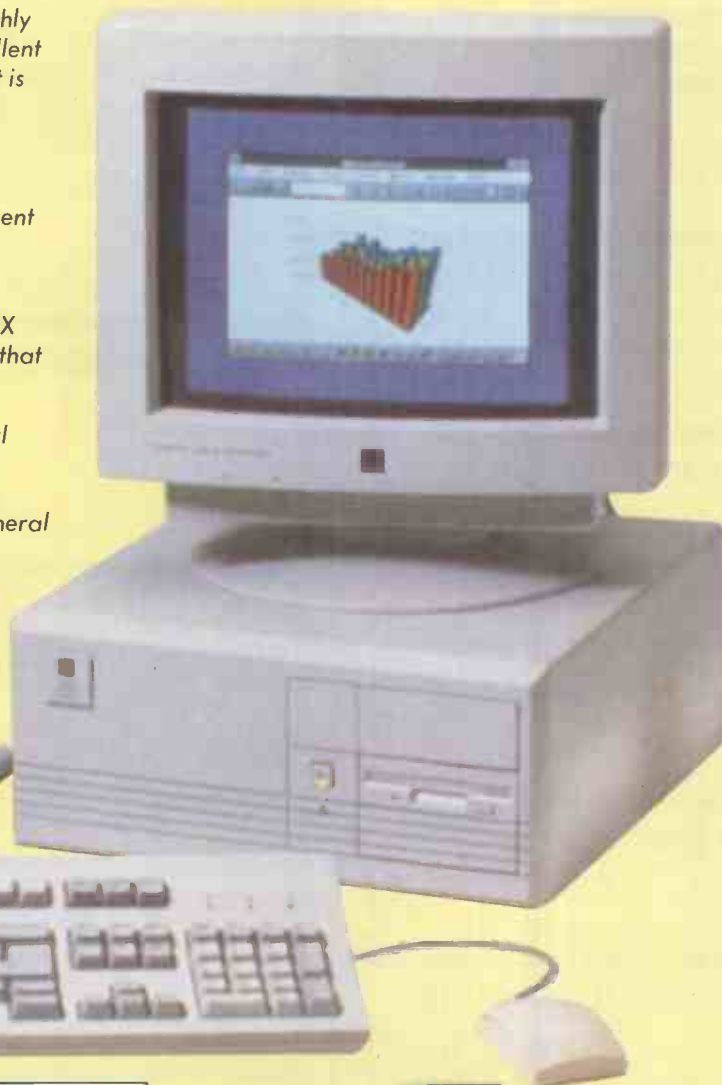
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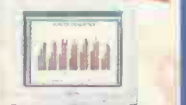
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		Scanman MAC Colour	£319
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ScanJet IIP PS/2	* £654		
ScanJet IIP MAC	* £585		
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ScanJet IIC PS/2	* £1129		
ScanJet IIC MAC	* £1059		
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		FXRS-506 + Wordscan	£578
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		XT/AT Interface	£129
		PS/2 Interface (506)	£198
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COMFAX	£212		HAYES	
RAPIER	£339		SMART 1200	£223
DOWTY			SMART 2400	£249
QUATTRO CARD	£454		SMART 2400 QUAD	£289
QUATTRO PLUS CARD	£545		SMART ULTRA 24	£339
HAYES			SMART 9600 + QUAD	£469
SMART 1200B	£218		SMART ULTRA 9600	£549
			SMART ULTRA 144	£669
MIRACOM			MIRACOM	
WS4000	£95		WS4000	£95
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GOLDSTAR				
GS1453+	14"	SVGA	0.39mm	* £1765
GS1460+	14"LR	SVGA	0.28mm	** £2295
GS1620+	16"	SVGA	0.29mm	* £5695
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2A-N	14"	MultiSync	0.31mm	£2975
3FG	15"LR	MultiSync	0.28mm	£3465
4FG	15"LR	MultiSync	0.28mm	£4455
5FG	17"LR	MultiSync	0.28mm	£8295
6FG	21"LR	MultiSync	0.28mm	£14895
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C13811e	14"LR	PanaSync	0.28mm	** £2595
C1395E	14"LR	PanaSync	0.28mm	** £3195
TX1713	17"LR	PanaSync	0.28mm	** £6195
TX2013	20"LR	PanaSync	0.31mm	** £10195
PHILIPS				
CM8833/II	14"	CGA	0.42mm	* £1655
7CM3209	14"	SVGA	0.28mm	* £1795
7CM3279	14"LR	SVGA	0.28mm	* £1995
4CM2799	20"LR	AutoScan	0.31mm	* £9195
SONY				
CPD-1420S	14"LR	VGA	0.25mm	£2795
CPD-1404S	14"LR	MultiScan	0.25mm	£4195
CPD-1704S	17"LR	MultiScan	0.25mm	£8995
GDM-2036S	20"LR	MultiScan	0.30mm	£19995
TAXAN				
787	14"	SVGA	0.28mm	£2255
787LR	14"	SVGA	0.28mm	£2455
770+LR	14"	MultiScan	0.31mm	£3555
795	14"	MultiScan	0.25mm	£4195
875	17"	MultiScan	0.26mm	£7195
875+	17"	MultiScan	0.28mm	£7495
970	20"	MultiScan	0.31mm	£11995
1075	20"	MultiScan	0.31mm	£10995
1075LR	20"	MultiScan	0.31mm	£12395
1150	21"	MultiScan	0.31mm	£15395
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Brother HL-BPS PostScript	8	£1239
Brother HL-10V	10	£1049
Brother HL-10PS PostScript	10	£1329
Brother HL-10DV Dual Bin	10	£1155
Brother HL-10DPS Dual Bin/PostScript	10	£1449
Canon LBP-4 Lite	4	£498
Canon LBP-4 Plus 1.5Mb	4	£648
Canon LBP-8 III Plus	8	£958
Canon LBP-8 IIIIT Dual Bin	8	£1339
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Epson EPL-4000	6	£484
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HP LaserJet IIP+	4	£543
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HP LaserJet IIISi Dual Bin/PostScript	16	£2429
HP LaserJet 4	8	£999
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IBM 4029-010	5	£669
IBM 4029-020	6	£825
IBM 4029-030	10	£1055
IBM 4029-040 Dual Bin	10	£1215
Kyocera F800T	8	£789
Kyocera F820T Dual Bin	8	£819
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Panasonic KX-P4420	8	£619
Panasonic KX-P4430	5	£598
Panasonic KX-P4451 Dual Bin	11	£999
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Star LP-8 III StarScript PostScript	8	£1140
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Texas Inst. PS17 Plus PostScript	9	£1165
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HL4/PS/V 1Mb Memory	£79	Adobe PostScript Si	£549
HLBE/D/V 1Mb Memory	£84	LaserJet 4 1Mb Memory	£59
CANON		LaserJet 4 2Mb Memory	£129
LB4/4 + 1Mb Memory	£132	LaserJet 4 4Mb Memory	£79
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EPL4100/8100 2Mb Memory	£89	KXP4410/4430 1Mb Memory	£99
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7440AU	† A4	£659	SKETCHMATE	A4	£319
7475AU	† A3	£899	SKETCHMATE	A3	£459
7550B PLUS	† A3	£2139	DXY 1100	A3	£489
7570AU	* A1	£1999	DXY 1200	A3	£624
7575AU DXL	* A1	£2559	DXY 1300	A3	£828
7576AU EXL	* A0	£3199	DPX 2500	† A2	£2347
7595C SX PLUS	* A0	£4699	DPX 3500	† A1	£2959
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AMBRA

Model	CPU	MHz	Hard Disk	RAM	VGA Colour	SVGA Colour
Sprinta	386sx	25	80Mb	4Mb	£581	£636
Sprinta	486dx	50	213Mb	4Mb	£1409	£1449
Sprinta	486sx	25	100Mb	4Mb	£779	£829
Sprinta	486sx	25	213Mb	4Mb	£939	£979
Sprinta	486dx	33	100Mb	4Mb	£1029	£1069
Sprinta	486dx	33	213Mb	4Mb	£1179	£1229
Sprinta	486dx	50	100Mb	4Mb	£1259	£1299
Hurdla	386sx	25	80Mb	4Mb	£750	£791
Hurdla	386sx	25	160Mb	4Mb	£887	£929
Hurdla	486sx	25	100Mb	4Mb	£824	£865
Hurdla	486sx	25	213Mb	4Mb	£979	£1019
Hurdla	486dx	33	100Mb	4Mb	£1069	£1109
Hurdla	486dx	33	213Mb	4Mb	£1225	£1269
Hurdla	486dx	50	100Mb	4Mb	£1299	£1339
Hurdla	486dx	50	213Mb	4Mb	£1454	£1494

All Ambra systems inc DOS 5.0 and Windows 3.1

AMSTRAD

Model	CPU	MHz	Hard Disk	RAM	VGA Colour	SVGA Colour	Ultra HIRE SVGA Colour
7286	286	16	40Mb	1Mb	£559	—	£649
7286	286	16	40Mb	1Mb	£599	—	—
Fam/Pack	286	16	40Mb	1Mb	—	£609	£699
7386sx	386sx	25	40Mb	1Mb	—	£669	£749
7386sx	386sx	25	80Mb	2Mb	—	£669	£749
6486sx	486sx	20	105Mb	4Mb	—	£1039	£1129

7286 Includes DOS 5.0 and Counterpoint

7386sx Includes DOS 5.0 and Counterpoint

6486sx Includes Windows 3, DOS 5.0 and Mouse

Family Pack includes Mouse, 3 Games, Soundcard & Joystick.

OSM provided 12 months with NCR

IBM

Model	CPU	MHz	Hard Disk	RAM	VGA Colour	SVGA Colour
PS/1 241	286	10	40Mb	1Mb	£469	—
PS/1 642	386sx	20	40Mb	2Mb	£674	—
PS/1 682	386sx	20	80Mb	2Mb	£749	—
PS/1 Pro E81	386sx	20	80Mb	2Mb	£749	—
PS/1 Pro E31	386sx	20	129Mb	2Mb	£839	—
PS/1 2133-111	386sx	25	85Mb	2Mb	£859	—
PS/1 2133-711	386sx	25	85Mb	2Mb	£869	—
PS/1 2133-114	386sx	25	170Mb	4Mb	£1059	—
PS/1 2133-144	486sx	20	170Mb	4Mb	—	£1189
PS/1 2133-174	486dx	33	170Mb	4Mb	—	£1399

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Select an IBM Easy PC Software Bundle for your PS/1 for only £60.

IBM Business Pack:- Includes Self Budget, Online, Berlitz Interpreter, Golf Game and Templates.

IBM Famipack Includes Famistart Program, PC Globe, Famitap Typing Tutor, Collins On-Line, World Class Chess and Bushbuck.

IBM Discover & Learn I (Ages 5-8):- Includes Adibou and Berenstein Bears.

IBM Discover & Learn II (Ages 8-12):- Includes Operation Wildlife Ez Cosmos, Abacadabra, Designasaurus and Mathcopier.

NEW IBM VP RANGE

Model	CPU	MHz	Hard Disk	RAM	£626	£809	£974	£1019	£1129	£1199	£1379
Desktop inc DOS 5											
PS/VP C20	386slc	25	80Mb	2Mb							
PS/VP F20	486sx	25	80Mb	4Mb							
PS/VP F40	486sx	25	170Mb	4Mb							
PS/VP M20	486dx	33	80Mb	4Mb							
PS/VP M40	486dx	33	170Mb	4Mb							
PS/VP M50	486dx	33	212Mb	4Mb							
PS/VP W40	486dx2	66	170Mb	4Mb							

VP RANGE MONITORS

6313 14" SVGA	£275
6314 14" SVGA	£324
6319 15" SVGA FST	£399

COMPAQ

Model	CPU	MHz	Hard Disk	RAM	VGA Mono	VGA Colour	SVGA Colour
ProLinea							
3/25sx Mod 40	386sx	25	40Mb	2Mb	—	£829	£899
3/25sx Mod 84	386sx	25	84Mb	2Mb	—	£869	£939
3/25sx Mod 84	386sx	25	84Mb	2Mb	—	£959	£999
3/25sx Mod 120	386sx	25	120Mb	2Mb	—	£1049	£1099
4/33 Mod 84	486dx	33	84Mb	4Mb	—	£1449	£1499
4/33 Mod 120	486dx	33	120Mb	4Mb	—	£1539	£1599

All ProLinea Systems complete with DOS 5

OLIVETTI

Model	CPU	MHz	Hard Disk	RAM	VGA Mono	VGA Colour	SVGA Colour
PCS286	286	16	40Mb	1Mb	£475	£555	—
PCS286	286	16	80Mb	1Mb	£555	£635	—
PCS286	286	16	120Mb	1Mb	£705	£786	—
PCS386sx	386sx	16	40Mb	2Mb	£559	£639	—
PCS386sx	386sx	16	80Mb	2Mb	£639	£719	—
PCS386sx	386sx	16	120Mb	2Mb	£719	£789	—

All PCS286's include MS Works, Mouse & DOS

All PCS386sx's include Windows, Mouse & DOS

TANDON POSITIVE RANGE

Model	CPU	MHz	Hard Disk	RAM	SVGA
386sx/33	386sx	33	100Mb	2Mb	£839
386sx/33	386sx	33	170Mb	2Mb	£945
486slc/33	486slc	33	100Mb	2Mb	£958
486slc/33	486slc	33	170Mb	2Mb	£1079
486dlc/33	486dlc	33	100Mb	4Mb	£1079
486dlc/33	486dlc	33	170Mb	4Mb	£1189
486dx2/66	486dx2	66	100Mb	4Mb	£1829
486dx2/66	486dx2	66	170Mb	4Mb	£1935
486dx/40	486dx	40	100Mb	4Mb	£995
486dx/40	486dx	40	170Mb	4Mb	£1105
486dx/33	486dx	33	100Mb	4Mb	£1269
486dx/33	486dx	33	170Mb	4Mb	£1379
486dx2/50	486dx2	50	100Mb	4Mb	£1509
486dx2/50	486dx2	50	170Mb	4Mb	£1619

All PCS386sx's include MS Works, Mouse & DOS

FAX

Amstrad FX5050 *	£210
Amstrad FX7000 *	£249
Amstrad FX6000AT *	£339
Brother FAX-305 *	£339
Brother FAX-450 *	£379
Brother FAX-550M *	£459
Canon 170	£525
Panasonic UF-121	£325
Panasonic UF-128M	£419
Panasonic KX-F2090BE	£454
Samsung SF-2200 *	£309
Toshiba TF-132 *	£351
Toshiba TF-172 *	£429
Toshiba TF-251 *	£719

* = 1 Year On-Site Maintenance

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30+ ASCII 14" A or G	£218	
50 ASCII 14" A or G	£292	
60 14" A/G or W	£295	
120 14" A/G or W	£295	
120ES 14" A/G or W	£325	
160 A or W	£345	
160ES A or W	£359	
185 ANSI 14" A/G or W	£298	
185ES ANSI 14" A/G or W	£315	
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Amstrad PCW9512+ & Canon BJ-10e Printer	£445
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Brother WP-70	£279
Canon Starwriter 70	£399
Canon Super Starwriter 95	£549
Scanner Option	£169

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Casio SF4300	£39
Casio SF5300	£49
Casio SF9700	£139
HP Palmtop HP95LX	£328
HP Connectivity Pack	£58
Psion Series 3 128k	£139
Psion Series 3 256k	£179

PORTABLES

NOTEBOOKS & LAPTOPS

Model	CPU	MHz	Hard Disk	RAM	
AMBRA					
Treka	386sl	20	40Mb	2Mb	£839
Treka	386sl	25	80Mb	2Mb	£1075
AMSTRAD					
ALT386sx	386sx	16	80Mb	2Mb	£799
AN8386sx	386sx	20	40Mb	1Mb	£645
COMPAQ CONTURA					
3/20 Mod 40	386sl	20	40Mb	2Mb	£879
3/20 Mod 84	386sl	20	84Mb	2Mb	£1149
3/25 Mod 60	386sl	25	60Mb	4Mb	£1299
3/25 Mod 120	386sl	25	120Mb	4Mb	£1659
COMPAQ LTE Lite					
20 Mod 40	386sl	20	40Mb	2Mb	£1569
20 Mod 84	386sl	20	84Mb	2Mb	£1799
25 Mod 84	386sl	25	84Mb	4Mb	£1979
25 Mod 120	386sl	25	120Mb	4Mb	£2199
IBM					
N33-E14sx	386sx	16	40Mb	2Mb	£759
N33-E15sx	386sx	16	80Mb	2Mb	£894
N51-E01sx	386sx	16	40Mb	2Mb	£825
N51-E02slc	386slc	16	80Mb	2Mb	£1434
L40-E44	386sx	20	60Mb	2Mb	£924
L40-E45	386sx	20	80Mb	2Mb	£989
P75-A01	486dx	33	400Mb	8Mb	£3949
TANDON					
Positive	386sx	20	40Mb	2Mb	£829
N8/386sx	386sx	25	40Mb	2Mb	£1039
N8/386sx	386sx	25	60Mb	2Mb	£1125
N8/386sx	386sx	25	80Mb	2Mb	£1209
N8/386sx	386sx	25	120Mb	2Mb	£1299
N8/486slc	486slc	25	80Mb	4Mb	£1469
N8/486slc	486slc	25	120Mb	4Mb	£1559
TOSHIBA					
T1800	386sx	20	43Mb	2Mb	£798
T1800	386sx	20	64Mb	2Mb	£930
T1850	386sx	25	85Mb	4Mb	£1170
T1850	386sx	25	120Mb	4Mb	£1269
T3300SL	386sl	25	80Mb	2Mb	£1369
T3300SL	386sl	25	120Mb	2Mb	£1499
T4400SLX	486sx	25	80Mb	2Mb	£1499
T4400SKP	486sx	25	80Mb	2Mb	£1499
T4400SLX	486sx	25	120Mb	2Mb	£1659
T4400SKP	486sx	25	120Mb	2Mb	£1659
T6400SX	486sx	25	120Mb	4Mb	£2169
T6400DX	486dx	33	200Mb	4Mb	£2659
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TM4000sxWin	486sx	16	80Mb	4Mb	£1599
TM4000dx2Win	486dx2	50	200Mb	8Mb	£2815
ZENITH					
320L Mod60	386SL	20	60Mb	2Mb	£1195
325S Mod 60	386sx	25	60Mb	2Mb	£1199
325S Mod 85	386sx	25	85Mb	2Mb	£1329
320L Mod 60	386sl	20	60Mb	2Mb	£1510
325L Mod 85	386sl	25	85Mb	4Mb	£1829
325L Mod 120	386sl	25	120Mb	4Mb	£1999
420S Mod 85	486sx	20	85Mb	4Mb	£1819
425S Mod 120	486sx	25	120Mb	4Mb	£2059

PANDON					
Positive	386sx	20	40Mb	2Mb	£829
NB/386sx	386sx	25	40Mb	2Mb	£1039
NB/386sx	386sx	25	60Mb	2Mb	£1125
NB/386sx	386sx	25	80Mb	2Mb	£1209
NB/386sx	386sx	25	120Mb	2Mb	£1299
NB/486slc	486slc	25	80Mb	4Mb	£1469
NB/486slc	486slc	25	120Mb	4Mb	£1559
TOSHIBA					
T1800	386sx	20	43Mb	2Mb	£798
T1800	386sx	20	64Mb	2Mb	£930
T1850	386sx	25	85Mb	4Mb	£1170
T1850	386sx	25	120Mb	4Mb	£1269
T3300SL	386sl	25	80Mb	2Mb	£1369
T3300SL	386sl	25	120Mb	2Mb	£1499
T4400SLX	486sx	25	80Mb	2Mb	£1499
T4400SLXP	486sx	25	80Mb	2Mb	£1499
T4400SLX	486sx	25	120Mb	2Mb	£1659
T4400SLXP	486sx	25	120Mb	2Mb	£1659
T6400SX	486sx	25	120Mb	4Mb	£2169
T6400DX	486dx	33	200Mb	4Mb	£2659
TEXAS INSTRUMENTS					
TM4000slcWin	486slc	25	60Mb	2Mb	£1445
TM4000sxWin	486sx	16	80Mb	4Mb	£1599
TM4000dx2Win	486dx2	50	200Mb	8Mb	£2815
ZENITH					
3201B Mod60	386SL	20	60Mb	2Mb	£1195
3225 Mod 60	386sx	25	60Mb	2Mb	£1199
3225 Mod 85	386sx	25	85Mb	2Mb	£1329
3201 Mod 60	386sl	20	60Mb	2Mb	£1510
3251 Mod 85	386sl	25	85Mb	4Mb	£1829
3251 Mod120	386sl	25	120Mb	4Mb	£1999
4205 Mod 85	486sx	20	85Mb	4Mb	£1819
4255 Mod120	486sx	25	120Mb	4Mb	£2059

Computers by Post

LOWEST PRICES GUARANTEED

Shown here is just a small selection of our extensive range of components for compatible PC's.

All products are sourced from major suppliers in the UK and abroad, and are covered by a 1 year guarantee.

The prices shown represent substantial savings over standard branded replacement parts.

GRAPHIC CARDS



MDA/HERCULES
With parallel port

£25

TRIDENT 1MB SVGA

9000 based 1Mb VGA card, with support for Windows 3.x, Autocad, Wordperfect and most popular software. XT & AT compatible.

£59

COLOUR IMAGE HIGH COLOUR CARD

ET4000 based graphics card with RAMDAC high colour chip set to give up to 32,000 colours on screen at once. Fast graphics handling makes it ideal for use with Windows 3.x.

£99

ORCHID: ProDESIGNER IIX

Established 16 bit SVGA card, well supported by most major software.

£169

ProDESIGNER IIS

1Mb 16 bit VGA with 32,000 colour modes, drivers include Windows 3, SCO Xenix & Autocad.

£199

FAHRENEIT

High speed graphics accelerator board with on board S3 based processor chip set. Ideal for all graphics intensive software where speed is vital. Up to 12 times faster than standard SVGA.

£319

DIAMOND: VRAM STEALTH 1MB

The latest in graphics accelerator boards for the PC which has won many major industry awards including the PC magazine best buy award. Benchmark tests have shown the Stealth to work 25 times faster than standard SVGA. Support for Windows included as standard.

£159

SPEEDSTAR 24

The very latest in 24 bit video cards, the Speedstar offers a staggering 16.7 million colours available on screen giving professional, photo realistic pictures and blistering speed. Complete with drivers for Windows and Autocad.

£99

HI-COLOUR RAMDAC OPTION

32,000 colour upgrade for Stealth card. P.O.A.

MathCo

80287 XLT £49

80387DX-16-33MHz £49

80387SX-16-25MHz £47

80387SL-16-25MHz £47

RapidCAD £199

80487SX-16-25MHz £299



KEYBOARDS

CHERRY G83

102 Key enhanced keyboard, XT/AT

£27

PS/2 keyboard adaptor

£10

Amstrad 1512/1640 102 key enhanced

£49

Amstrad 8256/8512/9512 enhanced

£59

MULTI I/O CARDS

2 x serial & 1 parallel port card, serial ports configurable to coms 1 to 4, parallel port LPT1 to LPT3

£16

AT Multi I/O with parallel, serial, game

£19

port and IDE/floppy controllers

£65

4 port multiseria card for DOS, UNIX/

£109

ZENIX

£109

8 port multiseria card for DOS, UNIX/

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ZENIX

£109

Multiseria cards come complete with drivers. DOS compatible C libraries and source code examples.

POWER SUPPLY UNITS



230 watt XT PSU £44

230 watt AT PSU £44

230 PS/2 & Mini tower PSU £44

UNINTERRUPTABLE POWER SUPPLIES

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Off line UPS:

GPR 250 250va £129

GPR 400 400va £199

GPR 600 600va £325

GPR 1200 1200va £648

On line UPS:

GR315 315va £658

GR630 630va £933

GR1260 1260va £1705

UPS CARDS

Installs inside the PC, using 2 expansion slots. On power-loss it backs up all in memory to the hard disk, when power is restored the system returns to its original position. Requires DOS 3 or higher

£199

SWITCH BOXES

1 in 2 out Manual Parallel or Serial £12

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1 in 4 out Auto Parallel or Serial £69

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4 in 2 out Auto Parallel 256k Buffer £219

8 in 2 out Auto Parallel 256k Buffer £259

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Desktop Case with 230w PSU £59

Mini Tower Case with 230w PSU £59

Full Tower Case with 230w PSU £99

MONITORS

12" FST Hercules/MDA compatible £59

Paper white 14" FST VGA Mono £79

VGA Colour 14" 0.31mm dot pitch £175

Super VGA Colour 14" 0.28mm dot pitch £189

Super VGA Colour 14" 0.28mm dot pitch non interlaced £189

MICE

GENIUS

GM-D320 Serial £15

GM-6000 Serial inc Mouse Mat £22

GM-F302 Serial inc Mouse Mat & software £29

LOGITECH

Pilot mouse-serial 3 button £22

Kidz mouse £37

MouseMan Serial(R/L handed) £40

MouseMan Bus(R/L handed) £40

MouseMan PS/2(R/L handed) £40

MouseMan Cordless(R/L handed) £76

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Trackman serial portable trackball £49

MICROSOFT

Mouse only, bus or serial + PS/2 £60

Mouse & Windows 3, bus or serial + PS/2 £87

Ball point PS/2 compatible portable trackball £78

NAKSHA

Serial/A mouse 9/25 pin including Dpaint II £34

PS/2 compatible mouse with Dpaint II £34

Amstrad Generation 3 compatible mouse £25

HAND HELD SCANNERS

LOGITECH

Scanman 32 XT/AT £63

Scanman PC Colour £249

Scanman 32 inc Timeworks V1.2 £138

Scanman 32 inc Catchword OCR £119

Scanman 256 for Windows £143

Scanman 256 PS/2 £189

Scanman Mac Colour £319

Catchword OCR software £88

Fotoman digital camera £379

GENIUS

GS-4500 inc Prodigy OCR £75

GS-105GX £108

MARSTEK

CG6000 Hand Held Colour Scanner with scan kit, rainbow studio & perceive OCR. £279

MEMORY BOARDS

HYPERTEC

Hyperam MC 32/16, microchannel memory card for PS/2's, Apricot, Olivetti and other microchannel machines. Board handles upto 32Mb ram. £269

LONGSHINE

32MB AT memory card, AST EEMS/EMS 4.0 & Extended memory compatible. EMS & Extended can be mixed on board. Includes memory manager, installing, printspool and disk utilities. £79

ACCELERATOR CARDS

Hyperace II 16mhz 286 upgrade board for XT's and compatibles with 80287 co-processor support. Includes 16k cache & LIM 4.0 support, also 2 year warranty. £199

Amstrad 1512/1640 Cable Kit £15

IBM PC Cable Kit £15

Olivetti M24/Amstrad 2086 Cable Kit £15

CPU UPGRADE BOARDS

HYPERTECH

25mhz 386 upgrade with 64k cache & co-processor support. £299

MOTHERBOARDS

80386sx 25MHz Baby AT size, Ami BIOS, Max 16Mb RAM on board £80

80386sx 33MHz Baby AT size, Ami BIOS, Max 16Mb RAM £89

80386dx 33MHz 128k cache A4 size, Ami BIOS, Max 32Mb RAM £149

80386dx 40MHz 128k cache A4 size, Ami BIOS, Max 32Mb RAM £149

80486dx 33MHz 256k cache A4 size, Ami BIOS, Max 32Mb RAM £429

80486dx 50MHz 256k cache A4 size, Ami BIOS, Max 32Mb RAM £599

80486dx 2/66MHz 256k cache A4 size, Ami BIOS, Max 32Mb RAM £699

80486dx 33MHz 256k cache FISA bus, Ami BIOS, Max 128Mb RAM £599

80486dx 50MHz 256k cache FISA bus, Ami BIOS, Max 128Mb RAM £799

NETWORK CARDS

Novell

NE1000 8 bit Ethernet card £70

NE2000 16 bit Ethernet card £108

NE2 MCA 16bit Ethernet card £177

NE2 MCA 32bit Ethernet card £367

NE3200 EISA Ethernet card £499

Compatible

NE1000 compatible card £79

NE2000 compatible card £89

D-Link

D-Link network cards have a low chip count for a high reliability rate. 10Mbit per second data transfer with on-board shared dual-port ram gives increased data throughput.

Compatible with Novell Netware as well as 3-Com, DECnet PCSA, PC-NFS, SCO Xenix/Unix and many other network systems.

DE-100 8 bit Ethernet card £69

DE-200 16 bit Ethernet card £99

DE-300 MCA Ethernet card £169

Pocket Ethernet adaptor, fits to parallel port £175

NETWORKING

NETPORT II BNC/AUT £339

NETPORT II TWISTED PAIR £339

NETPORT II TOKEN RING £589

ETHEREXPRESS 16 £89

ETHEREXPRESS 16 TP £89

ETHEREXPRESS 32 32 BIT £419

LANPROTECT £399



PC Components

TAPE STREAMERS

COLORADO (JUMBO)

The Jumbo tape streamers offer a low cost, reliable backup system for PC's and PS/2's. All streamers include full manuals and backup software.

DJ-10F Internal 60/120Mb Tape Streamer	£139
DJ-20 External 120/240Mb Tape Streamer	£159
KE-10 External XT/AT kit for above	£80
FC-10 Dedicated controller for DJ-10F & DJ-20 for faster data transfer	£75
AB-11 External port kit	£25
SU-53J Drivers for Xenix & Unix	£95
Large range of controller and cable options available, please call for details	
Tapes for DJ10F & DJ-20	£16

COLORADO TRAKKER (EXTERNAL)

Fits parallel port

60/120Mb external streamer	£245
120/250Mb external streamer	£317

COLORADO QFA-700 (700Mb)

Capable of backing up 700Mb of data on one cartridge with 12Mb/minute backup rate. Novell certified, the QFA is a perfect backup solution for file servers.

QFA-700 internal streamer	£559
QFA-700E external streamer	£739
TC-02 AT Bus ISA controller	£199
TC-02M MCA controller for PS/2's	£249

SUMMIT MEMORY SYSTEMS

Summit tape streamers include a 2 year warranty, Central Point Backup and DOS/Windows support.

SE-120 Internal 60/120Mb tape streamer	£169
SE-250 Internal 120/250Mb tape streamer	£189
External Kit for SE 120/250	£49
Extra cables for external kit	£25
SE-305 305Mb streamer, connectors to IDE controller	£240

BACKPACK

Ideal for portables or backing up multiple systems without additional cost, plugs into any standard parallel port.

Model 1040 60/120Mb external tape streamer	£349
Model 1080 120/250Mb external tape streamer	£459

DRAMS

64 x 1 (4164) 80ns	£0.98
64 x 4 (4164) 80ns	£3.00
256 x 1 (41256) 80ns	£0.90
256 x 4 (41256) 80ns, 70ns	£3.60
1MB x 1 (411000) 80ns, 70ns	£3.50
1MB x 4 (414400) 80ns	£18.00

SIMMS & SIPS MODULES

256k x 9 80ns	£11
256k x 9 70ns	£12
1MB x 9 80ns	£26
1MB x 9 70ns	£26
1MB x 3 80ns	£25
4MB x 9 80ns	£89

REMOVABLE/PORTABLE HARD DISKS

Removable hard disk kit for ST506/412 & ESDI drives	£39
Removable hard disk kit for IDE Drives	£39
Backpack external drives, connect to parallel port, will work with portables etc.	
Model 5040 40MB external hard drive	£277
Model 5100 100MB external hard drive	£452

HARD DISKS

Model	Size	AAT	FFR	HT	
SEAGATE "AT" IDE Drives					
ST351A	42Mb	28ms	3.5"	LP	£109
ST3120A	107Mb	17ms	3.5"	LP	£198
ST3144A	124Mb	16ms	3.5"	LP	£209
ST1239A	210Mb	15ms	3.5"	LP	£319
ST3283A	248Mb	12ms	3.5"	LP	£389
ST2383A	338Mb	14ms	5.25"	HH	£678
ST1480A	426Mb	14ms	3.5"	HH	£766

SEAGATE SCSI Drives					
ST3283N	248Mb	12ms	3.5"	LP	£489
ST2383N	338Mb	15ms	5.25"	HH	£719
ST1480N	426Mb	14ms	3.5"	HH	£790
ST1581N	525Mb	14ms	3.5"	HH	£738
ST4766N	676Mb	15ms	3.5"	FH	£834
ST41200N	1.2Gb	15ms	5.25"	FH	£1068
ST41200N	1.9Gb	12ms	5.25"	FH	£1830

Western Digital "AT" IDE Drives					
WDAC280	85Mb	17ms	3.5"	LP	£156
WDAC2120	125Mb	15ms	3.5"	LP	£221
WDAC2170	170Mb	13ms	3.5"	LP	£248
WDAC2200	212Mb	14ms	3.5"	LP	£309
WDAC3240	341Mb	13ms	3.5"	LP	£487

QUANTUM Prodrive SCSI Drives					
52S	52Mb	17ms	3.5"	LP	£155
120S	120Mb	15ms	3.5"	LP	£252
240S	240Mb	16ms	3.5"	LP	£455
425S	425Mb	14ms	3.5"	LP	£799

COMPAQ OWNERS

PC Components are specialists in hard disk upgrades for Compaq PC's. We will supply all parts needed for your replacement and upgrade needs, please call for details.

CONNER "AT" IDE Drives					
CP-2088	85Mb	21ms	2.5"	LP	£217
CP-3000	42Mb	28ms	3.5"	LP	£123
CP-3008A	85Mb	17ms	3.5"	LP	£153
CP-30104	121Mb	19ms	3.5"	LP	£212
CP-30174	170Mb	17ms	3.5"	LP	£230
CP-3204F	212Mb	16ms	3.5"	HH	£298
CP-3364	340Mb	12ms	3.5"	HH	£658
CP-3544	510Mb	12ms	3.5"	HH	£733

CONNER SCSI drives					
CP-3040	42Mb	25ms	3.5"	LP	£146
CP-30080	85Mb	17ms	3.5"	LP	£153
CP-30100	120Mb	19ms	3.5"	LP	£247
CP-30170	170Mb	17ms	3.5"	LP	£249
CP-3200	212Mb	16ms	3.5"	LP	£376
CP-3360	362Mb	12ms	3.5"	HH	P.O.A.
CP-3540	543Mb	12ms	3.5"	HH	P.O.A.

KEY

AAT	Average Access Time
FFR	Form Factor
HT	Height
LP	Low Profile as used in most portables
HH	Half Height (1.5")
FH	Full Height

HARD CARDS

MEGACARD	
30MB XT Hardcard 65ms	£149
PLUS HARDCARD	
HARDCARD IIXL 50	£222
HARDCARD IIXL 105	£330

FDD/HDD CONTROLLERS

SEAGATE	
ST05x 2 x 8 bit IDE drives for XT	£20
ST07a 2 x AT IDE drives	£17
ST08a 2 x AT IDE drives/2 x FDD	£25

FUTURE DOMAIN

MCA SCSI card for PS/2's and compatibles	£205
TMC 1670 ISA SCSI controller, for DOS, OS/2 2.0 & Novell	£109
Future domain based SCSI card for ISA	£89

LONGSHINE

XT intelligent RLL controller	£27
Intelligent SCSI/IDE Controller	£119
IDE Caching controller, 4Mb capacity uses 1Mb SIMMS	£109
DC-2040 SCSI Caching controller	£165

FLOPPY CONTROLLERS

XT/AT intelligent Controller, can be used as second controller	£24
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SCSI Dual cable	£9
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PSU Power splitter 3.5" drives	£5
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Monitor data extension cable	£9
3.5" to 5.25" LP HDD Frame	£10
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EXTERNAL FLOPPY DRIVES

BACKPACK

Backpack drives plug straight into the parallel port, allowing them to be used with desktops and portables. A through port gives a printer connection.

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AMSTRAD	
Ractec 3.5" 720k external drive for 1512/1640	£60

INTERNAL FLOPPY DRIVES

3.5" 720K	£43
3.5" 1.44Mb	£39
3.5" 1.44Mb Inc Frame and cable	£42
5.25" 360K	£38
5.25" 1.2Mb	£45
Canon 3.5" 1.44Mb & 5.25" 1.2Mb drive all in one half height slot	£89

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Introducing 2 new categories of Powerful Performance Boosters for Intel486SX and DX CPU-based systems.

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486DX-25	£299
486DX-33 SINGLE SOCKET	£399
486DX-33 DOUBLE SOCKET	£399



CD-ROM DRIVES

CUMANA

Internal CD Rom Drive with interface	£359
External CD Rom Drive with interface kit (Metal case)	£469
External CD Rom Drive with interface kit (Plastic case)	£469
IBM XT/AT interface kit	£85
Interface to drive cable	£239
Extra CD Rom Caddy	£8
CD ROM Drive Lock (Eliminates unauthorised removal of CD)	

CREATIVE LABS

Multi-Media all-in-one upgrade kit, includes Soundblaster PRO card, MIDI Kit, CD-ROM Drive & Multimedia software

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OPTISTORE	
7 Rewritable optical drive system, has a 28ms average access time. Appears as another hard drive on your computer.	
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AT Novell Kit	£369
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Gravis Ultrasound Card	£149
Zufi Speakers V2	£29
Addup PC Sounds S5550 Speakers	£35

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Understanding hard disk management (sybex) ref 5429	£21.95
Newnes hard disk pocket book ref 7384	£12.95
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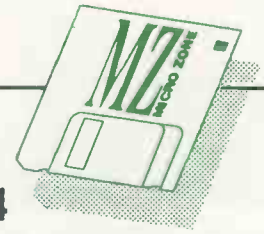
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6486 HD105 486/20 4MB RAM	—	1035	1135

7 SERIES INC. DOS 5.0, COUNTERPOINT, LOTUS WORKS 3 & 1 YEAR ON-SITE WARRANTY
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AST COMPUTERS

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(ALL AST BUNDLES INC. 14" SVGA-LR MONITOR, DOS 5.0, WIN 3.1, MOUSE & MAT)
OTHER CONFIGURATIONS, OPTIONS & ACCESSORIES FOR AST CALL.

AMBRA

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SPRINTA 486DX/33 213MB 4MB	1225
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HURDLA 486SX/25 100MB 4MB	865
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SUMMASKETCH SUMMADRAW A4 12" X 12"	CALL
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HP7596RX PLUS A0 DRAFTMASTER	* CALL
HP7599MX PLUS A0 DRAFTMASTER	* CALL
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HP DESIGNJET INKJET A0	* CALL
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CALCOMP 3024M A1	1775
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CALCOMP 2036M PACESETTER 1MB 8PEN A0/A4	4115
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ROLAND SKETCHMATE A4	319
ROLAND DXY 1100 A3	489
ROLAND DXY 1200 A3	624
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ROLAND DPX 2600 A2	* CALL
ROLAND DPX 3600 A1	* CALL
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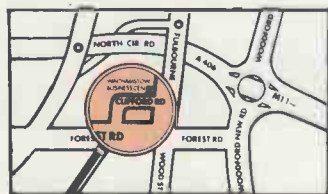
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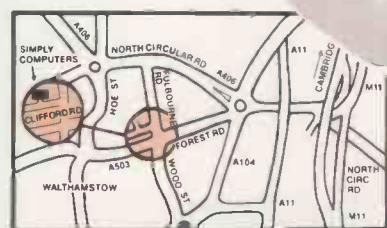
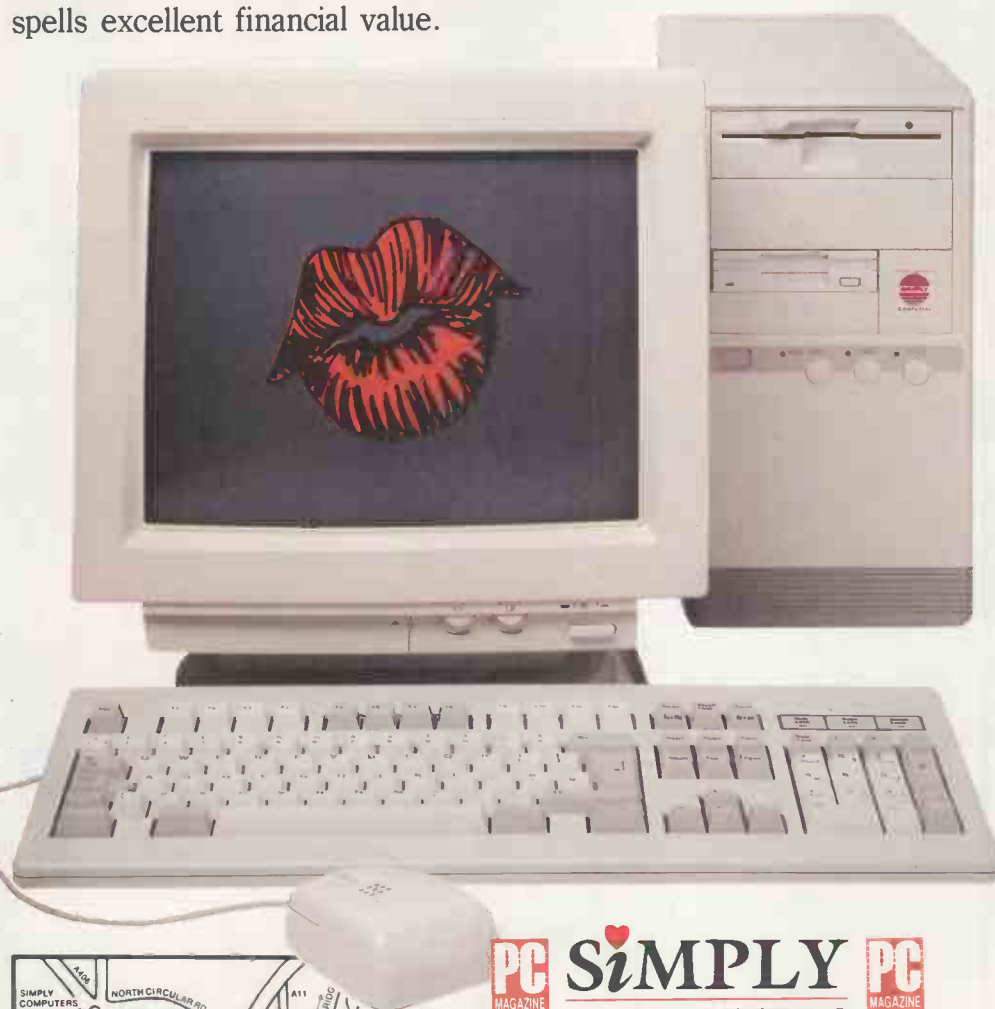
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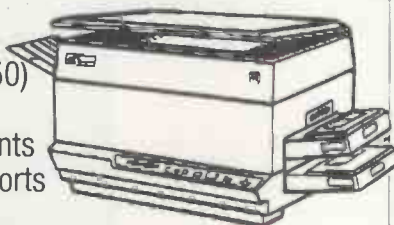
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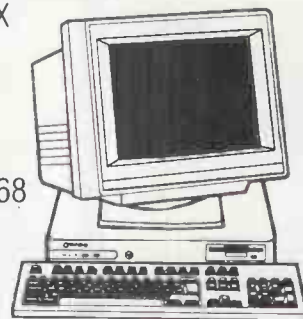


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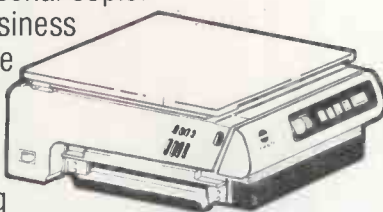


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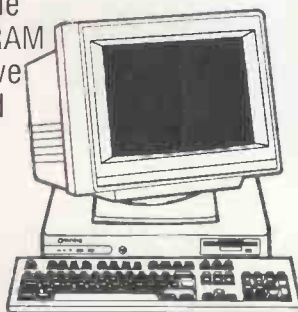


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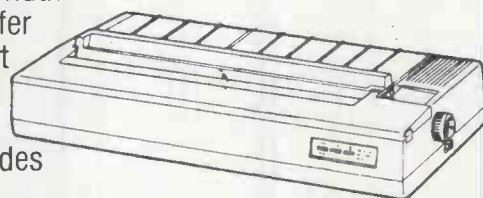


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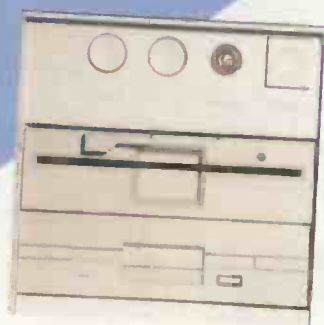
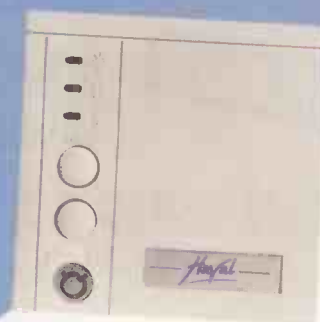
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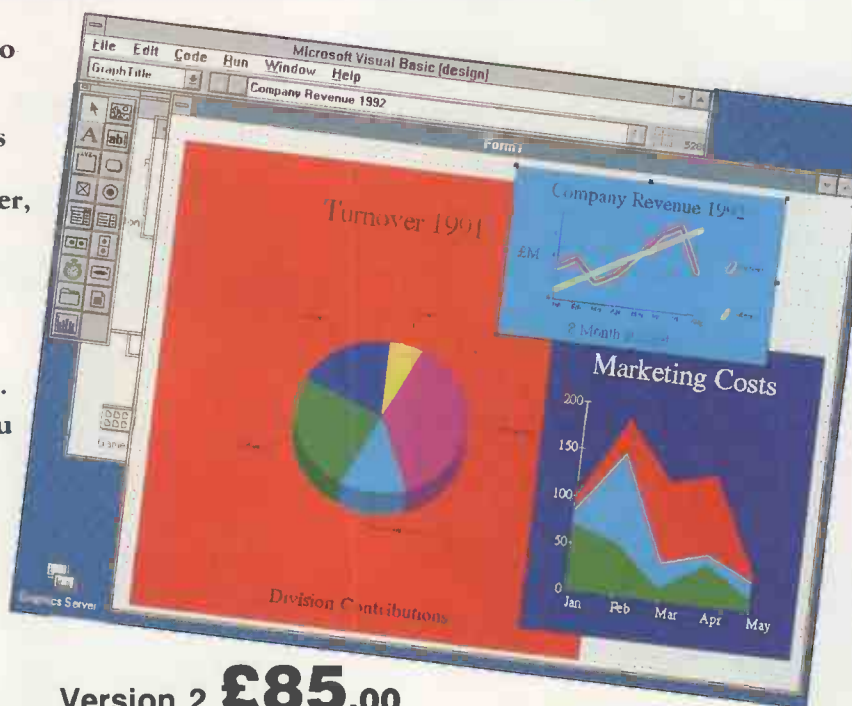


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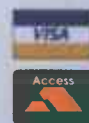
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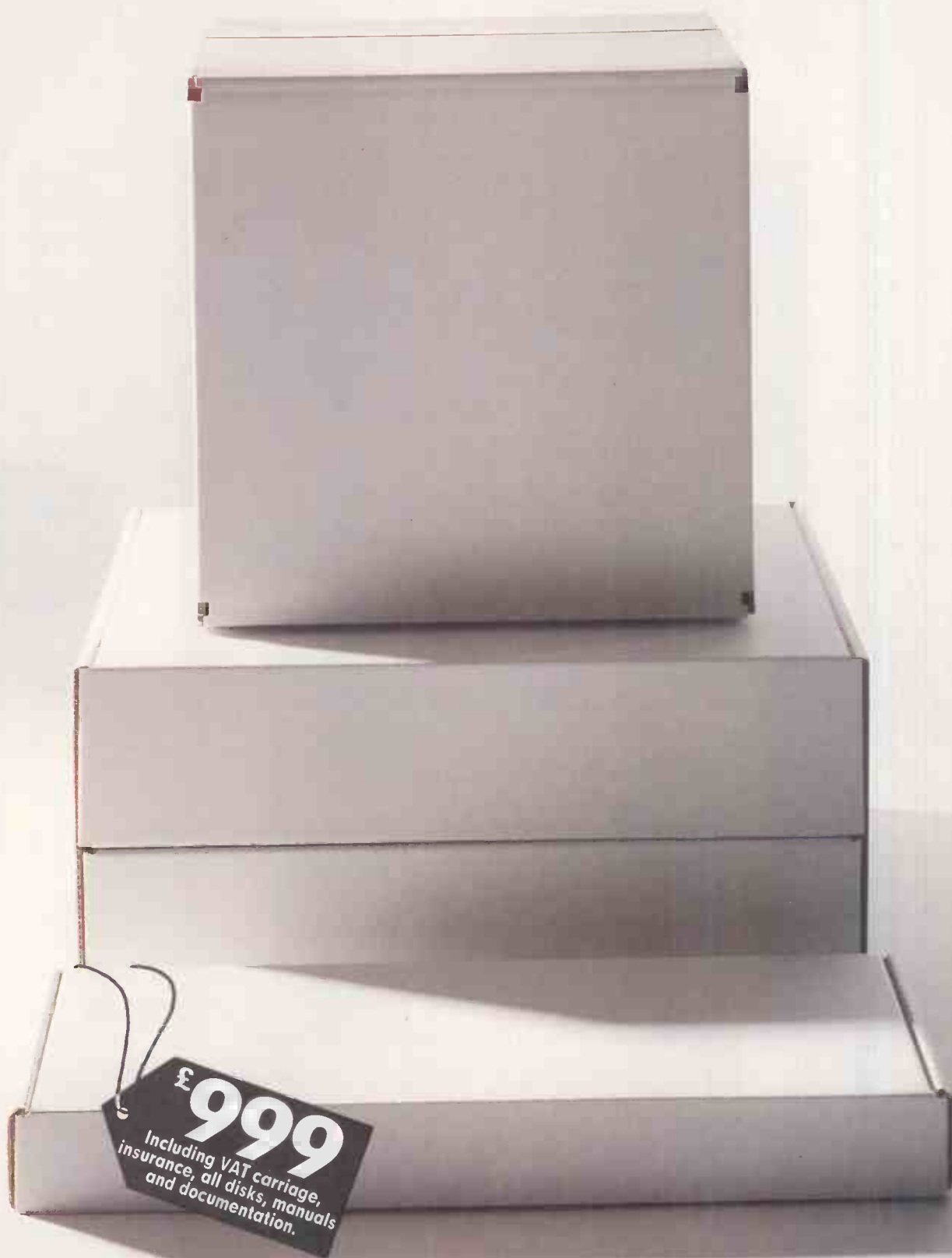
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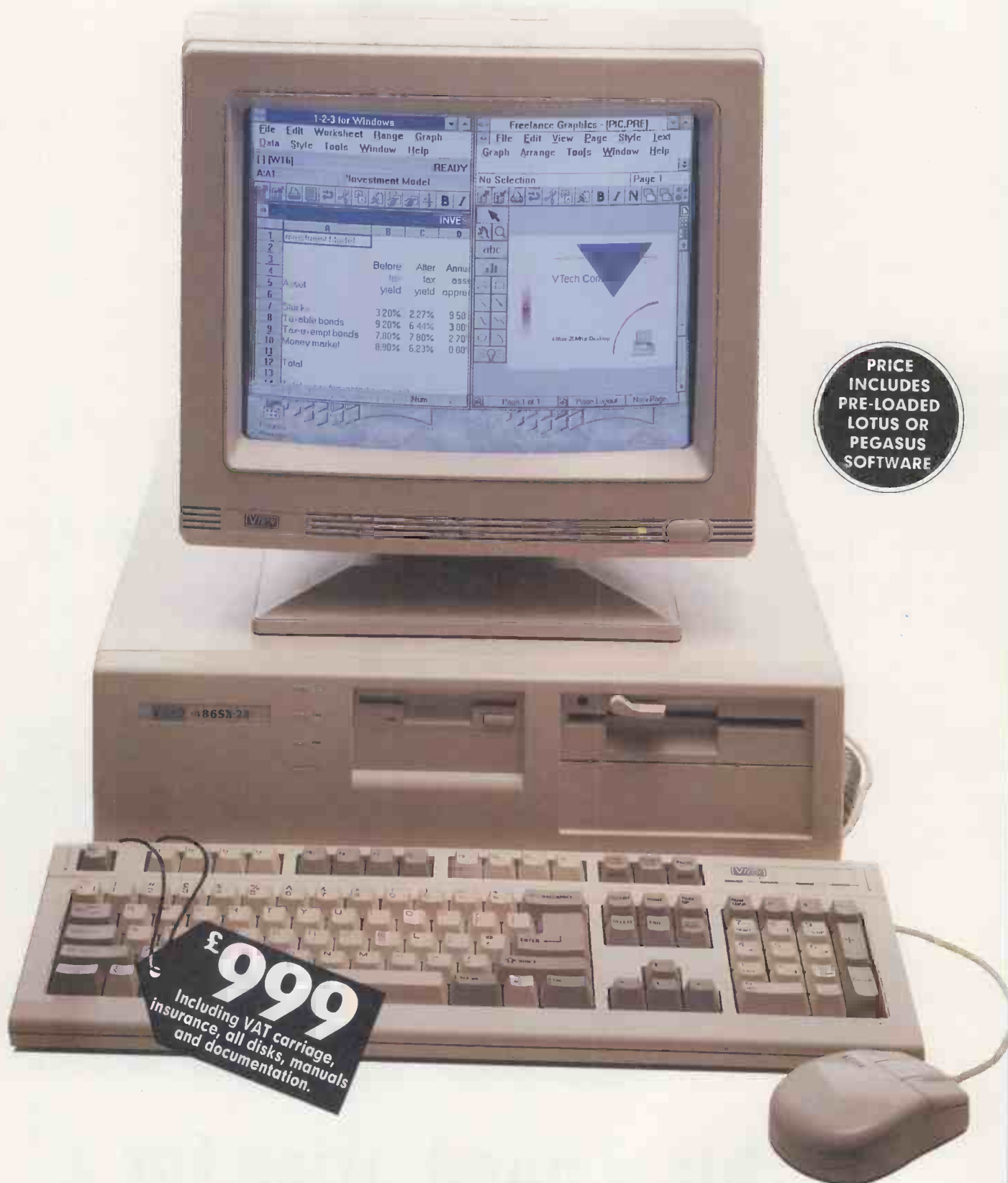
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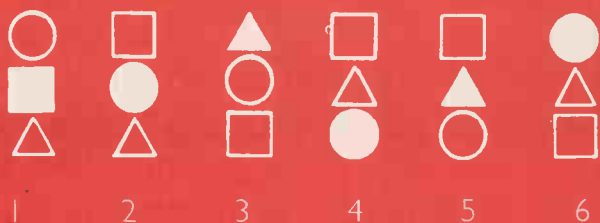
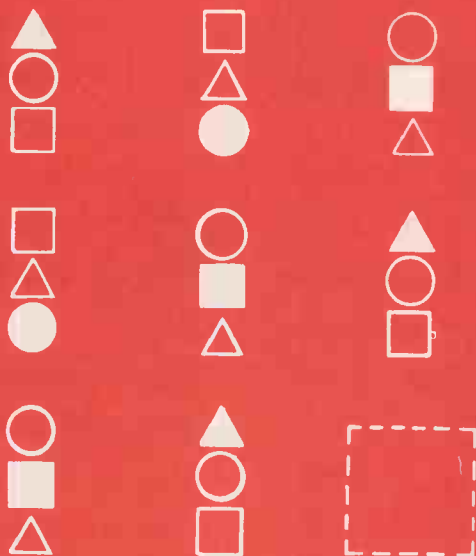
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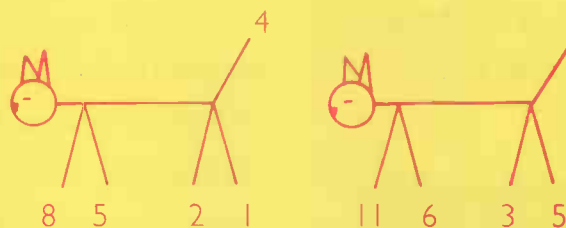
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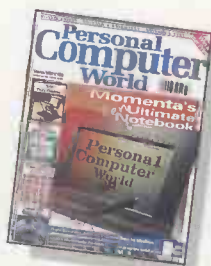
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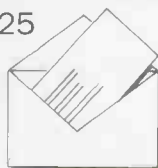
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Devalued pound causes price hitches in the UK

The Government's bungling of the Exchange Rate Mechanism has finally filtered through the channel to hit computer users, with at least eight companies hiking up prices as PCW went to press. Elonex, Olympic, Viglen, Kamco, Opus, Locland, Silicon Valley and build-to-order firm Solidisk have all had to raise prices on their machines as the pound drops against the dollar and computer components become more expensive to buy from the US.

Elonex hitched up prices on most machines by £100, bringing its entry-level system to £895. Elonex Sales and Marketing Manager, David Bridson, blamed the rise on the devaluation of the pound in the autumn. The company did manage to lower its EISA-based models by £45 and slice prices of some fast, high-capacity hard disk drives by 'a couple of hundred pounds'.

But this didn't stop Tulip's MD Steve McCall from crowing about the company's rises. 'I'm pleased Elonex has had to raise prices,' he said. 'They've been screwing the market up for a long time and they've been screwing themselves: their machines were set at stupid prices.'

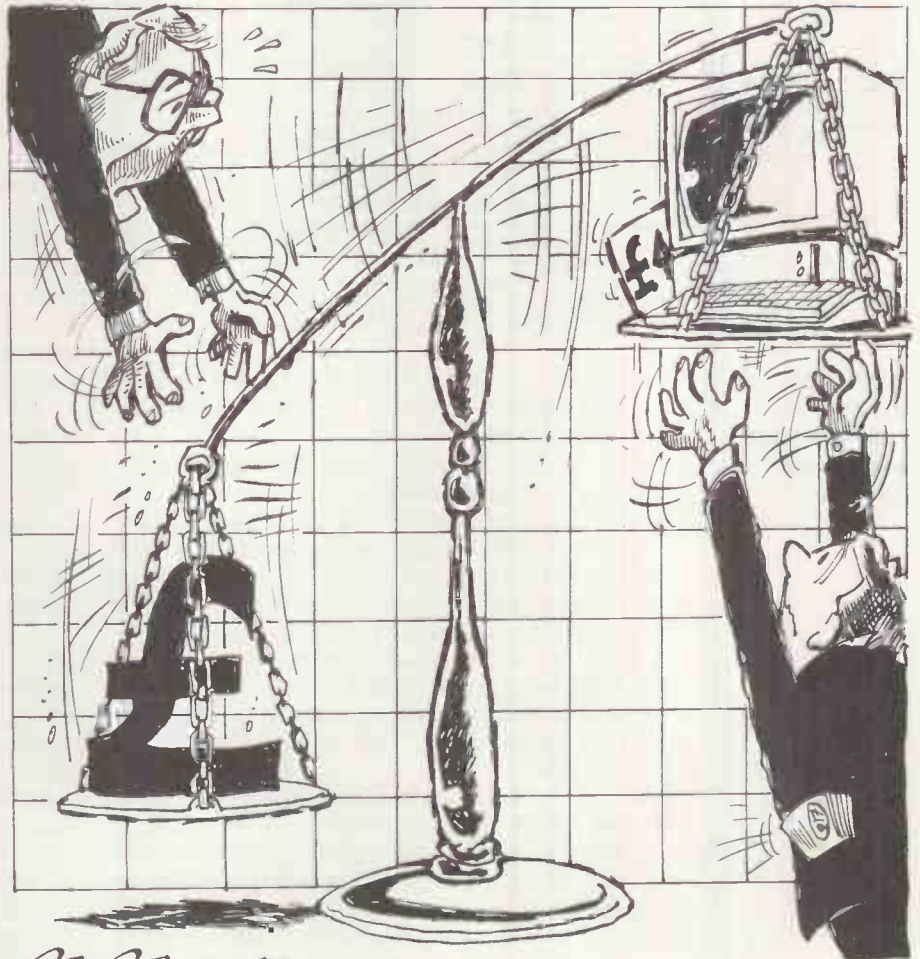
He also guaranteed frozen prices from Tulip until the end of the year. 'We don't propose to alter anything until the pound stabilises. We buy our currency upfront, on a quarter by quarter basis,' he said.

Tulip seems to be one of the few lucky ones, though: Viglen has raised prices by 5 to 10%, while Locland was set to hike its charges as PCW went to press. 'I'm sitting with my sales staff now deciding how much we're going to add on,' said MD Nabil Kassatly. 'There'll be a lot of knives flying around tonight, and that's certain,' he added. Other companies having to raise prices include Opus, which put them up in mid-November, and Solidisk, which raised prices earlier that month.

Apart from the devaluation of the pound by roughly 25% in the latter half of the year, the other problem for UK manufacturers is the levy placed on US RAM imports one week before the American election. One of George Bush's last swipes at the economy was to impose a levy on memory coming in from Korea. This has knocked prices up from £16 to £23 per megabyte in some cases. [See Jack Schofield, page 144.]

The manufacturers mostly regret the rises, although some see it as a mixed blessing. 'It's unfortunate for customers,' said Kamco MD, Ziggy Kamasa. 'But it's good for sales because people are wondering whether to buy now, in case the prices go up again.'

The move will work against smaller companies because medium to large firms buying in bulk can still get the best price, and in a situation where margins are more critical than ever, this will hurt more than it ever has done. Due to economies of scale, larger companies such as Compaq and IBM/Ambra could end up keep-



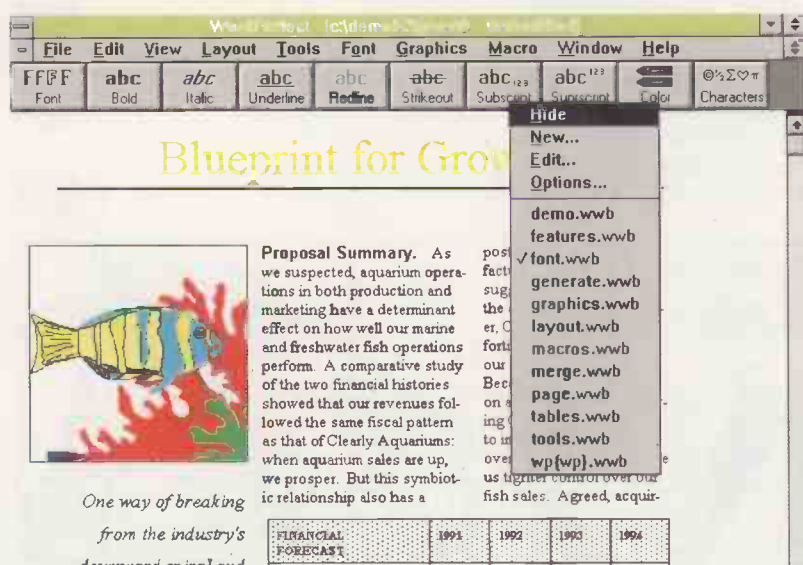
ADAMS 92

ing their prices low due to their component buying power. This could give rise to the bizarre situation where you'll be able to buy a large, brand name machine cheaper than some small, box-shifter ones. All this means that many more small manufacturers will be going under in the next few months.

Danny Bradbury

WordPerfect opens up as new launches widen product base

WordPerfect has been leaking information on WordPerfect 6.0 for DOS with a new secret weapon: a graphical user interface. As part of its new, open strategy, the company has also previewed version 5.2 of WordPerfect for Windows, which will ship with two separate appli-



△ WordPerfect for Windows 5.2: taking the product into the next generation

cations. Finally, it has divulged details of WordPerfect Office 4.0, which should be launched about now.

The next WordPerfect for DOS will use the graphical user interface that WordPerfect is making a standard with its DOS-based applications. It will contain a button bar and use radio buttons and hypertext help. According to the US press, the product will also include collapsible outlines, desktop publishing facilities, the ability to edit up to nine documents at once and a file manager. A leaked company document indicates the product will offer a text mode, the GUI mode, and a GUI mode with built-in WYSIWYG.

'It doesn't seem to slow things down: we've got the graphical interface on other products and it's been designed well enough not to make any difference,' said Vivienne Wilson, PR manager for the company. The product is said to be in beta and may appear on the shelves as early as spring 1992.

The new version is designed to complement the new WordPerfect for Windows product, the interim version of which was released in Spring 1992. WordPerfect for Windows 5.2 takes the product into its next generation, said Windows product manager Daniel Summers. It ships with two additional products, the Quickfinder file management utility and the Grammatik 5.0 grammar checker application.

Quickfinder is a document management application which can be used with applications other than WordPerfect for Windows. It works by asking the user to create an index of the various files and directories on the disk which will be used the most frequently; the whole disk can be indexed. When this has been done, the user can make attachments for the files by assigning them applications. Then, whenever the file is selected, the relevant application is automatically launched. The utility can be used from within WordPerfect for Windows to find, view and open documents. Grammatik 5.0 will run through your document and check it against certain grammatical rules, which can also be defined by the user.

WordPerfect for Windows 5.2 ships with a copy of Adobe Type Manager to provide additional font support. Other features include new macros and some prepackaged button bars, which are iconic toolbars. Printer handling has also been improved, so users can have full colour printing and tray selection, and include different paper orientation within the same document. OLE support has been included, as has a mail enable ability for mailing documents from within WordPerfect. The speller has been redesigned to be faster and more selective with its suggestions.

The product will cost £399, and there will be a competitive upgrade option for £99 if you can provide proof of purchase. WordPerfect is cocking a snook at other manufacturers, especially Lotus, over their product upgrades. In particular, Summers attacked Lotus' Ami Pro 3.0 for being file-incompatible with previous versions, although Lotus denies this.

According to Summers, WordPerfect users would want to upgrade from the existing DOS products because of the generic licensing arrangement that WordPerfect instigated in November 1991. Anyone who buys 5.1 for DOS is automatically licensed for 5.1 for Windows, which is particularly handy if you have more than one user. Users of WordPerfect for Windows 5.1 can upgrade to 5.2 for Windows for £35. The company would continue to sell heavily into local government accounts with these low upgrade prices, he said, because 'our local government contracts are going to be around for a long time.'

The third package from WordPerfect is version 4.0 of Office, which has been angled more towards workflow management. The product will be targeted at the likes of BeyondMail and WinMail from ESP and Finansa respectively, said Vivienne Wilson.

This will be the first version to include email message sorting based on content, and sched-

uling and calendar features in Windows. Rules defining the sorting of messages can be set up by the user as they can in BeyondMail.

The product will also ship with a form filler component, whereby forms can be passed around the network, filled in by users and either returned or forwarded. This time-saving feature, aimed at bureaucratic organisations, saves time when getting the necessary memos filled out. It includes a password authorisation process which enables people to sign forms electronically, for approvals.

The form filler will also be shipped as part of a complete forms design package, called Inform. The package has a design feature which enables users to put together forms using radio buttons. The user can define sections of the form as objects, which can be stored in object libraries and reused in other forms.

WordPerfect has been active in its inter-company negotiations as well as its product development. The company has revealed that it will be implementing a marketing agreement with Borland in the UK. The deal, similar to one organised in the US a few months ago, enables existing users of WordPerfect 5.1 to buy Borland's Quattro Pro product at a discount rate. In return, users of Quattro Pro will be able to scoop up a bargain on WordPerfect.

This move is not all that surprising, as WordPerfect and Borland have been in bed together for a while over one thing or another. Rumour has it that Borland has used WordPerfect code in one of its products, and it is known that hardware manufacturers have been approached and offered bundling deals with Borland and WordPerfect products.

This whole activity — the new document management facility within WordPerfect for Windows, the new workflow management within Office 4.0, the forms package and the chumminess with Borland — are all steps in WordPerfect's strategy to become a more 'open' company.

In Autumn 1992 it launched its WordPerfect Information System Environment (WISE) strategy, which aimed to widen the company's product base and standardise it more, creating a universal look and feel. The company said it would move into product areas in which it was traditionally weak, such as spreadsheets, DTP, email and document management. It hopes people will see it as something other than a one-product company, but judging from the weaknesses in DataPerfect and PlanPerfect it still has a way to go.

WordPerfect (0932) 850500

Danny Bradbury

Intel accused of extortion over processor patent enforcement

As Cyrix moves into the clone market for Intel-based processors, Intel is enforcing a little-known patent it has on the design of the personal computer. The company says its 1990 patent number 4,972,338 on computer system design covers PCs that use its microprocessor designs with any multi-tasking operating software. Specifically, it covers the way external memory is managed using paging and page tables with 32-bit microprocessors.

With more than one million Windows-based machines shipping each month, Intel could raise hundreds of millions of dollars in royalty fees if computer makers agreed to pay them. This move is targeted not just at Cyrix but at AMD, which has become a major bugbear of Intel over the last few years.

Intel is asking for a \$25 royalty per 486 computer or \$15 per 386 from any company that uses an Intel clone chip. But David Brand, Managing Director of AMD UK, claims that AMD has a cross-licence agreement on all Intel patents, so it won't be an issue. Cyrix claims that it, too, is covered. It cites a recent Federal District Court decision stating that 'Cyrix, as the purchaser of "licensed products" from SGS-Thomson, is free to use and/or resell the products.' A computer maker could avoid paying for a licence by not preloading multi-tasking software, but any customer who subsequently

loaded it would breach the patent. If a company used an Intel chip, that royalty would be waived.

Tom Brightman, Cyrix' Vice President of Business and Technology, termed the arrangement an illegal 'extortion scheme' aimed at forcing customers to buy from Intel; and Cyrix' President, Jerry Rogers, called Intel's actions 'outrageous'.

Cyrix already has a pending anti-trust suit against Intel and it plans to file another, seeking a ruling that would prevent Intel pursuing royalty payments from Cyrix customers. Intel has already approached half a dozen companies to negotiate royalty licences.

Intel (0793) 696000

David Brake & Tim Bajarin

HP portable printer

Hewlett Packard is about to enter the portable printer market — the only remaining market it doesn't cover. By February, the HPC2614A DeskJet Portable Printer should be available in Europe. It will cost approximately £425 (without the optional sheet feeder and battery) and offer 300dpi printing in a 2kg package.

The DPP is a repackaged DeskJet 500 and can print up to 100 pages on a standard camcorder battery charge. It has four portrait and two landscape fonts built in, and prints up to two pages per minute in letter quality mode or three pages per minute in draft mode.

Hewlett Packard (0344) 369369

David Brake



☐ DOS Programs - Icon View



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DOS



Quattro Pro

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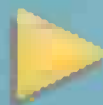
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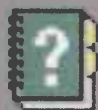
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OS/2 System



Master Help
Index

OS/2

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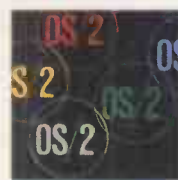
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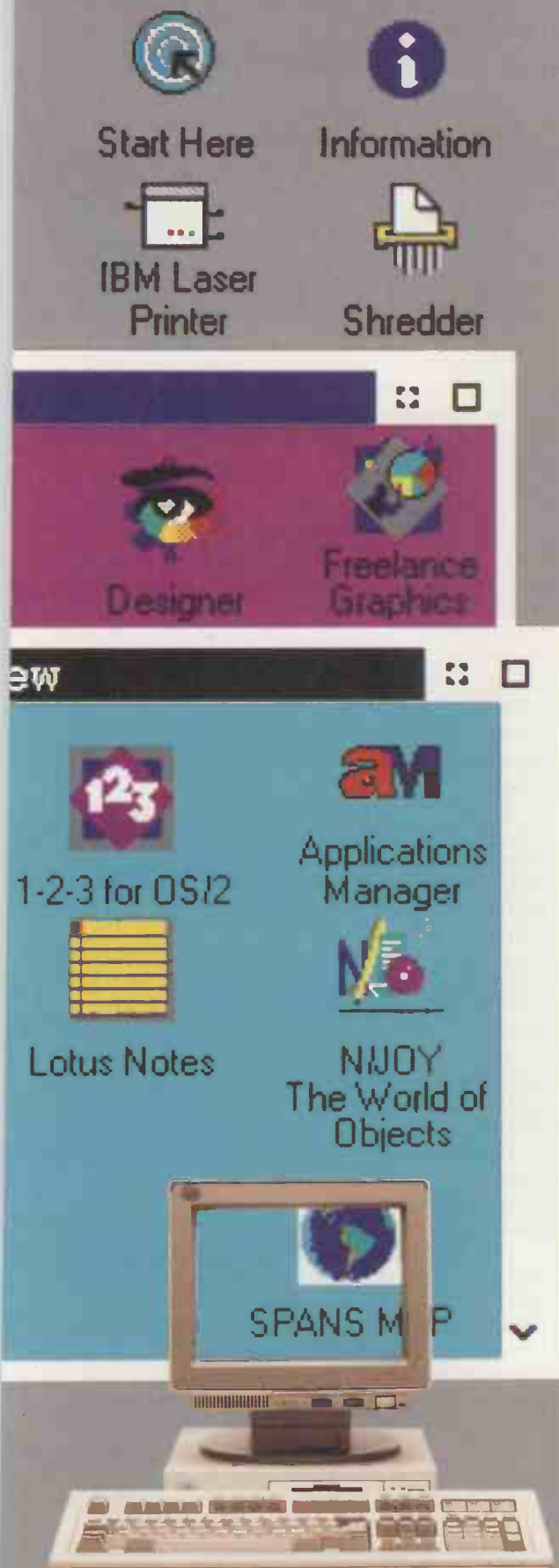
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IBM

Novell takes its Wares to the WAN market as Microsoft skirmish warms up

Novell is whipping up interest for its tardy NetWare 4.0 by releasing taster information on the product. The company has also announced that NetWare will ship on non-Intel platforms, beginning with Hewlett Packard's PA-RISC chip, and has released details of the System Fault Tolerance III v3.11 product for servers.

In the midst of a row with Microsoft over the use of Novell technology within Windows for Workgroups, and the public humiliation surrounding security problems with NetWare, the company has put a positive face on things by outlining features for 4.0 which include a virtual memory facility and an asymmetrical processing version.

The company is still smarting after having to delay the product until the second quarter of 1993. It has tried to sweeten the blow for end users by extending its premium promotion arrangements, under which existing users of 3.11 would receive a free copy of 4.0 when it was released. Unfortunately, the scheme will probably have run out by the time you read this.

One of NetWare 4.0's main features will be the NetWare Directory

Services (NDS). This will be complemented by its Wide Area Networking (WAN) capabilities, GUI utilities, increased native language support and enhanced security.

The Directory Services feature is a database which retains information about all network resources. It is accessed by all users as a single, physical location, eliminating the need to look for resources on a network. This ties in with the company's strategy to angle NetWare 4.0 more towards the WAN market. A new network-wide log-in and background authorisation process has also been added.

The database organises resources within a hierarchical structure, replacing the bindery that was the database structure for previous versions of NetWare. The NDS increases the reliability of the network because the database is stored over a whole network of servers rather than the single one catered for by the bindery, so there is less chance of it being lost in the event of a hardware failure.

A short time after the release of NetWare 4.0, we can expect the latest version of the System Fault Tolerant product from Novell, a version

of NetWare designed for system-critical applications where downtime on a network is a disaster. Unlike its predecessors, SFT I and II, this latest product is designed to mirror server hard disks; data will be duplicated, so if you lose the data on one disk you can recover it from the other. The product is already in 'controlled circulation', halfway between beta and commercial release.

Meanwhile, the company is touting a pre-Alpha version of the PA-RISC version of NetWare. A NetWare Operation has been set up to develop related tools and utilities for the product, but distributors derided the move as uneconomical.

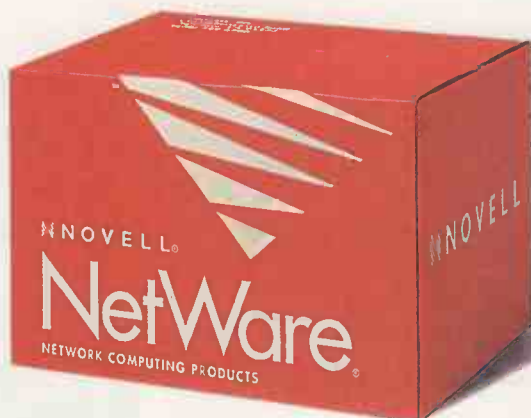
Paul Sherry, Divisional Director of Power for Novell distributor Frontline, was critical of the deal. 'It's interesting,' he said. 'It's not exactly an unreasonable move, because I know that HP and Novell have been very close and have had OEM agreements for a long time. HP's only options for a deal like this are Unix, NT or NetWare, but I can't see why Novell would bother. The bottleneck of the network isn't normally the processor, so there's little to gain technically from moving to a more powerful chip.'

Others agreed that the PA-RISC market is too small to be profitable, but Novell's strategy seems to be to use PA-RISC as a springboard into other architectures which will eventually make NetWare a hardware-independent operating system. Sources suggest that Novell's next platforms for NetWare after PA-RISC will include the RS/6000, the SPARC architecture, MIPS and the PowerPC platform, being readied by IBM and Apple.

Aimed at the WAN market, the latest release of NetWare will be less appropriate for large sections of users, according to one distributor. The very release of the product implies an aggressive attack on other operating system manufacturers, particularly Banyan, which sells large quantities of its Vines product into the WAN market.

Banyan's European Product Marketing Manager, Mick Delaney, didn't seem bothered. 'We view NetWare as a good thing because Novell's marketing will make more people aware of the need for enterprise networks,' he said. 'We have eight years of proven experience in this type of network, and the maturity of our product against Novell's new entry into this market means this development doesn't worry us too much.' Instead of NetWare 4.0, Delaney suggests Banyan's ENS for NetWare product, which introduces WAN facilities into existing NetWare 3.11 installations.

Novell Technical Marketing Manager, Graeme Allen, dismissed this out of hand. 'It's not an attack on Banyan because there's noth-



ing to attack,' he said. 'We've already taken the battle to the heart of Banyan territory and blown it apart.'

Banyan isn't the only company to be rowing with Novell at the moment. Novell is threatening to drag Microsoft into court over the use of Novell code in Windows for Workgroups. According to Novell, it licensed its client technology to Microsoft on the understanding that the company would bundle it with versions of Windows 3.x, which it did. Microsoft went one step further by telling OEMs that it would bundle the technology with Windows for Workgroups, a direct competitor to Novell's own peer-to-peer package, NetWare Lite. Microsoft is arguing that Windows for Workgroups is an extension of 3.x, and should therefore be included in the deal.

Apparently, Microsoft wants to resolve the issue out of court but Novell people in the UK are not commenting on the matter. They say the matter is *sub judice*, which suggests the company has already set the legal wheels in motion. In fact, the war between Microsoft and Novell seems to be hotting up on all sides: while Microsoft readies NT as a direct competitor to NetWare, Novell is preparing itself for the battle with a leaflet, provisionally entitled 'Selling against NT', which it is issuing to its sales force.

On a more technical level, Novell has finally admitted publicly the existence of security loopholes within NetWare 3.11, which were discovered after hackers managed to infiltrate the system at a seminar in the US.

The company has issued two fixes for NetWare to help counter the problem. The 'Phase One' fix sees protocol information encrypted to stop hackers intercepting and interpreting packets on the wire. The higher level second phase encrypts data moving across the wire. While the first phase should have

shipped well before this issue, the second is scheduled to appear early in 1993. Novell says the first fix probably won't cost anything, but the second one might. 'It's not just a fix,' said Allen. 'They're more than fixes. Yes, they address the initial problem but they're also significant enhancements.'

Novell seems to have turned around a rising tide of bad public relations and made itself look shiny again. The plans to port the operating system to other platforms are sure to increase the company's already gargantuan market share, while the latest release of NetWare will help it attack markets in which it already claims to be strong. On the negative side, the battle with Microsoft will continue as the two companies endeavour to carry out their monopolistic fantasies, attempting to corner the relatively new peer-to-peer market and gearing up for the war in the high-end networking arena. One thing is sure certain: Microsoft cannot afford to lose its compatibility with Novell, because Novell's installed user base is too large. When NT comes out, the sparks will really fly.

- Microsoft has announced version 2.2 of LAN Manager. Expected to ship at the end of the year, it includes new Windows network administration, a Windows Network Application Server which enables users to run applications from the network with no knowledge of network use, and a Print Station program which will let you use any DOS or Windows workstation as a print server. The company has changed the pricing and packaging of the product so that prices are for servers only, with workstation licences available separately. The price for a single LAN Manager 2.2 server is £1595 with one client licence.

Novell (0344) 860400

Microsoft (0734) 270000

Banyan (0293) 612284

Danny Bradbury

Samsung announces low cost laser printers

Samsung has launched a pair of low-priced, eight page per minute laser printers with powerful RISC processors: the SL-1082A and the 1082P.

The 1082A, which retails for £880, has five resident emulations including the HP LaserJet III, the Epson FX-850, the HPGL/2 plotter language and the IBM Proprinter XL/24E. Using a 10MHz Intel 960 printer chip, it ships with 1Mb RAM as standard but can be upgraded to 4Mb.

Its bigger brother, selling for £1193, also operates at 8ppm but contains a 16MHz Intel chip and is PostScript compatible. It includes 2Mb RAM as standard but can be boosted to 8Mb using standard SIMMs.

Samsung 081-391 0168
Danny Bradbury

Central Point releases free virus finder

Central Point Software has released a free, virus finding package into the public domain, and has upgraded its high-end package to include more features and connectivity facilities.

The product, Central Point Virus Scan-Only Software (CPV-SOS), detects roughly 1300 viruses. When it finds an infected file, the program leaves it to the user to delete the file or buy a full-blown version of Central Point Software Anti-Virus for DOS, which will disinfect the file and protect it in future scans.

The latest upgrade to the package, 1.4, can schedule virus scans. There is also a centralised installation feature, and the ability to update the desktop from a NetWare Server. The product now also supports Central Point's CentralTalk and CentralAlert technologies. The former allows communication of virus information across a NetWare 3.11-based enterprise, while the latter allows CentralTalk to notify network administrators of virus activity

via pagers and email, either locally or remotely.

According to Central Point, the package will recognise most kinds of viruses, including polymorphic (self-modifying) or stealth (self-concealing) strains. It costs £115, current users can upgrade for £19+VAT. Users wanting the free, scan-only package can download it from the Central Point Bulletin Board on 081-569 3324, or by typing 'GO Central' on Compuserve to get through to the CPS forum.

Central Point Software
081-848 1414

Danny Bradbury

WordPerfect buys Beagle

Last month we reviewed the Macintosh integrated package BeagleWorks. It has competitive features but its chief weakness was it came from an unknown company and was expensive.

Now, it has been bought by WordPerfect to expand its Macintosh line, moving BeagleWorks in a single bound from no profile to high profile. The new version, WordPerfect Works, will be based on an incremental upgrade (version 1.2) and should be available early next year. It should be cheaper than the old £219, and it will be supported by WordPerfect's technical support hotline — er... helpline. WordPerfect (0932) 850500

David Brake

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ELONEX

**P E R S O N A L
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Threat of US punitive tariffs sends RAM prices soaring

The US Department of Commerce has made the preliminary determination that Korean microchip manufacturers have been 'dumping' (selling chips below cost price) on the US market. The last such hiccup in the computer industry occurred in 1988, when the US Government punished Japanese chip suppliers for doing the same thing. It created a temporary RAM shortage, inflated prices, hurt American computer manufacturers and, amusingly enough, provided the Japanese manufacturers with windfall profits.

You might think the US Government would have learned something from this episode, but apparently not. The threat of a punitive tariff being slapped on Korean exports has helped the prices of RAM chips and some microprocessors to soar.

In October, several Korean manufacturers

including Goldstar, Hyundai and Samsung were ordered to post bonds based on preliminary estimates of their 'crimes'. The size of the bonds varies: Samsung has to pay an 87% bond and Goldstar 52%, while Hyundai pays just 6% and other Korean manufacturers pay an average of 62%. Should they by some chance be found innocent, they will of course get this money back. But it would probably not be wise for them to work on the assumption that this will happen.

The Americans will not be the only ones to suffer from higher prices. In September, the EC added a 10% duty on DRAM from Goldstar, Hyundai and Samsung. At the same time, the global chip market operates in dollars; America's actions will simply make our PCs more expensive too. This price increase will add to others that are already coming through due to the decline of sterling after its removal from the Exchange Rate Mechanism.

But it's not only chips that are affected: most of the parts of a PC, whatever

their point of origin, are priced in US dollars. The £10 note today buys fewer dollars than it did six months ago, which is bound to make PCs more expensive. Fewer will be sold and the computer industry recession will become worse as a result.

Ultimately, PCs will continue to get cheaper. This process is driven not by political or financial happenstance but by the semiconductor industry. There are two basic principles. First, chip prices are driven by production volumes: the more you make, the cheaper they are. (The industry joke is that all chips should cost \$5, except the ones that should cost less than \$5.) Second, the number of transistors on a chip doubles every year or so; this casual observation, made in 1964 by Intel's co-founder, Gordon Moore, became popularly known as Moore's Law.

I remember counting the chips on my first IBM CGA colour graphics adapter, and I think there were about 83 of them, just enough to produce a display considered naff even by Sinclair Spectrum owners. These days you expect a single chip to deliver more and better graphics modes than you can shake a stick at. Within a couple of years, an entire DOS compatible PC will fit easily on a single chip. The chip will be so cheap that it will be possible to build it into TV sets, video recorders, toasters and other gadgets. In the meantime, the price of PCs is going to rise.

The last time the US Government induced a RAM shortage there were several incidental effects. Apple bought lots of RAM chips at high prices to ensure that it could maintain the supply of Macs. When prices fell, these chips were still part of its inventory. Apple had to write off the cost, which led to a fall in profits, and Apple's shares were savaged on Wall Street.

Another firm hurt by the 1988 shortage was Alan Sugar's Amstrad, which then had a significant share of the British PC market. In order to protect his chip supply, Sugar bought 9% of Micron Technology, one of America's few RAM manufacturers. This turned out to be, in Sugar's words, 'a lousy deal', and Amstrad eventually disposed of its investment at a hefty loss of about £12 million.

Of course, it's an ill wind that blows nobody any good. Some American firms could benefit from higher chip prices, especially the ones that make their own chips. IBM, for example, does not divulge figures but is thought to be a large chip manufacturer. If world chip prices rise while IBM's costs stay the same, this could give Big Blue a little relief from the depredations of the cloners.

Jack Schofield

Hercules aims video card at the low end

Hercules, one of the first manufacturers of PC upgrade video cards, has recently concentrated on the high end, making video boards primarily aimed at CAD and other power users. Now it has returned to its roots and launched Graphite, aimed at mainstream Windows users looking to drive larger screens with more colours. It will cost £299 for an AT-bus card based on a new IIT chipset and (according to Hercules) will run twice as fast as a current generation S3 card. The IIT chips, the AGX-014 and 015, are among the first from third parties to be based on IBM's XGA architecture. The Graphite provides a range of display resolutions from 640 x 480 with 24-bit colour, to 1152 x 900 with 16 colours. Hercules is keen to emphasise that at 1024 x 768 resolution (with 256 colours) it has an 80Hz refresh rate, which gives flicker-free display.

Limited numbers are available now, with volume shipment by early next year. By late January, a VESA-compatible local bus version is expected, which will deliver further performance increases when used with a suitable PC, and possibly allow an even larger range of resolutions.

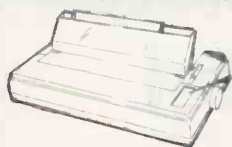
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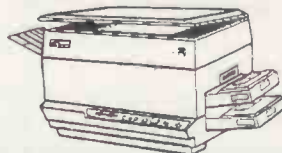
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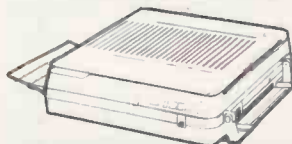
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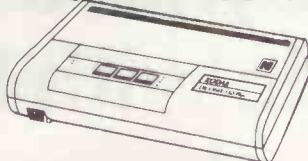
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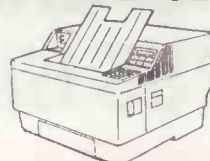


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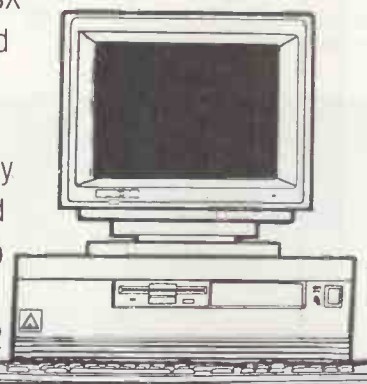
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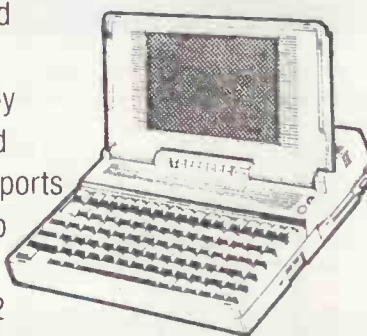


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Complete word processor; 256K CPU, 14"
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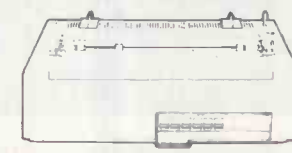
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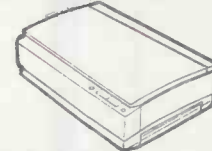
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Draft, LQ & enhanced modes, 132 col,
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20Mb, 286 NOTEBOOK
12MHz, 1Mb RAM, VGA LCD display,
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RRP £2500. 40Mb £499 **£399**

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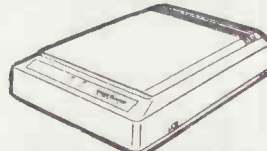
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AMD and Cyrix retaliate in 486 battle with Intel

Thanks to aggressive 486 pricing and promotion by Intel, the 386 market is slowly dying. This tactic was meant to squeeze out Intel's rivals, but they are fighting back.

AMD, which has not yet produced a 486, may be about to do so. It is awaiting a ruling from an Intel suit: if the judge rules in the company's favour and permits it to use Intel's own microcode, AMD will be ready to ship its first 486s before the end of 1993. If the judge

486. It has revealed details of a clock-doubled 50MHz 486-compatible processor which can fit in a socket meant for a 486SX and should ship in volume in the first quarter of 1993. It isn't really comparable to the 50MHz i486DX2: it doesn't have a maths co-processor on the chip (although Cyrix does make a range of Intel-compatible co-processors it would work with) and it has a 2K cache instead of the 8K available on Intel 486s. Cyrix says that despite its smaller size, the cache is superior because it is a write-back one (Cyrix codenames the architecture FasCache).

It is also cheaper than an Intel DX2-50. According to Cyrix, in 1000 unit volumes it will cost \$249, while the i486DX2-50 costs \$487. The Intel 486SX/33 costs \$189, but is expected to be somewhat slower.

Towards the middle of next year, Cyrix plans a second chip, codenamed the M7, which will be closer to a DX2 and offer a higher clock speed, larger cache, 486DX-pin compatibility and a maths co-processor on board. Meanwhile, it has launched the 486SLC/e, an enhancement to an existing chip aimed at the laptop market, with an extensive range of features and lower power consumption.

The Cx 486SLC/e is akin to a 386SX in that it fits into 16-bit motherboards, but it has a full set of 486 instructions. Available at 25 or 33MHz clock speeds, it has 3.3v as well as 5v versions and now supports its own System Management Mode, similar to the one built into the 386SL but faster.

It is hard to say how machines based on these processors will compare with those using Intel's until a variety of other manufacturers hit the market, but continuing credible competition can only be healthy in encouraging innovation and driving down prices.

• Texas Instruments has just launched a notebook based on its own version of the older 25MHz Cx386SLC (which lacks System Management functions). The 'entry level' WinSLC costs £1795 for a notebook with Windows 3.1 installed, 2Mb RAM and a 60Mb hard disk. It's an odd configuration since 2Mb is really insufficient to run Windows, but the next machine in the range, based on an Intel 16MHz 486SX with 4Mb of RAM and an 80Mb hard disk, costs just £200 more.

It seems that the SLC is being jammed by TI into a low-end position where it doesn't really fit.

Intel (0793) 696000

Cyrix (0793) 417777

AMD (0483) 740440

Texas Instruments 081-875 0099

David Brake



▲ TI's new TravelMate WinSLC is the first notebook to use the new TI486SLC processor

rules in Intel's favour it will delay AMD further, but even then the company expects to start shipping a processor based on reverse engineered microcode by the middle of 1993. Either way, AMD already has plans to release a Pentium-compatible chip by the end of 1994.

Cyrix, which has already written its own microcode, may beat AMD to the punch with a

Compression with security from Stac

Stacker 3.0, the latest version of Stac's data compression software, has just been announced. Owners of faster machines can fine-tune the compression ratio, sacrificing speed and memory consumption to gain up to 10% more disk space.

A Stacker Anywhere utility allows compressed files stored on floppy disks (or any removable media) to be read and written to by other PCs without Stacker installed.

A natural extension of Stacker's disk compression is data security: users can now password-protect their drives once compressed, giving either read only, or read and write access to data. Version 3.0 adds a Windows utility (the Stackometer) which graphically shows disk capacity, amount of compression and fragmentation levels.

There is a variety of improvements to ease of use; the one to appeal most to those of us wary of disk compression software is Un-Stack, which, we are promised, returns the system to its original state.

Stacker 3.0 costs £99 (existing users upgrade for £29.95) from Stac UK on (0734) 776484.

David Brake

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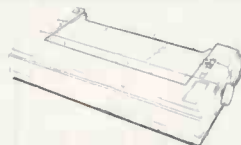
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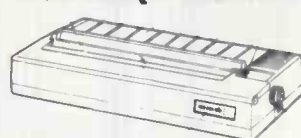
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20MHZ 386DX



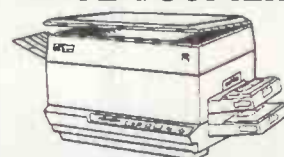
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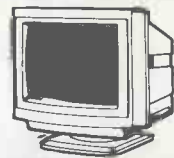
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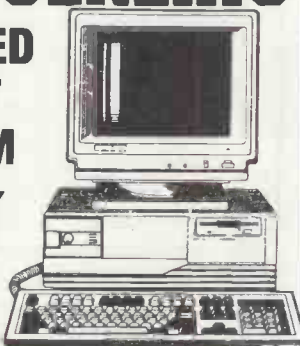
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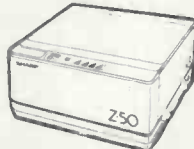
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MG 80Mb 386DX-33 80Mb (18ms) drive, 2Mb
RAM, 33MHz clock speed, 3 1/2" 1.44Mb floppy, parallel &
RS232 interface, 256K VGA output, keyboard and DOS.

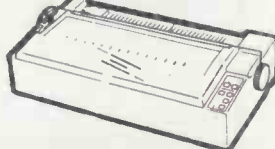
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EO communicates with the Hobbit

We now have the specifications for EO's pen-based Personal Communicators which we mentioned last month. The devices will use AT&T's Hobbit low-power RISC chip and GO's PenPoint pen operating system. What makes it different from pen-based systems already available is its broader target market and its emphasis on communications, aided greatly by the close involvement of AT&T.



The smaller of the two devices, the 440, measures 274mm x 18mm x 23mm and weighs a kilogram; the larger 880 measures 330mm x 229mm x 28mm and weighs 1.8kg. Both are more like small notebooks than palmtops. The smaller one is available without a modem if required (though not having a modem would be pretty silly for a communicator); otherwise, they come with a high-speed V32bis modem and fax built in. In the US, a version is available with a built-in cellphone, while in the UK and Europe you will be able to dock

your 440 or 880 with an Oki cellphone. When they are plugged into the phone system, you can use them to check your email, send or receive a fax or even dial the phone. Although it contains a speaker and microphone for voice annotation of documents, you won't be able to

use it as a speaker phone because of regulatory problems.

EO says the 20MHz 92010 Hobbit processor in the 440 has equivalent power to the 386SL running at 20MHz, while the 30MHz 92010 in the 880 delivers the same performance as a 486SX. Battery life for the 440 can be up to seven hours of continuous use with an extended-life battery pack. Without one, the 440 and 880 both should last for up to four hours (less with a hard disk).

The 880 will have a 64Mb hard drive option and the 440 can use a 20Mb unit (the first use of Hewlett Packard's 1.3in KittyHawk, in fact). Both come with 12Mb ROM and 4Mb or 8Mb RAM in the 440 and 880 respectively, expandable to 12Mb. The applications in ROM include GO's MiniNote notepad, GO Mail and Fax, Sitka PenTOP for communication with desktop computers through its serial port, and Pensoft Perspective, a personal organiser which is also a kind of database.

Network cards and other peripherals can be added using a PCMCIA Type II card slot (the 880 has two), and the computers feature a parallel port for printers or an external floppy drive and a PS/2 keyboard port. The 880 also features a SCSI port and a VGA port.

In the US, both machines should be available in volume by April, while we will probably have to wait until June. Initial shipments will go to large companies directly through EO, however, and broad distribution is not likely here until the end of 1993. Prices in the US will range from \$1999 (for a 440 without a modem) to \$3299, depending upon specification. Within six months, EO expects other companies, including some from Japan, to enter the market with the same basic technology. It is also looking for a European partner to help it market the machines over here and deal with European telecommunications standards like DECT and GSM.

Having looked at a prototype, my gut feeling is that it is too large, bulky and expensive to take off immediately, although EO expects to sell something like a million of them by 1994. The Personal Communicator is interesting not so much in itself but because it is the first device of a new breed. Watch this space.

- Market giant Toshiba has thrown its hat into the pen computer ring at last, in the US at least. It has launched the Dynapad, a 3.3lb, backlit tablet which uses an AMD 386SXLV processor. It has two PCMCIA slots, 4Mb RAM expandable to 20Mb, and a 40Mb hard disk which should run for two or three hours on a single battery. It is aimed just at vertical markets at present and will be sold through value added resellers for \$3499. There are no plans at the moment to sell it in the UK.

EO (0223) 843131

David Brake

No Robot Results Yet

We had hoped to announce the results of the PC Robots competition in this month's *PCW*, but then we expected around 50 entries. We felt this would be a likely number since each entrant was expected to put in a considerable amount of programming effort.

Fifty robots would have allowed us to organise the league and run the competition in a couple of days. We received over 230. The object codes ranged in size from under 4K to almost 40K, and the raw processing to play all the games will take over a month on a 33MHz 486. We hope to cut the time down by using five machines but hope you will bear with us while we run the competition.

The author of PC Robots, Paul Smith, has been very helpful in smoothing the judging process and has responded to the heightened interest in his program by agreeing to continue the competition, albeit without prizes, for anyone who is keen to exchange robots. Anyone who wants to contact him should write to:

Paul Smith
14 Camden Terrace
Bristol
BS8 4PU

Please bear in mind that this is a spare-time activity and not a business. Paul has asked that anyone writing to him sends an SAE if they expect a reply. If you send him a blank disk and a suitably stamped envelope he'll send you the latest version, and some sample robot executables to practise against.

In the meantime, we would like to thank you for your entries and your patience.



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PCW0193

Microsoft finally gains Access to Windows database market

▼ DataEase Express for Windows is being targeted at SuperBase and Approach

Microsoft may be coming late to the Windows database market, but it is making up for lost time with an aggressive launch for Access [benchmark, page 284, this issue]. Not only is it arriving at least two months ahead of Paradox

for Windows, but Microsoft will be selling sample copies of the £495 product for just £99 until the end of January. The offer is valid for one copy per person only, and to qualify you must attend a Microsoft seminar.

In the DataEase camp, DataEase Express for Windows is shipping for £385. The product presently consists of just a database engine and a Windows form design front end. The DataEase Query Language (DQL), which will boost it into the development market, is about three months away.

DataEase Express for Windows is being targeted at the likes of SuperBase and Approach, which are angled towards the low-end business user. The product uses a visual object-oriented technology for database design, and includes WYSIWYG and graphics support. Reports can be printed directly from the screen, and users can define subforms to show data from related tables. It supports connections to SQL Server, OS/2's Database Manager, Novell's SQL and Microsoft's Open Database Connectivity Standard on the server side. It also supports dBase, Oracle and Paradox.

dBase for Windows is even further away, as it has turned out to be a rewrite from the ground up. It is alpha testing now and will be beta testing in the first quarter of 1993, for release later that year. ODAPI drivers for Oracle, SyBase, InterBase and DB II will arrive in mid-1993 for use with either database. Anyone interested in updated OS/2, Unix, NT or Macintosh versions of dBase or Paradox will have to wait even longer. Borland is devoting all its energies to getting the Windows products out the door, and will only start on other platforms when they are finished.

Borland is positioning dBase for writing multi-user custom applications, while Paradox is for interactive multi-user environments. Neither is aimed at the individual user or first time database customer, although Borland does not intend to give up on these users, targeting them with ObjectVision and other, unspecified future products.

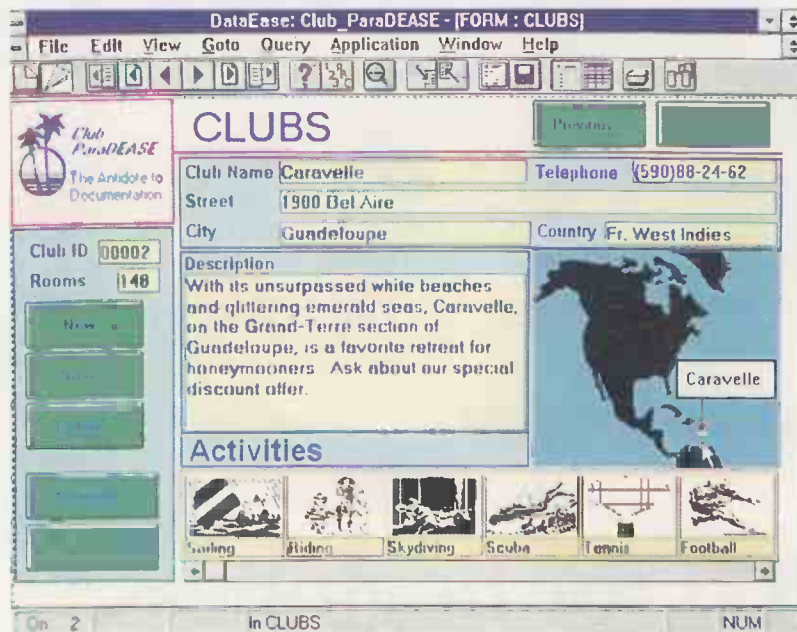
Access had not yet been released to the public at the time of writing, but Paradox has already met with a number of criticisms. Probably the most scathing claim is that Microsoft was able to launch before Borland because it used Visual Basic as the basis of its programming language (which was not tailored for database use) and tacked on existing database technologies. At least, unlike the initial version of DataEase for Windows, it has one.

Borland (0734) 320022

Microsoft (0734) 270000

DataEase 081-554 0582

David Brake & Danny Bradbury



Claris strengthens its cross-platform credentials

Claris, Apple's software subsidiary and the largest Macintosh developer behind Microsoft, has strengthened its cross-platform credentials. FileMaker Pro for Windows has now shipped, and ClarisWorks should follow in February. Claris' integrated software is the top-selling Macintosh package at the moment. According to Romtec figures, this makes it the only Mac package in the personal computer software top 20.

ClarisWorks includes a database, spreadsheet, word processor, draw module and a rudimentary comms package. All modules are cut-down versions of existing Claris products but work together using a frame metaphor. You can create a word processing document, then draw a spreadsheet on the page. When you click on a cell in the spreadsheet, you get spreadsheet menus and tools. An enhanced Macintosh version is expected in January, which could include up to two more modules.

The present version costs £195, but a price for the Windows version has not been set and it may differ from its Macintosh cousin: the comms module will probably be dropped, for example, since Windows itself includes one.

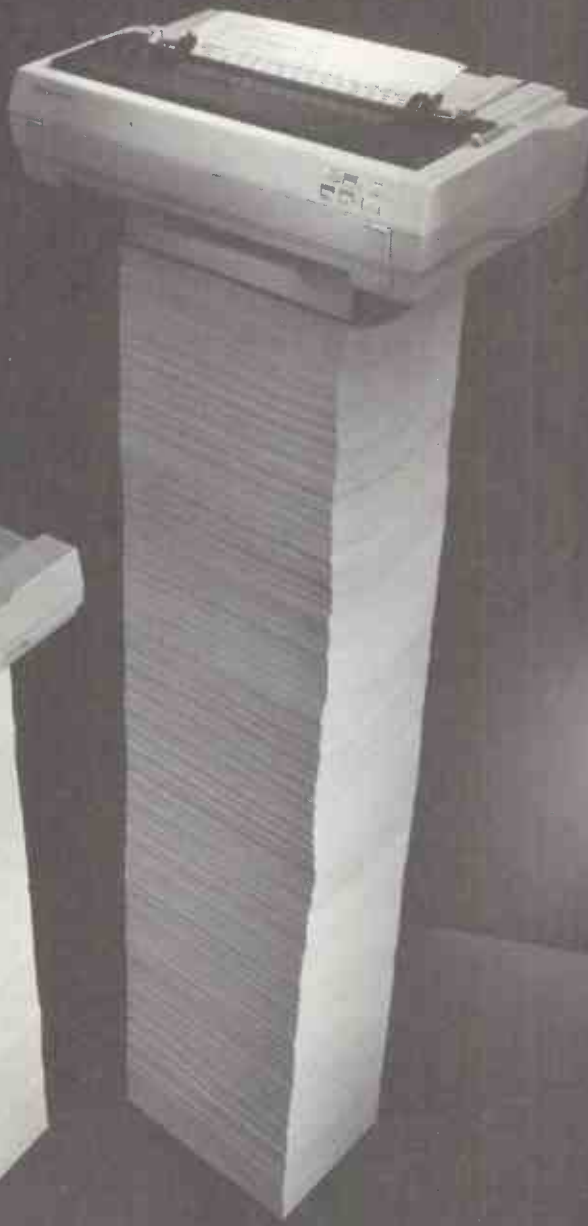
• Claris will also begin its Clear Choice program in the new year. The idea is to take low-cost products for the Mac and for Windows, then put the weight of Claris' marketing behind them in exchange for a share of the revenue.

Claris 081-756 0101

David Brake

Britain's favourite printer is now 30% faster.

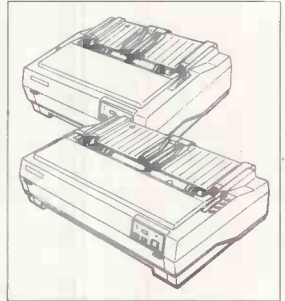
THE NEW EPSON FX-1170



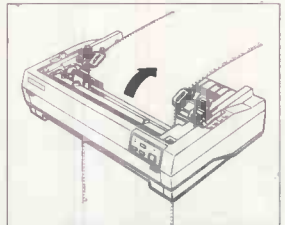
THE EPSON FX-1050



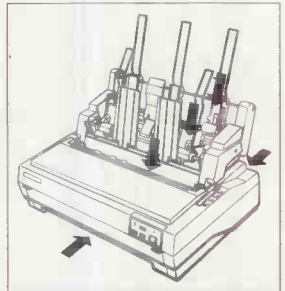
The new Epson FX dot matrix printers boast a 30% increase in speed, meaning they print at an impressive 380 characters per second, beating all the serious competition. The FX-870 and FX-1170 (respectively the narrow and wide carriage versions) are the successors to the de facto industry standard FX-850 and FX-1050. And they don't just live up to their fore-runners' high standards but improve on them. Best of all, they're selling at the same price as the printers they replace.



The narrow carriage FX-870 and wide-carriage FX-1170.



The new FXs have four paper paths including a straight paper path ideal for multi-part stationery.



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All of the above improvements make the new FXs very easy to use. And with the 30% increase in speed your paperwork need never pile up again. To find out more call Epson on 0800 220546 or contact your local Epson dealer.

EPSON

Sega/Accolade spat has wider implications

The US courts have made another decision with major implications for British computer users. The case concerns Japanese console and game cartridge manufacturer Sega, and Accolade, a New York software house. It lets Accolade market games that run on Sega's Genesis (sold in the UK as the MegaDrive).

Like arch-rival Nintendo, Sega tries to control the production of games for its machines. Inserting a cartridge in Genesis brings up the message 'Produced by or under licence from Sega Enterprises Ltd'. Accolade reverse-engineered the system to make its cartridges run on the Genesis, and Sega took legal action for breach of copyright.

A US Federal court found for Sega and stopped Accolade marketing unlicensed cartridges for the Genesis. This has now been overturned, a higher court finding Sega's actions 'clearly unlawful' under the Lanham Act — a finding against which Sega is appealing.

It appears Sega has three arguments, which I believe Nintendo shares. First, the licensing system restricts the supply of cartridges in a

beneficial way: firms put a lot of effort into producing better games, and the market is not flooded with rubbish. Second, the developer of a console is entitled to profit from its exploitation under intellectual property rights. Third, the licensing system helps combat the threat of international piracy.

The converse argument is that given a free country that believes in free markets, both suppliers and consumers should be given freedom of choice. Software houses should be able to offer programs for any machine in public use, and consumers should be able to vote for their preferences in the time-honoured way: paying for the stuff they like. Decompilation and reverse engineering must be allowed, not for copying but for interoperability (making programs run correctly).

Of course, this is more than a spat between a console manufacturer and a software house. It goes right to the heart of the computer industry. Suppose Microsoft wouldn't allow any other firm to market programs for Windows, or if IBM stomped on people writing for OS/2?

Thus, the Sega/Accolade case has involved several industry organisations, including the Computer Business Equipment Manufacturer's Association (CBEMA) and the American Committee for Interoperable Systems (ACIS). CBEMA was on Sega's side, and Sega said that Apple, DEC, Intel, IBM, Lotus and WordPerfect were among the firms that filed *amicus curiae* (friend of the court) briefs in its support. ACIS was on Accolade's side, and ACIS members include Amdahl, Bull, NCR, Sun Microsystems and Amstys.

In my simplistic way, I see the ACIS members as being the guys in white hats, the true believers in open systems, and the other mob as nasty, anti-competitive, proprietary suppliers. But frankly I don't care about the rights and wrongs of specific cases: if the law prevents companies from reverse engineering products and thus restricts their ability to provide interoperable systems, the law should be changed.

At bottom the battle is about hardware and software, so it's a shame it is being fought over a games console, because the console tradition is different to the computer world's. Think back to the Atari VCS, once the world's best-selling games machine, and you will recall that the hardware was relatively cheap but the games were expensive and far more profitable. When it comes to PCs and Unix-based 'open systems', however, the consumer benefits from an open market where, ideally, any software runs on any box and interoperates with any other software on the same or different boxes. If control is wrested back by proprietary suppliers, I suspect consumers will pay the price. And it is likely to be a very high price indeed.

Jack Schofield

Sugar tries to bolster profits by buying back Amstrad

Alan Sugar, Managing Director of Amstrad, is trying to buy back all his shares at 30p and take the company private. He issued a letter to all his shareholders in November, admitting that the company was now a 'me too' competitor and no longer a leader in product development.

'Attempting to replicate the past success of Amstrad by gambling on product ideas and building up large stocks in the hope of achieving "blockbuster" sales would be putting shareholders' funds at risk,' said Sugar, citing the success of Amstrad's PCW computer range in the mid-eighties and satellite products in the last few years.

The company pledged to keep all its employees if the proposal for the share buyout is approved by shareholders. But the company will be streamlining its business by concentrating on 'acceptably profitable' product areas and 'examining its operating structure in certain overseas markets', an indication that it may strip out unprofitable international sales operations. In his letter to shareholders, Sugar says the overseas subsidiaries were acquired 'without a coherent international strategy, bringing with them burdensome operating overheads'.

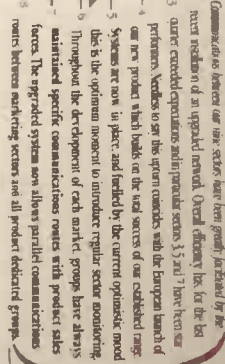
Amstrad leapt to success as a computer supplier in the last decade and Sugar was widely acclaimed as the man who brought the PC to the mass market. When the PC market began to flatten, he launched into the satellite market, which reaped high sales. Profit was dragged down again, however, by high inventories of PCs which had to be sold off at a loss.

Now Sugar is facing an uncertain future. He admits that he has no detailed plans for the company yet, and cannot offer any meaningful forecast of profit or loss in the context of the proposal to shareholders. But one thing seems certain: this eagle of the Thatcherite British market has had its wings well and truly clipped. Amstrad (0277) 228888

Danny Bradbury

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Motorola decides future of 680x0

Apple revamps peripherals

Apple's launch plans for early 1993 are already all over the trade press. US sources indicate that at MacWorld Expo (in January) it intends to revamp its range of peripherals. It is expected to bring out an inkjet-based replacement for its inexpensive StyleWriter, a 600dpi high-end network printer which uses the same engine as the HP LaserJet 4, plus two long-awaited colour products: a 24-bit colour scanner and a bubblejet-based colour printer based on the Canon BJC-820's engine.

A cheaper Personal LaserWriter is expected a month later, along with several new Macs. Not only should there be several new 68040-based Macs and a colour Classic II (as mentioned last month), but a faster LC II is due as well, which promises to go a long way towards closing the Mac/PC performance gap at the low end.

The improved model will run at 25MHz instead of the 16MHz of its predecessor, and will have space on the motherboard for a maths co-processor. Most importantly, it will have a full 32-bit processor bus, which should provide substantially improved performance.

Apple UK 081-569 1199

David Brake

I recently had a rather dispiriting chat with Jack W Browne Jr, who represents Motorola's 680x0 range. He thinks the desktop PC market will level off in the next few years, growing only 3 to 4% a year, so his part of Motorola will concentrate on selling 680x0 processors for putting into printers, telephones and cars.

This may be sound reasoning for Motorola but it could be bad news for computer manufacturers (notably Apple) which use the 680x0 family in their machines. That is because computer manufacturers tend to emphasise processor performance, while embedded systems manufacturers are more concerned with lowering component prices.

As a result, Motorola will continue to fall behind Intel in the speed of its fastest processors. There will not be a 68050. Browne says the public was not interested in an incremental upgrade, it wanted a significant performance boost, so Motorola has concentrated on designing a 68060 instead. This chip will run at 50 and 66MHz, giving overall chip performance three times that of a 25MHz 68040. Although comparisons between undelivered processors with different architectures are hard, this seems to make the 68060 roughly equivalent to Intel's Pentium.

Unfortunately, the 68060 is not scheduled to emerge until the first half of 1994, by which time the Pentium should be more than a year old — Intel claims that a Q1 1993 launch date is fixed in stone by now, though shipment dates have slipped before.

Apple and Motorola seem to be pinning their hopes for the high-end desktop on the PowerPC chip, which will emerge around the same time, if not earlier. It may be very fast on applications written for or ported to the processor, but I doubt very much it will supply top-of-the-line performance when it is simply running existing Mac software through emulation.

There is some good news. Remember all that fuss about clock-doubling? It turns out that while Intel was spending millions marketing it, Motorola was quietly incorporating it. All 68040 processors have been using the technique since the chip was launched, according to Browne. Portable Macintosh owners also have something to look forward to: the 68040V. It should arrive by late 1993 and give Quadra performance (but with full 3.3v operation), static design (so that it can be switched off completely when not in use), and use just a fifth of the battery power.

David Brake

Toshiba launch set to trigger price cuts

Despite statements from an increasing number of manufacturers that the end of PC price cuts is nigh, Toshiba, the portables-only company, has introduced four new models and drastically dropped prices across its whole range. The four new models are two top of the range colour TFT machines, the T4400C SX/120 and the T4400C DX/200, and two larger hard disk (120Mb) versions of the existing Standard T1850 range, the T1850/120 and T1850C/120. Prices of the 19 portables already on offer have come down by as much as 30%.

The new T4400s replace the previous top dog T4400 SXC/120, and have bigger displays and smaller price tags. The new TFT (Thin Film Transistor) screens are produced by DTI (Display Technologies Inc). They have 20% more display area (9.5in diagonal instead of 8.5in) but consume no extra power. DTI is a joint venture set up in Japan by Toshiba and IBM to compete head-on with Sharp, which currently dominates the TFT colour panel market.

Suggested retail prices are £3595 for the T4400C SX/120, with a 486SX 25MHz chip and 120Mb hard disk (against £4299 for the old SXC/120), and £3995 for the T4400 DX/200 which uses a 25MHz 486DX. This new price for the SX/120 represents a significant 16% reduc-

tion over the similar but inferior SXC/120. The monochrome T1850/120 and the colour T1850C/120 (using passive matrix technology, a dowdy poor relation to the bright active matrix TFT screens) are both based around the 386SX chip. They are priced at £1495 and £1875 respectively. All the new machines come packaged with DOS 5.0, Windows 3.1 and a Logitech TrackMan mouse.

Aside from Tosh's cheapest T1800 models, all the other machines in the range have had their prices cut by 8% or more. The biggest reduction is a whopping 30% on the T4400 SXP/120 (P for gas plasma) which comes down £924 to £2175. Toshiba's four mains power portables, the T6400 series, come down in price by around 15 to 20%.

According to latest figures from Romtec and DataQuest, Toshiba takes an entire quarter of the portable market in the UK and has the largest individual share (Compaq is second). These price cuts from the undisputed market leader will undoubtedly trigger a chain reaction from other manufacturers. If you're about to buy, and you're not buying Tosh, then hang on just a little longer: it should be worth your while.

Toshiba (0932) 841600

Nick Edmunds



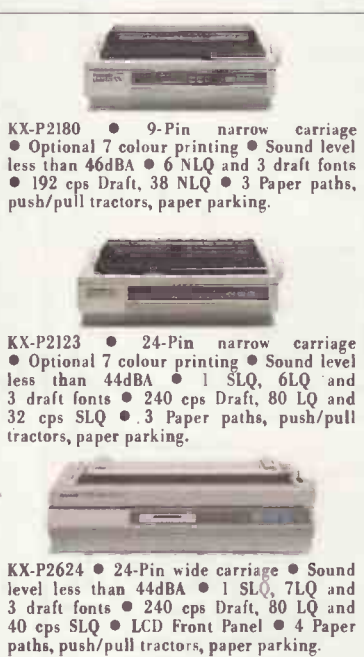
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Motorola/InFocus work on cheaper, flatter colour screen



Communicating in Cognito

Remember Cognito, the firm which promised two-way communications using pager-like devices over a nationwide network?

We reviewed the Messenger in February 1992, but in August 1992 the business was put on hold following a buy-out proposal. This has now happened: Cognito Group Limited has become Cognito Limited and the service was restarted in November, at £50 per month. This is £15 per month more than before, but, Cognito argues, heavy users previously incurred a packet charge which upped the rate. The new charge is all-in.

The service allows users to communicate with each other anywhere in the country on a two-way basis, using typed characters rather than voice. It covers around 80% of the UK population and requires Messenger hardware to communicate: each of these units costs £595. There were 1000 users when the system went off-line in August, and as marketing manager Noel Leslie tactfully points out: 'Most of those users are coming back. After all, it's a unique service; they've got nowhere else to go.'

Cognito 071-402 2272

Danny Bradbury

Over the last three years there has been a lot of work done on high resolution, flat panel displays for use with computers, televisions and consumer electronic devices.

One technology that has found a home in the portable computer market is passive matrix display. This screen is capable of only fairly good resolution and is too slow for full motion video. But the manufacturing process lets these be produced in high volume and low prices.

Flat panel screens, black and white or colour active matrix, are more expensive and difficult to make. And the yields, especially on colour, have been low. With this in mind, companies have been turning their attention towards making both key technologies work better.

The first joint venture to potentially change the future of passive matrix screens comes from Motorola and InFocus. Oregon's Infocus makes flat panel displays that fit on overhead projectors and that are used in computer-driven presentations. Motif Inc was formed last month and will be located in Portland, Oregon.

Infocus has long purchased passive matrix screens from Asian suppliers for its projection systems, but was frustrated it could not use these to project full motion video from a computer. So, its labs set to work developing a proprietary ASIC technology, Active Addressing. This can be attached to a passive matrix screen giving it the ability to speed display rates on screen. With a normal passive matrix screen, using the Infocus Active Addressing technology, that screen can run full motion video as well as a normal video monitor can.

This enhanced passive matrix screen is also sharper and the image much clearer so it can, in many ways, compete with active matrix screens. When Motorola found out about this technology, it offered the money to develop an ASIC manufacturing plant with Infocus.

At first, the screens will be 6.5in and under so they can be used on portable devices Infocus and Motorola have planned, though I expect Infocus to make a small screen projection device with its first models. Motorola reportedly intends to use it in pagers and cellular phones it has in the works. Today, Motorola's alphanumeric pagers can hold up to 20 characters on two lines, limiting the paging message. But, with a high resolution screen of, say, 5in x 4in in a coat pocket pager, you could receive an entire page of text or numbers.

The companies might put it on a PDA to act as a pager, calendar, or scheduler. They could add the extended paging feature right into a cellular phone. Extend this further and you can see this new screen on portable pocket televisions, portable digital Kodak Photo-CD readers, even pocket VCRs. The first screens from the joint venture will be out in late 1993.

Motorola and Infocus will be the first to use

the technology from the Motif venture, but will eventually license it to existing makers of passive matrix displays, providing what could be the salvation of that technology.

The other joint venture is at work on enhancing active matrix screens to display a sharper black and white image, yet be less expensive. Work is being done by Compaq and a major Asian active matrix screen maker. They have worked together for two years to develop the first VGA active matrix screen with 16 levels of grey. It will be introduced on a new Compaq, the 386SL LTE Lite/25E. This screen is a true, 640 x 480, VGA active matrix display with a whiter background than any active matrix screen on the market. Contrast this with the Apple's Powerbook 170. That has an active matrix screen, but resolution of only 640 x 400. The 170 costs over \$4000. The new Compaq, with new screen, 4Mb of RAM and 84Mb hard drive, will retail around \$3100. Breakthroughs made with the new screen keep costs down.

This box is unique in that you can upgrade the 386SL to a 486SL, as well as add Compaq's colour active matrix display if you wish. The new display, UltraView, will end up on most Compaq portables using monochrome active matrix displays. The big hurdle in active matrix screens today is lower-cost colour. While yields are up on active matrix black and white displays, they are still low on colour.

Most colour screens are handmade; automating this is difficult. As with active matrix, each pixel is lit individually. With black and white, the lighting spectrum is manageable. Add colour, and manufacturing becomes more time-consuming and harder to automate.

This is why Motif's adding faster refresh rates to passive matrix is so important. We already have manufacturing lines capable of cranking out large numbers of black and white and colour passive matrix displays. Adding the Motif ASIC is relatively easy, because it is added to the outside of the screen and does not have to be integrated into the already efficient internal manufacturing process.

This does not mean makers of active matrix colour displays will let passive matrix pass them by. They are working round the clock to perfect the manufacturing of colour active matrix displays at cheaper costs. But, it appears that we are still a good 18 months from that.

In the meantime, these new approaches to getting lower cost screens will continue to expand the demand for small, light, flat panel displays. Although Compaq's program is proprietary and it is not expected to share this technology with anyone, the fact it can do it will cause other firms to follow the lead.

With Motif eventually licensing technology to others, passive matrix could play an important role in both PCs and consumer products. If it can meet demand and get passive matrix manufacturers to use their technology to exploit this screen, these could be at the heart of an explosion in devices needing good, flat panel screens at low prices.

Tim Bajarin

Capture the future (and carry it away)

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Software links fax to networks

With the increasing popularity of peer-to-peer networks, the network fax software market has taken off. As Windows for Workgroups ships and brings GUI users formally into the

workgroup computing environment, five new packages, designed to let GUI users fax from the network, have hit the shelves.

Finansa, better known for its WinMail email software, has teamed up with fax card manufacturer Comwave to launch Mailfax. This hardware/software bundle based on WinMail enables users to send and

receive documents as either faxes or email.

The package, using Comwave's Microfax card, uses a central address book for both the email and fax modules. Taking advantage of the Windows user interface, the package can be installed on the button bars and menus of applications such as Word for Windows, Excel, Quattro Pro for Windows, Ami Pro and WordPerfect for Windows.

Working via Novell's Universal MHS standard, the software is said to be compatible with other email products such as Lotus' cc:Mail and the DaVinci product. It supports conversion of text-based documents, graphical files such as the PCX, TIFF, HPGL and AutoCAD formats, and will support PostScript conversion as an option. Other features include intelligent, automatic message filtering and a trash can facility. The product costs £1295 retail for the 10-user version, and £2995 for 50 users.

For users who would rather choose their fax cards themselves, Traffic Software has launched

Object Fax, a Windows 3.1-based product which sends PostScript, TrueType or ATM faxes.

Touted by its developer as a package for all network sizes, the software includes its own button bar which 'floats' on top of any other Windows application so it isn't limited to the most popular applications, as Mailfax is. There is an event queue for outgoing transmissions, and buttons are included for systems administrator control. It also supports DDE and OLE. Prices start from £850 for a five-user package, supporting one fax gateway. A 50-user licence costs £3000: a lot dearer than Finansa's package considering Mailfax contains all the necessary hardware.

Modem manufacturer Andest has just started shipping its own network fax software, Multifax Lite. The product, which costs £599 with a V22bis Roadrunner Quad fax modem, will offer a line for up to five users and can run either in the background on a 486 or as the sole product on a 12MHz 286. Initially a DOS-based product, there is a Windows upgrade available for £200, and the package can be bought without the fax for £299. Users can add cover pages of their own to faxes, and it has its own phone book which takes contact data from existing databases. Running in Windows, it can take any Windows application file for transmission, or import WordPerfect 5.1 files in DOS. It also contains its own text editor.

While new products are being spawned, others are being updated. Delrina has revamped its standalone Windows-based fax package, Winfax Pro. The latest version, 3.0, has fax annotation, advanced phonebook management with multiple phonebook support using dBase formats, and image processing using line smoothing and noise elimination techniques. The package has Optical Character Recognition (OCR), a cover sheet designer and support for the TWAIN scanner standard. This gives a universal communications protocol between peripherals and compatible applications.

Meanwhile, software developer Equisys has updated its Zetafax package to version 2.0. The Windows-based package, allowing sending and receiving of packages, starts at £195 and supports 16 fax cards at up to Class 2 standard. The software has been enhanced to include Windows for Workgroups support, a billing log, and shorter transmission times when using poor quality fax lines. The latter feature works by remembering what page it was on if it has to hang up and try again.

The product is available on both Windows and OS/2.

Finansa 071-405 4054

Equisys 071-403 2227

Andest (0908) 263300

Traffic (0628) 477077

Delrina 081-207 3163

Danny Bradbury



△ Andest's MultiFax Lite


WordStar is Joking

Wordstar International last month announced a new product that is quite a deviation from its word processing roots, but is related to document creation. Just Joking is a quality collection of classic and modern humour drawn from two recent books: *The Comedy Quote Dictionary* by Ronald L Smith, and *Friendly Advice* by John Winokur.

Just Joking covers 250 topics. Once the writer locates the joke or quote he wants to use, it can be added to a document through a simple cut and paste. This is especially helpful for those who have to make speeches and need a bit of humour to get the audience's attention. Priced at \$49, it will be out by the end of November, just in time to be a good stocking stuffer for the computer user on your Christmas list.

Tim Bajarin

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DTMF pushes new network standard

Canon unveils printer trio

Canon has unveiled three new printers: a faster, small office version of the popular BJ-10ex called the BJ-200; an upgrade of Canon's high-end colour printer, the BJC-880 (due in January); and the LBP-8 IV, which uses the same Canon 600dpi engine as the Hewlett Packard LaserJet 4.

The BJ200, at £399, is £100 more than the BJ-10ex but includes an 80-sheet cut paper feeder which would cost £59 if bought separately. It also works faster. It has a 16-bit processor and a new ink cartridge and print head. Together these increase print speed from the BJ-10ex's 83cps to 240cps in draft mode, or up to three pages per minute. Unlike its smaller brother the BJ200 cannot work off batteries.

Canon is keen to emphasise that the other two printers have CaPSL IV. This is the latest version of Canon's own page description language (analogous to HP's PCL and Adobe's PostScript). The colour printer benefits from the new version's improved colour-matching facilities, and both printers exploit its scalable fonts and improved vector graphics handling.

The LBP-8 IV has the same specifications and roughly the same pricing as the HP LaserJet 4, but doesn't use HP's PCL and lacks expandability as shipped. It seems it is aimed largely at Value Added Resellers, who will add their own special software and customise the innards. Canon 081-773 3173

David Brake

The Desktop Management Task Force (DTMF) has finally come up with the Desktop Management Interface (DMI). It hopes DMI will standardise the way third-party hardware and applications programs interact with each other on networks.

Intel, a founder member of the group, has taken advantage of its involvement with the API to put together a LAN management package, LANDesk Manager. Meanwhile IBM, also a DTMF member, has launched its own network management package for OS/2, LANFocus Management/2, to make OS/2 a viable networking alternative.

The DTMF was first formed at the Interop conference in May 1992 in Washington DC. The consortium originally consisted of Intel, Microsoft, Novell, Sunconnect (a Sun Microsystems company) and Synoptics. Later on, these companies were joined by DEC, Hewlett Packard and IBM. The DMI is said to enable networking hardware and software developers to develop products for one interface.

Intel, which launches its LANDesk Manager program soon, is marketing it as a console manager. The Windows-based product will be a shell to which users can add network management modules. Included in LANDesk Manager are features such as an alert box, which alerts the user to problems on the network, and a monitoring tool, which tracks application usage on the network.

Modules that can be added include LANDesk Protect (a DMI-aware version of its LANProtect,

LAN virus package) and LANDesk Inventory Manager (which gives a summary of software and hardware resources across the network). Unfortunately, Intel did not include a print manager because it wanted to reduce the time to market, but one will be available in module form later. Pricing was not announced at the time of going to press, though it will also be available as a LANDesk Management pack with the two modules included.

Shaun Malone, director of Intel product group Europe for Intel, described the importance of the DTMF and LANDesk Manager. The total LAN worldwide administration cost for networked PCs would account for \$1 billion by 1995, he said, adding, 'There is a large investment in PCs and software in the networking market. There is probably more of an investment in this area than in cabling.'

IBM's own collection of products is based on another standard: the Open Software Foundation's Distributed Management Environment (OSF/DME). It allows management of OS/2 LAN servers, IBM OS/2 2.0 and IBM DOS 5.0 either alone or with Windows 3.1 running on it. Shipping with this family of management products are applications allowing the configuration of OS/2 workstations and servers without user involvement, a program to monitor system performance over the network, and another to report software and hardware failures.

Intel (0793) 696000

IBM 071-928 1777

Danny Bradbury

Getting the message

Two products have been launched, designed to handle your calls from a Windows-based PC. Telelink Pro and Supervoice are aimed at the small business and home business market. Both are hardware/software combinations, and include fax and messaging capabilities along with remote user access to play back your calls.

Pacific's Supervoice acts as an answerphone, using touchtone responses for other options. Using the phone's touchtone pad, incoming callers get faxes from the host machine, and send and receive data, using modems. It also lets the machine owner dial in, pick up messages, and change the recorded greeting.

All messages and greetings are recorded on the hard disk, which can store a message in roughly 6000 bytes. Pacific doesn't specify how long the message is, though. The software comes with a selection of logic scripts for different environments, taking users through a few steps to access the function they need.

The product should be shipping when you read this. The software costs £99 retail, but you'll need a board with it. The boards shipped

by Pacific Image will mostly cost under £100 but won't be BABT-approved, and if you are looking for third-party cards you'll need ones with voice facilities as well as fax — pretty rare at the moment.

Source Corporation is about to ship Telelink Pro, a higher-end package, which it says can replace a normal PABX system. Users can create up to 999 mailboxes for their staff; these can be used for recording messages, sending faxes or forwarding messages. Other features include voice activated faxback, datacommunications and multi-user password protection. According to Source, the system can be used to develop applications including a message centre, fax on demand, receptionist, pager alerting and dictation. The system will store roughly 20 minutes of speech in 40Mb of hard disk. Although pricing hadn't been decided at time of writing, it should be shipping — in fully BABT-approved form — by the time this hits the coffee table.

Pacific Image Communications Europe
081-423 5940

Source Corporation 081-578 5668

Danny Bradbury

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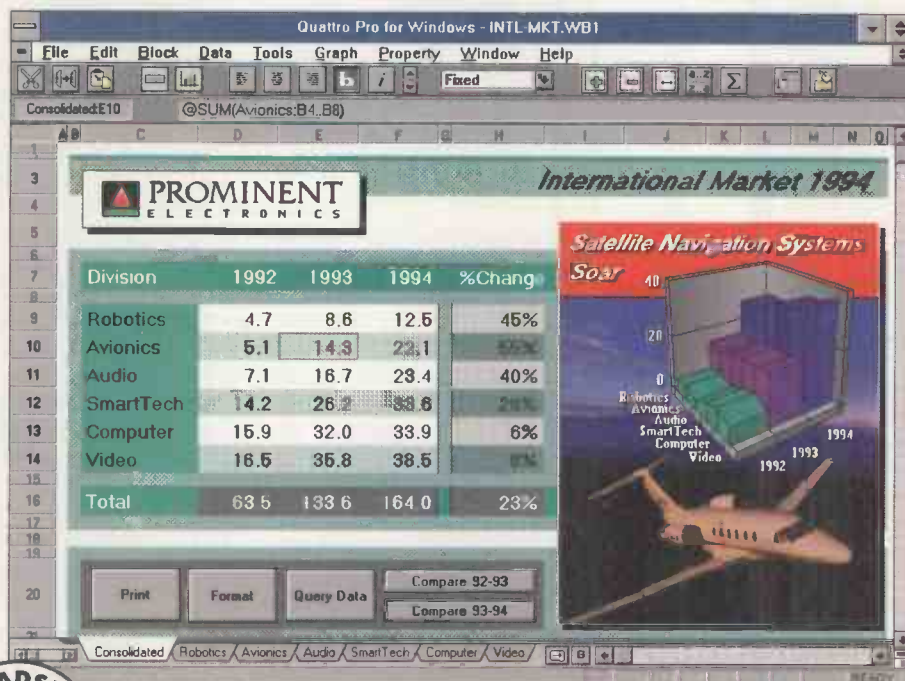
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*Quattro Pro for Windows and Spreadsheet Notebooks have patents pending. † All prices exclude VAT (and P&P where applicable)

OBJECT INSPECTORS

BUILT-IN GRAPHICS

DATABASE DESKTOP

LOTUS 1-2-3 COMPATIBILITY

Mac catches up on fax software

A profusion of fax software, both single and multi-user, is available for PCs, particularly those running Windows. But the Macintosh market has lagged behind. If you can get software, it tends to be written by and for particular modem manufacturers, which limits its usefulness and tends to raise the price.

Now one solution is at hand. Glenwarne, a British developer which used to offer its own software with a dedicated fax machine, has written a new version as a generic single or multi-user fax driver. FaxExpress should drive most Class 2 fax modems, which means Macintosh users will benefit from the rising number of inexpensive devices available to PC owners.

The software costs £99 for a single-user version, or from £399 for a multi-user solution. If you want to buy the entire solution, Glenwarne can provide you with a V42bis BABT-approved fax modem and single-user software for £299, or a variety of multi-user bundles.

Glenwarne
(0753) 643180

David Brake

Text and finance programs fill the gaps in Series 3 software

Four new applications for Psion's Series 3 are now available. Two new text-based products are based on technology from Microlytics and squeezed onto 1Mb ROM.

Speller and Thesaurus fills one of the few significant gaps in the Series 3's built-in software base. It should be familiar to users of desktop word processing software, with a 100,000 word dictionary and a 660,000 word thesaurus. Custom dictionaries can be added, though they have to be saved onto another solid-state disk or into internal memory as the program disk is read only. As a bonus, it also includes a puzzle-solving function which can decode anagrams and find words with missing letters.

The second new product is Berlitz Interpreter which can interpret between any two from English, French, Spanish, Italian and German, with a vocabulary of 28,000 words and common phrases per language.

Both products can be linked to the built-in word processor. Berlitz Interpreter costs £59.53 and the Speller and Thesaurus costs £42.51. The latter requires a Series 3 with 256K of internal memory.

The other two programs, both financial, were actually developed initially by third parties and have been tidied up and released by Psion.

Professional Finance is akin to a financial calculator. It includes formulae to help you calculate cash flow, depreciation, rates of return and even currency conversion. Accounts and Expenses is a personal financial management package which can manage up to 30 accounts and keep track of standing orders (it also has a foreign currency calculator). Both cost £42.51.

• I quizzed Peter Norman, Psion's Marketing Director, about the ultra-inexpensive fax for the Series 3 he discussed several months back. It turns out that development work was delayed, but it is on track for delivery around the second quarter of 1993. The good news is the delay will let Psion include modem as well as fax functionality, and, possibly, links to on-line services.

Psion developers should now have a much improved PC link interface for the Series 3 and Word. It will allow much more control over files on both machines to be handled on the PC rather than the Series 3. Moving files between PCs and Series 3s has always been possible, but it isn't as easy as it should be. Upgrades of the link software to end users will follow in time, but if you are interested, it might be worth putting your name in now.

Psion 071-262 5580

David Brake

WinRules takes MS mail handling one step Beyond

Beyond Inc is the first company to announce software specifically designed to enhance Microsoft's Windows for Workgroups. WinRules adds BeyondMail's mail handling technology to Microsoft Mail and Schedule+.

Ralph Bancroft, PCW's network correspondent, said of Beyond: 'In a market dominated by Microsoft and Lotus, Beyond brings some genuinely new and valuable ideas. It could be on to a winner.'

The Beyond idea is agents by another name, something getting a lot of well deserved attention. You could tell WinRules to take all of your mail with 'football' in its subject line and throw it away before you have to read it; you could instruct it to forward all mail with the word 'computer' in it to a person of your choosing. No UK pricing or availability information is available at the moment, but it should ship by the first quarter of 1993 in the US and cost \$99.95 per station.

• Beyond has also announced BeyondMail for Lotus Notes, which will be delivered around the same time in the US.

ESP is Beyond's UK distributor on (0628) 23453

David Brake

Apple CD-ROM cuts get even kinder

Last month I told you that the CD-ROM option in the new mid-range Macs would be a bargain at £300, including a megabyte of extra RAM and extra video RAM. It turns out that I was, if anything, under-enthusiastic: Apple subsequently revised its price premium for the drive to £230.

Apple's internal projections indicate that 40 to 50% of its IIfx's and IIfx's will ship with CD-ROMs. If these projections are accurate, and the new Macintosh models sell as well as expected, the market for Macintosh CD-ROM software is set to explode at last.

But there is a small item of bad news, however: the CD-ROM kit includes nine CDs, not ten as promised.

I also told you that Apple had no immediate plans to launch the Performa range in Europe. That was true at the time, but it now looks like some kind of Performas will arrive, in the UK, perhaps as early as in the first quarter of 1993. They won't be the same as US Performas, though, which probably means they'll cost more and include less.

Apple Computer UK 081-569 1199

David Brake

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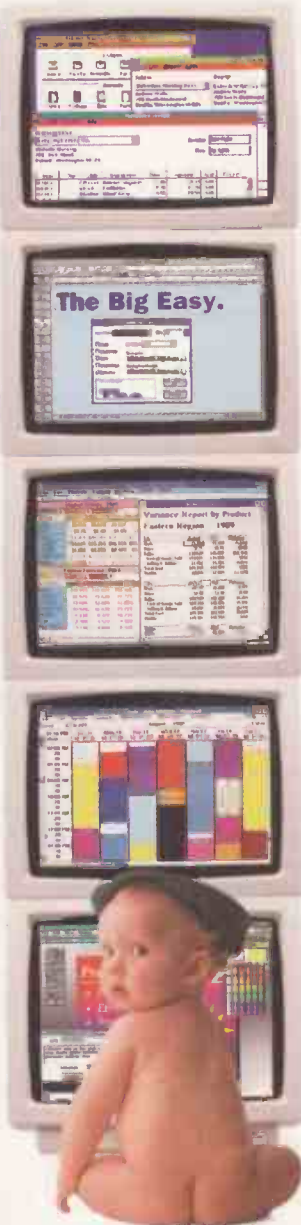
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*Suggested retail price, excluding VAT.

Adobe moves Photoshop into Windows

Adobe has moved into the Windows market with its Photoshop retouching package, and upgraded its Macintosh-based product to produce two code-identical applications. The package, now labelled version 2.5 on both platforms, has been completely rewritten to include new tools. The rewrite has enabled Adobe to design the product with hardware improvement in mind.

The company's strategy seems to be to make the product more attractive by letting some third-party board developers do some of the hard work. Adobe has formally stated it expects boards to be developed using high-powered RISC chip technology and Digital Signal Processors, specifically to boost the performance of the product. It has even promised marketing deals with hardware vendors to provide Adobe Photoshop driver products for their accelerator boards. The company believes many number crunching functions such as image

resizing, rotation and

software architecture to accommodate these more readily than before.

The package, now file-compatible on both platforms, has been enhanced with a number of new features including a dodge-and-burn tool. This mimics the technique used in development studios where certain parts of a photograph are developed more than others, to achieve greater detail.

Redrawing within the package has been speeded up, and toolbox controls have been extended to include masking facilities. The brushes palette now includes all paint options, so users can set things like opacity, pressure and roundness. There is an improved colour palette which includes support for customised palettes, with users deciding greyscale or RGB intensity using slider controls.

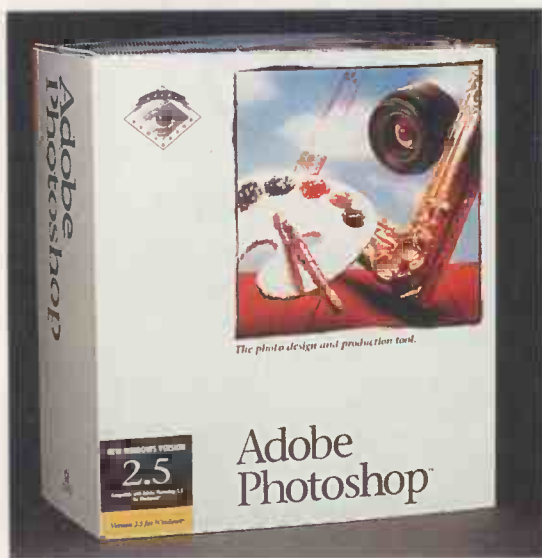
The software now supports the TWAIN standard for scanning images directly into software applications, and Kodak's fledgling Photo-CD standard which sees high-quality images cut onto CD format for storage advantages.

The rewriting of the product to create a standard core technology is part of a growing trend of developers standardising their internal development processes, eliminating incompatibilities between versions and cutting update times.

We have already seen this sort of activity with companies such as WordPerfect and its WISE strategy [see story, page 136], and with Symantec, which recently introduced its Bedrock technology.

Adobe 081-547 1900

Danny Bradbury



At home with Bill Gates

I recently spent a week in Seattle, and friends of mine who have a boat on Lake Washington asked if I wanted to see the house Bill Gates is building on the lake.

As you perhaps know by now, Gates has been named by *Forbes* as the richest man in America, with assets over \$6.5 billion. Gates, and Microsoft co-founder Paul Allen, are both building mansions on the lake. You cannot get near their houses from the street, but by boat you can get a good view of the work in progress.

Gates' house will be a 42,000 sq ft estate. It is built into the side of a mountain, with a 4000 sq ft garage built into an underground cavern. Gates collects cars, especially Porsches, and the garage can house 20.

Sources say the estate includes a residence and two separate pavilions for guests and receptions. The main house will have seven bedrooms, including three children's bedrooms and one for a nanny, should Gates ever marry. There will be three kitchens, a 10,000-book library, a 20-seat movie theatre, two elevators,

a 60ft swimming pool, an exercise room, games room and three dining rooms: one for private family dining, a larger one for small parties and a third for large events. Gates has property surrounding the estate and has already planted hundreds of mature alder and maple trees as well as other native plants. When finished, the estate will have cost around \$35 million.

By contrast, the Allen estate is a virtual sportsman's paradise. Since basketball is Allen's passion (he owns the NBA Portland Trailblazers) he has built a \$6 million sports complex on the property, including a complete pro-sized basketball court, an indoor swimming pool and tennis court. Downhill from the sports complex is the entertainment centre with a theatre, an art gallery and a star-gazing room.

His own home will be an 8500 sq ft mansion right on the water. His estate also includes a 6500 sq ft house for his widowed mother. Allen's father was a librarian and his mother worked in the library at the University of Washington, so her house includes an 1800 sq ft library. The cost for his estate will be around \$30 million when finished.

Tim Bajarin

Winner of Windows User Award for "Best desktop publishing software."

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Lotus Ami Pro v.3 for Windows

The worlds' finest Word Processor. The number one word processing software has taken the world by storm. PC User said: "Ami Pro 3.0 is the best all round Windows word processor you can buy."

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
The last word

 I was initially surprised at your award of the PCW Seal of Approval to Microsoft's Word for Windows [November] until I noticed that the product was reviewed by Guy Swarbrick who is, by his own admission, already a convert and hence knows how to extract the best from the product. In contrast Ami Pro 3.0 was reviewed by Chris Cain who admits he only had a few days to get to know it. Talk about tilting the playing field!

Even so, Chris was apparently impressed enough to switch. In welcoming him to the fold, could I point out that the only criticism he was able to make in the Bad Points summary is an error. You can very easily select all the text in a document. First position the cursor at the top (pressing Ctrl & Home). Then press Ctrl & Shift & End. All text is now selected and may be manipulated as usual. Experienced Windows users will know that these are standard keyboard shortcuts. They are documented in the Microsoft Windows User's Guide.

Bob Anderson
Bourton-on-the-Water
Gloucester


Chris has subsequently gone back to using Word for Windows in the office because everyone else does. Ami Pro is a fine product, however, and if it is any consolation there were bitter arguments about which should win the Seal of Approval.

 In the November issue of PCW, Guy Swarbrick's review of Word for Windows incorrectly reported a lack of a proper word count facility: Alt-F being 'pitifully inaccurate'.

Use of Word's standard grammar checker does however present an accurate word and character count along with other information. Perhaps Guy was deterred by the thought of obtaining Flesch Readability Statistics on his PCW prose!

Ron McCulloch
Quest Real-Time Ltd
Newbury
Berkshire

Guy doesn't have anything against grammar checkers as such, although he hasn't found one he likes yet. It is a pretty strange way to get a word count, though.

 A couple of comments on your Group Test of word processors in November's PCW. Your useful list of features has a row entitled Style Sheets, but not all style sheets are equal. In particular I believe that most Windows


paring word processors.

Of course, you do not use a word processor to produce printed output: you use it as an editor and shove the files into PageMaker. But ordinary mortals use their word processors for printing as well. My other complaint about Word for Windows is of course that it permits only paragraph styles.

I'm not blindly devoted to WordPerfect: at present I feel a definite urge to experiment with FrameMaker. But Word for Windows seems to me an amateurish product.

Jonathon Palfrey
Vallingby
Sweden

What can we say? If you are thinking of using FrameMaker — a pretty powerful DTP package — to word process with, few standard word processors will please you. We don't see pair kerning as a general requirement, and just for the record, Word does allow the use of styles on elements as small as a character.

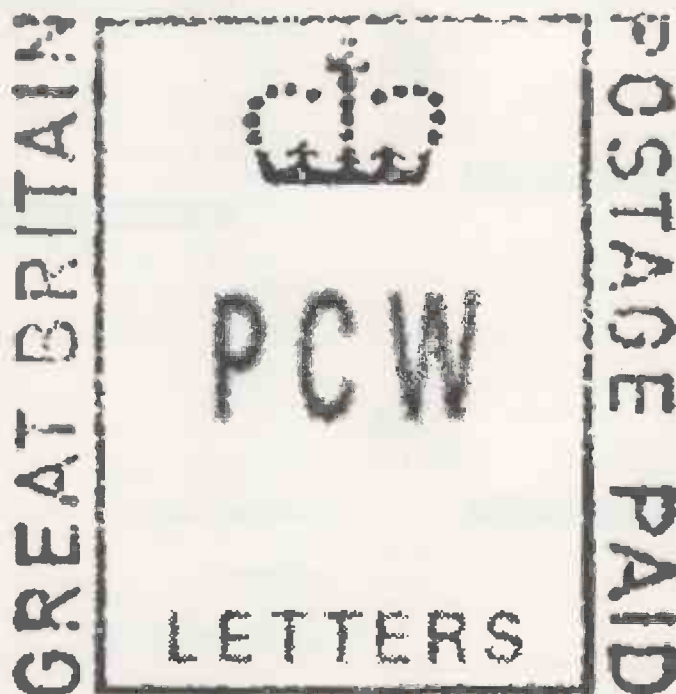
 Your Group Test of word processors concerns me. In the first place, you present no information as to what the ideal word processor should do. Some reliable statistics on usage, rather than what the manufacturers think we might

need, could help in deciding which tests were the most useful.

Secondly, different users with widely differing requirements tested the packages and their subjective results were used as a basis for comparisons. Thirdly, these were computer journalists, not secretaries. My own feeling is that secretaries still form the bulk of full-time users. They in turn are more likely to spend most of their time writing letters and reports.

Finally, one's favourite word processor is usually the one you were brought up with, or a derivative. Alternatively, it's the one you've subsequently changed to, usually for specific personal reasons. In other words, one often has a strong individual bias.

Hardly surprising then that Guy Swarbrick loved Word for Windows 2.0. He admits that it's his regular, favourite word processor anyway. So what's new? But he's a journalist, heavily into page layout. Would his views have been different if most of the tests



word processors don't allow styles to be applied to any element smaller than a paragraph. This is a rather severe limitation. I use WordPerfect professionally to write software manuals, and make extensive use of styles for small textual elements within paragraphs. It would be a definite step backwards to lose this facility.

You have a row entitled Adjustable Kerning which in fact seems to refer to automatic pair kerning. Some programs allow you to adjust kerning manually without providing automatic pair kerning; I'm glad you've concentrated on automatic pair kerning which is more important, but I think your row title is rather misleading.

I use Microsoft Word for Windows in order to produce Windows help files. However, I find it difficult to understand your recommendation of Word for more general purposes. It won't do pair kerning, for one thing, which means that the quality of its output should be the first criterion when you are com-

had involved typing reports and letters I wonder?

For this sort of job, when no graphics are involved, maybe Protext would do the trick. Indeed I thought Simon Rockman's review was pretty fair. This is a good DOS processor for entering a lot of text quickly.

Chris Cain clearly loved Ami Pro. He obviously enjoys a Windows based/mouse processor and clicking on icons. Indeed, he said he was going to change to Ami Pro from Word for Windows, he liked it so much. Nevertheless, Word still got the accolades at the end. So you also gave this guy Tasword to review: a pure DOS processor? It's pretty evident that he hates the idea of a DOS job; had him 'hanging onto his mouse in panic', as he says.

To set Chris Cain's results and prejudices against Guy Swarbrick's review of Word, his favourite word processor, is hardly a way of devising even-handed assessments.

OK, he's prejudiced. So am I. I love Tasword. It's my favourite. I write text in it first, and transfer this afterwards to Word for Windows 2.0 or PagePlus, because it exports essentially ASCII code and because it's blindingly fast. Yes, I know Chris said 'scrolling is amazingly sluggish and the cursor is slow as well,' but he never bothered to select customisation from the main menu, then go into rates and delays, did he? The defaults are pretty slow.

Chris didn't like the spellcheck, either. Funny that he particularly slams the spellchecker batch mode which Simon lauds in the Protext review. Tasword's equivalent is particularly useful to me, as I use a lot of technical words which don't occur in your average checker, and have lists of scientific references. Differences between spellings of obscure cited authors, equipment or chemicals show up readily in the list.

Oh, and Chris, there's one huge bug in Tasword PC2 which is now being fixed, and which particularly affects scientific writing. Didn't you notice it? You certainly don't mention it. But then, perhaps it's not important to you and you wouldn't.

All this goes to show that different users' requirements vary considerably, and that one man's meat is another man's poison. Nevertheless, I personally think you have to be a lot more careful in your comparisons, perhaps by using some sort of quantitative system, than you have been in these reviews. What do other readers think?

DA John Wase
Bishampton
Worcestershire

Antisocial behaviour



Concerning software costs in the UK: Monday's mail brought a letter from Polaris Software, California, USA. This offered a PackRat upgrade to version 4.1 at a cost of \$29.95, including a free copy of the new PackRat Integration Library version 2.0, worth \$29.95. After 30 November 1992 the upgrade price will increase to \$49.95. At today's exchange rate of \$1.692 to the pound, the \$29.95 equates to £17.70.

Yesterday I received a letter from The Roderick Manhattan Group, London. This offered the same upgrade to version 4.1 but without the Integration Library, for 'just' £49.

I feel very strongly about such flagrant profiteering. Where is the added value to justify such a markup of the US price? No wonder the UK economy is enfeebled, supporting drones like Roderick Manhattan.

I have considered involving my MP in a campaign for a fairer pricing system. However there does not appear to be a cartel in operation, and there is no law against excessive profit-taking. The only way to stop such antisocial practices seems to be through publicising each instance as it is detected. Also, purchase software direct from the States, which I do on a regular basis.

David Erickson
Stowmarket
Suffolk

A Roderick Manhattan representative pointed out that the price it charges for PackRat itself is much more in line with the exchange rate, and points out that it couldn't buy the upgrade itself for the price quoted to you, let alone ship it across, send it to you and support it.

Pole position



I have visited Poland on several occasions, and have been able to mark its progress towards a free market economy. Having blood ties with the country, and being a programmer, I have taken special interest in the development of information technology in eastern Europe as a whole. The Amiga computer is increasingly attracting attention there as a platform for serious use (as it is here).

Because of this interest and affiliation, I am trying to make moves to assist students and enthusiasts in Poland build their own sources for reference. The Communist regime did little to

encourage information technology and while any technologist in the West takes for granted the ability to access information via libraries, our counterparts in Poland are not so lucky.

This is where I am trying to help. Being a subscriber to various periodicals, I have accumulated a substantial collection of magazines over the years and have donated these to the library at Warsaw Polytechnic. I have also advertised the donation in Poland, inviting the public to utilise the material as a reference source.

However, what I have donated is still only a historical record of the past two years or so of the computer industry. The libraries urgently need as much assistance as possible in order to match their books and journals with those of the more developed nations.

I intend to continue to try to raise funds to supply more comprehensive reference texts to libraries in the old eastern bloc. Any assistance from readers would be most gratefully received.

Bernard Wozny
4 Westfield Grove
Idle
Bradford
West Yorkshire
BD10 8RT

Mirosaw Nader
Instytut Informatyki
Wydzia Transportu
Politechnika Warszawska
ul. Koszykowa
Poland

Falcon facts



In Chris Cain's review of the Atari Falcon 030 [November] he states that true colour mode is 320 x 200 pixels with 65000 colours, and 640 x 480 pixels with 256 colours. Is he absolutely sure about this? I have seen a technical specification sheet for the Falcon which stated: 'True Colour mode 768 x 480 over 65000 colours on the screen at one time' and 'SuperVGA: 640 x 480 with 256 colours from a palette of 262144 colours.' The technical spec I quote is part of documentation supplied by Atari to various interested parties in the computer trade.

Another discrepancy between the review and the tech spec concerns the Motorola 56000 DSP. According to Chris, it has 32K of static RAM for its own use while the spec sheet gives a figure of 96K. Did Chris obtain his information from Atari? If that is the case, which set of figures is correct?

Finally, Chris expresses reservations over the 'limited' 65Mb internal hard

disk. May I remind him that Atari users do not have to allocate valuable disk space to MSDOS and Windows 3.1!

Bill Brand
Perth

Yes, you can get the higher resolution of 768 x 480 but only if you use a multisync or Atari monitor, otherwise 640 x 480 is your limit. The static RAM is 32K as we said, but that is 32K words or, as you say, 96K bytes. As for the internal hard disk, yes, Atari programs aren't the disk hogs Windows ones are, but Chris says the programs he had would easily fill 65Mb.

Computer Aid

Could I suggest that you expand on AE Adams' letter (November 1992, page 168) on what to do with old computer hardware and software?

There must be thousands of companies and individuals who, having upgraded their system, are then faced with the problem of what to do with their old items, many of which still have a great deal of useful life left in them. The thought of throwing them into a skip appalls me.

I am sure that many people would be only too glad to donate these items to deserving causes, as charitable giving always provides one with a warm glow.

May I therefore propose that you ask for charities, societies, educational establishments and the like to let you know if they would be prepared to accept such material and, at the same time, indicate what they are looking for and for what purpose they would use it.

Chris Philip
Whitbourne
Worcestershire

OK, we're asking. Would worthy causes step forward and identify themselves?

Service industry

I am writing to sing the praises, for a change, of two companies that advertise in your magazine. The first is Javelin Computers of

Blackburn. On 5 October, at 5:05pm, I rang them to enquire about the price of a Hewlett Packard DeskJet 500. They told me they were selling them at £265 (at least £5 cheaper than anyone else in the magazine) and that they had stock (which most of the other suppliers didn't).

I placed an order using my credit card and they told me I would get the printer the next day. I laughed. The reason that I laughed is that I have been ordering computers too long to believe a single word that is said by any sales staff as to the date of delivery of goods. At 2pm the next day the DeskJet 500 was delivered to my door, as had been promised. For the first time in my career I actually telephoned the company and told them how impressed I was with the way they had handled the order from start to finish.

The second company is Olympic Computers of London. Not only do they seem to have the cheapest computers in London, but they have good telephone support and sales staff and they deliver when they say they will. I called last Monday and I was told that they did not have stock but would be getting some in on Wednesday so my machine would be with me by Thursday or Friday. I smiled. It arrived on Thursday. A brilliant machine.

I just thought it would be good (and I have read other letters about good service; this is just to add to them) that companies who do give such excellent service should be brought to the attention of others who are thinking of spending large sums of money on equipment.

Steve White
Crouch End
London

To be fair, we have had one or two complaints from other readers about Olympic Computers, but we're glad they came up with the goods for you.

Readers' letters are welcome and should be sent to: The Editor, *Personal Computer World*, 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.



Hindsight

January 1979

'The facilities of the system demonstrated provide for the creation of text, storage of the text onto standard audio cassettes, retrieval of text from the cassettes for re-use and editing and the printing of text on the line printer.' *Text Processing demonstrated on the Nascom 1*

January 1981

'Two fascinating little details about Visicalc: first, it was the winner of the most prized US micro award earlier this year; second, the orthodox data processing business doesn't believe it exists.' *Guy Kewney, Newsprint*

January 1983

'The best-selling word processing package for personal machines is WordStar, and the best-selling personal printer is the Epson, but there are no commercial versions of WordStar which can drive the Epson properly.' *Guy Kewney, Newsprint*

January 1985

'Denon, Philips and 3M have announced the development of a CD-based optical ROM system for computers.' *David Ahl, Yankee Doodles*

January 1987

'A multi-tasking version of Windows is due in 1987, and several people seem convinced that [it] will be available before June.' *Guy Kewney, Newsprint*

January 1989

'Now that Apricot is selling genuine PS/2 clones with full Micro Channel bus [a] flood of fully-licensed imitations can be expected any day.' *Guy Kewney, Newsprint*

January 1991

'Ami, now, will become a market-leading product without doubt. It has little established competition, it has an estimated 15% of the 'graphical word processing' market and Lotus does know how to exploit a winning product.' *Guy Kewney, Newsprint*



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Reconciling your bank statement couldn't be faster – Quicken automatically shows you a list of transactions that you can compare each time your bank sends you a statement. Simply check through, clearing each one or whole groups at a time in one keystroke. There's no technical jargon or accounting mumbo jumbo to learn. But, just in case you need it, there's comprehensive on-line help throughout.

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What Can Quicken Do For My Business?

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Will It Put Me In Control Of VAT Data?

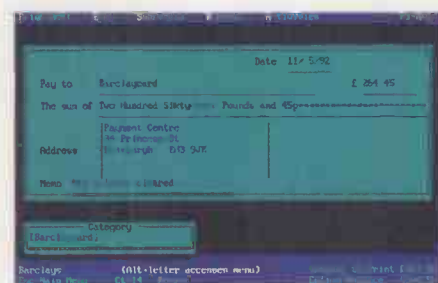
Yes. It's incredibly fast and easy to produce all the figures for your VAT returns. A simple on/off switch enables you to choose between standard, zero, exempt, or customised VAT ratings. All the information you need to complete your VAT return is now kept in one place.

Can I Save More Time By Printing Cheques?

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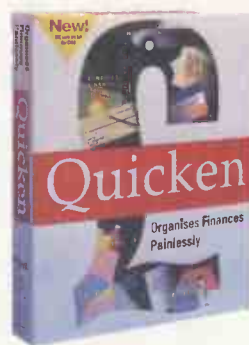
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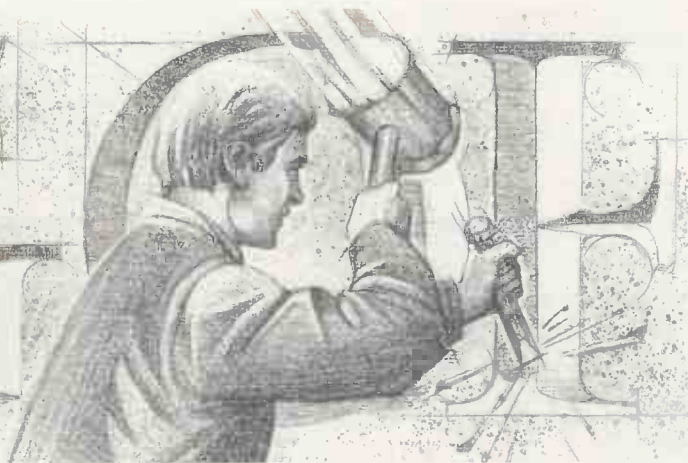
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Michael Hewitt

I returned from Italy (see last month's column) to find a fast decomposing heap of mail welling up behind my front door. Having broken out the crampons and ice axe and made it to the summit, I delved into the *mélange* at random. 'Version 4.2 represents the most significant development in the field since version 4.1,' said one piece of paper. 'Ours does it twice as fast as anyone else's, and over a network, too,' revealed another. 'If you don't give us £63 in the next ten days we'll send men round to cut you off,' said yet another. A thorough excavation of the various strata followed until all life-threatening material had been extracted and neutralised with the aid of a cheque-book. Only then could I comfortably deal with the coniferous forest's worth of communiqués from the public relations companies that remained.

I get the impression that many people on the receiving end regard reading press releases as the journalistic equivalent of train spotting or collecting beer mats. However, a few of them can be quite informative and some relatively unsoporific. It's just that getting them all in one go like this is rather akin to having Domino's, Pizza Express, and Pizza Hut all deliver at once. Even if you've got the appetite for the lot, you soon find there really isn't that much to choose between them. Regardless of the merits of its free-range anchovy topping, one franchise's double deep-pan tends to look and taste exactly like its competitor. Similarly, all brands of 486 and 386 have now developed a boring, Tory Cabinet-style homogeneity which is impervious to even the most glowing PR's prose, while the software market is so dominated by the major league players as to have ceased to be exciting at all. In the circum-

stances, then, shifting a warehouse full of computer gear must be like trying to corner the Italian spaghetti market.

By necessity, the message being conveyed by box-shifters is starting to boil down to a simple 'My rebadged box of chips is better than his rebadged box of chips' type statement. The implicit 'Yah, boo, so there!' while not yet writ large, bubbles under the surface nonetheless. But given the circumstances, exactly how and why anyone should be trying to claim any degree of superiority in the first place seems a tad confusing.

Price differential, once one of the all-important issues, is today largely irrelevant. Most 486s now seem to be stabilising around the £1000 mark, even IBM's (a *volte-face* by its marketing executives of Norman Lamont proportions). And come the 586 next spring or whenever, I suppose we can expect them to do a Black Wednesday. Integrity of components is likewise a non-issue. All motherboards seem to be manufactured in the same street in Taiwan, while the other bits and pieces — monitor, keyboard, disk drive — can be ordered by the skipful from more or less anywhere and generally work to spec.

Consumers are therefore going to have to start applying totally different criteria in order to make their choice: criteria based, not on the product itself, but on the 'feel good' factor behind those selling it. For example, has the supplier of the 3.5in drives ever been convicted of possessing controlled substances? Did he inhale or just suck? Does the monitor manufacturer cheat on his wife, and if so, is the girl above the age of consent? What about the keyboard vendor's trip to Moscow back in 1987? It actually isn't as far-fetched as it sounds. I notice an increasing number of press releases and advertisements are now starting to adopt a line that subtly implies that their rivals have

neither the moral fibre nor the competence to be in the market.

'OK', says one I have here (I'm paraphrasing, of course), 'our computers have all got Intel inside like what you'd expect, but ours is a *quality* product, manufactured to rigorous standards, and we're a company you can trust, with years of experience in the market.' So in other words, not only are all their components the real McCoy, but unlike their competitors, they know how to stick them together properly, too, and without dropping cigarette ash all over the IDE card. Furthermore, they've got a Royal Warrant dating back to the Regency period, which means they're still likely to be in business this time next week. You try giving your credit card number to those Johnny-come-latelys over there, on the other hand, and likely as not they'll do a Maxwell with your money. That's if they're legitimate in the first place, of course, and not just some Tottenham Court Road-based front organisation for Bolivian cocaine barons.

Another ploy, and one that's becoming increasingly trendy in this 'green' era, is to suggest that your computer is environmentally much more friendly than anyone else's. Given the public gullibility on matters ecological, you're likely to be believed, too. Every day an 'expert', usually in California, discovers that something we've been consuming by the ton for years as an essential ingredient in, for instance, Pot Noodles, is in fact lethal to rats if ingested anally. Given this, with all the pieces that make up a computer and all the manufacturing processes they have to undergo, the odds are there's bound to be some element in there which is carcinogenic, or which you can only obtain by clubbing a baby seal, netting a dolphin, or evicting an Indian from his reservation. So to boldly state that your computer *doesn't* have it has got

to be something of a plus point (as well as guaranteeing that Sinéad O'Connor won't tear up a picture of your product live on network TV).

For example, as Barry Fox quite rightly revealed only a couple of months ago in this very publication, thanks to ozone emissions, you're lucky to walk out alive from any room that has a laser printer in it. It always *did* strike me as being a bit odd that the world's biggest gap in the ozone layer should lie, not over the industrial northern hemisphere, but over Antarctica, a continent where sales of CFC-laden refrigerators and hairspray must be, at best, sluggish. But now we know: the real cause is that the penguin population doesn't have enough HP LaserJets chugging out sufficient O₃ to plug the space. So given the sheer volume being exhaled, can it be long before filter-tipped printers become mandatory; the choice for the new generation? Kyocera Extra-Mild and Fujitsu Lights? Come to Hewlett Packard Country?

And monitors. What with the consensus being that radiation is a bad thing, these days there can't be many monitors that *aren't* advertised as emitting lower levels. Indeed, the copylines are starting to imply that ordinary VGA displays pour out so many neutrons that just turning up the brightness is enough to shrivel up your testicles and make your grandchildren look like David Mellor. And you carelessly leave a lump of plutonium anywhere nearby, and within seconds it will go critical and take out half the Home Counties.

But this is all by the bye. We know that in reality most people just couldn't give a XXXX either for their own or anyone else's wellbeing. Despite all the warnings, a good third of the UK population still smokes, the roads are full of drunks on Friday night (the mortuaries on Saturday morning), and my bedroom furniture is made of Amazonian hardwood. So we need yet another tack.

Branding is what they call it in the advertising business. A baked bean is a baked bean and thus has it ever been. Nevertheless, a million housewives every day pick up a can of beans and say... Heinz has established such a level of credibility in the market that its name has become almost synonymous with the product. It's the advertising jingle. The logo and the striking packaging. By contrast, computer manufacturers and software houses are rank outsiders with no idea whatsoever. What we need are 'I bet he uses Quark XPress' type ads, or commercials of men abseiling down cliffs and swimming through shark-infested waters in order to deliver a maths co-processor

into the hands of their beloved.

Another obvious selling ploy, one that has been tried successfully with every other sort of product, is of course sex. Ads based around, say, arty black and white photos of semi-naked young couples, limbs sensually intertwined, stuffing disks into each other's laptops might raise the profile of floppies considerably. Likewise, a series of 30-second playlets based around the theme of the blonde from next door popping round to borrow an Exabyte tape from her hunky neighbour could give that storage medium the same sort of lift. But what do we have at the moment? Just a sigmoidoscopy of a PC with an Intel chip in it. Hardly the sort of stuff guaranteed to provoke a trolley gridlock in PC World.

This, we're told, is the future of hi-tech computer sales. Croydon's PC World has been styled a 'computer supermarket', and tries to live up to the name by piling it high, selling it relatively inexpensively, and providing shopping trolleys with which to lug the goods round the store and out. The trouble is, to me (and to most people, I daresay) the place just doesn't *feel* like a proper supermarket. There's no kosher section. No-one's copy of WordStar ever bursts open while he's standing in line and has to be mopped up and replaced by another. You rarely, if ever, see a trolley so loaded down with gear that it risks breaking its back axle. Indeed, pressure of business isn't such that the management has seen fit to set up a '5 items or less' checkout to speed people through, either.

The place and its wares lack the aforementioned branding for a start, which makes wandering past the shelves a rather lacklustre experience. There seems little real inducement to linger or otherwise browse. You go in, you pick up exactly what you're after, and you go straight out again. (Alternatively, if you don't think you can sneak past the security men, you pay for it first.) I have no motivation at all to swap two boxes of my existing software for one box of brand X, while Selina Scott has never come out publicly in favour of *any* word processor. Given, then, that there's box after box of the stuff just sitting there, how am I, an ordinary member of the public, going to make my decision?

Giving your program a fancy name could help sway the undecided. But first of all you have to dream up the thought-provoking appellation. I've sat in on committees whose job it's been to do exactly that, and the ensuing boozy 'brainstorming' sessions have shown how difficult a task it really is (I'd like

to have been the man who supplied the alcohol to the team who came up with 'Quark'. Or perhaps to have owned shares in the company that supplied them with the aspirins the next morning.) Not only should the brand name encapsulate the very essence of the product, but it should do so without either sounding ridiculous in English or meaning 'whore' in Cantonese. One of the reasons given for the demise of the late, lamented Librex, for example, was that it was virtually the homonym of a well-known feminine hygiene product. I suppose the acid test is whether or not you get arrested if you venture out in public wearing a tee-shirt printed with the logo.

One company which obviously has no self-doubts in this area is ChickenShit Software of Hungerford, Berkshire, which very kindly sent me a range of tee-shirts and floppy disks, all emblazoned with the company name and rather unique corporate image. The disks I've used, and very nice they are, too, but so far, I blush to say, I haven't dared to go out of the front door in the shirts. Give me time and a decent lawyer, though... Anyway, whether or not the name excites you and impels you to buy its products, you at least know what ChickenShit is about. The capitalisation — the upper-case 'S' in the middle of the word — tells you it's a computer-related business.

This rather interesting debasement of English was inaugurated, I believe, by Apple back in 1984. I think its trouble was that 'Macwrite' without the capital sounded like something you painted over your metal drainpipes to stop them rusting. On the other hand it's perfectly clear what MacWrite is: the 'Write' element makes it quite obvious that the thing's a word processor and that it's unlikely to calculate your biorhythms, while the 'Mac' lets you know who's to blame for it. An all-in-one word encapsulating manufacturer and function. Like Hoover, except it hasn't managed to turn it into a transitive verb.

So I suppose this is a *sort* of branding. Certainly everyone else is doing it now: PostScript; SuperStor; AutoRoute; Chicken MacNuggets (of course the latter aren't actually anything to do with silicon chips, they just taste like them). It seems to be a deliberate attempt to contract the language down to its bare minimum.

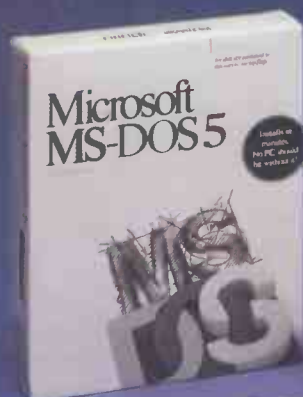
Eventually we'll be able to dispense with the prefix and suffix letters, too, just leaving the capital all by itself. And while this may not do a lot for product identity, it sure as hell will make press releases a lot shorter.

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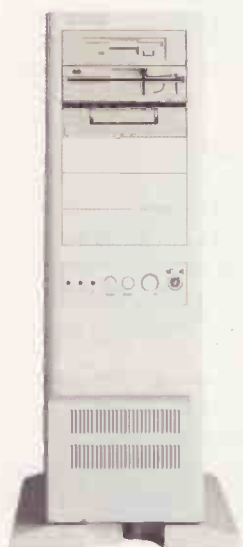


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JANUARY 1993 PERSONAL COMPUTER WORLD

177



Barry Fox

So Packard Bell is finally to bring CD-ROM to the High Street, by selling a Multimedia PC through Dixons and Currys. Not a hope. Unless a lot of leopards change their spots.

Packabell's announcement came shortly after I had received an invite (as punter customer, not press) to the Sunday launch of Curry's new Computer Superstore at Staples Corner in North London.

'Upgrade to a new kind of computer superstore... everything you could need is conveniently under one roof.'

I needed some computer leads, both serial and parallel, some gender benders and switch boxes, so instead of mail-ordering I drove over to Currys. I was a sitting target for at least £100 worth of easy self-service sales. All they had to do was take my money for what I took from the racks.

I left the Superstore after a few minutes, empty-handed and with my money intact. The 'everything you could need' Superstore stocked just one type of lead, the bog-standard IBM PC-to-printer connection. The salesman told me that was all I needed to connect everything Currys sold. How, I wonder, will Currys cope with the questions on Multimedia PC CD-ROM systems that customers are certain to ask?

Like what questions? Surely all the leads will come with the system, except perhaps the printer lead which Currys will sell you.

A while before the Packard Bell announcement I tried using Virgin's 'North Polar Expedition', a CD-ROM based on icy expeditions by Sir Ranulph Fiennes. I followed the instructions and typed 'Go' at the DOS prompt for the ROM drive. The screen went blank and threw up an error message. 'Sorry, you have insufficient memory.' But my 386 PC

had two megabytes of memory, and QEMM memory management to make the best use of it. It ran plenty of other ROMs.

The error message on screen told me to try typing 'NP', which I did. The computer then locked itself into a cycle of displaying 'invalid directory' over and over again. After a cold restart I tried running some other ROMs just to check that the system was not faulty. They ran smoothly.

I tried running the Polar CD-ROM under DESQview. I got the same error message, but this time the whole system crashed. On rebooting I found a string of problems. The crash had corrupted a large and valuable data file. Luckily I had a recent backup so only lost a few entries. But the crash had also corrupted the MSCDEX extension to the MSDOS operating system which is needed to control a CD-ROM drive. It had also corrupted the .EXE file for my word processor. It took me four hours to find backups and original source file disks, and rebuild the hard disk.

The instruction manual for the Polar CD-ROM has a section on Troubleshooting. It told me to go through my Config and Autoexec files, looking for drivers to remove. I should also reduce the number of files and buffers. And because other software will need more files and buffers, I should keep and load a special copy of my Config file for running the Polar CD-ROM.

In the end I had a much better idea. I just left things as they were and did not bother to run the Polar CD-ROM. But perhaps in the future I can ask Dixons or Currys for advice.

Packard Bell is proudly publicising the fact that there are over 600 ROM titles available in the UK. Meckler's new 583-page book, *CD-ROMs in Print*, lists nearly 3000 and predicts 5500 by the end of 1992. This follows the ROM market pattern of more than doubling

the number of available discs per year. The book is available on a CD-ROM.

And hereby hangs a tale. The Meckler disc was compiled with ROMWARE and is searched using SimpleFace software, both from Nimbus. To run the disk you put it in your ROM drive, change the prompt (eg to D: or E:) and type GO. For a monochrome monitor you type GO/M instead. Within a few seconds, a menu comes up on screen that is completely intuitive. You just move the cursor between search choices, such as 'title', 'subject areas', and 'publisher'. Although there are a few notes on advanced search options in the six-page disk sleeve-note, the on-screen menu and prompts, plus a little commonsense, will let anyone get a search result without even looking at the printed notes. Although there is the option to print to disk, simply running the ROM and searching installs nothing on the hard disk. All the search software comes from the ROM. It's a 'plug and go' system. To compare the Meckler ROM with the bulky Meckler paper book makes a nice advert for what CD-ROM technology can offer.

Now compare using the Meckler ROM with running many of those other 3000 CD-ROMs now available. Some, for instance the Oxford English Dictionary, can only be run from Windows — not much use if, like me, you prefer DESQview or running programs from the DOS prompt or a shell. The Oxford University Press say they have to use Windows, to provide the fonts needed to display the special characters required for some languages, such as Greek and old and middle English. (I am not convinced, but on the principle of, if you can't beat them, join them, I am now experimenting with DVX, which should run Windows in a window and thus should be able to run the OED ROM. But that involves upgrading to another computer with more

memory, which at the moment does not have a CD-ROM drive, and anyone who is now in the market for a new drive should be waiting for an XA drive that handles multi-session Write-Once discs such as Photo CDs, not buying a drive that will soon be out of date.)

Fortunately not all ROMs require Windows, but more and more of the ROMs listed in Meckler's catalogue require installation of the type which, ironically, Meckler's own ROM proves to be wholly unnecessary. Have the people developing ROMs given any thought to the reality of the situation?

Installation creates a tree of directories on the hard disk and then transfers what can easily be a megabyte or more of search software. Although memory is getting cheaper and hard disk capacity larger, there is no bottomless pit of megabyte storage. Only a designer working on a network paid for by someone else can be so naïve as to discount the cost and finite limits of hard disk storage. Already it has been eaten into by the hungry demands of DOS 5.0 and Windows 3.1. How many of those 5500 titles available by the end of this year can someone actually use without running out of hard disk space? Remember that the whole point of CD-ROM is to get bulk data off floppies and Winchester and onto the much more efficient optical media. It is quite impractical to de-install a ROM after use, because this involves going through all the directories and sub-directories which the ROM has created and deleting all files before removing the directory tree. Then the ROM has to be re-installed before it can be run again. This is like binding a book before reading it, and unbinding it afterwards.

Over recent years Chadwyck-Healey of Cambridge has moved deeper into CD-ROM territory, publishing discs of various newspapers. Recently the company sent me *The Economist* on CD-ROM. I tried to load it and immediately got a friendly 'Fatal error' message telling me I did not have enough spare space on my hard disk. It needed a minimum of a megabyte. (Incidentally, the installation process also objected to the fact that I had no floppy in my B: drive while apparently being perfectly happy that there was no floppy in my A: drive.) Without a megabyte of spare space I could not install *The Economist* search software and without installation I could not run the ROM. Yes, Messers C-H, I could clear a few megabytes, but only by removing something else that I will later have to re-install after de-installing *The Economist*.

Working on the last straw principle, I wonder if any of the people who publish CD-ROMs can answer a few simple questions. If they can, let's hear the answers. If they cannot, they should not be in the business of publishing ROMs.

The first and key question is this. Why can you not make all your ROM discs work on 'plug and go' principles? Why can users not run their CD-ROMs direct from the CD-ROM, without first having to install files on the hard disk? We know this is possible, because Nimbus has already shown it to be possible, with Meckler's own disc providing a very convenient reminder. And it is certainly far more convenient for the user who wants to keep a library of different CD-ROMs and plug and switch between them.

These are the arguments I have so far been given in favour of obliging

"Working on the last straw principle, I wonder if any of the people who publish CD-ROMs can answer a few simple questions. If they can, let's hear the answers. If they cannot, they should not be in the business of publishing ROMs"

users to install files on a hard disk when running a CD-ROM:

1) Users may wish to install their own screen colour configuration for the access software. But if anyone really wants to do this, then the facility to diverge from pre-set colours could easily be provided as an option, rather than an obligation. Monochrome display is easily dealt with by an /M switch at the GO command.

2) Users may wish to attach their own notes or earmarked pages to the CD-ROM database. Again this could easily be provided as an option, not a reason for obligatory installation.

3) Users may wish to dump data for later processing. Once again this could be an option.

4) The retrieval software cannot correctly identify the user's hardware (eg PC type) automatically, so a configuration file based on the user's own replies to questions about hardware has to be

created. I understand that there have been some problems over automatic identification of video graphics cards, but again this could be provided as an option, needed only if plug and go running gives problems.

5) The retrieval program requires that indexes are stored on the hard disk to increase access — ie search — speed. Surely this is simply an admission that the retrieval software 'engine' is poorly conceived or poorly implemented? And why not give users the choice between plug-and-go with slow speed access, and installation with higher speed searching?

In cases 1, 2, 3 and 4 the file structure stored on the hard disk can be very compact and certainly need not soak up the megabytes of storage which many ROM applications, like *The Economist*, now demand. Case 5 looks like a symptom of sloppy programming.

One point made to me is that ROM disc developers have steered clear of plug-and-go ROMs because they know that if they make a mistake in the software, they must remaster the ROM which is expensive, rather than replace the installation floppy which is cheap. The *Economist* CD-ROM, although only just released and designed to install from the ROM, still comes complete with a floppy containing 'maintenance' software and an addendum sheet. Getting a ROM right first time is devilish difficult.

But desktop CD recorders are available for around £3000 and the cost of Write-Once blanks has been artificially inflated. Kodak has recently proved this by selling Photo CD blanks at under £5, retail including VAT. It should already be possible for ROM developers to get a plug-and-go ROM disc right with one-off Write-Once test discs, before mastering for a pressing run.

The trend in retrieval engines seems to be towards dumping ever larger masses of setup files onto the hard disk, instead of making things easier by running everything direct from the ROM disc. More and more I suspect that there is only one good reason for this. That is because the publishers let the programmers get away with the easy option. And the reason why the publishers get away with murder is that the publishers have grown up with paper, do not understand the new technology and never put themselves in the real world position of trying to set up and use a library of different ROM discs. Try it some time, folks. You might even learn something to your advantage.

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In the software corner Catherine Eade gets to grips with Permax's Power Letters, designed to help you generate the perfect job application letter.

Atari ST users after more power for their pennies will be interested in the Turbo 25, a processor accelerator from System Solutions, while the more musically inclined on a budget should study Ian Waugh's review of Cubase Lite.

Other products on test include a 24-bit PC graphics card from Radius, a sound card from Orchid and the recently launched Image from Computer Associates. There's also a treat for Psion

3 users in the form of three applications from those colourful people at Purple Software.

And not only little machines but little people get a look-in, with Count and Add, while Spellbound helps our reviewers brush up on their spatial awareness.

Count and Add & Spellbound!	183
VideoLogic Rapier 24	184
PenMagic Numero	186
PowerPrint 2.0	188
Dotlink 486 66MHz EISA	193
SummaScribe	194
Series 3 File Manager, Paint and Convert	195
WinFax 3.0	196
Sound Producer Pro	198
Atari Turbo 20/25	204
CA-Cricket Image	206
Atari ST Cubase Lite	208
Power Letters	212

Euro Test Labs Benchmarks

Personal Computer World, in conjunction with all the major European computer magazines, uses the Euro Test Labs suite of benchmarks. They have been devised to extensively test each of the machines we review and provide a common measure of performance for comparing similar hardware.

The tests are divided up into Low Level and Applications programs, with the Low Level section looking at CPU performance, RAM, video display and hard disk. Several tests are run for each: the CPU integer and floating-point performance is clocked with the traditional Dhrystone and Whetstone tests.

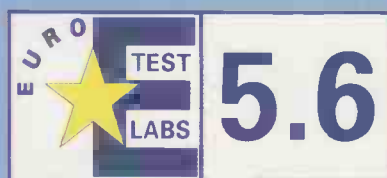
The RAM tests look at conventional, high and extended memory areas. The hard-disk tests look at access time and transfer rate and are carefully calibrated to ensure that a fragmented disk does not provide incorrect statistics. Video tests deal with text and graphics performance. Line drawing, flood-fills and scrolling are also put through their paces.

Raw performance testing can be open to abuse and misinterpretation. In the past, manufacturers have adapted their machines specifically to

fare well in *PCW* tests. A more meaningful method is to look at the jobs people actually do with computers. The most popular applications are word processing, databases and spreadsheets: the programs we use are the industry stalwarts of dBase, Lotus 1-2-3 and Microsoft Word. One very valuable test runs Windows 3.0 and an application written in Visual Basic.

All the results are condensed to provide three indexes — Low Level, Application, and a final *PCW* Index figure. This final figure is normalised to show how the machine being reviewed compares with a Compaq 486/33, which has achieved a score of 10. Note that this is not a perfect top score: anything faster will score more.

With the backing of magazines in France, Germany, Italy, Spain, Holland and Belgium, the Euro Benchmarks are the best computer performance tests yet devised.



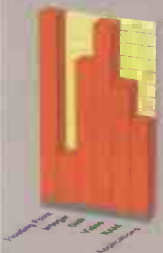
How to read our graphs

Raw figures will give you an idea of how good a product is, but what you really want is an idea of how well it compares with others.

The graphs we use are designed to do this in two ways. They give a relative feel for how each product fares against its competitors, and they show this against a scale which uses the performance of one of the products as an example.

The relative figures are shown in the bars. The top of the bar is the score achieved by the best item in the test, the bottom point, the worst. The intersection shows how well the product you are looking at did.

These are effectively the same as high/low/close graphs used by financial traders; the colours reflect how well a device did in the light of its peers. The more green in a bar the better. The more red, the worse the

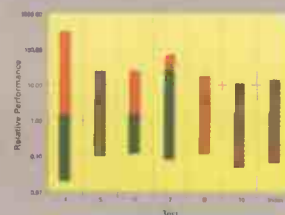


performance when compared with other units on test. It might help if you think of this as a fuel gauge on a car. Knowing how well a product performs in relation to others

is fine, but if they are all either fast or slow the results are not that useful.

An anchor point, which shows how all the machines compare with an average product, is required. The scale on the left-hand side of the graph shows how the product reviewed compares with one of average performance. This scores 1 on all the graphs.

A product which scores 18 is 18 times faster and one which scores 0.5 is half the speed of the base unit.



Count and Add & Spellbound!

Catherine Eade enjoys her second childhood with two new educational games from Lander. Having checked her maths with Count and Add she got hooked on Spellbound!.

Count and Add is a maths program for four- to seven-year-olds and Spellbound! is a game for sevens and over. Although the term 'edutainment' (cringe) may be enough to put some parents off, Spellbound! has to be one of the most addictive games I've ever played.

Both packages are available on the PC, Commodore Amiga or Atari ST. You'll need DOS 3.2 or higher and 540K free RAM. Loading, from one 3.5in disk (PC version) poses few problems unless you find a warning message telling you the drivers are not suited. If you have Sound Blaster or 100% compatible drivers in your machine you will hear sound effects. If you don't have the correctly configured drivers on your hard disk, you'll hear nothing at all.

This review of Spellbound! would probably be at home in the Screenplay section as it is an action adventure game more than anything else. The point is not to improve spelling and language skills, but to encourage and develop 'logic, memory, spatial awareness, judgement, and coordination skills'. Phew!

To check the accuracy of this description it was required that I spend some time testing the aforementioned game to see how my spatial awareness could be improved. One hour later, having pulled out most of my hair and been reduced to a quivering wreck I decided to let Chris 'Screenplay' Cain have a go. As I predicted, within ten minutes he'd reached the top level and finished the game. I discovered the best way to manage this was to set the fuel tank and number of lives to the highest setting, slow down the robots and create a new, smaller word list of three- and four-letter words. It still took me a long time to reach the final level, let alone master it, but I won't embarrass myself by saying any more.

The object of the game is to collect letters in the correct order to spell a word that flashes up on screen at the start of each level. Each correct word represents a key, and after five different

words have been captured on five levels, five keys will have been won. Thus can you open the door behind which lies Morgana the Morbid's magic wand? Having some of the characters from the previous games is more fun for the



children using the packages. It should also encourage parents and teachers to buy others in the series.

The first level, Raves in the Caves, features not a bunch of weirdos dancing to acid house music, but an assorted mix of flying and stationary robots (disguised as animals and insects) all lobbing missiles at our hero. Other levels feature a battle underwater with an impressive array of aggressive fish, flying above the rooftops of Manhattan, snowmen in the Alaskan wastes, and, the most difficult, Spaceship Frenzy, with all manner of aliens and fireballs to avoid.

The number of different creatures, obstacles and environments is impressive and the quality of the graphics high, particularly for an educational package. You do need Sound Blaster drivers though which are both hardware and software compatible. Having non-compatible drivers, I couldn't get any sound effects at all — much to the relief of my workmates, but to the chagrin of myself and the Editor. Another annoying thing is that you can't escape the program; you have to wait until all your lives have gone or your fuel tanks are empty.

Count and Add is, as you might have expected, a simple introduction to counting and adding. Aimed at four-year-olds and upwards, the game has

the usual parent/teacher section for adjusting the range of numbers used and the number of questions asked. It's possible to save and print out results (on an Epson-compatible printer) and there are animated 'reward' screens to heighten motivation. Randomly generated questions on five levels get the student to match and count objects and animals, do simple adding and, in Spider, more advanced addition within a time limit; if you don't get all the answers right in time the spider eats the butterfly.

The program is designed to help pupils master addition and subtraction within the guidelines of the National Curriculum. It is also suitable for older children with learning difficulties and can

be made easier or harder by returning to the control screen. A clock is also provided — shades of a Fisher-Price activity centre — but it's purely to tell the time and cannot be adjusted. Count and Add features digitised speech, and although I assumed I would have the same problem here as with Spellbound!, the sound effects came out through the PC speaker when I disabled the drivers I had installed.

Early access to a computer does have advantages. Research has shown that children who are ahead in the early years of their education are more likely to remain ahead throughout their academic careers. And if you can get your children interested in computers right from the start they're much less likely to suffer technophobia in later life.

I would recommend Count and Add for young children, as the graphics and sounds are colourful, simple and well-suited to the age group specified. Spellbound! is certainly of a higher quality than other educational software programs, but its claim to improve a child's spatial awareness, logic and judgment must be taken with a pinch of salt; the same thing could probably be said of Super Mario.

Count and Add and Spellbound! each cost £34.99 from Lander Software on 041-357 1659.

VideoLogic Rapier 24

It's fast, expensive and produces incredibly lifelike images, but do you really need 16.8 million colours? If you want the most professional job you do, says Gordon Laing.

Reality is big, really big. Reality is where most of us spend most of our time and despite many of its nasty traits, we'd like our computers to take part too. Don't get me wrong, I'm not talking about digital recession or crime; what I'm referring to is perfectly reproduced sounds and, in particular, photo-realistic images.

The former has featured in our lives in the form of CD players for many years, while digital audio sampling is nothing new to our computers and their sound cards. You may look at your TV and wonder why, despite having a lower resolution than your computer it has a more realistic picture. The answer is lots of colours. We've all looked up close at our TVs and seen that each pixel consists of three coloured lights, one red, one green, the other blue: O Level Physics explains that a combination of the three produces an infinite number of colours. But for the moment TVs remain analogue instruments while computers are entirely digital with exact numbers of attributes, like colours.

The answer to how many colours are required for photo-realism lies in grey levels. The human eye cannot discern between subsequent grey levels when there are more than 200 or so of them between black and white. Rounding up to 256 for binary purposes means 8 bits per pixel are required to reproduce a black and white photographic image. For colour, you need 8 bits each for red, green and blue: 24 in all. Two to the power 24 equals almost 16.8 million colours. Tempted to upgrade from 256? You'll need a new graphics card such as VideoLogic's Rapier 24 and quite a bit of spare cash besides...

VideoLogic isn't a newcomer to the field of video hardware: in the past it produced cards to digitise live video for display in a window or for genlock capture. More recently this hardware has incorporated JPEG compression making the files manageable (see last

month's *PCW*). Those who consider 24-bit colour acceptable at the lower resolution of 640 x 480 may be inter-

tor this is connected to the Rapier card, while VGA is accessed via the pass-through cable. VideoLogic provides cables for connection to your existing video chips, whether they are on a separate card or integrated onto the motherboard. If you're flash enough to own two monitors then the high resolution one should be connected to the Rapier exclusively for Windows, while the other connects to your old card, providing VGA only for DOS; in this situation, the pass-through cable is omitted. Before closing the case, you may have to change the jumpers to use an I/O address which doesn't



ested in the new Rapier 8/24 card at the cheaper £995.

The Rapier 24 is a full-length card, requiring a single 16-bit slot and enough surrounding space to physically accommodate its dimensions. 24-bit cards are undoubtedly impressive-looking beasts with stacks of chips consuming the entire surface area. Dominant in the centre is one Texas Instruments 34020 graphics processor running at a nifty 40MHz. Surrounding this is 1Mb of program memory and the considerable 3.5Mb of video RAM required to display those millions of colours.

The card is well designed and built, with no extra bits carelessly soldered on as an afterthought. It provides resolutions from 640 x 480 to 1152 x 882 at a variety of refresh rates up to 75Hz; also present are modes compatible with PAL and NTSC for direct connection to video equipment. VideoLogic has ensured virtually any monitor can connect to its card, including Apple models via an adapter included in the package. Hardware installation is straightforward: I found a spare slot, plugged in the Rapier and connected it to my video card with the VGA pass-through cable provided.

The Rapier only supports Windows and needs your existing video card for standard VGA. If you've only one moni-

tor conflict with any other device in your PC.

Software installation is executed from DOS and is as friendly as you could hope. Two disks are provided, one with drivers for Windows 3.0, the other for 3.1. The accompanying manual suggests you'd better have technical details of your monitor on hand to key-in when prompted. This sounded ominous but VideoLogic has included the specs of many monitors into the driver disks. My NEC 4FG was on the list, so installation proved only as complicated as selecting this and letting the software get on with it. Post installation, your system will have 24-bit TIGA 2.05, Panacea ADI and Windows drivers ready for action.

The action could prove difficult. Once you complete the installation and launch Windows, you notice little difference until you find an application that supports 24-bit colour. I launched CorelDraw!, selected the colour wheel and was delighted to find it displayed perfectly, with absolutely no dithering. Try the airbrush: with almost 16.8 million colours on tap, the shades are amazing.

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ideal and topical application for a 24-bit card would be to display and retouch images from Photo CD. VideoLogic goes a step further by offering hardware options to capture and return altered moving video images and create your own, professional looking TV shows.

Professional performance is no coincidence. 24-bit colour is gorgeous to work with, but not entirely necessary for most of us. VideoLogic isn't trying to appeal to the masses with the Rapier 24. It's for professional use and the price tag reflects this. At £1995 it's

more expensive than any of the cards in our video accelerator card Group Test [September 1992] and that includes several 24-bit competitors, but it was no slouch. It scored an astounding 187.39 on the Wintach CAD test and an impressive overall score of 100.76, making it considerably faster than both a standard ET4000 (which scores a mere 7.52 on the CAD and 5.46 overall) and the already nifty Opta MonaLisa. It's certainly worth the extra couple of hundred quid if speed's a concern. Admittedly, the screen redraws weren't as fast as my Orchid direct video card, but

to be fair, that was only shifting 8 bits at a time while conversing one-to-one with the processor.

I've lived with the Rapier 24 for some time and have no complaints concerning performance. The bottom line is I'm hooked on 24-bit colour and reckon I've got the best PC card for the job. The Rapier 24 is fast, expandable, desirable and expensive. I guess you pays your money... Me? I'm off out to transfer my favourite pics to Photo CD.

The Rapier 24 costs £1995 from VideoLogic on (0923) 260511.

PenMagic Numero

PenMagic has based its spreadsheet around pen input. More, it has based it around the user, watching how accountants work and fitting it to them. Geof Wheelwright adds up.

When is a spreadsheet not a spreadsheet? When it is a 'financial work processor' designed to be used with Go's PenPoint pen-based operating system. Such is the nature of an innovative new Canadian pen software package called Numero.

It is produced by North Vancouver's PenMagic, which has been developing pen-based software for PenPoint for the past two years, and is designed to make technology fit the way most financial users work, rather than the other way around. It is very much reflective of the whole PenPoint operating system design philosophy, which makes the pen act more like a traditional pen than as a mere substitute for a mouse.

Numero's designers started from a blank sheet of paper, in more ways than one, in designing this product. Rather than trying to re-invent the spreadsheet so it might be used in a 'pen-centric' operating system, PenMagic started by looking at the way most people who work with numbers actually use them.

What it discovered was that most people spend much of their time filling in forms on paper, then using the forms to do calculations. So PenMagic designed something that allowed people to fill out forms on-screen instead of paper, and have spreadsheet-style power when it came to making calculations based on the forms.

As a result, Numero ships with some 70 predefined forms, each comprising a separate vertical market application within a single PenPoint 'book'. There are standard accounting forms, columnar sheets, expense and time reporting forms, invoice forms, inven-

The power of an Excel-style spreadsheet can be accessed using gestures. You can use them to copy formulae across a range, intelligently create a series of data types and sum up a whole range of columns with a single pen stroke. There is a great deal of intelligence built into the gestures. For example, it understands the accountants' convention of having different parts of a cell for 1s, 10s and 100s. So if you enter the number 9 in the left-hand part of a Numero cell with your pen, it automatically knows that you want the number 900 stored there.

Despite the fact that it doesn't look or act anything like an ordinary spreadsheet, Numero can accept data from existing PC spreadsheet products. Lotus 1-2-3 files in .WK1 and WKS format can be

imported, along with Excel .XLS files and comma-separated (.CSV) and standard ASCII text files. The data from these sheets is imported as a single Numero grid the same size as the spreadsheet it started life as. This process lets you maintain all the data and formulae that are appropriate to the PenPoint and Numero environment. Any formulae not understood will be turned into values, while macros will be converted into text.

Keep in mind that because Numero operates in a totally pen-centric environment, there are a few things you can

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04/02/92	Go Crumpton			532.5	1227.5	750.0		2510.0
04/03/92	Developer Meetings			532.5	1227.5			1760.0
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tory sheets and others. Data can be entered into each of these simply by writing it on the screen.

Numero is, however, more than the sum of its parts. You are not limited to the forms included with the package: they are merely predefined templates for your work. Data on any page in Numero can be linked with any other, and the pages themselves can contain a variety of data types including pen, ink and alphanumeric as well as charts. Establishing these links, and all other forms of editing in Numero, is a matter of a few simple pen gestures.

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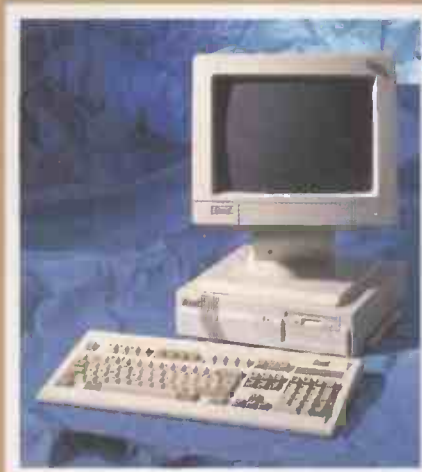
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do with it that would be hard to replicate on a garden-variety PC Windows spreadsheet. The page-oriented nature of the PenPoint environment, for example, means that there are some DTP-like and presentation graphic elements to the way Numero can be used. You can zoom in and out of your view of any Numero page and easily get a sense of what it will look like when printed and shown to a customer or colleague.

In addition, PenMagic has designed a system for 'folding' pages so that not only are you able to work with extra-wide pages (and therefore fit lots onto them), but you can 'fold away' any parts of the sheet extra to your needs at any point. It is a lot like the screen-

splitting function of most spreadsheets, but its execution is more elegant.

There are lots of good ideas at work in the design of Numero, but the real question is how many people will ever get to use them. Although PenPoint has started appearing on a few premium-priced systems (such as those manufactured by NCR and Samsung) Microsoft's Pen for Windows clearly has the development edge at the moment. It is by no means clear how the market for pen-based systems will develop, and whether there will be an eventual user base large enough to support a product such as Numero.

A PenMagic developer did tell me, however, that Numero could be ported

to Pen for Windows, although it would require a great deal more effort. He said Go's PenPoint offers a much more complete pen-based development environment, while Pen for Windows largely just substitutes mouse operations for pen operations.

The long and short of it is that if you have a PenPoint-based PC, then Numero is a must see. It offers an innovative and thoughtful approach to working with numbers that is unusual for a startup company like PenMagic.

Numero costs \$(Can)399 (around £180) from PenMagic on 0101-604 988 9982. The company is currently looking for a UK distributor.

PowerPrint 2.0

Your Macintosh can print out fonts any shape or size you will ever need, so why buy non-Apple? Try price and availability. Keith Brindley looks at one alternative.

While the Macintosh has long been a versatile weapon in the computer war there is one damp squib in Apple's armoury: a relative inability to interface with printers other than Apple's. Sure, ImageWriters, LaserWriters and lately StyleWriters give better performance than printers coupled to other computers (where the general user is concerned, not for the specialist, of course) so why would any Mac user want to use another make of printer? The answer's simple: price and availability. Apple printers have tended to be pricey, and there are more non-Apple printers around than Apples.

To put the record straight, it's neither the printer's fault nor the user's that hard copy from non-Mac systems rarely matches that from a Mac; it's really a matter of how the system software treats printers. A Mac (like Windows) treats fonts as the prerogative of the computer: fonts loaded in the computer are printable on a printer, whether the printer has the font integrally loaded or not. For years, Macs have been able to print fonts just about any size and style you could wish for, while other computers had only the fonts and sizes in the printer.

Recently, Apple has started to take all its eggs out of its single basket (maybe something to do with Windows 3.0). Lower prices, high street availability, greater compatibility and more machine variants has meant a moving of Apple's goalposts. So the computer for the rest

of us really is the computer for the rest of us. Now Mac users want cheaper products (printers being just one exam-



ple). Even more, PowerBook users have begun to roam the globe looking for compatible printers.

On the other hand, printing to non-Mac printers is still not only awkward, it's near impossible. There are two reasons for this. Firstly, Macs have a serial printer output while most printers have a parallel input and Apple provides no drivers for printers other than its own.

Second, a Mac's serial output is both drawback and boon. Output is to EIA422 standard, a common enough standard in computers and a reasonably fast one

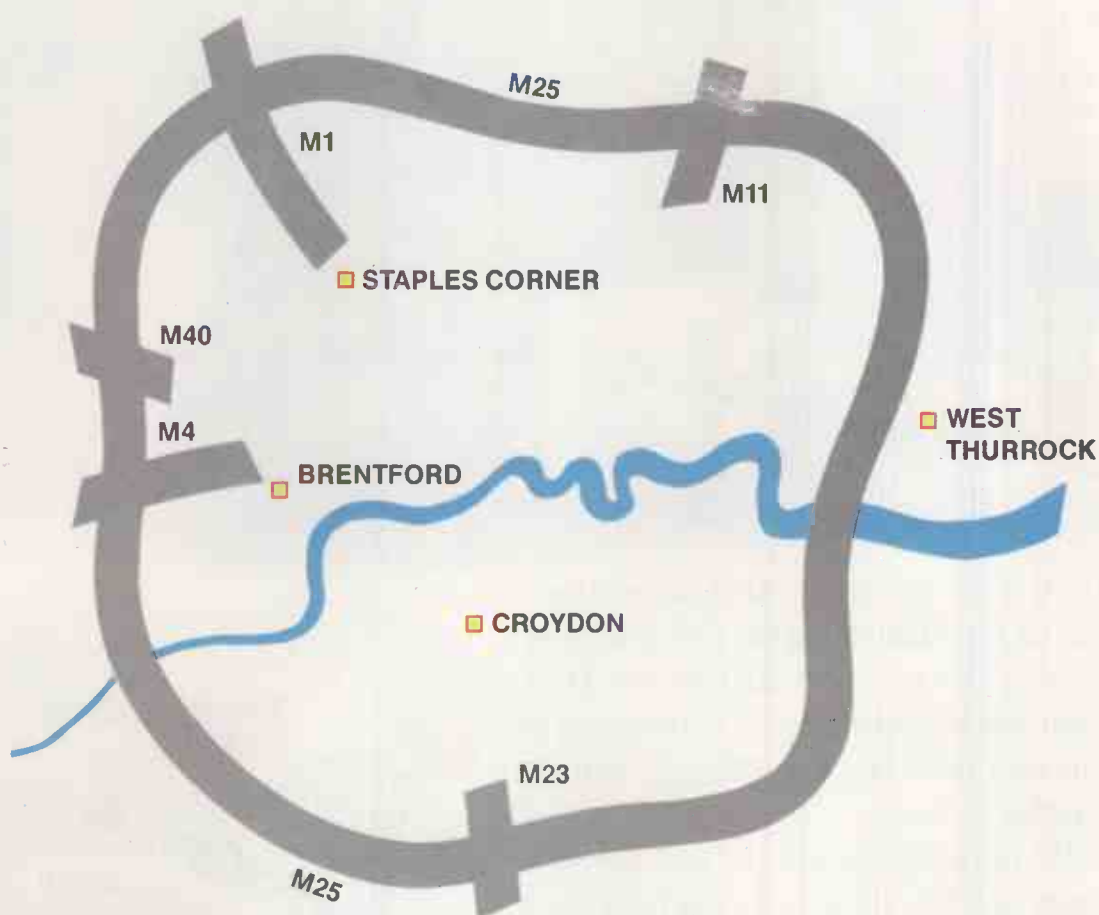
in printer terms. It lets the Mac output to a printer of either EIA422 or EIA232 standard (EIA232 is the correct term for the commonly misquoted RS232C. For reference, the letter C simply means the third version of the standard (as such this is out of date, a D now exists, and RS is meaningless). Most printers, on the other hand, have a parallel input to the more-or-less standard Centronics interface. Occasionally printers have a single serial input instead (Apple printers and some others); some have both, though this is rarely the case.

Even if a printer does have a serial input Apple doesn't provide drivers for non-Apple machines, so unless the printer manufacturer provides a driver, chances are you can't use it. There are exceptions, and some clever interfacing software has been developed by a few suppliers to convert a Mac's printer output code into particular printers' input codes.

PowerPrint, on the other hand, takes a very different tack. By converting the Mac's serial output into parallel Centronics form and including conventional Mac-style printer drivers, printers are accessed via the _ menu through the chooser, the same way any standard Apple printer is accessed. Even background printing is now available and, although not controlled by the conventional Mac PrintMonitor, works well.

Drivers supplied with PowerPrint are those of popular printers from Canon (bubblejet and laser), Hewlett Packard

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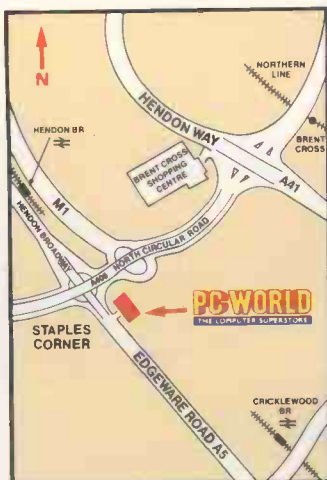


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M25

M11

A406

M4

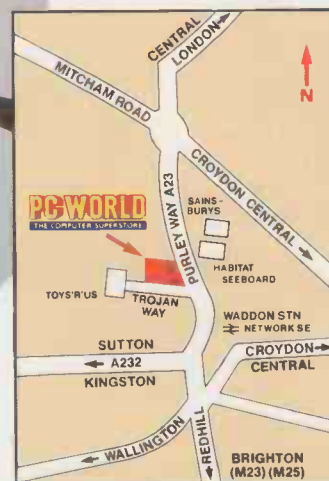


M23

M25



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(DeskJet, ThinkJet and LaserJet ranges), Epson dot-matrix, together with NEC and Toshiba variants. Together the 16 drivers cover just about any printer currently manufactured, as most printers emulate one or more of them as standard.

In practice, printing is then as easy as normal with a Mac and quite seamless. Conventional dialogs guide you through the print run, offering options such as paper size, print resolution and so on. But for the fact you see the output come from a non-Apple printer you'd think an Apple printer was being used.

The product's real beauty is its compactness. The serial to parallel conversion is all done within the interfacing cable. There's a miniaturised, surface-mounted, printed circuit board to perform the biz, positioned inside the Centronics plug which connects to the

printer. Power is supplied via the lead from the Mac, so there's not even that to worry about. An integral LED on the circuit board, visible through a hole in the printer connector, flashes when signals are transferred from Mac to printer so you can keep some track of what's happening. I imagine most users won't even notice it flashing: who cares as long as the paper comes out with ink on the right dots?

PowerPrint is strongly geared for PowerBook users. Armed with a PowerBook and PowerPrint you can walk into just about any situation, plug into a printer and print to the usual Mac standard, with the usual ease. Alternatively, a sole Mac user in a non-Mac environment can print to already available printers without needing to buy a new Apple one. Just think of the look on their faces when you print a docu-

ment to your usual Mac quality, and they're stuck with the printer's in-built fonts.

It's a revelation to Macintosh-philas, generally used to feeling a bit different. If you think about it, it's an alarming prospect: a Mac which really is compatible with mainstream computing.

Well, no, not really. I mustn't go overboard or who knows where it will all end? Us Mac users don't want too many converts from the IBM-compatible world or it will be us who are the boring old stick-in-the-mud mainstream users!

To a Mac user who wanders the printing wilderness, PowerPrint 2.0 is manna from heaven. Pity Apple didn't think about it a few years back.

PowerPrint costs £115 from Academy Software on 081-656 9560

Dotlink 486 66MHz EISA

Bucking the trend to low-end, cut-price PCs, Dotlink announces its 486 and damn the cost. Super-fast and with strong graphics, Danny Bradbury found it a joy to use.

At a time when everyone seems to be entering the cut-price PC market, with machines designed for the wallet rather than for the image, it's nice to see someone refusing to bend to market forces and staying at the high end. Such a company is Dotlink. The Wembley-based firm started in the UK at the end of 1990, and though it does sell entry-level, low-end machines (down to 386SX level) it attacks the high end with machines ranging all the way up to an EISA-based 486-66. It launched the EISA-based machine in August 1992, but this was with a standard configuration. The machine as reviewed didn't ship until last September.

As the name suggests it's an EISA-based machine with a 66MHz 486DX2 processor, supplied with a very tasty 17in Qume colour monitor. Engineered in a standard creamy off-white, it contains a single 1.44Mb floppy disk and two storage bays into which one can slot removable hard disks: the company supplies its own removable cartridges which house 40, 80, 105, 120, 170, 210, 330, 400 or 520Mb IDE disks. Soon there will be a SCSI-based device with a capacity of 1Gb. These disks are easy to insert and can only be

removed using a key, so they're nice and safe.

The graphics subsystem is what the



company offered the advanced option on in September. The high configuration option, shipped with the review machine, is a Genoa multimedia card,

capable of displaying from 16 colours in 1280 x 1024, to one million colours in 480 x 600. The card also has a Tseng

Labs processor, so it is meaty enough to take on the heavy graphics operations Windows demands. This sort of configuration targets the machine directly at image-intensive applications, including prepress and advertising design.

The whole of this storage subsystem, and the large grey power switch, is covered by a rather flimsy smoked perspex screen which pulls down from the inside top of the machine. When it's in place the only visible things left on the front are the Dotlink logo, the turbo and reset buttons, and the hard disk and turbo lights.

At the back are six full-length and two half-length EISA slots. Although two of the cards (one half-length and one full-length) are taken up by the video and hard disk controller boards, this still leaves room for expansion.

As far as connectivity goes, the machine is reasonably well connected. It has two COM ports, one 9-pin and one 25-pin, and a parallel socket too. There are spaces for a number of other sockets in the machine, in the form of press-out plastic templates in

the chassis. Although this makes the machine even more flexible in expansion terms, it does indicate that the casing has not been designed specifically by Dotlink. This is no great disadvantage as it does keep the price down, but for a company that claims a high-end customer base it is a little disappointing.

Looking inside reveals the processor sitting on the motherboard, underneath a heatsink. Because a 486 running at 66MHz can overheat, the machine needs something to cool its brain down. Alongside is the co-processor socket. It's a shame the board isn't upgradable to use Intel's up and coming P5 chip, the Pentium, though the company promises to release a Pentium-aware computer soon.

Although this card uses the usual ISA bus, the hard disk controller takes advantage of the machine's EISA capability, meaning that the communica-

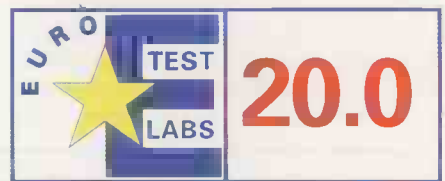
tion between the hard and floppy disks and the CPU will be much faster. This is complemented by the fact that the machine has a large hard disk cache — 4Mb. Consequently, the speed of the thing hits you immediately, and is especially noticeable in Windows. When Windows uses virtual memory to run programs, it often reads and writes to the hard disk, treating it as extra RAM, meaning that the speed of the disk directly affects the speed of your application. Add to this the whizzy graphics processor, the CPU which runs at the highest speed yet available, and the EISA feature, and you're talking super-fast.

It is extremely difficult to fault this machine. It was a joy to use. I wish the same could be said of the company's response, though. Getting a price for the system to complete this review was an uphill struggle. I phoned several times and, on the rare occasions when

it wasn't engaged, asked to speak to the sales manager responsible for the machine. 'He's not in,' said the receptionist apologetically. 'Oh, then can I speak to the sales department please?' I said. 'I'm sorry, they're not in either,' she said.

No-one's machines are so good they don't need to try their hardest to sell them. When Dotlink gets its pre-sales support sorted out, it will be a company to be reckoned with.

The 486 66MHz EISA (with 420Mb removable hard disk) costs £2750 from Dotlink on 081-902 5802.



SummaScribe

Pen computing has been more talked about than used up to now. Cliff Joseph looks at an application that aims to bring it within the reach of the everyday PC user.

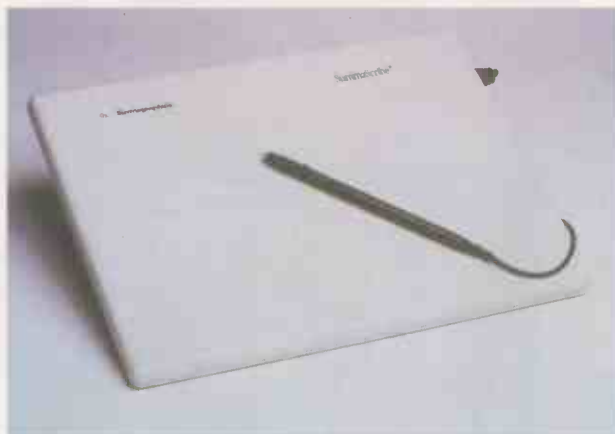
Handwriting recognition has grabbed a lot of headlines over the last year, but few functioning systems have actually reached the market so far. The ones that have shipped have tended to be expensive, full-scale computers designed around handwriting input.

The SummaScribe tablet takes a different approach. It's a conventional graphics tablet bundled with Microsoft's Windows for Pen Computing software. Because it's a simple add-on rather than a standalone device, the SummaScribe is much cheaper and opens up the possibility of handwriting input to anyone who already owns a PC.

Summagraphics is well-known for its graphics tablets, and the SummaScribe is a standard tablet and stylus device. If you're not using it for handwriting, it can be used for drawing graphics, or even as a replacement for the mouse.

The tablet is slightly larger than A4, and the 'active' area, which corresponds to the computer screen, is 6in x 9in. The stylus plugs into the tablet, and the tablet into any comms port, so hard-

ware installation is quite simple. Installing the software was a little more difficult: Summagraphics' manuals



aren't too good, and I found myself resorting to the file manager to find the drivers on the supplied disks, as they weren't properly installed by the setup program.

Once through the installation process you're in the hands of the Windows for Pen software. This includes a number of accessories for practising on, as well as a Notebook for writing short memos and notes. Inside any Pen-

supporting software, the arrow cursor turns into a pen whenever it is over an area that accepts pen input: you simply write what you want onto the screen.

I particularly liked the ability to use the pen as a replacement mouse, as this lets you use the pen both for text input and for selecting menu options, as well as activating applications, and moving and resizing windows. In effect, the pen starts to take over the functions of both mouse and keyboard, and speeds up your work simply because you don't have to keep moving your hands between the two.

Few applications support pen input at the moment, so the pen tools include a Pen Palette which allows pen input into these applications. The palette stays on screen alongside the application, and text is entered into a window attached to it. When you're happy with the text, clicking the OK icon transfers the text into the application.

Text has to be entered one character at a time — no joined-up writing I'm afraid. The palette's text window can

be resized to fill as much of the screen as you might want, and it provides guidelines divided into boxes for individual characters. This makes it easier for the software to tell characters apart, though it does mean you have to take care to keep characters within the guidelines, or accuracy of text recognition suffers.

Not surprisingly, the main problems tend to revolve around similar letters, particularly h and n. And letters such as c which are the same shape in both upper and lower case tend to come out in upper case more often than not.

At first, I thought the software would necessitate writing characters very carefully, but I found it better than I expected at coping with the loops and sloping characters of my handwriting.

It still has rough edges, though. The worst of these is a habit of crashing when faced with a particularly awful piece of handwriting. This doesn't happen too often, but it's still irritating, and does raise a question about how much you can rely on handwriting input to

replace the keyboard. However, Pen for Windows does include a training feature which allows you to 'teach' the software how to recognise your handwriting. I also found these crashes less frequent if I didn't try to write too quickly.

The stylus can be detected even when it's 0.5in above the surface of the tablet, allowing you to trace text or graphics, and it also means you don't have to press too hard to get a response. The tip of the stylus doubles as the left-hand mouse button; there's a second button on the barrel of the stylus that acts as the right-hand mouse button. Pressing down on the stylus selects an item or menu, just as a single mouse click would. A quick tap across operates like a double click. At first I didn't like this, but it soon started to feel even more natural than using a mouse, perhaps because the stylus feels like an extension of your fingers, rather than a separate object like the mouse does.

As for the tablet's uses, well, the software still isn't accurate enough to

replace the keyboard. You have to enter text very slowly if you don't want to sacrifice accuracy, and entering more than a few words at a time would be impractical. I'm a fairly slow typist, but I can still type more quickly than I can write by hand. I suspect the SummaScribe will be most practical for entering small pieces of text: filling in forms, scribbling notes or phone numbers, manipulating data in spreadsheets. Schools might also find it useful for teaching reading and writing.

Despite the lack of accuracy, I did find that using the pen felt very natural, and pen input definitely has a future. Widespread use will require greater accuracy than Pen for Windows currently offers, but if you could use it for the applications mentioned above, then at just £225 for a combination of pen input, graphics tablet and replacement mouse, the SummaScribe is a good value package.

SummaScribe costs £225 from SummaGraphics on (0635) 32257

File Manager, Paint and Convert

Purple Software's trio for Psion's Series 3 includes a useful conversion tool and a rather misplaced painting package. What did catch David Brake's eye was File Manager.

One of the most encouraging things about Psion's Series 3 is that, slowly but surely, third party developers have emerged to produce programs for it. Purple Software is one of the first, with three mini-applications. These can be purchased in ones, twos and threes on floppy disk or Solid State Disk (SSD).

The application that first caught my eye was the File Manager. You can perform all the standard file operations on the Series 3 as it is: copying files, deleting them, creating directories and so on, but it is certainly not easy to do. The Series 3, as it ships, is aimed at fairly unsophisticated users who aren't expected to create complex directory structures on their SSDs. File Manager aims to be a kind of XTree Gold for more sophisticated users to manage their data with.

It largely succeeds, offering several facilities the Series 3 lacks which make file handling much easier. Probably the most important single feature File Manager offers is the ability to locate files hidden in subdirectories on an SSD. It works reasonably fast (a search of 400K of data took around five seconds) and

gives you a window of matching files which you can open or manipulate any way you wish. This function's only weakness is that it displays the whole path for each file on the screen, which can make it impossible to identify deeply-nested files without opening each one. The File Manager can move individual files or directories (the Series 3 makes you copy, then delete the original) and it is much easier to visualise and navigate through structured disks thanks to File Manager's XTree-like graphical display of directories and subdirectories.

File Manager doesn't solve every problem yet, however. While it is very flexible in the way you can tag files in a given directory (say, selecting all files whose third letter is p), like the Series 3 it doesn't allow you to tag files in different directories all at once, unless you have used the Locate command to find them. Neither does it let you undelete files from Flash disks. It is infuriating to know that a Flash RAM disk contains all deleted files until it is re-formatted, but that you can't get at accidentally-deleted files unless you

return the disk to Psion.

The other two applications are considerably less useful, though they may come in handy for some. Paint looks at first like a bizarre idea on a machine with a 240 x 80 pixel monochrome screen and no way to attach a mouse. It is certainly unlikely to be used to create works of art, but it can load, store and print pictures as large as 1024 pixels square in .PCX, CompuServe, .GIF, and Windows .BMP, as well as Psion's own .PIC format. This means Series 3 users with desktop computers can put artwork from their PC into their pocket for the first time, without having to print it out.

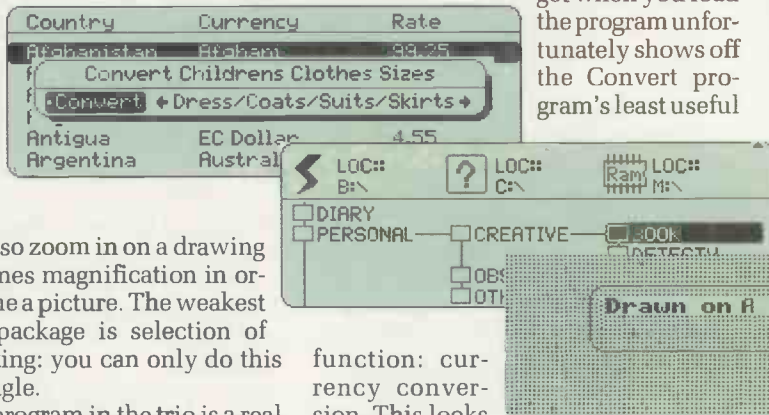
Those with scanners can use the Series 3 to store maps. I've already seen one owner with a map of London's Soho in his machine. Bitmap files on desktop PCs can fill megabytes of hard disk space, but because pictures in a Series 3 will typically be quite small, and because it only needs to store black or white information for each pixel, they can turn out quite small. A .PIC that fills a Series 3 screen takes just 2300 bytes.

For would-be Series 3 artists, and for retouching existing images, Paint, to its credit, has a fair array of bitmap editing tools. You can use it to draw lines, boxes and ellipses, and you can fill areas with ten preset patterns.

You can also zoom in on a drawing up to four times magnification in order to fine tune a picture. The weakest part of the package is selection of areas for editing: you can only do this with a rectangle.

The final program in the trio is a real curate's egg. Convert is what you would think: it converts between commonly-used measurements of length, volume, fluid measurement, weight, area, speed, pressure, temperature, energy and even clothes size. So far so excellent. It can

even convert numbers between ordinary decimal (base 10) and hexadecimal, octal and binary. The screen you get when you load the program unfortunately shows off the Convert program's least useful



function: currency conversion. This looks a daft notion when currencies seem to bob up and down like corks in a tempest. Fortunately, you can update the exchange rates at any time.

Unfortunately, the user interface is

also a bit fussy; the hot-key to search is Psion-B, because Psion-F has been taken for Fluid measures. You also have to type in the name of the country whose money you want to convert (or the name of its currency) exactly right — misspell it or type it incomplete, and it comes back 'not found'. That being said, if you want to impress your colleagues by knowing what Bhutan's currency is (the Ngultrum) and approximately how many you get to the Pound (43.25, it says here) it might be worth investing in.

Purple Software is on 081-886 9779. Prices (including postage and VAT) are: single application (floppy) £29.95, (SSD) £49.95; two applications (floppy) £39.95 (SSD) £59.95. All three (floppy) £49.95 (SSD) £69.95.

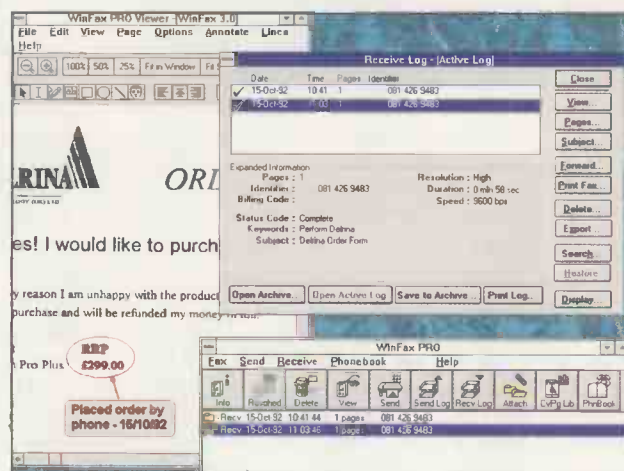
WinFax Pro 3.0

Half a million WinFax users can't be wrong, but they can be tempted to upgrade. Steve Greenham believes that version 3.0 will set the standard for fax software.

A wise man once said that no software is worth buying until it reaches Version 3.0. Half a million WinFax users may disagree — until they see the latest version. WinFax emulates a Windows printer driver. To send a fax in any Windows program simply choose Print, type in the name and fax number of the recipient, click the Send button, and the document is faxed. Delrina simplifies things further by providing macros for common Windows applications: for example adding a fax button to the Word for Windows toolbar.

Receiving a fax is totally automatic. WinFax saves the incoming fax as a disk file with an .FXR extension, from where it can be viewed and printed. You can choose the level of interruption caused by an incoming fax. It can be silent, or you can display faxes in a viewer immediately after receipt. WinFax can also be set to bleep or, using Windows' multimedia extensions, play a sound file. *Star Trek* fans could have Uhura's voice say 'Incoming Message Captain!'. An impressive new feature is a mini viewer

window which displays a thumbnail miniature of the fax as it arrives. As soon as the letterhead is visible you can tell whether you need to deal with it immediately.



WinFax has a comprehensive phonebook facility which allows recipients to be grouped and faxed together. Phonebooks are stored as dBase files so information can be imported from other databases, filtered and searched. External personal informa-

tion managers, such as Polaris PackRat, can be used as phonebook servers via DDE linking.

As an introductory offer Delrina is bundling John Caldwell's Cover Your Fax cover-page templates.

These encompass a variety of business and personal topics in a cartoon style, and can be further customised using the built-in cover-page designer. The designer is a cut-down version of Delrina's Perform Pro (see PCW November 1992) which allows text, graphics, and variable information (such as sender's name) to be placed anywhere on the page. Variables which are not already known are prompted for when the fax is sent. Cover pages can be grouped into libraries and selected by clicking on thumbnail views.

The secure transmit option only sends if the receiving machine gives a specified answer back. Although this is dependent on the owner of the receiving machine having set it up correctly, it does give some assurance that confidential documents haven't gone astray.

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The viewer used to display received (or outgoing) faxes is similar to that of previous versions. Pages can be displayed 25%, 50% or 100% of full size, or scaled to fit the window by width or height. The addition of toolbar buttons greatly speeds viewing operations.

The ability to add an annotation layer is an important new feature. This is essentially a transparent overlay you mark up using similar tools to those of the cover-page designer. Annotations can be merged permanently onto the fax image, or stored and displayed separately. For example, a query regarding the contents of a fax could be resolved by writing on an annotation and sending it back to the originator.

Often line noise, or a badly maintained fax machine, gives rise to dirty faxes, covered with streaks and speckles. The Fax Vacuum processes these errant pixels and greatly improves the image although some genuine lines may

also be removed. Fortunately the change is not permanent until you save the cleaned image back to disk.

A welcome addition is Optical Character Recognition (OCR). Delrina has negotiated an exclusive licence to Caere's Anyfax neural network technology, widely regarded as one of the leading packages. OCR output can be to the clipboard, an ASCII file or to an interactive editor in which the text and fax image are displayed in horizontally tiled windows. As you move through the text window correcting recognition errors, the original image is scrolled to keep pace. A spell checker is also included. You can set WinFax to perform OCR automatically on each incoming fax and specify a batch file to perform post-processing: perhaps to convert the output to an email and forward it to you.

Stored faxes consume huge amounts of disk space, several hundred kilo-

bytes per page. If you have to keep them, you will be pleased to learn that WinFax now has the facility to save faxes to archives, compressing them by up to 25 times. When you archive a fax you are prompted for indexing information which can be saved in ASCII or dBase format. Filters can also be set on the receive log, for instance to archive all faxes from a particular location that arrived before a certain date.

WinFax Pro version 3.0 will set the standard by which other fax software is judged. Casual use is extremely easy while OCR, annotation and comprehensive phonebooks and logs will enable power users to establish sophisticated fax management systems. If only it had a macro language.

WinFax Pro costs £99 (£35 if you upgrade from a previous version) from Delrina Technology (UK) on 081-207 3163.

Sound Producer Pro

This new sound card does everything the Sound Blasters can do but with a bonus — compatibility with a range of popular sound standards. Mat Beard listens in.

Orchid has been making PC peripherals almost as long as there have been PCs. The company started in 1982 with the world's first local area network: PCnet. Since then, it has made a range of 'world's first' peripherals. 1984 saw the first accelerator board for PCs, PCTurbo, which was soon followed by ECCELL, the first PC multifunction board with error correction. RamQuest 50/60 was the first expanded memory specification, developed by Orchid in 1987 for IBM PS/2 computers.

These were all important developments, but Orchid's biggest success to date is the ProDesigner II, the first SuperVGA adapter to support 1024 x 768 graphics in 256 colours on non-interlaced monitors. The success of the ProDesigner II was followed by the Fahrenheit 1280, the first graphics card based on S3's 86C911 chip.

With the introduction of Windows 3.1 and Orchid's experience in graphics, multimedia seemed the obvious next step. The company has released two new sound cards, the Sound Producer and the Sound Producer Pro. It is also soon to release a new version of the

Fahrenheit card, which will incorporate some basic audio capabilities.

The Sound Producer cards are similar in specification to the cards of simi-



lar name from Creative Labs, the Sound Blasters. Unlike Sound Blaster cards though, the Sound Producer Pro is compatible with four popular sound standards — Sound Blaster, Adlib, Covox Speech Thing and Disney Sound Source.

The card is accompanied by a fairly substantial manual to guide you through installation and setup, but in most cases it should simply be a matter of plugging

the card into a free 16-bit slot and installing the software. If you do encounter any problems, such as address or interrupt conflicts, the manual clearly explains how to change the card's setting using its various jumper switches. The Sound Producer Pro can also be used as a CD-ROM interface for AT-bus or SCSI drives. The two CD-ROM interfaces are built into the card, but a single chip upgrade is required to use the SCSI interface.

The card's FM music capabilities are handled by a 20-voice stereo FM music synthesizer with four FM operators. The digital side of things is down to two 8-bit Digital-to-Analog Converters (DACs) which provide output of digitised sounds such as speech, music and sound effects. The two DACs also take care of stereo digitised recording and can handle sampling rates of 4kHz to 22.05kHz (4kHz to 44.1kHz in mono). The card also has a stereo digital/analog mixer built in, which allows selectable input and mixing of all audio sources for recording; this includes line-in, PC speaker, stereo CD audio, stereo DAC, FM music and stereo microphone. Speakers or headphones

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In fact, to buy a Compaq Prolinea 4/33 Model 120 configured to an equivalent specification* would cost at least 40% more.

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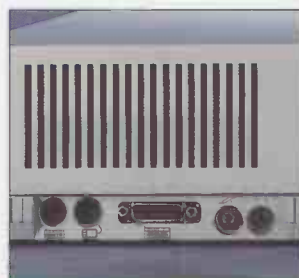
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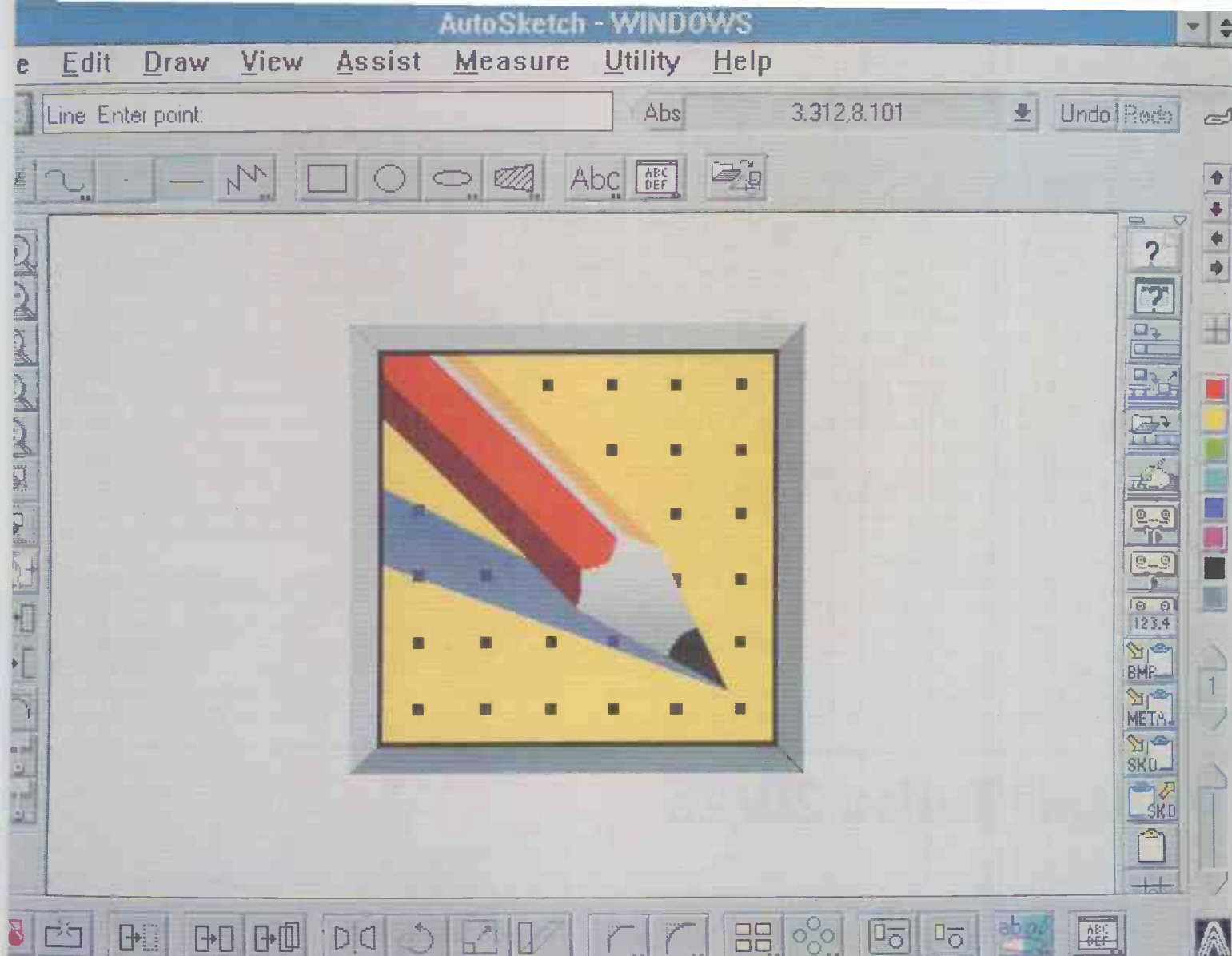
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can be plugged into the line-out socket at the rear of the card, where they will be powered by the built-in, 4 Watts per channel stereo amplifier. A standard 15-pin, D-shaped connector doubles as games port and MIDI interface.

A wide variety of software is provided on the accompanying disks, for both DOS and Windows. Among the DOS software are utilities to diagnose and configure the card, play audio CDs, and convert various sound standards, including .WAV, .SND and .VOC. A DOS multimedia authoring package called SoundScript is also included, which lets you combine sound files with images and animation using a simple programming language.

The Windows software is more interesting. As well as Sound Producer Pro MCI drivers, there are various programs for playing and recording music and sounds. Jukebox lets you enter sound events onto a playlist which can be played in the background while you

do something else. A sound event can be anything from a .WAV or .MID file to a CD track. Jukebox is compatible with Microsoft's Musicbox and can use its playlists. The Jukebox program stores CD data in a MUSICBOX.INI file so it can remember information such as CD title and track title, and checks to see if there is any information stored when a new disk is inserted.

Win-Mix lets you mix input sources and alter settings such as volume balance, bass and treble. The new settings can then be stored in the card's EEPROM. WinDAT is for playing, recording and editing digital audio files. It works in a similar way to the Windows Sound Recorder, but WinDAT allows you to manipulate .VOC files as well as .WAV files.

The program Orchid believes will sell a lot of its cards is Voice Notes. It allows recorded messages to be inserted into any application file or document that supports OLE and played back

simply by double-clicking on the small icon. This idea isn't new, the Windows Sound Recorder can do it, but what is new is the ease with which it can be done. Two clicks are all that's required to start Voice Notes, start recording, stop recording and insert the message into a document, compared to nine using the Sound Recorder. Orchid also provides an option to create a Voice Notes Player Disk. This allows machines without a sound card to play messages recorded with Voice Notes through the PC speaker. Orchid will soon start to ship all its new products with a copy of Voice Notes, in the hope of promoting business audio.

Sound Producer Pro costs £169, including stereo speakers and lapel-style microphone. Sound Producer costs £69, including speakers, microphone and Voice Notes. Both include four-year warranty and lifetime free technical support, from Orchid on (0256) 479898.

Atari Turbo 20/25

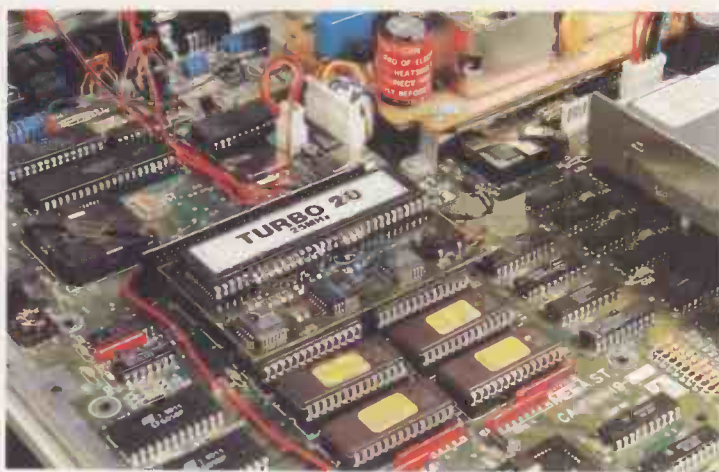
It beefs up the clock speed and it's backwards compatible with existing ST software. The Turbo could be the answer to Atari owners' prayers, says Andrew Wright.

With the Falcon 030 still waiting over the horizon, many Atari ST owners are looking closely at their machines and thinking about an upgrade. The DSP chip and industry standard ports should prove useful, not to mention the promised multi-tasking operating system, but the Falcon 030 is unlikely to be 100% compatible with existing software written for the 68000-based ST. What if you simply need more speed to run your existing software?

The new Turbo 20/25 board from System Solutions addresses the problem faced by professional users who need the speed now, without worrying about software compatibility. Until recently the 68000 processor could not run faster than 16MHz but innovative wafer technology has made it possible to increase the clock speed up to 20 and now 25MHz.

The Turbo board is essentially a surface-mount technology circuit board,

comprising a CMOS 68000 chip and an oscillator driving the chip at 25MHz. This increase in clock speed provides over three times the CPU performance



of the 8MHz ST, and a considerable increase over the 16MHz Mega STE. It isn't clear how it will perform against the Falcon, although the latter will probably come in somewhere between three and a half and four times faster than the

base model ST.

Simply turning up the clock speed isn't going to give the best results, however. There is still a bottleneck between the turbocharged processor and the system bus, still running at 8MHz. The answer lies in the 32K of high-speed static RAM on the board. This cache memory is divided into a 16K data/instruction cache and a 16K memory cache, allowing the full benefit of the extra clock speed.

The Turbo 20/25 is supplied in an anti-static bag, carefully tucked in a strong cardboard box. The instructions are still in German, unfortunately, so DIY fitting is likely to be awkward. On the other hand, according to supplier System Solutions, there are inherent problems with the components in some STs, particularly in substandard blitter chips and low-performance RAM buffer chips. Making use of the supplier's £30 fitting service will ensure that the upgrade is

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Fitting the Turbo board consists of removing the existing CPU by cutting the 68000's pins, clearing the holes and soldering in a 64-pin socket in the empty slot. The Turbo board is then pushed gently into place. A second, 64-pin socket is provided for Mega ST owners who need additional clearance to avoid contact with the adjacent ROM chips. There is also an option for wiring in a switch to turn the video cache on or off so as not to conflict with third-party graphics cards.

Having clambered over the fitting obstacle, things couldn't be easier. Booting the machine will automatically switch to the default 8MHz mode but a disk full of utilities is available to make it boot up in 25MHz mode. A desk accessory is also provided for the same purpose, so the machine will reset with the CPU running at the required speed.

The main reason for fitting a Turbo 20/25 is its speed, but its strongest selling point is backward compatibility

with virtually all software. Several 68030 boards are becoming available with clock speeds as high as 50MHz but their compatibility with existing applications is likely to be questionable.

The Turbo board means the ST is still an ST. It will run nearly everything you can throw at it, from obscure PD patches and utilities, through the mainstream applications like word processors and graphics programs, to top-end packages like Calamus SL and Didot Professional.

I've been running an early revision of the board over several months and I can count the number of problems on one hand. Cartridge-based applications can fail to work properly: scanner drivers to which timing is critical, and some music applications such as C-Lab Notator are cases in point. Other widely-used music programs such as Cubase are believed to work but I haven't been able to test them all.

As far as word processing, DTP and graphics is concerned, the difference is immediate. Benchmarks show that CPU

speed is increased by a factor of just over three, as expected. The remaining bottlenecks, namely the hard disk and the video, mean few real-life operations achieve this, however.

Large files load roughly twice as fast, slowed down by the hard disk, while flipping a large TIFF file, which relies partly on the video display, will show similar improvement. Other, more CPU-intensive operations offer better improvements: archiving and de-archiving files, converting fonts or autotracing an image will achieve near three times the speed, with other day-to-day operations somewhere in between.

At just under £330 fitted, the Turbo 20/25 will give many an ST owner a new lease of life with his machine. It doesn't match up to the 32MHz 68030 TT (it's still only a third as powerful in CPU terms) but it beats waiting for the Falcon.

The Turbo 20/25 costs £299.99 plus £30 for fitting (inc VAT) from System Solutions on 081-693 3355.

CA-Cricket Image

Impressed by the operations available on this image manipulation software, Steve Cassidy was fully prepared to be bowled over. But trying to use them had him stumped.

The PC marketplace seems to be moving away from simply shifting boxes. Where, a few years ago, you'd buy a box of a given speed and display capability, the emergence of Windows as a common platform for hardware and software developers to connect to has prompted much interest in doing things with a PC other than word processing, spreadsheets, or compiling programs.

Computer Associates is famous for its ultra-corporate, careful and 'sensible' approach to the market and its customers. This made its purchase of the cute and cuddly Cricket software house (famous for Cricket Graph on the Mac and precious little else) seem rather curious.

Now, a few years after the takeover, the Cricket name still pops up in a few CA releases, presum-

ably to denote products CA feels unable to present within the pinstripe straitjacket of its corporate image. CA-Cricket Image is exactly that kind of offering: image manipulation software.

The reason for image manipulation software on the PC is that, as with the Mac a few years ago, the components to

support the task are now relatively widespread: a handheld colour scanner costs £300 or so, and delivers 24 bits of colour (admittedly in three chunks of eight) to your PC. By a slightly different route, it's fair to expect a £300, Photo-CD compatible CD-ROM player to deliver images of equivalent quality, if not right now then certainly by Easter 1993. So, given a Windows environment with an up-to-date SVGA video driver, why not use your PC to fiddle with your holiday snaps?

Maybe because you've been stuck with a copy of CA-Cricket Image. The sort of non-functionality I am about to describe might be excusable in an early developmental alpha but I was sent a complete, shrinkwrapped version. It's on a single HD disk,

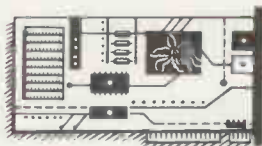


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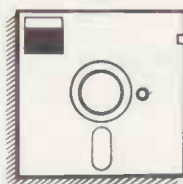
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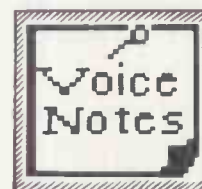
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and there's a thin and well-written manual to go with it. A couple of megabytes of your disk is given over to the program, and to some megabyte-sized, example 24-bit colour files.

Let's step through the tasks you're likely to perform in a job of image editing and see how well CA-Cricket Image copes. First, you're looking to bring in a file, in one of several formats. Image scores highly here: .TGA, .BMP, .TIF, .PCX, GIF (89a standard), CVP and even the new JPEG 'structured loss compression' format is supported.

You pick a file, and take a look at what you have. Alternatively, you'll be off to make a cup of coffee, drink it and wash up the cup: on a 486SX25 with 8Mb of RAM and a 200Mb drive, it takes Image well over seven minutes to load a 6Mb JPG file. In the same time, a 20MHz Mac IIx with roughly the same hardware spec and a copy of Adobe Photoshop can load the same file eight times. A copy of PhotoStyler, Adobe's Windows version of PhotoShop, returned times similar to the Mac, so I can only conclude it's a CA-Cricket code problem.

Most images are going to be larger than the screen you're using to view them with. How depressing, then, to find that CA-Cricket chooses to display them at only one magnification (one image dot to one screen dot) inside a file window whose size and shape seem to bear only a vestigial resemblance to the size and shape of the picture in question. There are no options to zoom in or out of the picture, something so basic to picture understanding (if you're any kind of design professional) that it was in Windows

Paintbrush in Windows 1.0.

However, once the picture is loaded, an impressive number of operations can be performed on it: change of bit depth (start with a 24-bit TIFF and render it back to a 16-colour Windows bitmap, for your impoverished pals with standard VGA adaptors); conversion to different formats; colour correction (suppose you took a picture with daylight film inside, and everything's yellow); contrast maximisation (underexposed? No problem. It's amazing what you can pull out of an underexposed picture); 'posterisation' and CMYK separations. It has the full range of manipulation options, almost as if someone had gone away and tick-sheeted the feature sets of the competition. The options for filtering an image, sharpening edges, removing halftone moire effects, even an averaging filter to give an oil painting effect, are strikingly similar to those of Photoshop/PhotoStyler.

At least, their presence implies familiar territory: their execution is another matter altogether. It's feasible to select a region of the image, for instance, and apply a filter or process to it (to pull a dark detail out more clearly without washing out bright highlights, for instance). Woe betide you if the region you wish to effect is larger than the display window: drag the selector to the edge and watch it stop, not scroll. Were CA-Cricket Image to allow zooming in and out, this might be excusable, but the absence of both features is frankly ludicrous.

Furthermore, any operation on the colour balance, contrast, brightness or any other attribute of the image has no

preview mode unless you're in 256-colour mode, and must take place over the entire picture. Take the case of the 6Mb file I mentioned. This could mean a five-minute wait to see if the arbitrary green level curve you drew in the dialog box (to overcome the problem of daylight film with artificial lighting) had the desired effect. By comparison, Photoshop on the machine next door changes the values of the system palette as you move the slider, generating instant feedback.

There were problems, too, with the 'create new image from cut region' option. The idea is that an image can be resized, or a new file made from a resized selection from an existing file. Several times I worked around the absence of zooming in by cutting a region and blowing it up. But closure of the newly-created file by double clicking on the window control icon would then result in a deadly embrace: none of the document windows showed up as active, and in fact the system clearly thought I could see a dialog box which wasn't on display, because nothing would happen until I hit Escape.

One thing most people are keen to do to images is indulge in a little editing: scrub out that zit on your kid sister's nose, make dad's bald patch a little less prominent. Well, forget doing them in CA-Cricket Image: there are no pixel editing or painting tools of any kind.

If you're given CA-Cricket Image free with a scanner or (Photo)CD-ROM, it's a lovely advert — for everybody else's products.

CA-Cricket Image costs £279+VAT from Computer Associates on (0895) 272501.

Cubase Lite for the Atari ST

For budding composers Steinberg's Cubase Lite is a bonus. With music notation and editing capabilities at under a hundred pounds, Ian Waugh likes the arrangement.

Until the latter half of '92, professional sequencer software typically cost around £500 — more than the STs they ran on. At that time the best-known sequencers, Steinberg's Cubase and C-Lab's Notator, were reduced to around £300, but that's still a lot of lolly if you don't want or need all the bells and whistles these programs offer.

Both Steinberg and C-Lab had already released cut-down versions of these programs, Cubeat and Notator Alpha. Now Steinberg has released yet another budget version of Cubase,

Cubase Lite. It will run on any ST with 1Mb of RAM and a mono monitor. The disk isn't copy-protected (oh that all software was free of this encumbrance) and is easily copied to, and run from, a hard disk.

The main attraction of Lite is that it handles music notation. Cubeat doesn't support notation at all. Alpha does, but only four tracks at a time, a rather crippling limitation imposed to justify the higher cost of Notator Senior. Lite can handle up to 16 tracks and print out 15 of them.

One reason Cubase is so popular is because of its Arrange window. Here you record music parts, which appear as rectangles. You copy, cut and paste them together, merge them, transpose them, and move them around, placing them anywhere in the song. It's a superb way of arranging your music.

Lite retains the Arrange window and the basic Arrange facilities though it lacks some of Cubase's more sophisticated functions like the Play Parameter window. This gives you detailed control over each Part: individual program

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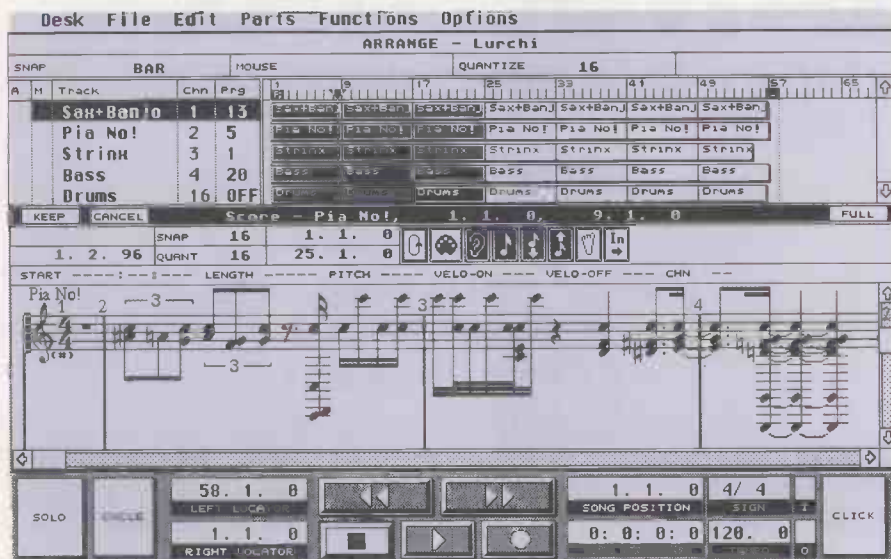
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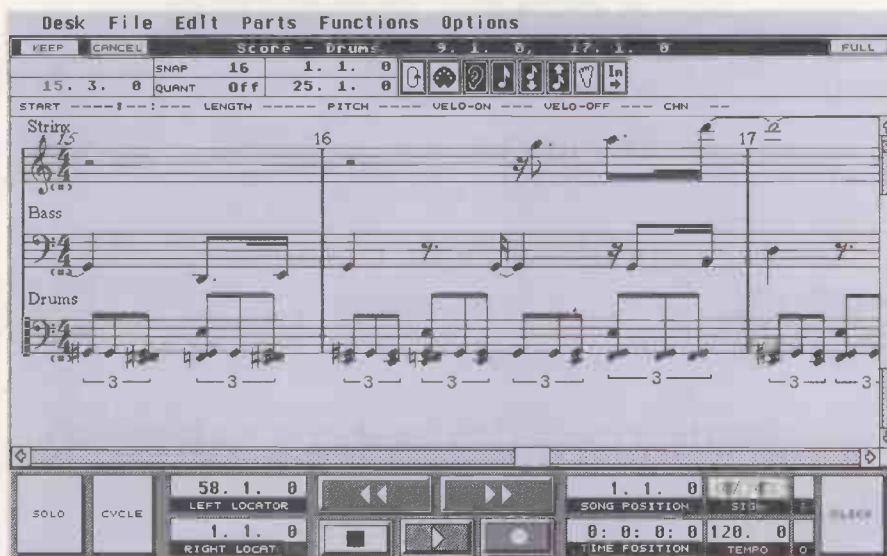


changes, volume, velocity, delay and compression settings, plus a filter and microscopic control over the Part's position in the track.

Lite only has 16 tracks and the track list has MIDI Channel, Program Change number and Volume columns. The basic recording and arranging procedures are the same, however. There are the standard tape transport controls, Left and Right Locators, Cue Points, Song Position, Time Position counters and so on. You can mute and solo tracks, and record in Cycle mode, which many musicians use when they are building

toolbox which appears when you hold the right mouse button. You simply select one of the four tools, Pointer, Eraser, Scissors and Paste, then release the button. Brilliant.

Lite supports Ghost Parts. These are duplicates of the original Part but any edits made to the original are automatically applied to the Ghosts. They are useful for creating layered sounds and MIDI delays. Quantization is not as flexible as in the more upmarket programs. It's basically a straightforward note on quantization, with no grooves or analytical quantize functions.



up drum tracks.

When a Part is moved or copied to another track it plays on that track's MIDI channel. Alternatively you can have it play using the MIDI channel on which it was recorded. This is not as useful as being able to set a Part's transmission channel, which you can do in Cubase's Play Parameter window. To help with editing, Lite has a pop-up

Lite has only one edit page: Score edit. If you like working with 'the dots' you'll like this. You can select as many Parts as you like for display, although the window will typically only be able to show three staves at once. You can scroll through the Parts using the scroll bars.

There are many edit facilities including another toolbox containing

Pointer, Eraser, and Rest and Note tools (for note and rest insertion). Notes can be moved by clicking and dragging, and can even be altered from an external MIDI keyboard.

You can input notes in step-time from a keyboard, too. There's a separate Loop function independent of the Cycle setting in the Arrange window. It's really useful to be able to edit while the music is playing.

Lite retains Cubase's Score Display window which lets you set parameters to ensure the most accurate display of the score. There are no music symbols, dynamics or text input and many of the bells in Cubase don't ring here, but it handles basic editing well.

However, the Score page is the only form of editing: there's no grid editor or even an event editor, so if your grasp of notation is a little shaky, so will be your editing. The lack of any kind of event editor means you can't get at controller, program change or any other kind of MIDI message.

Lite is supplied with printer drivers for many popular printers including Atari, NEC, Seikosha and the IBM 9-pin. A couple of Epson drivers should take care of most other popular printers and there's an HP LaserJet driver too (no PostScript, though). You can set the margins around the paper but it only prints on A4 in portrait. You can print in Fast or Best mode and select the range of pages to be printed; output is very good.

Lite has only one file format, the Cubase equivalent of Songs, but it handles MIDI files, too: an essential requisite for any sequencer. There are keyboard equivalents for most operations. These are detailed in the manual which is informative and easy to read, but it lacks an index: five Contents pages is not quite the same thing.

As with all budget programs, especially those that have been cut down from larger programs, Cubase Lite has limitations, some of which have already been mentioned. However, it offers a good range of facilities for a nominal price. If scorewriting's what you're after Cubase Lite must be at the top of your list, although if you're not into notation you're not going to get very far with editing. Even then, the program has several editing limitations.

However, Lite has much of Cubase's superb arrange facilities and is currently the cheapest scorewriter and printer on the market. That has got to make it an attractive buy for anyone wanting to print scores on a budget.

Steinberg's Cubase Lite costs £99 from Harman UK on (0753) 576911.

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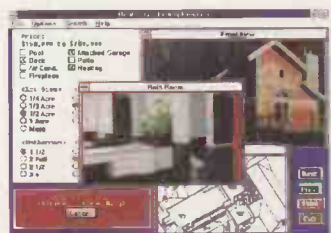
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Power Letters

Always the applicant and never the successful candidate? This software gives you letter layouts, and a contact log to keep track of your job searching. Catherine Eade reports.

Back in the August issue I reviewed a package called *The Perfect CV* which offered help and advice to those searching for the job of their dreams. Soon afterwards I got the job of Staff Writer at PCW. Was it the software program? Was it fate?

Whatever it was, I'm still here and the other day I received *Power Letters*, the follow-up software program from Permax. If you thought a perfect CV was enough to get you that job, think again. Effective letter writing skills are

by the time this review is published) comes with a 20-page booklet. A command line runs along the bottom of every screen so you are clear about options available and keys that can be used.

The first move is to start entering contacts and prospective employers into the Address Book, which resembles a database. The information you enter is imported in your letter, and you can print out your entire address book, envelopes or file cards. You can choose

how to sort your contact list with various criteria, and there's a search option. Pressing F4 allows you to add memory jogging comments to your address in a separate screen.

The Letter Builder is the main part of the program and is essentially a customised word processor, designed to help you write letters to accom-

The contact log is for you to keep a record of your activities, so you always know who you've contacted and when. This is a very useful feature, one I could have done with all those times I was applying for jobs and losing track of who and when and where. You can review the log on every contact and add information to keep track of your status with the employer.

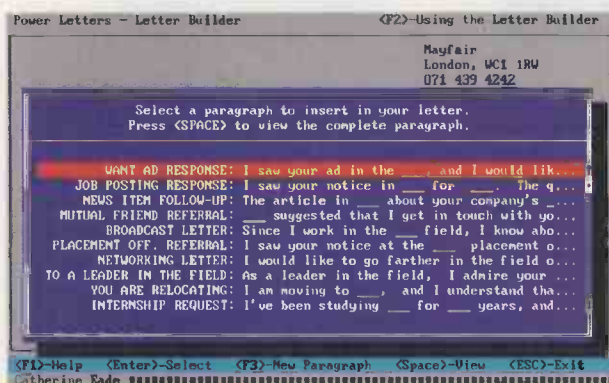
Once you've saved your letter you can use it in any other word processor that can read a standard ASCII or text file, to change style, fonts and so on. Courier is the only font available in the program, and as far as changing the format goes, you've just got the option of switching from block letterhead style to standard.

Saving and printing the document is just a matter of pressing a function key. If you're printing straight from the program without refining the style, your efforts won't look too spectacular. It's better to polish up your letter in a more advanced word processor before sending it to a prospective employer.

The package is really aimed at first-time job seekers and college leavers rather than seasoned, out of work executives. It could be beneficial to a multitude though, as it gives advice on structure, ideas about what to say and the best way of saying it. Database entries are only limited to hard disk size, and the mailmerge is useful. The contact log means you always know exactly when you applied to what job and to whom you addressed your letter. *Power Letters* can also be run under Windows to save jumping from one environment to another.

Writing letters is an intensely personal pastime however, and you may find it difficult to stick with some of the sentences offered in the package simply because it isn't you. Some of the suggestions are a little too simple, and some paragraphs sound a bit wooden, but remember that you can modify the whole document if you want, and the permutations are endless. For the price you can't go wrong.

Power Letters costs £25 from KIMS on (0486) 53406.



also essential for job seekers, and this is where *Power Letters* comes in. The latest program from career development consultants Tom Jackson and Bill Buckingham is a specialist word processing system, designed to produce cover letters for over a hundred different situations.

System requirements are a minimum of 512K RAM and DOS 3.2. Human requirements are grim determination and the will to succeed. Unlike *The Perfect CV*, *Power Letters* can be installed onto your hard disk drive. Start up the program by typing PL at the prompt, fill in your personal details as you'd like them to appear on letter headings, and move to the main menu screen complete with calendar.

Top of the main menu is the Program Guide which in turn contains information on the Program Overview, Ten Hot Tips for writing covering letters, and how to use the Address Book, Letter Builder and Contact Log. In the US version I reviewed, the program overview acts as the manual, but the UK version (which will have been released

company CVs and job applications. There are five types of letter: cover/application format, interview follow-up, offering acceptance, offering rejection and response to rejection. Highlighting and clicking on your selection brings up the appropriate screen and choice of paragraphs. A list of different sentences flashes up on screen, with a brief description of when best to use each one. Depressing the space bar displays the whole paragraph so you can assess whether it's right for the occasion. There are three types of paragraph for each letter: opening, body and closing, each with a set of at least ten alternatives.

Once you've decided which paragraph to use, insert it in your document by pressing enter on the highlighted section and you can start to work on it by filling in the gaps, for instance 'My experience in ___ could help your company to achieve its goal of ___.' As well as adding your details, you can alter the actual sentences as much as you wish, so if you like what the paragraph says but not the way it's said, you can rewrite it completely.

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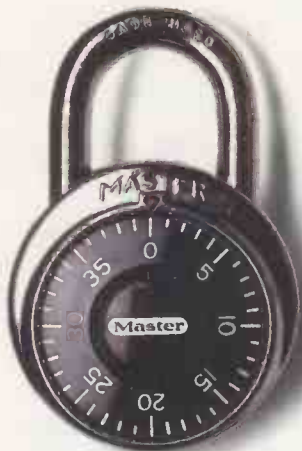
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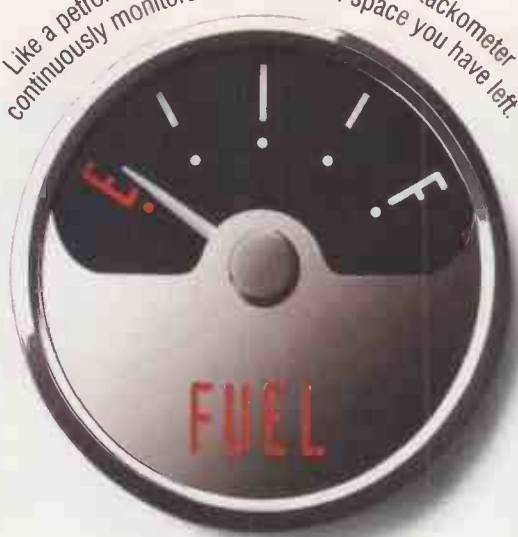


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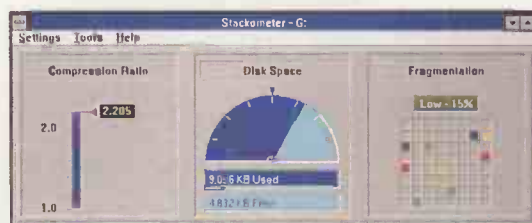


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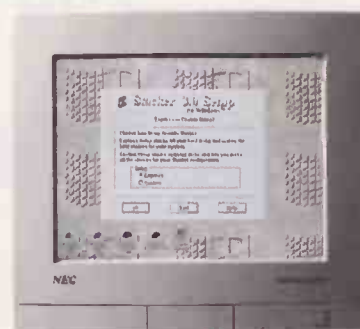
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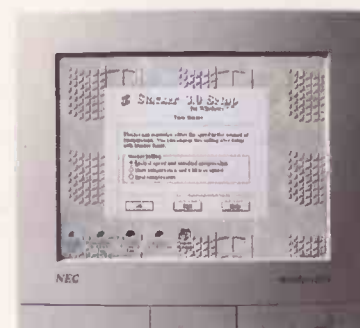
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A Windowful world

User friendliness doesn't always mean happy programmers and the steep learning curve of Windows development has its price. But the success of the OS has produced new development environments; David Gristwood and Adrian Lea looked at eight of them.

'Windows, Windows, Windows' is how Bill Gates recently summed up Microsoft's strategy. It is said that even he was initially surprised by the success of version 3.0, but true to form he has not been slow to capitalise on it. Its success has been user driven: Windows represents the start of a new era in user friendly applications, which are more intuitive, use the same user interface and can share data.

The same ease of use does not apply to the programmers who have to develop these applications. Windows development has brought with it a whole new programming paradigm, quite unlike its DOS predecessor. A number of the larger companies, such as Lotus and Ashton Tate, were caught on the hop by the success of Windows, having been convinced by IBM that OS/2 represented the way forward. Switching development midstream has been no easy thing, and the steep learning curve associated with Windows programming has meant delays in launching Windows versions of their popular DOS applications. This has made the Windows market turbulent. Fortune, not to mention the very future of some software houses, depends on the ability to develop successful Windows applications and gain vital market share.

Paradoxically, all the features that make Windows applications so easy to use are those that make Windows so difficult to program. Even Microsoft, its architect, has had no easy time of it. Version 1.0 first saw the light of day in 1984, but it took six years and a lot of development effort before version 3.0 was finally launched. Unlike their DOS predecessors, Windows programs have to share their environment with other programs and are no longer in control of their own destiny. Even though Win-

dows itself takes care of much of the housekeeping, there are messages that need to be handled, protocols that must be obeyed, and a whole new graphical environment to master.

Not surprisingly, this has resulted in a host of new development environments, each of which aims to reduce the time and effort required to create Windows programs. In this PCW round-up, eight such products are reviewed. Half of them are based on traditional development languages in which programmers might already be proficient, due to their availability across a range of existing hardware and software platforms. The other half are applications either exclusive to Windows, or at least closely tied in with similar GUI-based environments such as the Macintosh. They run the gamut from professional application development tools through to end-user utilities.

The review includes two C++ compilers, a reflection on the way that the language and its class libraries have been actively marketed as Windows development tools, rather than a particular endorsement of the language *per se*. C++, riding high on the wave of interest in object-oriented programming, has been the target for much computer press coverage. The market has become a two-horse race as Microsoft, with its C/C++ 7 compiler and Software Developer Kit, and Borland, with its C++ and Application Frameworks package, battle it out. Accordingly, both their compilers are included in the review.

C++ is not the only language being targeted specifically at Windows development: Borland has added object-oriented capabilities to its Turbo Pascal for Windows compiler, which includes many of the development tools from its C++ compiler. The move has proved

popular, allowing the vast army of Turbo Pascal programmers the opportunity to program for Windows without the need to change languages.

Another object-oriented language that has become quite well known within the realms of Windows programming is Actor. It takes many of the 'pure' object-oriented concepts and applies them to the Windows environment. Although it does not have a large market share, it has its own distinctive approach to program development, which has some benefits.

Of the more traditional procedural languages, Microsoft has long been an advocate of Basic, perhaps because it helped put Bill Gates on his way to fame and fortune. Several Microsoft applications, such as Word for Windows and Excel, include a Basic-like macro facility. Microsoft clearly sees this as the casual users' programming language, and Visual Basic has become its flagship development product.

Since Borland's acquisition of Ashton Tate, Microsoft's 'share-exchange' with FoxPro and Computer Associates' takeover of Clipper, the future direction of xBase remains uncertain. There is a large xBase market looking for a Windows platform, with Computer Associates aiming for a piece of the action with dBase, a dBase interpreter for Windows.

The last two products have been tailored specifically to Windows, and attempt to move away from conventional programming techniques in favour of a more intuitive development environment. The Asymetrix ToolBook, based on the Apple Macintosh HyperCard, uses English-like script language, while Borland's ObjectVision takes this concept even further and has completely removed the need to use any form of programming language.



Actor

Actor proclaims itself to be 'The Premier Object-Oriented Windows Development Environment'. The object-oriented aspects are heavily emphasised right from the start, with a read-me-first booklet written in a brash, chatty style using handwritten text and with drawings and doodles liberally sprinkled around. It starts with axioms such as 'Windows programming can actually be FUN — in Actor', and gains pace, but in no time at all it is into the whole object-oriented paradigm of instance variables, class definitions, inheritance, polymorphism and object reusability. The whole thing is made more comprehensible by the use of a sample application, which is included in source form supplied on its own disk.

There are no less than six manuals, plus the aforementioned read-me booklet and a pamphlet containing a corrected index for the programming manual. The latter's 700-plus pages make this a heavyweight tome by any standards, particularly after the chatty introduction booklet. The number of manuals is due to the composite nature of the product: it comprises the Actor development system, Borland's ObjectWindows Library (see the Borland C++ review for more details), a Windows help compiler and the Whitewater Resource Toolkit.

There is a cut-down version of Actor without these last three features, just the bare bones of the development environment, which is available at a lower price.

Also included is Pioneer Software's Q+E database library which provides, by means of DLLs, read and write access to xBase and Paradox files, using SQL commands passed via function

calls, plus read-only access to Excel worksheets. Further DLLs are available from Whitewater for a range of SQL server systems, including Microsoft (Sybase), Netware SQL and Oracle. The provision of this via DLLs contrasts with Actor's own class libraries, the advantage of DLLs being that they can be called from any environment. The ObjectGraphics library arranges Windows graphics calls into a set of classes, making the generation of graphical output more intuitive and hence easier to manage. ObjectGraphics is also available for Borland's C++ and Turbo Pascal compilers.

A full installation requires over 9Mb of disk space, spread across several directories including the main Windows directory. A variety of installation configurations are possible to reduce storage space, depending on requirements. Only one substantial source code sample program, ObjectDraw, is supplied with Actor. Although slow — an accusation that can be made of Actor as a whole — ObjectDraw is a sophisticated drawing package that uses ObjectGraphics classes to create and manipulate its

disjunctions this might produce.

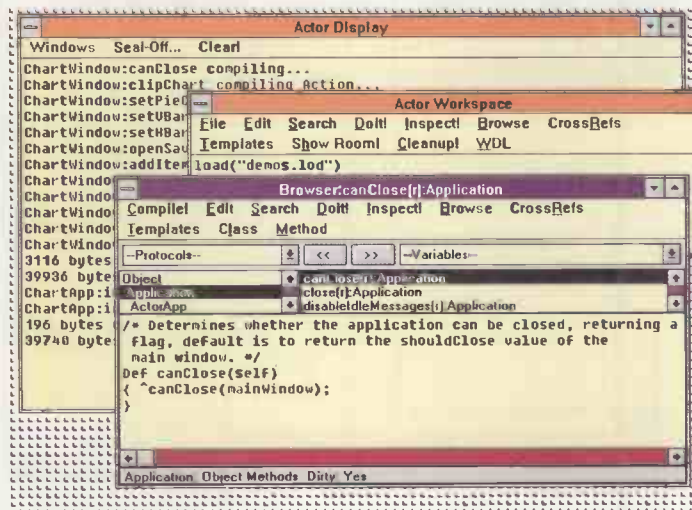
The development environment follows the same object-oriented paradigm. It lacks any form of interactive screen designer, with object development taking place instead via a command window. Inheritance principles mean that, in many cases, there may well be an object already in a class somewhere to use as a starting point, or that once development is under way, custom designed objects can be reused. Application development therefore means switching back and forth between the command window and the browser, the latter being the main means of examining class library contents. Once the mental adjustment has been made, which is not trivial, given the great differences in approach compared with a traditional procedural language, progress is rapid.

Like dBFast, Actor is an interpreted language, requiring the freely distributable Actor runtime program to be present on a target machine. This may well contribute to the tardy nature of developed code, contrasting with the small, nimble executables produced by native compilers. A 'seal-off' option strips unused classes from the development image to produce a final image (.IMA) file, which then requires only the runtime to execute. This takes up several hundred kilobytes of disk space, even with a trivial application.

The Whitewater Resource Toolkit is a full-blown utility in its own right, and was originally bundled with early versions of Borland C++ and Pascal compilers. It takes over responsibility for many aspects of Windows applications, including the definition of keyboard

shortcuts, bitmap and cursor manipulation, dialog box setup, icon editing and text strings, the last feature easing the way to multi-lingual or user-customisable applications. As well as individual resource files, it can modify .EXE files in situ to allow substantial changes in the program's appearance.

The help compiler is also worthy of mention, taking rich text format (RTF) source and producing a fully-fledged Windows help system. Whitewater is coy as to whether its other applications use this for their on-line help, but given its capabilities — as well as text, it supports selectable fonts, .BMP files, keyword lookups and context sensitive access — it is certainly up to the job.



images. A minor drawback is the use of a non-standard Windows format for storing images, though the source code for the ObjectGraphics library is included in the package.

Actor's emphasis on object-oriented programming and design is such that the nature of the language is not immediately apparent. Whitewater describes it as 'C-like', but in reality C++ users would find it more familiar. Even then, the esoteric syntax mix, C-like function calls and parameter passing, along with dBase IV style Menu/Popup/Item commands, only serve to blur the issue. It is perhaps best described as a language optimised for Windows and object oriented programming, regardless of any



Asymetrix ToolBook

HyperCard achieved great success on the Apple Mac, providing users with a simple way to organise and access information, from text through to digitised images. Much of its success lay in its adhesion to one of the key Macintosh philosophies, ease of use.

When Windows 3.0 was launched, similar success was predicted for a number of such Windows based products, including the Asymetrix ToolBook. Early versions of Windows even went so far as to include a runtime version of ToolBook, and a ToolBook personal information organiser and diary. It succeeded in creating a lot of interest in the product, particularly as at that time the Microsoft Windows SDK was one of the only other ways to develop applications. But its success has been limited, partially due to the incredibly slow pace at which the ToolBook applications ran, a factor which will deter many potential users.

Version 1.5 of ToolBook addresses many of those early criticisms, especially those regarding speed, as well as providing the package with an all-round tidy up. Installation is a simple affair and takes the best part of 8Mb of disk space. The manuals that accompany the package are similarly compact and straightforward, and are geared to the novice Windows developer.

The whole ToolBook development environment is based around the single analogy of authoring a book. An application is viewed as a book made up of a number of pages, each of which corresponds with an application screen.

When a ToolBook application is running, it is possible to view each of the pages. The order in which the pages are viewed is determined by the way the user interacts with the book; clicking on buttons typically takes the user to specific pages.

This analogy makes ToolBook suitable for applications such as slideshow presentations, interactive tutorials and hypermedia documents, and to a lesser extent database front ends and application prototyping. Not only does it come with a number of such sample applications but it contains an extensive tutorial, itself a ToolBook application. Asymetrix chose to write the help system in the same manner and, while useful, its user interface is at odds with the standard Windows help system and thus with the idea of a consistent user interface.

ToolBook is a very interactive and visually-oriented development environment. Developers build up an application or book page by page, pasting text and graphics objects onto the pages

otic data entry and display screens.

Once the objects, such as buttons and hotspots, have been assembled, actions can be assigned to them by attaching a script. All the programming logic for a ToolBook application is expressed in a special language known as OpenScript. Emphasis has been placed on a language that virtually eliminates cryptic symbology in favour of English-like commands, in some cases to the point of verbosity. In this respect it has some similarities with dBase, although, as with dBase, its success has also depended to some extent on the take-up of what is after all a proprietary programming language.

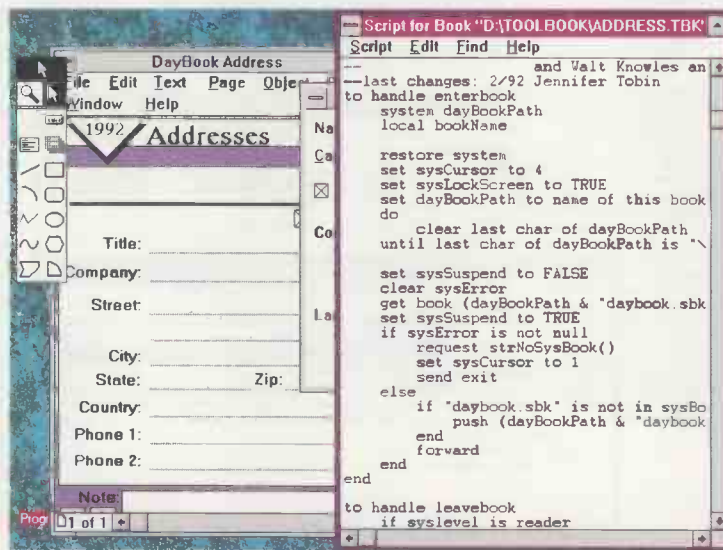
The programming environment is event-driven. The script traps events, such as a mouse button being clicked or a page being turned, and acts on it as required. Typically, scripts are used to move from page to page or to manage data entry fields. They can be attached to objects, pages or the book itself. When an event occurs, the appropriate object is checked first. If no script is present,

the page and then the book itself are checked. This neat approach reduces the number of scripts that need to be developed and ensures consistent application behaviour in a similar fashion to Visual Basic.

The scripts are English-like in appearance but they still require some effort to become proficient, for all but the most trivial of applications. Much of the difficulty in mastering the language comes from getting to grips with the different system events which can occur, and the correct way to handle them. Some of this effort can be reduced using the macro recorder,

which records a sequence of events and turns it into OpenScript which can then be edited as required. To aid developers there is a script debugger, which can be used to step through the script in order to track down bugs.

A runtime interpreter is required to run ToolBook scripts. Earlier versions of the package required a separate licensing fee, another factor which put many people off, but Asymetrix has changed its policy with the latest version. Another major improvement in version 1.5 is to give ToolBook applications a turn of speed that was desperately needed. Unfortunately however, the inability to produce standalone executable files does impose a limit on the speed improvements.



using the tool palette in a similar fashion to Visual Basic. Every page consists of a background and a number of transparent foreground layers. Placing objects on the foreground sheets specifies the way the page is built up and determines which objects overlap each other. Re-using pages offers the opportunity to reduce development time.

Objects include anything from boxes and data entry fields to imported graphics. Although it is possible to copy some of the artwork from the wide range of sample applications included with ToolBook, additional clip-art to get newcomers started would not go amiss. Some limited animation is supported but, on the whole, ToolBook applications are best geared to less ex-

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Borland C++ 3.0 & Application Frameworks

Borland has established a solid reputation over the years for producing high-quality programming tools, especially for the more price-sensitive end of the market and typically for the home user or hobbyist. The company, best known for its Turbo Pascal compiler, has recently become active in the C and — arguably more importantly — the C++ market. At the same time, Borland is moving upmarket into the more lucrative professional developer's arena, competing head-on with Microsoft. If anything, this has only served to redouble the company's efforts to become the number one player in the market.

Two versions of the Borland C++ package are available for Windows: the full professional developer's pack, Borland C++ & Application Frameworks (BC&AF), and a lower cost Turbo Windows version. The BC&AF includes a full development environment for DOS and Windows, and additional development tools such as Turbo Assembler. BC&AF is reviewed here, as it competes head on with Microsoft's C7 C/C++ & SDK package.

Borland has chosen to market this primarily as a C++ rather than a C compiler, although it is well suited to both rôles, able to accept both ANSI standard C and AT&T C/Front version 3.0 C++ code. The latter feature makes Borland one of the first C++ vendors to support the latest version of the language. Earlier versions of the compiler did little to enhance Borland's reputation for producing high-quality code but this has changed over the last

year or so, the latest version having a wide range of optimisation and code generation options that make for tight coding.

Borland's approach to Windows development is based around traditional program development rather than the more visual and interactive style adopted by Microsoft's Visual Basic. Borland has concentrated on a highly productive programming environment, based around its Windows Integrated Development Environment (IDE) and a range of supporting tools and utilities, not to mention extensive documentation. A side effect of this is the package's demanding disk requirements: nearly 50Mb is needed for a full installation, though this can be reduced if developers choose not to install all the sample programs and utilities supplied. Equally heavyweight is the documentation, fifteen colour-coded manuals covering both the compiler and the Windows API, all up to Borland's usual high standards.

Borland has always prided itself on the ease of use of its development environment and the Windows IDE is no exception, offering a slick user interface and easy access to most of the development tools. Apart from a few utilities that still use a character-based DOS interface, such as the Turbo

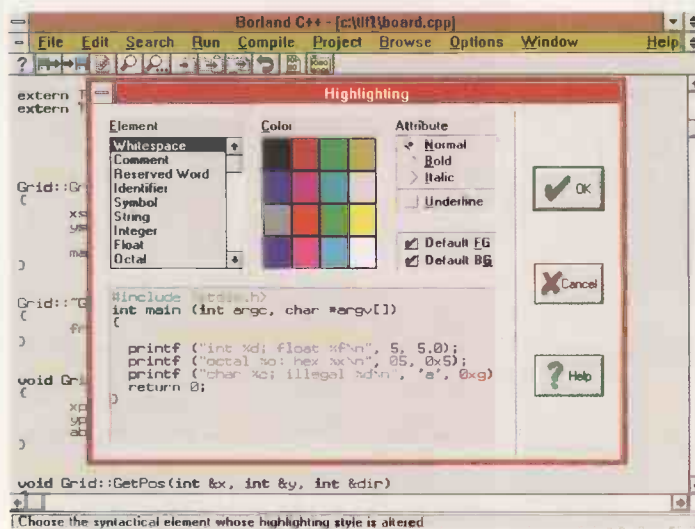
tamed, this feature makes for genuinely readable code.

Borland abandoned the cryptic Unix-style Make files long ago in favour of its own project management tools for handling multiple-file applications. As with many of the other utilities, project management is an integral part of the IDE. The logic to handle much of the recompilation and linking of files is built into the project manager, so selecting a list of files to make up a project is often all that is required. It automatically checks for dependencies within headers, resource scripts and source code files, and takes the appropriate actions to build an executable.

An example of the detail that has gone into the IDE, which shows off the Windows graphical user interface to good effect, is Borland's object browser. Once a file has been compiled with the browse option set, a simple click of the right mouse button in the editor, or on a function or class, automatically brings up the Browser window onto the screen, with detailed information on the object. In the case of a class, it is possible to view up and down the object hierarchy viewing class member functions, or go straight to the source code file for a selected item.

The Whitewater Resource Toolkit, which was shipped with early versions of the compiler (and is still part of the Actor package), has been replaced with Borland's own Resource Workshop, a much more powerful utility. The Workshop's main strength is its fully integrated approach to managing resources. Not only does it contain the various dialog, font and bitmapped editors necessary to create the actual resources, but it also creates the resource script files. It can work directly on compiled resources and executable files so it is possible to alter the resources used by other Windows applications.

Windows-specific tools include WinSight, a utility for viewing Windows messages on the fly, and WinSpectator, a program which can intercept UAs, creating a log file that can be examined after the event and used to track down bugs. The Turbo Windows Debugger is unusual in that it has a character-based interface rather than offering the proper Windows one. Borland puts this down to the special nature of the debugging program that prevents it from being a true Windows application. Fortunately, it has the look



Debugger, the integration is very tight. Many of the commonly used commands can be accessed directly from the toolbar, which is not customisable. The editor itself is simple to use but should prove powerful enough to satisfy the needs of most programmers. An excellent new feature is colour co-ordinated syntax highlighting, in which different parts of the source code, such as pre-compiler directives, reserved words and data arguments, can appear in different colours. Once the urge to create a kaleidoscopic Pop Art masterpiece has been

and feel of the standard IDE, so users should feel at home. One consequence of the character interface is that while Windows programs are being debugged, the screen flips annoyingly back and forth between the Windows and debugger screens. But there is the option for remote debugging, via the serial link or over a local area network, and dual-monitor support.

Also included is Borland's Turbo Assembler, TASM. Although the compiler supports in-line assembly, for all but the most trivial of programs a fully-fledged assembler is better suited to the job. TASM is a powerful assembler, supporting macros and a variety of assembler directives. Borland's Turbo Profiler, also supplied, is able to generate information on a program's execution, enabling developers to identify those sections of a program that would benefit from additional tuning.

New to BC&AF is Phar Lap's 286|DOS-Extender Lite. Looking very much like a last-minute addition, it comes on a single disk in a cellophane wrapper. DOS extenders allow programs running on a 286 or above to break free of the 8086's 640K memory limit by running in protected mode. They can allocate extended memory up to the full 16Mb supported by the 80286 without alteration. Phar Lap's 286|DOS-Extender Lite is a deliberately crippled version of its 286|DOS-Extender SDK, with a number of restrictions such as an artificial memory limit of 2Mb, cut-down disk-based documentation and no runtime licence. As an upgrade route is available to the full SDK (at a price of course), the Lite version is little more than a demonstration program. Borland is right to address the needs of developers by including a DOS extender, but a fully-fledged extender is needed rather than a crippled demonstration program.

In order to ease the transition to Windows development, the Borland compiler allows standard DOS applications, which use only standard input and output, to be recompiled to run as true Windows applications without the need to change any code. These have their own window, which can be moved

and resized as with any other Windows applications, but there is only support for a limited number of runtime library functions and they lack the proper Windows look and feel.

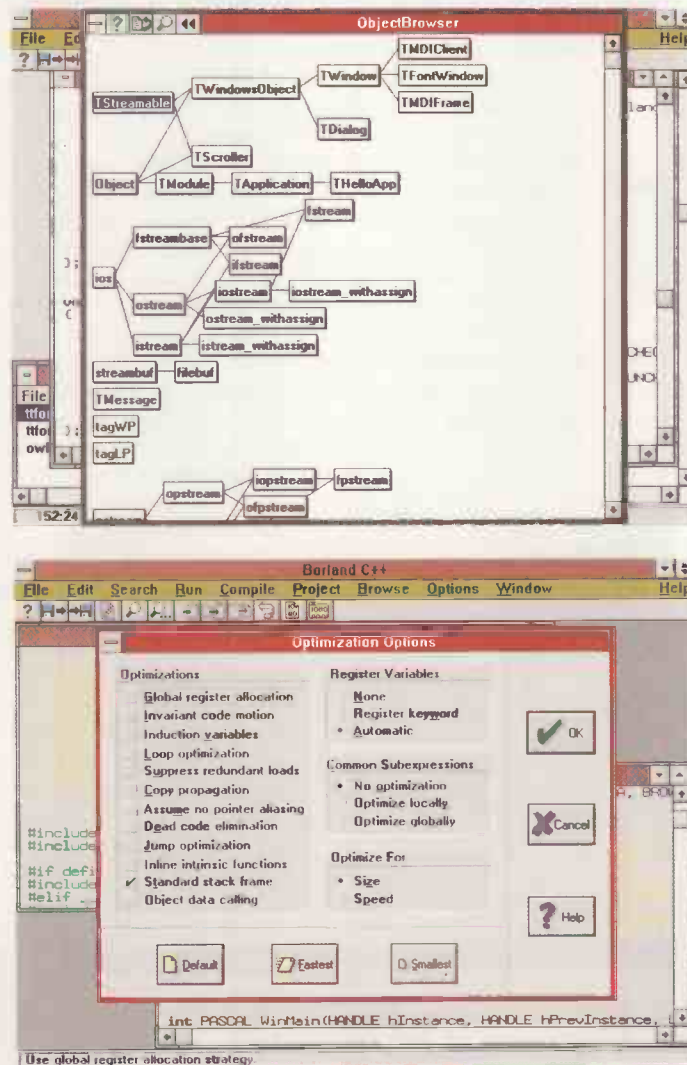
For true Windows programming, two approaches are available. The first is to work directly with the Windows API in a similar fashion to the original Microsoft SDK. Many professional developers have used this approach, benefiting from the true Windows development tools so long denied to them by Microsoft. This strategy makes little use of the object-oriented capa-

bles Library (OWL) for Windows applications. Both ease the development process by using C++'s object-oriented capabilities to create a framework around which applications can be built. TurboVision and OWL are similar in design; though there is no attempt at source code compatibility, TurboVision DOS applications should be able to migrate to Windows with relative ease. This is quite a strong selling point, as TurboVision is part of the Turbo C++ for DOS package and has been used by a number of DOS developers. Indeed, Borland wrote the DOS IDE using TurboVision.

OWL does not remove the steep Windows learning curve, but it does lessen the difficulties of getting to grips with Windows as well as speeding up the whole development cycle. The library comprises a hierarchy of classes that applications use to handle the Windows user interface rather than calling the Windows API. The C++ classes hide many of the complexities associated with the Windows environment, as well as reducing the likelihood of making simple errors such as calling incorrect functions or passing wrong arguments. With OWL, much of the low level tedious work necessary for virtually every application has been built into the library.

The bare bones of an application can thus be created quickly and easily by declaring a few basic window objects or deriving new objects from existing OWL objects. Customising and adding functionality does require more work, and larger programs can become quite complex. The OWL philosophy still allows programs to call the API directly to perform specific tasks, but these tend to be for

the application-specific parts of the program rather than the more general purpose housekeeping and window management routines. Using OWL as a development tool means making a heavy commitment to Borland's approach to object-oriented programming, which in turn ties developers into Borland's compiler: porting OWL applications to a different compiler would be no trivial task. However, Borland has indicated a strong commitment to this strategy, which should reassure many programmers.



bilities of C++, though there is nothing to prevent classes being used in other parts of the program.

The other approach, which Borland is setting much store by, is to use its Windows class libraries to avoid direct interaction with the 600 functions that make up the Windows API. In addition to a general-purpose class library, including useful containers and lists, Borland provides two C++ class libraries. They are designed specifically for developing user interfaces: TurboVision for DOS applications and Object Win-



Computer Associates dBFast

Computer Associates' dBFast started out as an attempt to secure a share of the Windows xBase market, well before its takeover of Nantucket gave it a separate route into the DOS arena (see panel, 'Whither xBase?', page 238).

Compared with other Windows products, dBFast is suspiciously small. There are only two manuals, totalling less than 500 pages, although part of the package includes a complimentary copy of Alan Simpson's book *The dBase III Plus Programmer's Reference Guide*. This is more than just a reference however, as the 1000-plus pages start from first principles and cover all aspects of dBase, including networking, security and assembly language interfacing. The 'III Plus' in the title reveals that this product makes no concessions to the dBase IV language.

Apart from the badge on the front cover, no mention is made anywhere in the book about dBFast, though this is not surprising given the publication date of 1987. The book makes up for the lack of a tutorial in the dBFast documentation but it does not make the switch into the GUI environment any easier. Nor do the manuals cover all command options, leaving this to the more detailed on-line help. More seriously, they also contain inaccuracies: the user manual refers to appendices in the reference manual which do not exist.

dBFast is supplied on just two high-density disks, one of which serves only to receive the registration details for subsequent return to CA in a pre-

paid envelope. Although this should save some retyping by CA's registration section, using a high density disk to transfer a few hundred bytes of information seems a bit of an overkill. A fully-fledged installation of the dBFast system and demonstration programs takes up less than 2Mb of disk space. However, CA has produced a remarkably efficient piece of work since this provides not only a program development environment but two runtime systems, single user and network, and a utility to capture screen portions to the clipboard.

On running dBFast, the experienced dBase user will be immediately comfortable with the development environment, referred to as the Executive. Programs can be built up and executed from this development environment in the same manner as that of dBase IV or FoxPro. Indeed, generic xBase code can be entered with near total compatibility with either of these two products. This defeats the aim of a GUI, as the result will be applications that look no different from their DOS counterparts. To make the shift to Windows style event-driven programming requires using dBFast's enhancements to the dBase III Plus language. These are aimed at shielding many of the com-

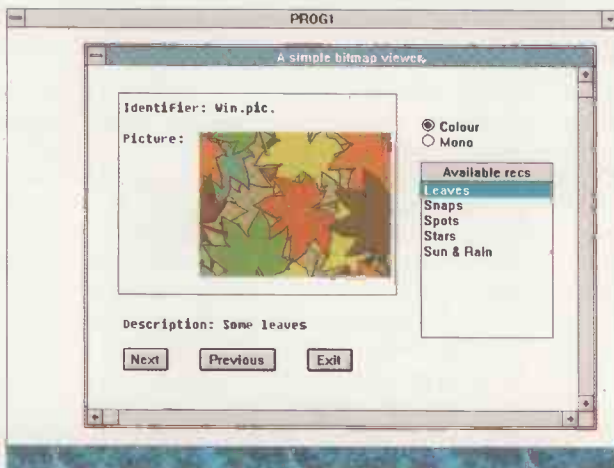
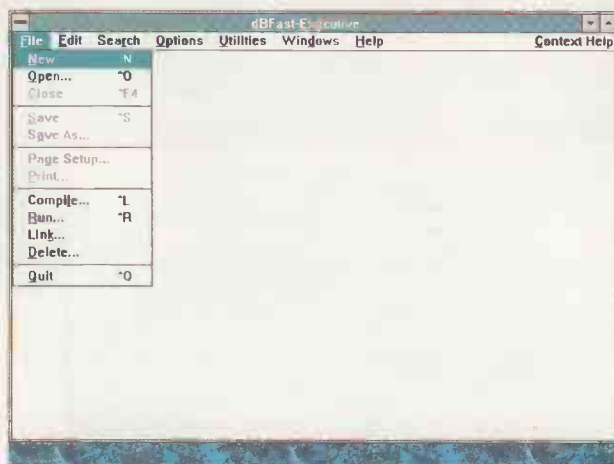
plexities of Windows programming, but they do so by imposing certain restrictions on the type of applications that can be created.

The development environment is basically a programming editor with compile, execute and debugging facilities. As the editor has limited capabilities, many programmers may choose to use an alternative although this will slow down the development cycle. The editor has some unusual characteristics: although up to four editing windows can be opened simultaneously, some features such as the report generator and command box cannot be activated until all program windows are shut down. Trying to get round this by clicking on the dBFast icon back in the program manager simply reactivates the same task. Although the same program can be loaded in more than one window, changes to one copy are not reflected in the second and a compilation cannot be carried out until only one copy of the program is opened.

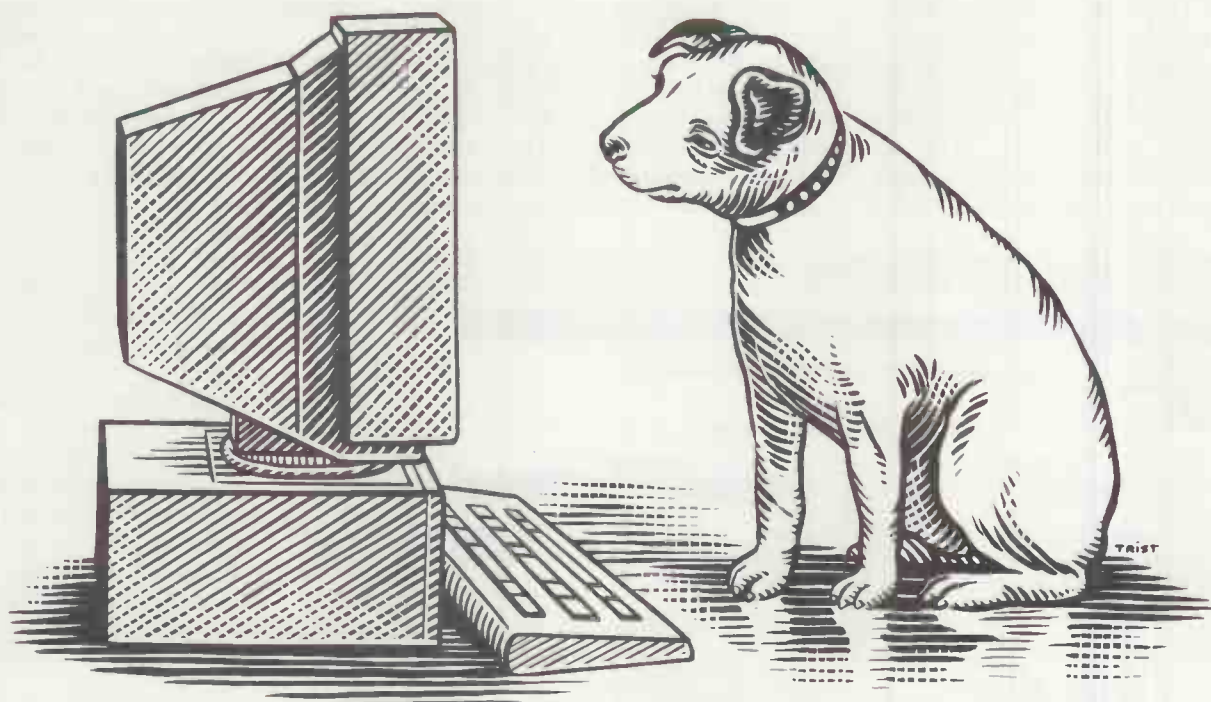
A further limitation of the development environment is that a single compile and run option is not supplied. Instead, a tedious sequence of selecting and reselecting filenames must be entered each time round the development cycle. Executing a program closes down the source windows, which must then be reopened. Overall, this falls some way short of Borland's Integrated Development Environment (IDE) which is an integral part of its Turbo Pascal and C++ systems. The compilation process stands out as very un-Windows like. Errors are directed to the main window, which is cleared of source code, after which the user is invited to press a key. No amount of mouse clicking, even on non-greyed options such as Quit, will suffice as an alternative, and the only means of aborting the compilation is to press Escape.

Major features absent in dBFast are any form of screen painter, and on-line development tools: no toolbars here, customisable or otherwise. Application development starts with a blank screen, ready for the first line of source code. Fortunately a good range of examples is provided as a starting point for application development.

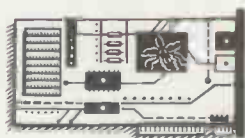
dBFast supports multiple-level pull-down menus, and .BMP files can be loaded into memory for display on the



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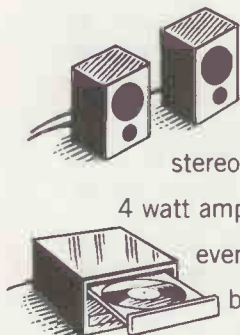


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screen or storage in a record structure via the bitmap field type. Radio buttons, lists and check boxes are available via function calls, and a set of predefined window types are available. These specify attributes such as the ability to move or resize a window, the existence of scroll bars, and border characteristics. Multiple windows, including child-parent relationships, can be generated and positioned relative to each other, and icon files can be loaded

can be sent out explicitly under program control or automatically whenever the contents of a file change, for instance when a record is edited. Commands can be exported, if supported by the receiving application, and a subset of the dBFast language commands can be accepted by a dBFast Server. These cover the opening and closing of files, creation of new records in an opened file, and record positioning by means of a given number or search expression.

ess is a choice between creating a single user or network-aware application.

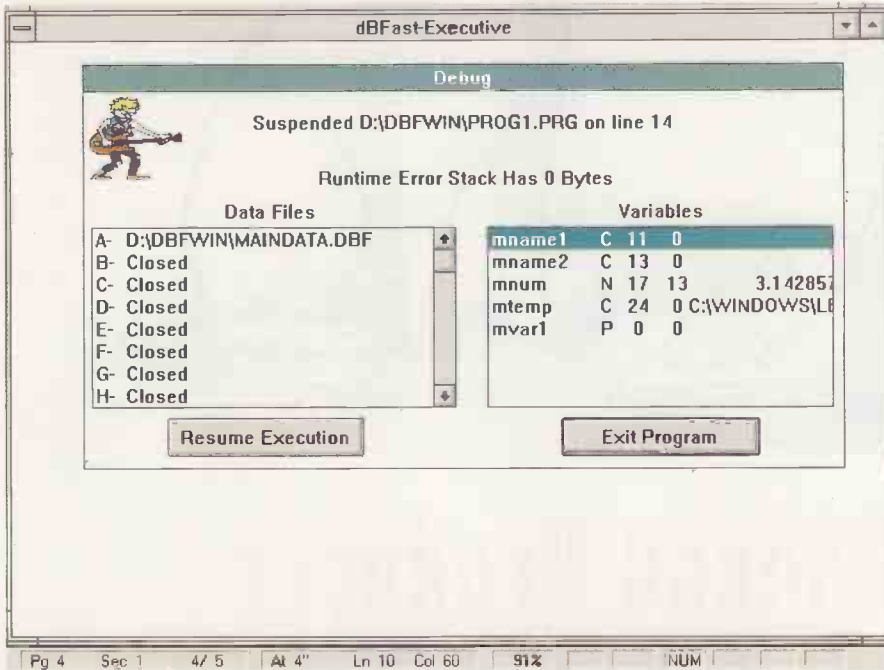
The run-time module can be distributed free of charge to allow application remarketing, either on its own or in linked form. An important consideration in the latter case is the fact that each program will require at least 400K of disk space, whereas the .FST file is not much larger than the source code and also has a shorter startup time. A linked program can have its own customised icon in a program group while if the standard dBFast runtime is shipped, only one icon is possible and it is impossible to distinguish applications from the Program Manager screen. Only one copy of the runtime can be executing at a time, whereas any number of linked programs can execute.

Providing network support as part of the standard package is an unexpected benefit, as more often than not it has to be purchased separately. Novell NetWare and Lantastic are supported, and the User Guide covers the relevant network commands and discusses record and file locking strategies in detail.

Given the product's name, a high performance might be expected, but CA makes no real claims or comparisons. It would not be fair to compare data processing speed with, say, that of DOS-based FoxPro 2.0. Aspects such as window generation and filling, although occasionally hesitant, were comparable with Visual Basic but slower than genuine executables such as Borland C++, due to dBFast's interpretative nature.

Debugging facilities are somewhat limited. A runtime error drops the program into an inspection screen, allowing open files and variables to be examined, but offers little else. The debugging window is frozen in size and access to other tasks totally disabled. If an error has been caused due to an attempt to load a non-existent bitmap, the runtime prevents any access to the file manager to investigate the error without closing down the program, at which point the remaining debug information is lost. To compound this, the inspection of any data is hindered by the limited (and unchangeable) size of the debug window.

Finally, the Capture utility allows any part of the screen to be selected by a scissors icon. The image is transferred directly into the utility, bypassing the clipboard, where it can be cropped or resized prior to being saved as a bitmap or transferred to a DDE-aware application. A special dBFast command can then be used to recall this or any other .BMP file for display.



inside buttons to allow the building of a toolbar but only in monochrome.

The conversion of procedural xBase code to the object-action model (the term used in the dBFast documentation) is achieved by building loops around selected functions which detect when an event occurs. Although this design appears somewhat convoluted, it will be familiar to procedural programmers with a gentle lead-in to event-driven programming.

Additional features, not part of the standard xBase language, include a music command which can play a short series of musical notes through the PC speaker. As it is interrupt-driven, it can play while the dBFast program gets on with its work. To go beyond the in-built functionality requires using DLLs which can be accessed by means of a declaration statement defining input and output parameters, after which their usage is indistinguishable from a native dBFast function. dBFast itself cannot create DLLs.

DDE is supported in three Server and several Client modes, with up to twenty simultaneous conversations. Once a link has been established, data

One of the Client DDE modes is a graphical DDE facility, which can pick up images directly from a graphical server such as the capture utility and place them in a memory variable. As part of its technical support, CA offers assistance to any hardware manufacturer or software developer of image manipulation systems, including possible provision of source code, to allow communication with dBFast via DDE Servers. This should allow it to extend its documentation to cover more than just DDE with Excel or another dBFast program. There is no support for OLE at the moment, but this is promised in a future release.

Features such as pre-processor directives, and the ability to set up external references, make dBFast start to look like a compiler, as does the 'compilation in process' stage necessary before code can run. This is not really the case as a run time is required to interpret the .FST file created by the compiler. There is a link option which can generate an .EXE file from an .FST, but the executable is merely the dBFast run time with a link to the appropriate .FST file. The only option within this proc-

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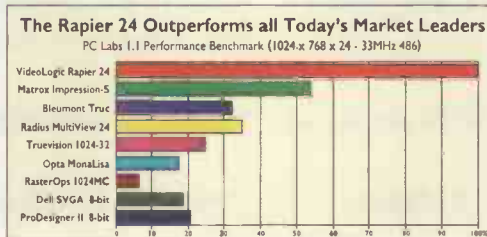
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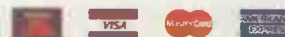
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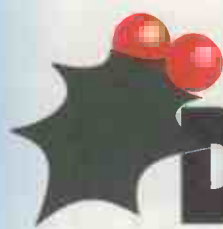
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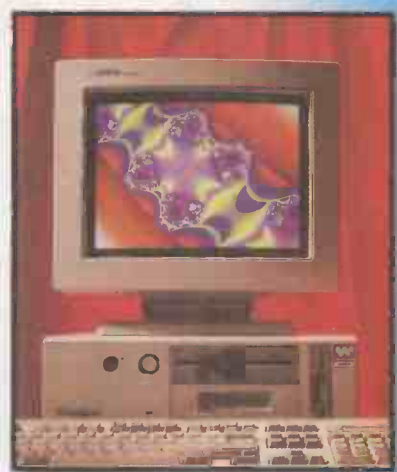
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227



Microsoft C/C++ 7.0 & SDK

Microsoft's C compiler has an ancestry that dates back to the early days of the PC, and has long been the compiler of choice for many professional developers. During this time it has developed a reputation for producing fast, optimised code. However, Microsoft has been slow off the mark to launch a C++ compiler and has lost valuable market share to Borland and, to a lesser extent, Zortech. The latest version of the compiler, version 7.0 (MSC7), sees Microsoft in fighting form with the launch of a heavyweight package that combines a C and C++ compiler with its traditional Windows Software Development Kit (SDK).

Microsoft builds the package around the compiler, adding development tools and utilities almost on an *ad hoc* basis. The compiler doubles as both a C and C++ compiler, an indication that Microsoft still regards the C programming base as one of its prime markets and is keen not to alienate this community by abandoning C in favour of C++. The C compiler conforms to ANSI standards, but the delay in bringing a C++ compiler to the market is reflected in its support for AT&T 2.1 rather than the latest version, 3.0. The main difference is the lack of support for templates as part of the language, although this feature is available through a separate utility. Exception handling is also supported, but by means of a set of macros.

MSC7 is intended as much as a DOS

development environment as a Windows one, even down to the installation process which requires the compiler and SDK to be installed separately. As with Borland's compiler, MSC7 is heavy with its demand for disk space, a full installation taking up the best part of 50Mb although part of this space is accounted for by the large number of sample programs. The dozen manuals that make up the MSC7 package cover the compiler and the Windows development tools, while the SDK manuals have to be purchased separately for £99. The manuals adopt the familiar Microsoft style of presentation, and on the whole are informative and well laid out. A refreshing touch is the inclusion of a C and C++ language reference guide.

New to version 7.0 is the ability to generate a form of code known as p-code, which Microsoft has been using for some time for its own development in Windows applications such as Excel and Word. It is more compact than machine code, as many instructions occupy only one byte. It can thus re-

program to be optimised for speed. Where speed is critical, in-line assembly is supported by the compiler. For more serious development, Microsoft's assembler, MASM, has to be purchased separately.

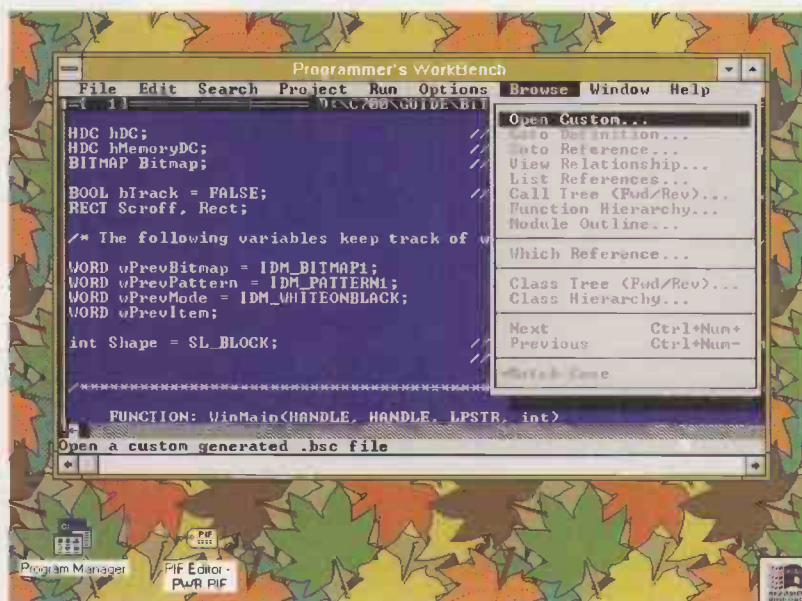
Part of the Microsoft package includes a full shrinkwrap copy of Qualitas' 386Max Memory Manager. The reason for this is that the MSC7 compiler requires a DPMS server to run, such as Windows, or a memory manager such as 386Max. The compiler can be run on a Windows system without 386MAX; its inclusion is for the benefit of non-Windows users. Almost as a side effect, though, DOS and Windows users can enjoy some of the benefits offered by 386MAX, such as maximising the amount of usable memory available to programs and extracting the best performance from applications.

Early versions of the Microsoft compiler were only available in a command line format, forcing users to purchase and work with a separate programming editor. Although a Programmer's WorkBench (PWB) is now part of the package, and the compiler has a more integrated feel to it, many of the utilities are still designed to be used equally well from the command line. One of the most useful is the quick help utility, which can be used to bring up hypertext help on just about any programming related topic.

A Windows version of the PWB was widely tipped to be included in version 7.0, but this has turned out not to be the case. It is still DOS-based, and although it has been improved since its first appearance it does have all the shortcomings associ-

ated with character-based applications. Compared with Windows programming environments, such as Borland's Integrated Development Environment, it looks clumsy and old-fashioned. Despite these criticisms, PWB is a useful tool which provides access to many of the Microsoft utilities without having to revert to the command line.

The editor is quite powerful and not particularly outstanding, although it affords a high degree of customisation. The browser, an integral part of the PWB, is a worthy utility for managing larger projects. Setting the browse information flag creates a separate browse



duce a program by up to 40%, although the penalty for this is reduced speed of execution as p-code requires an interpreter. Microsoft's argument for developing p-code is that much of a Windows program is tied up with handling user interaction, which is not time-critical and can therefore benefit from code size reduction. Compiling a program to p-code automatically causes the compiler to include the run-time interpreter within the executable file. For maximum flexibility, selected portions of a program can be compiled to p-code, leaving the remainder as normal machine code, enabling key areas of a

file that holds cross-reference information for a project. Separate options on the Browse menu enable programmers to jump directly to any declaration or references to a variable or function. The browser supports C++, and is able to display class hierarchies in a pseudo-graphical display as well as listing data and member functions.

Microsoft's project management facilities, for handling multiple file programs, are based around Nmake, a variation on the original Unix Make utility. The move reflects the product's command line origins. The PWB project management utilities create and manage 'make' scripts automatically, rather than requiring the developer to write the scripts from scratch. When a make script is invoked, it is in fact Nmake executing in a separate window.

The venerable Microsoft debugger, CodeView, appears in its latest incarnation. There are two versions supplied with MSC7, the traditional CodeView for DOS plus a new Windows version which now sports a NuMega logo. The Windows version is a character-based application with a similar look and feel to its DOS counterpart. As with earlier versions of CodeView, commands can be accessed via pop-down menus or through its terse command line interface. The latter has its roots in the MSDOS debug utility. It is cryptic at times, but once mastered it is a powerful debugging tool which seasoned MSC7 developers will find quick and easy to use. While debugging DOS applications, it runs within a separate window. Both the debugger and application are visible at the same time, although on a standard VGA display screen most of the application will be eclipsed by CodeView. Alternatively, CodeView supports remote debugging via the serial port.

A variety of additional development tools are also supplied. They include a source code profiler, which can track the time spent executing different parts of a program's code, and a stress utility which systematically consumes system resources such as heap space and file handles, in order to test a program's resilience when running with low system resources.

A number of Windows-based utilities from the original SDK still form part of the MSC7 package, including an image, dialog and font editor. As their names suggest, these utilities are used to create and edit images such as icons and cursors, dialog boxes and character fonts. Other utilities include Spy, which can monitor messages sent to Windows, DDESpy, which monitors DDE messages, and Heapwalker, which is used to examine memory heaps.

One area in which MSC7 scores well, but to which other vendors have not paid much attention, is that of application installation. Microsoft's Setup Toolkit is designed to create scripts that can be used to install completed applications on to a host computer system, so that developers do not have to write the program themselves. The Setup Toolkit allows the whole process to be driven by a special installation script language which can check different hardware and software setups and install the appropriate programs and drivers.

To ease the transition from DOS to

tionality through a few simple library calls. Although such support is limited to areas such as controlling multiple child windows and their positioning, it can prove a quick and effective way to migrate simple DOS programs to the Windows environment.

For true Windows development, programmers can choose either the standard SDK, first available with version 6.0 of the compiler, or the Microsoft Foundation Class (MFC) library. Although Microsoft still actively supports the standard SDK, and many early developers have used it to create the early Windows applications, Microsoft is positioning MFC as the natural way forward for developers.

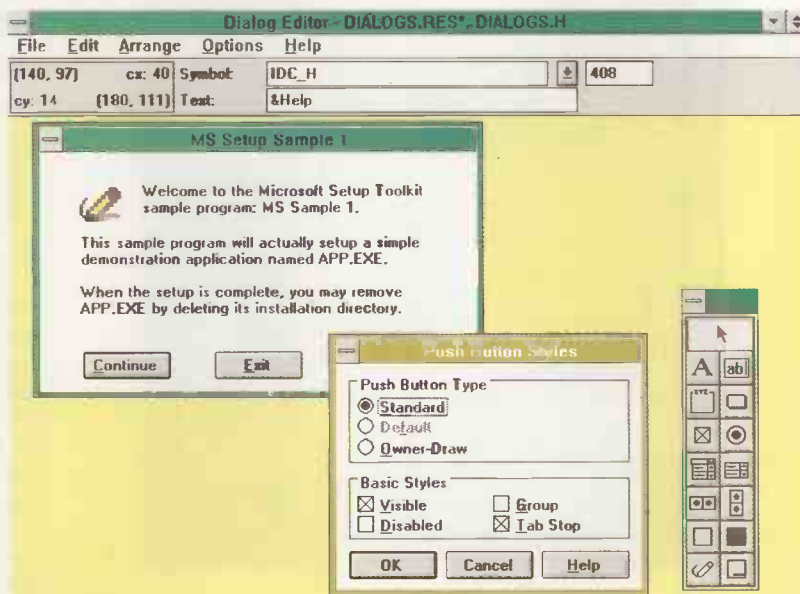
Although MFC contains a few general purpose classes, it is a C++ class library aimed primarily at Windows developers. It is designed to remove much of the need to interact directly with the 600 functions that make up the Windows API. The bulk of the objects in the library are special purpose Windows classes which encapsulate virtually all Windows API functions. Many

of the difficult and low level Windows details that would normally have to be explicitly coded in C are automatically handled by the class data and member functions.

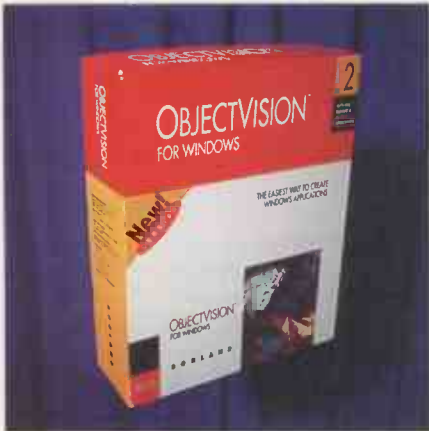
Compared with some other class libraries such as Borland's Object Windows Library (OWL), MFC offers only a minimal level of abstraction from the Windows API, although it will still have a dramatic effect on the amount of effort required to develop Windows applications. An advantage of this approach is the ease with which existing Win-

dows programmers, who are familiar with the standard API, should be able to migrate their code to MFC. Microsoft also argues that this approach leads to smaller, tighter applications which execute much faster.

In the longer term, Microsoft is positioning MFC as the base point for a new generation of class libraries that will encompass the new 32-bit Windows as well as Windows NT. Microsoft is in a unique position to offer a path for the MFC that should drastically reduce the amount of work required by developers to move applications on to these new platforms.



Windows, the Microsoft QuickWin library can be used to convert simple DOS programs to Windows programs. There are restrictions on the type of program that can be converted: typically they must be text-based applications that use standard input and output commands. In its most basic form, a non-Windows program can be transformed by simply recompiling with the QuickWin flag. These programs have their own menu bar, with access to the clipboard and the ability to rearrange windows. The real benefits of the QuickWin library lie in its ability to add some basic Windows-style func-



ObjectVision 2.0

ObjectVision is the black sheep of the Borland fold. Launched nearly two years ago, it has yet to find its niche in the marketplace. This is partly due to the way Borland has marketed the product: although it has many features in common with a database environment, there is not enough for it to qualify as a fully fledged database product in the same mould as Paradox or dBase. So, Borland has chosen to present it as a visual application builder.

The slogan adorning the ObjectVision box describes the product as 'The easiest way to create Windows applications'. This is misleading; it may well be one of the easiest tools to use, provided you want to create form-based applications. ObjectVision's paradigm is based squarely around forms, such as the data entry and query screens found in traditional database products or their paper-based equivalents. ObjectVision users interact with a number of such forms, which together form an application. As if to demonstrate the versatility of the form-based approach, Borland supplies a number of sample applications with the package, ranging from an invoicing system right through to a time-keeping system, en route encompassing a hangman game.

One of ObjectVision's key benefits is the absence of any form of programming language. Traditionally, a programming language such as dBase or Basic is required to specify the calculations and logic that make up a database application. ObjectVision, on the other hand, uses a visual charting technique

to specify the programming logic, similar to that of a flowchart. These charts, which are referred to as 'trees' in Borland parlance, are created interactively using the mouse and are easy to learn. This makes ObjectVision an attractive proposition to the casual or infrequent user, as it removes the need to learn a potentially unwieldy language. This visual technique is also far more intuitive than its programming counterparts.

One of the most appealing aspects of ObjectVision is the way it separates the creation of such forms from the database, allowing users to concentrate on the user interface rather than the underlying database structure. The creation and manipulation of forms is one of the key activities within ObjectVision and the form designer is excellent, exploiting all the features that make good Windows-based applications easy to use. Fields can be created at the click of a mouse button on the toolbar, and resized and moved around the screen at will. A range of basic drawing operations, such as boxes and underlining, is also supported. Clicking the right mouse

complex financial calculation that takes a number of fields and factors into account. Event trees compliment value trees and allow the designer to initiate an action when a particular event occurs, such as a user selecting a field or when the value of a field changes. They are most commonly associated with buttons, and can thus be used to move to a separate form or to update data.

ObjectVision supports a wide range of spreadsheet style '@' functions in the value and event trees, which are based on Borland's own Quattro Pro spreadsheet. There is a heavy emphasis on financial calculations, with functions that support interest rate and annuity calculations. Most functions act on a single record rather than across the entire database, which turns out to be one of ObjectVision's main weaknesses. This restriction makes some calculations, such as standard deviation, impossible to perform. While it is possible to register a DLL function, which could perform the calculation, having to create a DLL defeats the whole point of ObjectVision.

The inability to perform certain functions may well tempt users to look to more fully fledged Windows packages such as Paradox or FoxPro. As these contain all the functionality of ObjectVision, and much more besides, ObjectVision may be found wanting in some situations. Borland has Paradox for Windows lined up in the wings, so this may not cause the company too much concern in the longer term.

Once a set of forms has been created and the application logic defined, the final step in creating an application is to attach the forms to a database. Known

as linking, this step has been designed to keep database considerations separate from the application, allowing ObjectVision to work with a number of major database formats, namely dBase, Paradox, Btrieve and plain ASCII files. It is also possible to connect to other databases, though this must take place via the Window's DDE mechanism. ObjectVision includes a database engine that supports all these file formats itself, so it is not necessary to own dBase or Paradox to use their formats. The choice of format is only relevant if the data is to be shared with another application, and the wide variety of formats supported should be enough to meet most users' demands.

ObjectVision - ADDRESS.OVD

File Edit Form Field View Tools Help

Address Book (Goal)

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Notes: Borland makes the hottest Windows development products, including ObjectVision and Turbo Pascal for Windows. Stay in touch to get all info on product updates!

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button over a field brings up a floating menu, which can be used to access the different attributes of the object.

As with other packages of this nature, each field can be set up to accept different data types such as numeric, date and strings. The data verification is not true to the spirit of ObjectVision: it operates in a non-visual fashion, requiring designers to memorise cryptic character masks to specify different types of input validation.

ObjectVision uses two type of trees, value and event. Value trees are the most widely used and are for calculating the value for a field. This could be a simple calculation such as a VAT amount or column total, or a more

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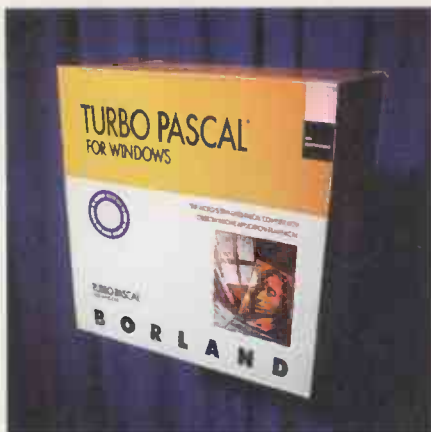
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Turbo Pascal for Windows

Turbo Pascal is available in both Windows and DOS varieties, the latter having a long history as Borland's premier product. Borland's trend is towards combined Windows and DOS packages with increasingly consistent appearances, and given its success, Turbo Pascal could be next in line. In the meantime, it remains a popular Windows development platform for the Pascal programming community.

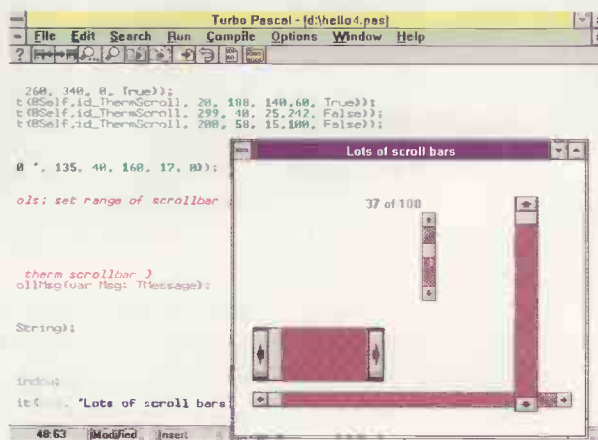
A full installation requires 14Mb of disk space, but this can be reduced to below 10Mb by removing the demonstration source. The package is roughly split into the Turbo Pascal compiler, with its Integrated Development Environment (IDE), and the Resource Workshop. The compiler side includes a set of Windows interface libraries, a complete ObjectWindows class library and the Turbo Debugger. The first five manuals cover these aspects, including a complete reference to the Windows API. The Resource Workshop gets its own manual although the others frequently refer to the Whitewater Resource Toolkit, belying the fact that Borland's own offering has replaced it. The depth of coverage by the documentation is considerable, with object-orientation covered in depth in the user's guide. The six manuals are filled with much detail, including how a variable is stored in memory, and the heap management utilities employed by Windows.

The similarities with Borland C++ are immediately apparent: the ObjectWindows Library (OWL), the IDE and the debugger are virtually identical. At the language level, the object-oriented enhancements to standard Pascal are very C++ like. Although inline assembler is supported, Borland's

own fully functional assembler, TASM, is not included, nor is the Turbo Profiler. This ability to share development tools across its range of compilers has helped ensure that Borland's offerings remain one of the best available.

The Turbo Pascal compiler creates self-contained executables which are compact: a small application takes up a mere 12K, including an icon added using Resource Workshop. Turbo Pascal can be used to create DLLs, as easily as normal programs, via one of the compiler options. Included within the system is a set of Windows 3.1 specific DLLs, including routines for the decompression of .LZH files, and OLE support. Speedwise, it lives up to its name. Borland claims some 85,000 lines per minute on a fast 386, although it is coy about how much free memory is required for this sort of performance.

The language enhancements are significant. There is a proper file handling system, which was missing from the original Pascal language definition, and strings are supported, limited to 255 characters. An entirely new null terminated string type is supported, identical to C's pointer to char, with a 64K limit. It is widely used to pass parameters to the library routines. A host of C-like pre-processor directives are available, to allow for example conditional compilation.



The language supports 'units', which to all intents and purposes can be thought of as libraries. A declaration of their usage must be made, after which all the constants and functions are available for use. Pascal units can be created and compiled as easily as normal programs, to build application-based libraries. A set of six units is supplied (but without the source) including WinCrt, which implements many routine Windows functions such as creation, sizing, and font usage without making any Windows calls. The result will be a DOS-like text output, albeit in

a resizable window.

Monolithic applications may be forced into using Pascal units, as programs are limited to a 64K code segment and a 64K data segment. (A unit has its own program and data areas.)

There is no limit to the number of units which can be used by a program. Unit chaining is performed automatically, so if a main program calls unit A which in turn makes calls to unit B, the main program does not need to declare usage of unit B unless of course it requires direct access to the functions stored in it.

By means of these units all the standard Windows functions are available, including single and MDI windows, scrolling lists, check and radio buttons, and file and dialog boxes. Building these takes place at a lower level than other development environments such as dBFast. For example, scroll boxes are built separately from the host window. 'Combo' boxes are also supported, useful for tasks such as making a file choice from an expandable list.

The IDE is covered in more depth in the Borland C++ review. Suffice it to say it is a delight to use. A nice touch is the syntax highlighting although, as has been pointed out elsewhere, caution is necessary to avoid nauseating colour schemes. The Turbo Debugger has an excellent range of facilities, such as line by line stepping through a program, variable and object examination and statement trapping. It also offers reverse execution and dual monitor support, the latter being particularly useful for debugging Windows applications.

The Resource Workshop's range of resource handling tools, includes bitmap and cursor manipulation, dialog box setup, shortcut key definition, icon editing and menu setup. It can manipulate resource scripts and compiled resources, and unpack and rebuild .EXE files directly without the source. It even allows bitmap definitions within menu options, for more exotic applications.

A key element of the resource toolkit is the project organiser, which comes into its own when managing complex resource sets. Its facilities not only match the earlier Whitewater Resource Toolkit one for one, but exceed its capabilities. It has Borland's own look and feel and among the variety of bitmaps and other resources are the Borland Windows Custom Controls. They allow the 'Borland look', grey steel with large ticks and cross buttons, to be applied to any application.

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Microsoft Visual Basic

Microsoft still seems surprised by the runaway success of Visual Basic, describing it simply as a 'Programming System for Windows' and avoiding any sort of object-oriented hype. Its terminology seems slightly out of step with the current fashion, referring to windows as forms and objects as controls. Despite the inclusion of the word Basic in the title, it has been hailed as a surprisingly good language in its own

Basic is one of the few products in this review to adopt this approach, providing an on-line walk through first steps in application development although it stops short of a full programming guide. There are two manuals, a programmer's guide which starts from first principles and runs through all the topics, and a language reference which lists all facilities in alphabetical order, from the most simple Basic statement to the most complex API call. There is only the most brief overview for the novice Windows programmer, making it difficult to find the documentation on a facility if only its broad capabilities are known.

The development environment is split into a standalone menu window, an active form (a design window), the project manager and a floating toolbox. Initially these are all separate, so the result can be a confusing mix of active and inactive Windows unless the Windows Program Manager is minimised on use.

Visual Basic starts off with the project manager instead of the initially empty screens of, say, dBase. Controls (or objects, using the terminology of the other products) must be added to this

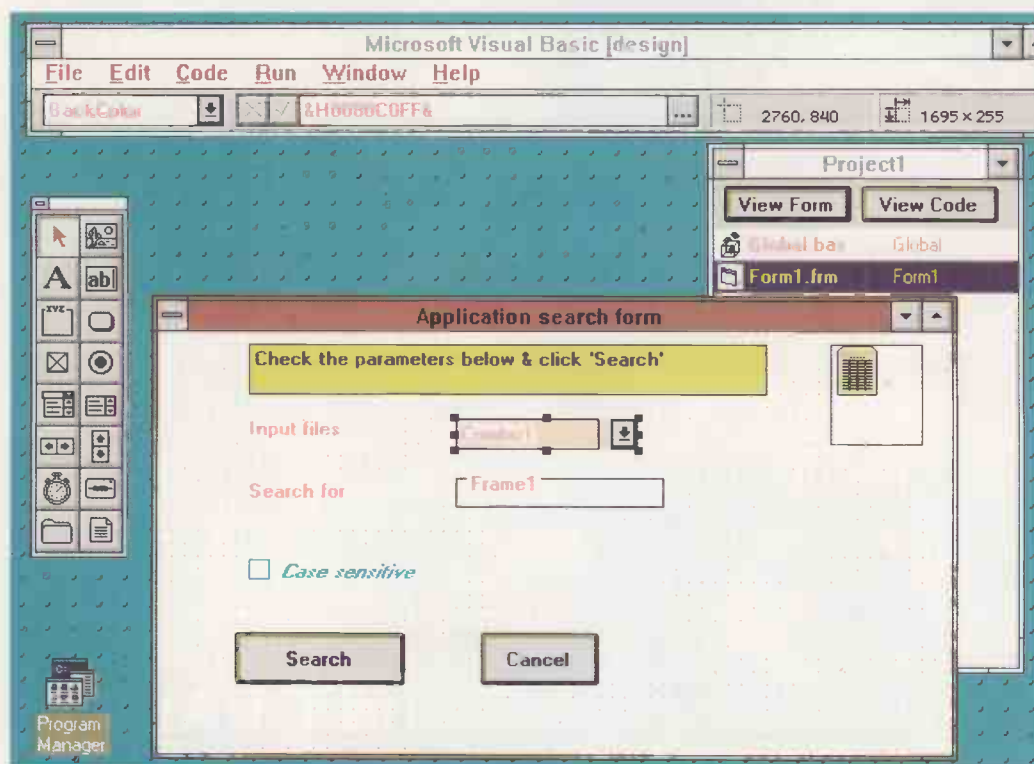
same problem as the language reference manual in that the exact name, such as a Basic keyword or API function name, must be known.

The floating toolbox, in allowing selection of a particular control, displaces the equivalent menu options. Once development is under way it can easily get lost under other windows, although a menu option in the Task window can be used to bring this and any other lost components back into the foreground.

A control can be moved and resized once it has been dropped onto the form, although this becomes difficult when two controls are heavily overlapped. Tools available to the developer include check and list boxes, text areas, scroll bars, frames, file selection and menus. A few 'combo' boxes are also supported, such as file selection, or an entry selection from a given array. Bitmaps and icons can also be loaded into the window, or the latter can be embedded within a button to produce application toolbars. The menu control system is particularly powerful, with multiple level menus, and the use of arrays permits menus to be changed at runtime.

Controls have a wide range of properties, such as co-ordinates, colour scheme and drag and drop capabilities. Consistent naming conventions across the different controls make handling the varied selection of controls far more manageable. However, it is not possible to change a single property across a number of controls in a single operation, like changing the position of a group of controls within a window.

The screen is just one of a number of predefined special controls to which programs have access; others include the clipboard and printer. Switching between objects simplifies creating reports or transferring text or graphics to the clipboard. In the case of the clipboard, the data format of



right, let alone as a good object-oriented, Windows-based application development tool.

The installation program requires some 2Mb for Visual Basic itself. It grabs another 3.2Mb for an enormous range of bitmaps, plus up to 1.5Mb in examples and a tutorial system. Visual

window, and only once this has been done can the code section be created or modified. This is right up with the Asymetrix Toolbook design methodology, and makes the whole development process far more intuitive than plain coding. There is also context-sensitive help but it suffers from the

its contents can be checked prior to access. A graphical subsystem allows the loading and scaling of bitmaps, plus a variety of calls to draw points, lines of varying thicknesses (and thus empty or solid boxes), ellipses and arcs.

Visual Basic's language aspects are a close match to Microsoft's own Quick

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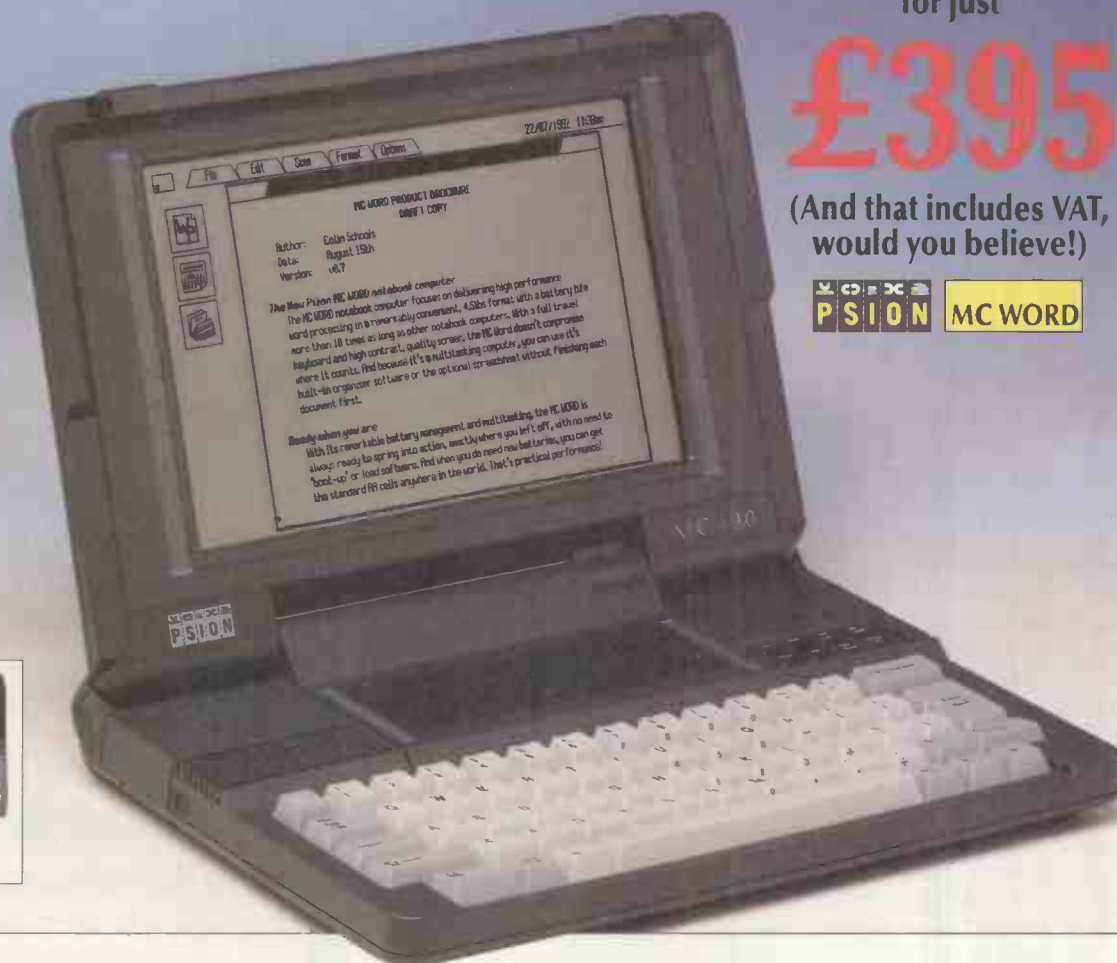
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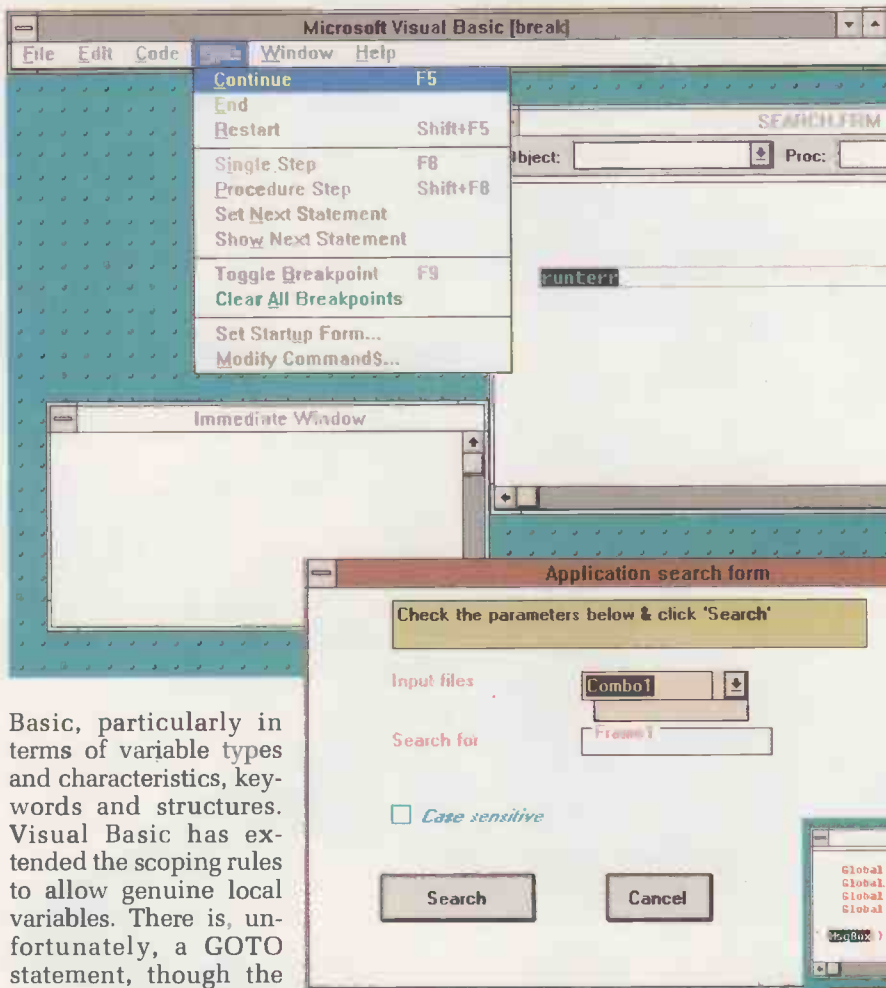
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Basic, particularly in terms of variable types and characteristics, keywords and structures. Visual Basic has extended the scoping rules to allow genuine local variables. There is, unfortunately, a GOTO statement, though the manual points out that programs with many of them can be difficult to read and debug. This is rather like HM Government's warnings on cigarette packets: not an effective dissuader to the hardened user. Variable declaration remains optional, again with a warning that 'on your own head be it'.

There is also a host of miscellaneous language enhancements. As well as integer, string, Boolean and real variables there is a specialised currency type, a numeric value with a fixed decimal place which avoids the rounding errors associated with reals. Parameter passing to functions works in a Pascal-like style, by value or by reference, the former preventing accidental modification of a variable by the called routine. The ability to dynamically resize arrays is very useful, for example in the selection combo box.

There are also low level functions to allow the sensing of non-ASCII keys, such as the Shift, Ctrl and Alt keys. A timer with an interval property allows real-time applications to be written, but its accuracy is limited to the nearest 18th of a second. DLLs can be called from Visual Basic programs (the runtime is itself a DLL), though it cannot be used to create DLLs. Microsoft points ad-

vanced users towards its SDK, whose complexities are at odds with the easy to use philosophy of Visual Basic. A set of declarations for the Windows API is included, although details of the functions are not given. To make full use of these, the Windows SDK or the Professional Toolkit must be purchased.

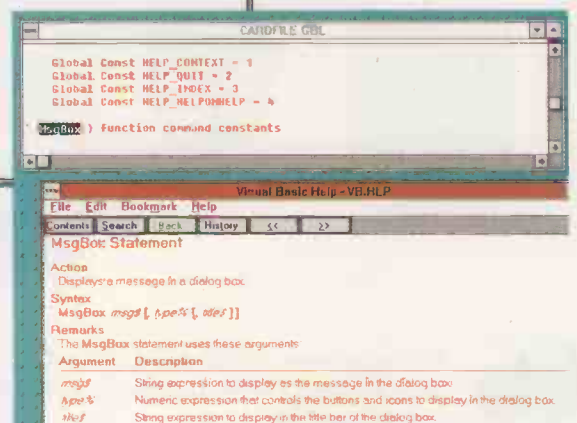
DDE is also supported: any window can be a server, and any box or label a client. Hot-links can be set up so that any change in the link item (the property of the control) results in a transmission. Microsoft's own Paste Link is supported, which sets up a link via the clipboard to applications such as Excel and Word for Windows. Commands can be sent to other DDE-aware applications. For applications ignorant of DDE, a separate command can be used to force keystrokes into the application, or back into the Visual Basic program for testing purposes.

Error handling can be added locally, within the code attached to a control, or in the initial global level present in all applications. This allows particular errors to be trapped in a specific routine, or via a catch-all in the global area.

A runtime error, such as a disk not present, can be trapped globally without the need to code an error handler for every read or write operation.

Although it is an interpreted language, a highly compact .EXE can be created: a simple single-window application can take up less than 5K. Upon execution, a Visual Basic application looks for the 270K runtime which the installation program has quietly dropped into the main Windows directory. This method ensures minimal disk usage, as opposed to dBFast's duplication of the runtime into every application.

The debugger is built into the development environment and allows a standard range of functions, such as setting of breakpoints, single-line stepping and variable examination and assignment. By virtue of the interpreter, changes can be made to code after a stop has occurred, and the program continued from the same statement.

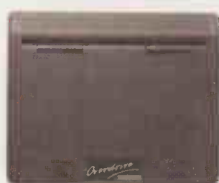


Procedure stepping allows single-line trace through a defined level of code, with complete execution of sub-procedures. Although there is no step-back capability, a restart can be specified anywhere within the level of code at which the error occurred.

As complex applications incorporate more and more code on the back of controls, a disadvantage becomes apparent: the execution speed of this code is considerably slower than the native functions, due in part to its interpretative nature. This makes complex user-developed controls impractical, a criticism Microsoft has answered with its Professional Toolkit. This also tackles another bugbear, the lack of a Multiple Document Interface (MDI) control. As this review went to press, Microsoft announced version 2.0 of the Visual Basic package. See page 248 for a full review.

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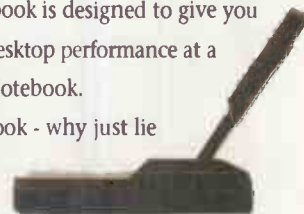
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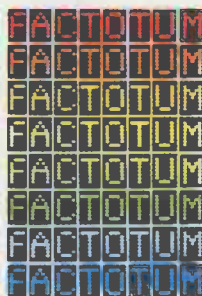
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Whither xBase?

Of the products reviewed here, only dBFast offers a migration path for the xBase market. The paucity of xBase offerings for Windows belies its large presence in DOS applications, and recent acquisitions by Microsoft and Borland can only strengthen this hold. The situation is set to change, as both companies are offering Windows versions of their new prizes.

Microsoft has already announced FoxPro for Windows as part of its Developer Tools, along with Access and Visual Basic 2.0. FoxPro will be promoted as the heavyweight application development system, with the additional benefit of easy migration of existing FoxPro code. Even before acquisition, FoxPro 2.0 already embodied Windows-like features such as radio buttons, lists, pop-ups, resizable windows and the like, under DOS.

Meanwhile, Borland is pacing

Microsoft with dBase IV for Windows, although the release date is shrouded in mystery. As dBFast demonstrates, xBase is not a natural choice for the object-oriented Windows environment, and dBase IV even less so than FoxPro. But both products, in allowing the migration of generic xBase code to Windows, should tap into a large skill and application base as well as competing head-on with dBFast.

There is another option. Over a year ago, Nantucket had already spearheaded the move to an object-oriented Windows platform with a project codenamed 'Aspen'. After its acquisition by Computer Associates, the need arose to position this project in relation to CA's own dBFast. The stated aim is for the current dBFast and Clipper products to evolve via major releases (dBFast 2.0 and Clipper '5.X') towards a final single-product goal, namely Aspen.

This, it is claimed, will offer platform independence. OS/2, Unix and Windows NT versions are already promised, but only after the initial Windows-based product is established. New features will include rich text, image and sound facilities and open database architecture, via the replaceable database driver (RDD), a concept first introduced in Clipper 5.0. The latter will include both existing xBase file system and SQL client/server support.

Aspen's embracing of object orientation will provide full class definitions allowing seamless interfacing at the message passing level of GUIs such as Windows and OS/2, and will include class libraries for functionally specific products such as FoxPro. The new compiler technology is claimed to allow levels of performance previously associated with languages such as C.

Glossary of terms

The world of Windows programming brings with it a host of new technical terms and jargon that can intimidate even the most experienced of developers. The following are a few of the terms that have been used in this review, as well as some that crop up regularly in product reviews and technical discussions.

API (Application Programming Interface)

An Application Programming Interface defines the access interface between an application program and a particular set of system resources. Typically, an API comprises a list of function calls, messages and data structures that an application may use to access those system resources.

The original Windows API defined some 600 functions that programmers could call upon to create Windows applications.

DDE (Dynamic Data Exchange)

Dynamic Data Exchange is one of a number of mechanisms supported by Windows that allows data to be exchanged between applications. Based on the Windows messaging system, DDE allows two Windows applications to create a link through which a conversation can take place, and through which data can be transferred. Applications which support DDE can therefore interrogate each other automatically, and access up to date information.

DLL (Dynamic Link Libraries)

Dynamic link library files, usually denoted by their .DLL extension, contain functions that can be called upon by Windows programs. Placing these routines into a library means that programmers can easily reuse them, rather than writing them from scratch. They are similar to their MSDOS .LIB counterparts, but instead of being attached to the .EXE file at link time they remain as separate files. They are loaded into memory at runtime and can be accessed by more than one program, regardless of the originating language.

OLE (Object Linking and Embedding)

Object Linking and Embedding was introduced with Windows 3.1, and enables applications that support OLE to create compound documents containing different kinds of data, such as text, spreadsheets and illustrations. The information can be embedded in the document itself or can take the form of a link to the actual data.

Compound documents thus allow users to mix and match their choice of applications, combining the results in a single document.

Resources

Icons, cursors, fonts, menus and dialog boxes are examples of Windows resources. Most development environments provide a range of tools to create and edit individual resources which are stored as external files rather than hardcoded into the program.

All the resources required by a program are defined in a separate resource script, and at compile time the resource compiler brings together all the resources and places them into the application's .EXE file.

Prices

Borland C++ 3.1: £439.95
 Microsoft C/C++ 7: £335
 ObjectVision 2.0: £129.95
 dBFast: £339
 ToolBook 1.5: £310
 Turbo Pascal for Windows 1.5: £119.95
 Actor Professional: £349
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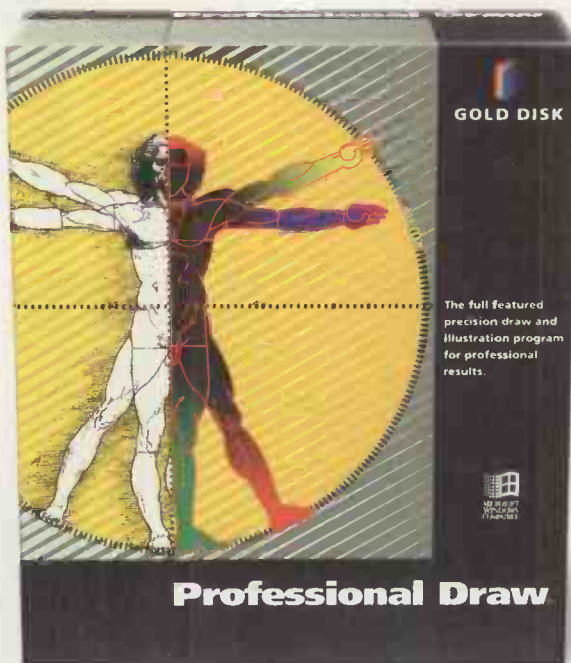
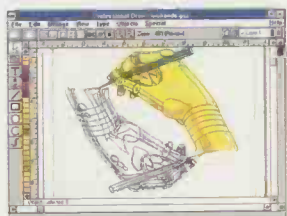
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*Publish, June 1992. **Import filters for Micrografx Designer, CorelDRAW, Adobe Illustrator, AutoCAD. System requirements, Windows 3.0, 3.1. Minimum 286, 2MB RAM, MS-DOS 3.3 or greater. Recommended 386sx 2MB RAM. Professional Draw and Gold Disk are trademarks of Gold Disk Inc. All trademarks acknowledged.

How they developed

Finding the right Windows development package depends on a wide range of factors such as programming experience, time available to master it, the type of application to be created and even monetary constraints. There is no reason why a developer should not master two or three packages: some lend themselves well to particular tasks and in some cases it makes sense to mix and match the best tools for the job.

The professional developer wishing to create an application that will be used by others, especially if it is to be distributed commercially, should look to one of the 'true' programming environments. These allow the programmer to interact directly with the Windows API, meaning they are not limited by any artificial design constraints and can be used to create literally any sort of Windows application. This power is normally gained at the expense of ease of development. The learning curve is usually steep, as there is much to understand and master.

This category includes the Microsoft and Borland C++ compilers, and Borland's Turbo Pascal for Windows. For C programmers who wish to proceed along this route, C++ is the obvious choice. Both C++ compilers reviewed are excellent, and developers would be hard pressed to pick between them. If anything, though, Borland has the slight edge. The development environment is Windows-based, the supporting tools like the resource editor are particularly slick, and the compiler supports the latest 3.0 C++ standards. Turbo Pascal has many offerings for the non C/C++ addicts: a genuine compiler, access to libraries such as OWL and Borland's excellent IDE.

Visual Basic is surprisingly good. It's sophisticated but easy to use. Although the language is fundamentally Basic, it's as far removed from the GW-Basic of years gone by as Windows 3.1 is from 1.0. It's a pity that some programmers may dismiss it, purely because of that one dirty word.

The only major criticism is the speed, which Microsoft has already tackled with Visual Basic 2.0. Given

the popularity of release 1.0, this improved version should ensure the product's continuing success.

dBFast comes out poorly in comparison with the other products. The language can safely be described as the least object-oriented of the eight reviewed here, a reflection of xBase's procedural structure. It is essentially dBase III+ with a few 'Windowy' bits tacked on to it. The User Guide talks about dBFast having the tools to make a user's program 'look and feel like a Windows program', but this appears to have taken second place to the stated aim of providing maximum dBase III+ compatibility. Compared with the Borland IDE, the development environment is primitive to say the least. Finally, the requirement to generate linked code to obtain any semblance of a real

rub: if an object-oriented language is the best for Windows development, why not go the whole hog into mainstream C++? Actor stands slightly to one side and risks being left in its wake. In its favour, it is an excellent language for getting into object-oriented methodologies without getting lost in the depths. This is analogous to Pascal being an excellent teaching language, but somehow it loses out to C once the learning is complete.

Of the Windows-specific tools, ObjectVision is perhaps the most disappointing. The pre-launch information generated a lot of interest, but the realisation of that idea failed to live up to those expectations. For quick data entry or query screens, the product can't be beat, but its limitations are such that more sophisticated requirements may well exceed

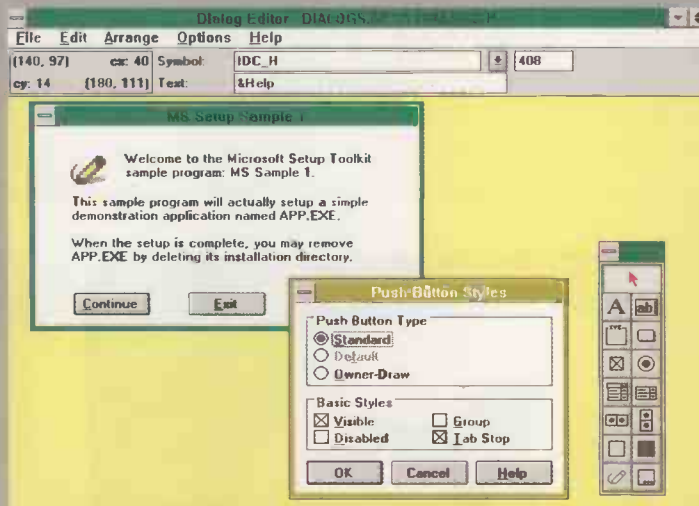
its capabilities.

ToolBook is also somewhat disappointing. HyperCard created much interest on the Macintosh but Windows versions have never achieved the same success. In the case of ToolBook it can be partially put down to the poor performance of the original version, a position from which it never really recovered. Although the English-like language does not look as intimidating as conventional languages, there is still a steep

learning curve for all but the most trivial programs. Having said that, for interactive demos and computer-based training programs, the effort is probably well justified.

For the casual user and non-programmer, Visual Basic stands out as a powerful and intuitive product which is able to produce a wide range of applications. For the professional programmer and Windows developer, Borland's C++, and to a lesser extent Turbo Pascal for Windows, can be used to create fully-fledged products. This is thanks in part to their powerful Windows libraries, although Microsoft is not far behind with MSC7.

This is not to say the other programs are not without merit: many fill particular niches and user needs that other products fail to cover in such depth.

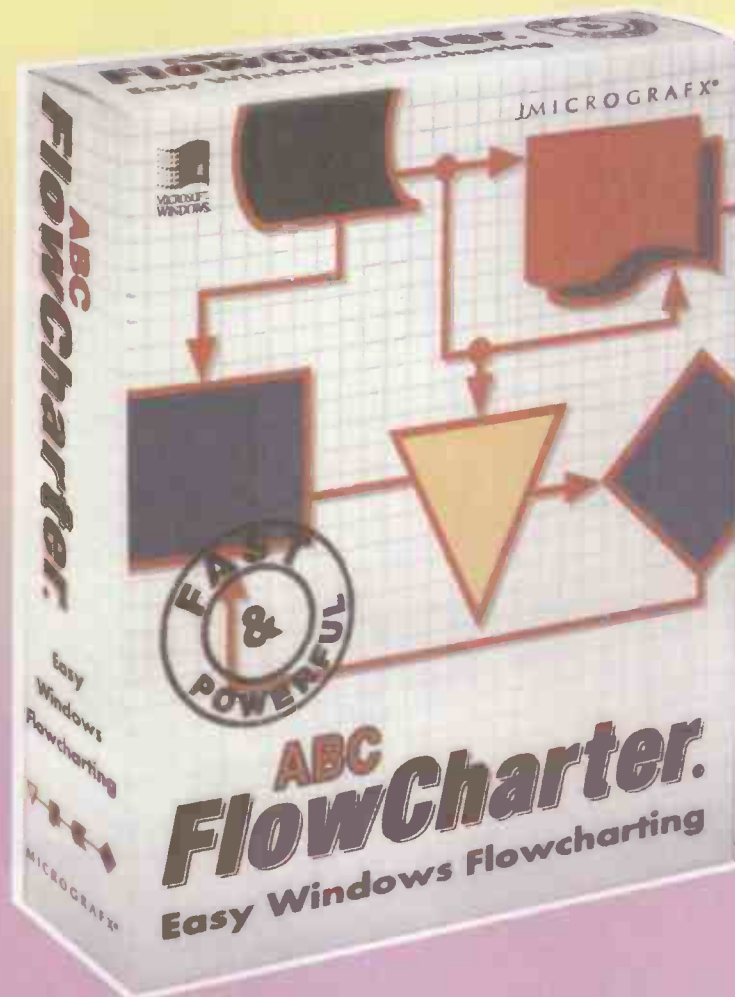


△ Microsoft's C/C++ 7.0 & SDK

application means potentially wasteful amounts of disk space unless a monolithic approach is taken.

Actor is not quite as 'pure' an object-oriented language as Whitewater would suggest, but it's the purest of the eight. There's no doubt that it's powerful, but much of this power derives from the robust and well-written class libraries without which the learning curve would be dauntingly steep. Even so, there is still a mental shift required as object orientation must be taken by the horns to make progress in Actor. Visual Basic and dBFast all allow a more gentle step into non-procedural code. The language is close to C++ but not close enough to be compatible, and therein lies the

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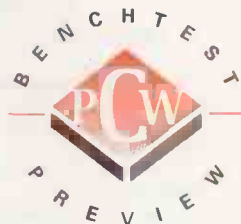
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Compaq LTE Lite 4/25c

TFT portables are always an attractive option, and Compaq's new LTE Lite is further enhanced by its 486SL chip. It weighs 1kg less than the equivalent Toshiba, but Simon Rockman's true idea of desirability was the new trackball.

There are good reasons for using a desktop machine when you have a portable. The screens on portables are never very good and using Windows without a mouse, even if you have a stick-on trackerball, is pretty unsatisfactory. Oh, and the keyboards on portables are always a bit cramped.

With the LTE Lite 4/25c, Compaq has addressed all these problems save that of the keyboard. The screen is every bit as good as a CRT, albeit only 640

thought quality like that was impossible' display. The viewing angle is great (perhaps too good if you don't want the passenger next to you on the Tube to see your spreadsheet) so the brightness control is redundant. The screen is readable at all settings.

The screen is the second best thing about the machine. The best bit is the trackball. I hate trackballs; even the Mac PowerBook, generally acknowledged to have the best trackball arrangement in the business, makes me feel a little uneasy, and that has only a single button. The designers at Compaq haven't just come up with a new approach, they've solved the problem. The Alps 150mm ball, as fitted to Sharp notebooks, is recessed in the underside of the lid. When you put your thumb on the ball your fingers naturally curl around the screen to rest on the top of the lid. There they will find the buttons. The important thing is the word 'naturally': it is so easy to use that you are very soon thinking about the problem in hand and not about the mechanics of using the trackball.

Beyond the screen and the trackball, there is nothing particularly remarkable about the outside. It's very like a Compaq LTE with a different lid and it uses the same case as earlier Compaq TFT computers. The floppy drive is at the front, along with the hard disk access light and the removable battery. When a disk is in the drive, the eject button pops out a long way which makes it vulnerable. A light on the battery shows when the machine is being fast charged. This machine uses Nickel Metal Hydride batteries which are easier to predict the discharge rate of than conventional NiCads. They are also recyclable and much more expensive: Compaq charges £100 for replacements.

The disk light is not that easy to see, which is a nuisance since the machine grinds to a halt when it powers up the disk. If you are using a power-saving mode the disk often powers down and the system gives the impression that it has hung when it needs to wake the disk up. In a quiet environment this doesn't matter, but on a train you won't hear the disk start up.

The release catch for the battery is on the left-hand side. The mechanism is a little strange since



x480 in 256 colours. While the prevalence of SVGA has made 800 x 600 pretty much the minimum on the desktop, the limitations of flat screens have kept the pixel resolution down. But in common with other TFT, active matrix notebooks, the Compaq has a stunning screen, a real 'blow your socks off, I

you have to push the battery in, hold the catch and then release the battery, but it needs to be like this because there is no backup battery to hold the data while you swap over. The right-hand side of the case is equally dull with just a cover for the internal model (not fitted to the review machine). Compaq's RAM cards are fitted through this slot, sliding in below the modem. The slot provides enough expansion to fit one of Compaq's own modems — a 2400 bps unit is shipping but V32bis is yet to become available — or a third party modem, fax or Ethernet board.

All the usual stuff happens around the back. A sliding door covers the connector for the docking station. It looks a bit like a scart connector and gives 16-bit access to the station. Opening the flap reveals the standard posse of connectors: power, PS/2 style mouse or keyboard, numeric keypad, VGA, parallel and serial.

The least obvious button is just inside the hinge and detects when the lid has been shut — like the light switch inside Schrödinger's fridge. The whole lot is quite bulky by modern mono notebook standards, but it is on a par with anything that was in the shops nine months ago and is lighter than its 486 rival from Toshiba. An important aspect in the overall weight of a portable system is the size of the power supply. The LTE Lite 4/25c uses the same PSU as the standard LTE, which at under 400g is pleasantly light.

The keyboard isn't great. The need to keep the height down (the TFT makes the lid an inch thick) has resulted in poor travel on the keys. With titchy function keys and an atrophied Return key you wouldn't want to use this one for a significant amount of database entry. Each of the small keys is half the height and six-sevenths of the width of a real key. Despite the early production nature of the review machine — it was at Compaq's factory in Germany the day before we got it — the 4/25c had a proper UK keyboard. The inverted 'T' for the cursor keys is more usable than on earlier Compaqs and with the trackball you need to use them less anyway.

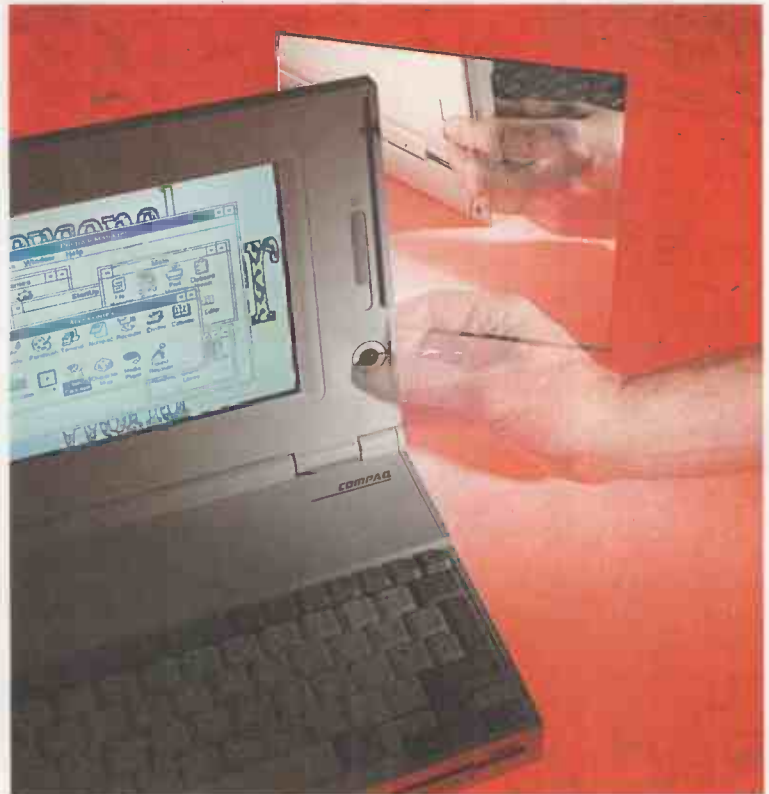
Software

The external configuration of this computer is clearly right for a Windows portable and this is complemented by the software. The trackball is supported by a program called Cursor Enhancement which has an icon of a mouse sitting on a ball like a seal at the circus. The screen is so good that the software isn't necessary but it does serve a useful purpose. One feature lets you have the minimised icon pointing to the cursor, which is great if you tend to lose the pointer on the screen; I'd be tempted to use it on a 1600 x 1200 desktop display.

Under Windows, power management is available as a driver in a similar way to 386SL machines. The Windows power-saving features supplement those built into the hardware but for most you have to shell out to DOS. This is all done transparently from Windows with a program group and icons, or pifs, for the power-saving programs. The power conservation program and its accompanying help utility try hard to look like Windows programs and almost make it, but it is a shame Compaq could not

manage the real thing. As on most laptops, the power conservation works by turning bits of the machine off when they are not being used. Only experience will show if the settings you have chosen are sensible. For the word processing I was doing to write this review, the default disk time-out was a long way from the optimum; whenever the disk timed out I seemed to do something which caused it to power back up again. I solved this by increasing the default time-out from two to five minutes, which was enough to stop the disk from powering down. It may seem more wasteful than switching it off but a running disk does not consume nearly as much power as it needs to get it up to speed.

As with the 386SL, the 486SL has a standby mode which allows the machine to go to sleep instantly — great for changing trains or popping to the drinks machine. With a fully charged battery the computer can be left in standby mode for up to 80 hours; when you exit standby your information returns to the screen where you pressed the button. If the computer is set with the hibernation mode on and left on standby until the battery goes flat, an alarm will trigger and it will save a snapshot of the system to the hard disk. Similarly, if the computer beeps in use it flashes an LED and saves a temporary file. When you plug it back in, the system reboots and goes back to where it left off, printing up a message and giving you the option to reboot from cold if you wish. Hibernation is the deepest level of sleep for the SL. It starts with a System Idle mode



which is triggered by three minutes' (as a default) inactivity, then goes into standby and finally into hibernation. System Idle merely dims the display and drops the processor speed. To make the most of these features you should not use a screensaver.

One of the special features of the new Compaq is

The Intel 486SL microprocessor

One of the interesting things about the Compaq LTE Lite is its Intel 486SL CPU. About four years ago, Intel began developing a chip specifically designed for mobile PCs that would control power usage. The System Management mode, first implemented on the 386SL, was a major factor in the usability of machines such as those in the notebook Group Test in the October 1992 issue of *PCW*. The 386SL not only boasted lower power consumption enabling extended life or the use of smaller, lighter batteries, but was in fact smaller than the 386SX.

The System Management Mode saves power by allowing the CPU to slow down, suspend or completely shut down various system components. The CPU's power consumption is dependent on speed, so the ability to slow it down or even shut it down entirely can result in dramatic power savings.

The latest processor in the Intel SL range is predictably the 486SL, currently only available at 25MHz. A further 25 486 CPUs will be available in 1993, including a 33MHz SL anticipated early in the year. Intel initially implied that this would be joined by 12, 16 and 20MHz models, but has disappointed expectant developers by changing its mind. The company's portable components Product Manager, Andy Keates, commented that 'a few companies were a little bit upset' although this hasn't been a concern for the manufacturers working with the 25MHz. In addition to Compaq, NEC and AST have notebooks based around the new chip.

The core of the 486SL is a genuine 32-bit Intel 486DX processor, providing an on-chip maths co-processor, 8K cache, 32-bit memory and ISA bus controller. By placing these components on the chip, the physical size and amount of power consumed are reduced and reliability increased. Further performance gains are achieved through reduced clock cycles per instruction.

Most importantly, this core operates at 3.3v instead of the usual 5v. This reduction means that even when operating full-on, the power consumption of the motherboard is reduced by 50%. Since the motherboard accounts for around half of a typical system's total power consumption, this provides overall savings of up to 25%.

Before you consider ripping out the current SX or DX in your portable and replacing it with a shiny new SL (even if this was physically possible), total incompatibilities would occur with the power difference. This said, it may be worth upgrading to a computer with a processor featuring power management. Intel's 486SL will be launched at a slightly cheaper price than the equivalent 486DX, but before rushing out with your hard-earned it may be worth waiting to see what rivals Cyrix and AMD have up their sleeves. The computer commuter can only benefit.

Gordon Laing

The whole power-saving process is reminiscent of the mainframes of old. In the days when a computer needed a three-phase mains supply to power disk drives, there was always a good chance of a power failure. Computers were designed to sense the 'brown-out' as the power went down and save data to disk as elegantly and quickly as possible. Another big computer trait of the Compaq is a serial number built into the ROM. Software can be made to run on your machine and *only* yours. This has great anti-piracy implications and is slowly becoming more widespread, although every computer with an Ethernet card has a unique number which could be used for the same purpose.

The internal components are pretty standard, with Compaq's own BIOS and a combination of Intel and Compaq silicon. Opening the machine is not something an end user should do: Compaq dealers have a special tool to get the thing back together, snapping the eleven plastic lugs into place. But since any expansion is likely to be through the modem slot, this is not too much of an imposition.

The video processor is Compaq's own AVGA. Drivers run the TFT at 640 x 480 in 256 colours and an external monitor at 800 x 600; the machine handles this with 512K video RAM. The video subsystem has built-in bit blit features which greatly improve video performance under Windows, so the ECP figures, which use a mixed bag of DOS and Windows tests and applications, give a disappointing score of 7.0. Running Windows, the computer feels a lot faster. By contrast, a machine with direct video would score a lot better without delivering much better performance under Windows.

Conclusion

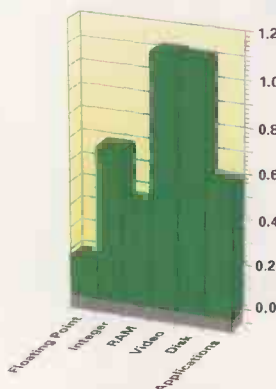
Two hours isn't a lot in terms of battery life, but the results are great. The recharge time of 95 minutes is reasonable and what the machine does in two hours is impressive. The quality of TFT portables makes them instantly desirable, and for a long time the Toshiba 4400SXC was the clear leader. With its ability to take an OverDrive chip (which Toshiba does not recommend), it might still have some advantages, but the Compaq is 1kg lighter.

For me, the trackball clinches it. The LTE Lite isn't cheap, and with Toshiba's recent price cuts there is a real premium to pay. At £3500 the model reviewed here, with a 120Mb hard disk, costs a good £500 more than the Toshiba. Both companies now offer 200Mb models and the Toshiba has a bigger screen, so you'll need to look very carefully at both.

that it supports Advanced Power Management (APM), a Microsoft-led specification which affects DOS, Windows and applications, working in conjunction with the BIOS. For the most part, APM runs behind the scenes by powering down elements of the system when they are not being used.

The Compaq-written BIOS has some great extras. Hot-keys produce pop-up windows which show the state of the battery and which of the power-saving modes are being used. Produced by the BIOS, they will appear as Windows-like windows in either DOS or Windows.

The indicators do not flinch when the processor is slowed from its usual 25MHz state through 12.5MHz and 6.25MHz, and finally down to 3.125MHz. The CPU, for all Intel's brouhaha, doesn't affect consumption that much, but this will change when 3.3v RAM and disk storage become available. (Plenty of disk manufacturers have shown 3.3v hard drives but no-one is shipping yet.) Only the central core of the 486SL 3.3v is in this computer: beyond that it's the regular 5v stuff. A better way of saving power is to dim the edge-lit display of the TFT screen. The power-saving control programs offer limits on the maximum brightness.



Specifications

Compaq LTE Lite 4/25c

Processor

486SL 25MHz

RAM

4Mb, 20Mb max

Mass storage

120Mb, 209Mb option

Monitor/display

640 x 480 on screen,
800 x 600 on monitor

Weight

3kg

Contact

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Visual Basic 2.0

When both users and programmers told Microsoft what they wanted from a new version of Visual Basic, it listened. Version 2.0 is what it came up with. Cast aside any doubts you may have, says Mat Beard: this is a programming language to be reckoned with.



The first version of Visual Basic for Windows was launched by Microsoft in May 1991 and quickly exceeded all expectations. A comprehensive user survey in May this year, exactly one year after the release of Visual Basic 1.0, showed that over 113,000 applications had been developed and shipped, which translates to almost five million users of Visual Basic applications.

Visual Basic 2.0 is the result of that user survey, and hundreds of other requests from programmers using the first version, for more features and a richer programming language. Consequently, it has over 300 improvements over earlier versions, the most important being better performance and increased program capacity. Microsoft is so happy with 2.0 that its own software developers are using it to write applications. The first Microsoft application entirely developed using Visual Basic is due to ship shortly, but the company isn't giving away any clues as to what form it will take. The executive vice president of Microsoft's worldwide product group, Mike Maples, said: 'Like many large companies, we've been using Visual Basic 1.0 for a number of internal projects since it was introduced. Now, with the performance and capacity enhancements in version 2.0, we are choosing Visual Basic to develop packaged software products ourselves. Visual Basic 2.0's rapid development capability will help us get products to market more quickly.'

According to Andrew King, Visual Basic's product manager, using Visual Basic 2.0 a software project can go from white-board to completion in around 18 months, compared to three years when using conventional development tools such as C and C++.

There are two versions of Visual Basic 2.0, Standard and Professional, the Professional edition being equivalent to Visual Basic 1.0 plus the Professional Toolkit. The Professional version, the subject of this review, is designed for MIS staff, corporate programmers, analysts, consultants, value-added resellers and independent software vendors writing vertical market applications. It includes all the

improvements and refinements of the Standard version plus enhanced versions of the features formerly found in the Professional Toolkit. It also provides tools to create new workgroup and database applications.

The system requirements are similar to those for Visual Basic 1.0: an 80286 or higher running Windows 3.x, 1Mb RAM and a hard disk with 14Mb of free disk space (more if you install the Open Database Connectivity (ODBC) support), EGA, VGA or Hercules display and a mouse. Being realistic, I wouldn't try to use Visual Basic on anything less than a 386 with at least 4Mb of RAM. Visual Basic, as with any development tool, benefits from a big screen and a high resolution.

After about 20 minutes of the usual Microsoft setup procedure, when you are told that 'Now would be a great time to fill in your registration card', the Visual Basic icons are added to the Program Manager. As the program starts up, several windows are scattered around the screen. Immediately obvious is the addition of a toolbar under the main menu window, which holds common programming and debugging operations. Centre stage is the Form window, which is basically a blank page onto which bits of an application can be placed. Application segments are kept in the customisable toolbox which by default is to the right of the Form window, but can be moved anywhere, as can all the windows.

To the left of the Form window are the Properties and Project windows. In Visual Basic 1.0 the properties of an application's objects were displayed and altered in a couple of drop-down text boxes beneath the main menu bar. The Properties window is a new addition in Visual Basic 2.0: it performs the same function as the two text boxes, but gives easier access to all the different options and includes many more properties that were not available in Visual Basic 1.0.

The Project window is basically the same as in Visual Basic 1.0, and is used to quickly switch between forms and modules when developing fairly

Basic [design]



900,1335



7590x5115

complex applications. Modules contain general declarations and procedures that do not apply to a specific single object. The Project window also lists all the custom tools that have been added to the toolbox. The professional edition adds an extra 18 tools to the toolbox by default and more are supplied. A file named AUTOLOAD.MAK determines which extra tools are loaded at startup, rather like a PC's AUTOEXEC.BAT file.

Programming

The programming method in Visual Basic 2.0 is the same as in earlier versions, but putting together a working application is easier due to the improvements to the language and Microsoft's usability labs. All applications start life as an empty form to which controls are added from the toolbox to define appearance and behaviour. The standard toolbox contains all the different parts that make up most Windows applications, such as scroll bars, buttons, text boxes, pull-down boxes and check boxes.

Menus are not obtained from the toolbox; instead, a button on the toolbar calls up the Menu Design window. This makes creating a menu bar simply a matter of typing what you want to appear on the menu and submenus: you can even determine what you want the 'active' letter to be, so that it can be accessed by the Alt key.

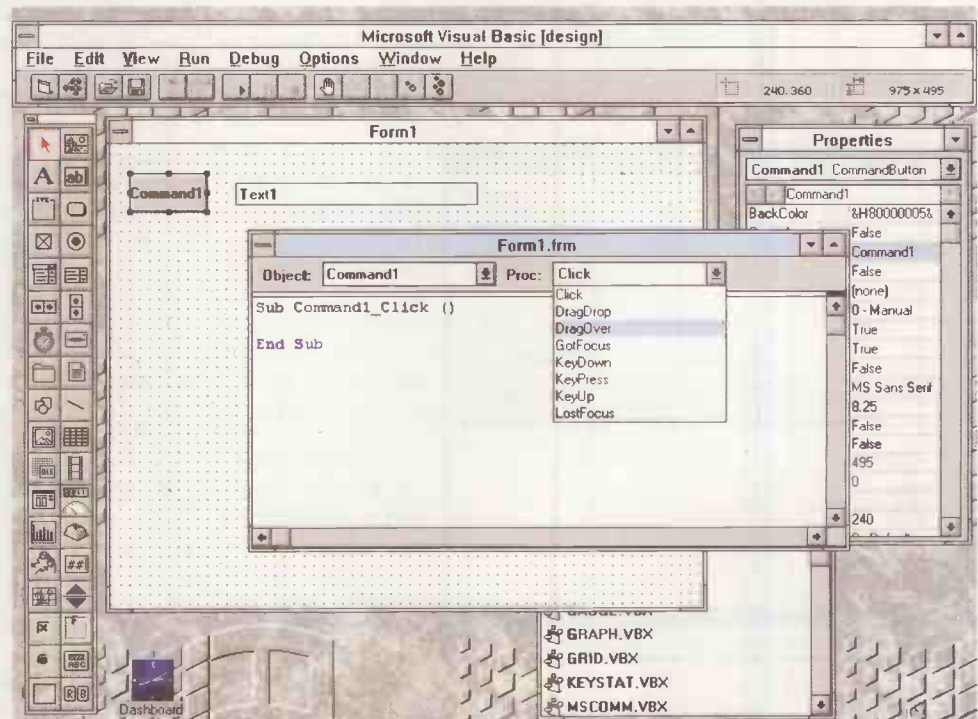
Programming in Visual Basic is quite different to any other type of language: it's a type of backwards method. The first step to creating an application (apart from deciding what you want it to do) is to design the interface, with buttons and dialog boxes or whatever, from the toolbox. Once you have the application laid out, the next step is to set the properties of the various object, such as the labels on the buttons. That done, the final step is to tie all the objects together with code.

That final step is the tricky one, but Visual Basic simplifies it. It doesn't write the code for you, but it's the next best thing. I have not attempted any programming for a very long time and although Visual Basic's language seems on the surface to be quite different from traditional languages, I soon found that I could get objects to do what I wanted — the Basic principles are the same.

Double-clicking on one of the objects in a form

calls up the code window. The code window consists of two drop-down text boxes and a large space with the words 'Sub' and 'EndSub' highlighted in blue. The first of the text boxes allows you to switch between the different objects on the form and the second determines what action that object is waiting for, such as a keypress or a mouse click. When an object detects a particular action it executes its code; until then it does nothing. Visual Basic 2.0 uses code that is compatible with Visual Basic for DOS (many VB for DOS apps will run under Windows with little or no alteration), QBasic and Basic Compiler 7.1.

Programmers can use IF..THEN..ELSE blocks, loops, numerous math and string functions and seven data types: Integer, Long, Single, Double, Variant, Currency and String. The syntax is checked automatically as the code is entered and if a fault is detected a message box appears telling the programmer what is wrong. The code is also colour coded so that comments are in green, keywords



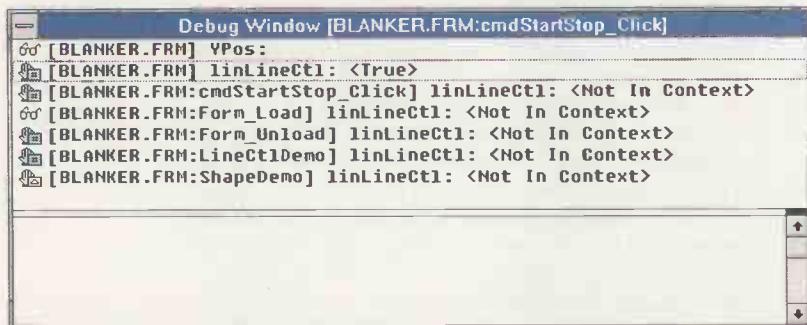
blue and identifiers black; these colours can be user defined, too.

Many enhancements have been added to the Visual Basic language to give developers more flexibility and control in developing applications. These enhancements include new declaration scopes such as private declaration for procedures, which prevents conflicts between reusable mod-

△ The code window for a button. The code is executed when the button is clicked

ules and project-specific procedures. This allows better structuring of code and helps to support teams of multiple developers, both absent from earlier versions.

Visual Basic 2.0 provides true MDI (Multiple Document Interface) support to allow developers to create commercial-quality applications. MDI applications consist of a container (the MDI form) along with a number of other forms (MDI children) that are confined to the client area of the container.



△ The debug window allows you to see the status of a procedure at a glance

The client area of an MDI form consists of the internal area, not including the border, menu or any picture controls. MDI children can be moved, resized or minimised within the MDI form. An example of an MDI application would be the Windows File Manager or Word for Windows. The enhancements to the Visual Basic language also include commands for handling the open windows in an MDI application: Arrange, Cascade and Tile.

The performance and capacity limitations of Visual Basic 1.0 have been removed, so it is now feasible to write an application such as Excel or Word entirely in Visual Basic. Version 2.0 supports huge arrays, up to the available system memory in

Windows Enhanced mode, and there can be four times as many procedures per application as in earlier versions. Also, string space is now limited only by memory, as opposed to 64K in version 1.0. Even if applications written in Visual Basic 1.0 had no size limitations, their speed would become the limiting factor. Performance has been greatly improved

though, due partly to the same application being on average 30% smaller in 2.0 than in 1.0. Smaller applications means faster loading (up to 400% faster) and faster execution (on average 35% faster).

If you don't fancy doing all your own programming, then use someone else's: Visual Basic 2.0 comes with a large selection (18 in the Standard edition, 27 in the Professional) of sample applications, to which the code is well annotated to help you understand what's going on. Users are free to

use all or parts of these applications in their own programs, so complex applications can be quickly put together.

It is unlikely that you will finish your application in one session, so you can save it at any point. Visual Basic saves applications as 'projects' with a .MAK extension.

You can test your application at any time, and because Visual Basic is an 'event-driven' language, it will not fall over just because you've only written the code for half the objects. Three buttons on the toolbar can be used to start, break and end execution of a project, alternatively the same options are available from the menus.

Debugging tools

It is at this stage that any errors in your code will become apparent. Finding the problem in Visual Basic 1.0 wasn't easy, but 2.0 has some new debugging tools which help pinpoint errors. All these tools are in the new Debug menu and some are available from the toolbar. The debugging tools are of four types: Watch Expressions, Break Expressions, Instant Watch and Calls Dialog.

Watch Expressions display their current value and range of execution in the Watch pane of the Debug window when the program enters Break mode. The range of execution can be a specific procedure, all procedures in a module, or global. Bitmaps are displayed at the start of each line in the Watch pane to help distinguish between Watch, Break When True, and Break When Changed expressions. Double-clicking on an expression brings up the Edit Watch dialog so that the expression can be changed during Break mode.

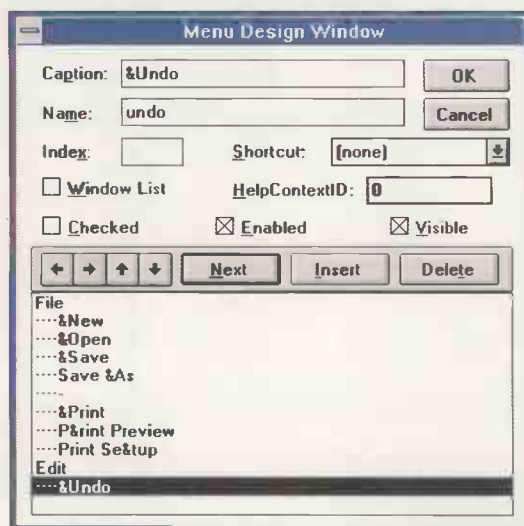
Break Expressions halt program execution when they evaluate to True or when the expression changes, depending on which type of expression is set. Range of execution can be a specific procedure, all procedures in a module or global.

Instant Watch provides an instant evaluation of a specified expression. The expression is selected either in a Code window or the 'Immediate pane' of the Debug window. The value is displayed in the Instant Watch dialog. An expression marked for instant watch can subsequently be changed to a watch or break expression.

At a break in execution the Calls Dialog displays the structure of active procedures and functions along with their respective module file names or form names. The list of calls is ordered from most recently executed at the top to the first procedure executed at the bottom. Double-clicking on any of the procedure names brings up a Code window for that procedure.

Applications design enhancements

Various new controls have been added to aid application design, the most significant being grid control, graphical control and OLE client control. Grid control allows developers to easily add spreadsheet-style displays of tabular data to applications such as accounting, data retrieval and reporting. Grids or tables can be created and manipulated using more than 45 properties, specifying, among others, number of rows and columns and addressing individual cells in grids. For example, the FixedRows



△ Conventional Windows menus can be easily created by typing the menu commands you want to appear

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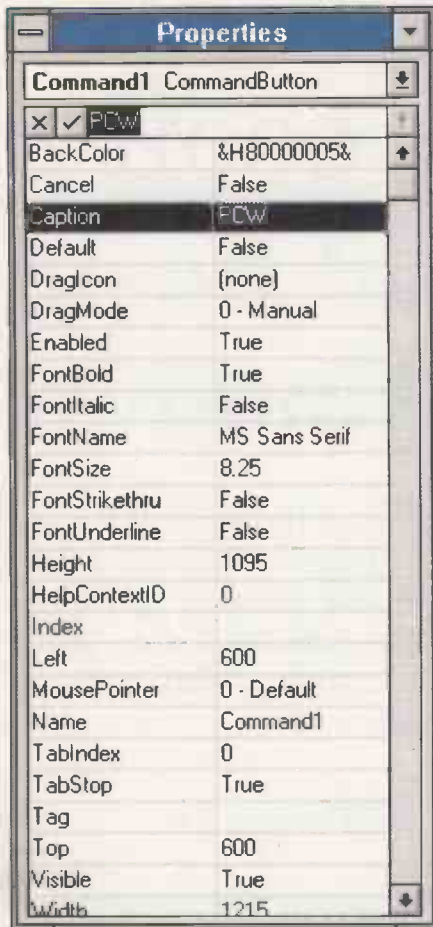
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△ The Properties window lets you define the characteristics of an object

document, or vice versa. The OLE Client control gives developers an easy way to implement this feature in Visual Basic applications. Applications can exploit word processing, graphics and spreadsheet functions from other applications — the OLE Client control contains a representation of

and FixedCols properties create stationary rows and columns to display static information to the end user.

New graphical controls reduce the coding needed to create graphical effects and improve form paint speed. In addition, the Control Development Kit supplied with the Professional edition allows developers to create their own graphical controls. The graphical controls supplied are Image, Line and Shape.

Object Linking and Embedding (OLE) is a potentially useful and important feature that was introduced with Word for Windows 2.0, and is now a standard Windows 3.1 feature. I don't actually know of anyone who uses OLE seriously, but I suspect that's because people are not yet aware of its benefits.

OLE allows documents to share different types of data and even different applications: for example, an Excel spreadsheet can be embedded in a Word

data that was produced by another application. The data is displayed as a picture, which will stretch or shrink to fit the OLE Client control, whatever its size. When the user selects the OLE Client control, it activates the application where the data was created and transfers control to it, allowing the data to be edited. When the application is exited, focus returns to the Visual Basic application and the updated data is displayed.

That's how OLE works now — but not for long. OLE version 2 is soon to be introduced. This works in a similar way, but instead of starting the 'parent' application when you click on embedded data, OLE 2 just replaces the existing menu bar (and toolbar, if the app has one) with that of the other application. This happens almost immediately, as only a small part of the application has to be loaded, and the rest of the document remains visible while allowing you to edit just the embedded data. Because of the modular nature of Visual Basic 2.0, it will be able to support OLE 2 as soon as it is introduced.

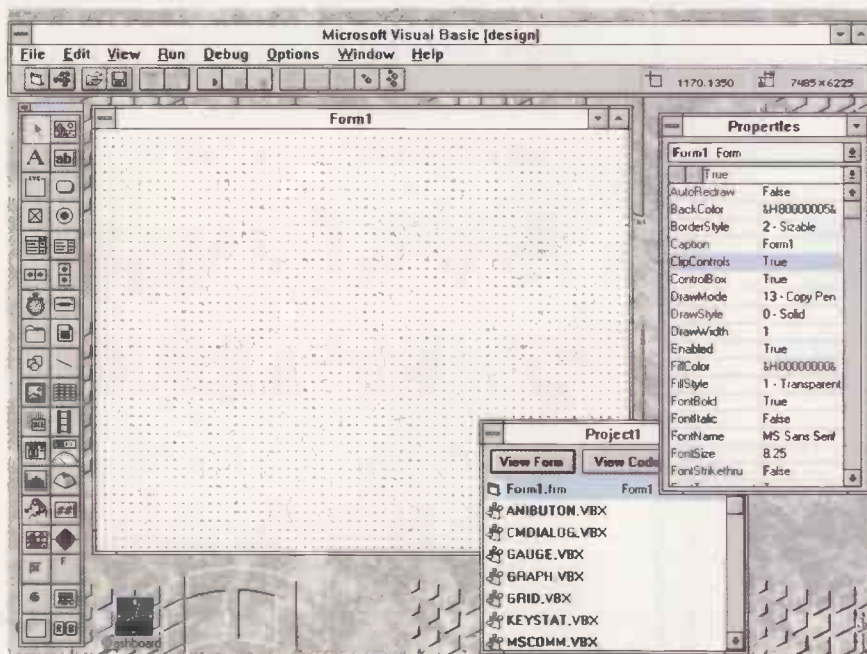
Windows for Workgroups has only just been released and as yet there are very few Workgroup applications. Visual Basic 2.0 aims to change that by implementing the Messaging Application Programming Interface (MAPI), which allows developers to create custom messaging solutions that are independent of the network messaging system. This is achieved through MAPI's dual interface: the Application Program Interface (API) which forms the client-to-MAPI link, and the Service-Provider Interface (SPI) which completes the network system-to-MAPI link. This allows MAPI to work with a variety of network messaging systems, such as Microsoft Mail and Lotus cc:Mail. This open-ended architecture allows applications to be mixed and matched with messaging systems without the incompatibility problems.

Interoperable database applications

A similar architecture is employed in Visual Basic's Open Database Connectivity (ODBC) option. Traditionally, database application development has been complicated by differences in database interfaces and network software. Applications must translate database requests into appropriate commands for each database management system (DBMS) and network system; for example, a DB2 database expects only DB2 commands and might use Systems Network Architecture (SNA) for network access, whereas a different system may use Oracle as its DBMS, linked to a TCP/IP and Ethernet. This arrangement would normally require the developer to have a reasonably good grasp of each DBMS before writing a database application.

Microsoft's ODBC interface introduces a certain amount of interoperability. It is not tied to a specific DBMS, so programmers can use the same set of ODBC functions for each application. In some cases, little or no modification to an application is required when a different DBMS is speci-

▽ A high-resolution display is a bonus as the programming environment relies on many overlapping windows



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accelerator card
Monitor

PRICE

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Processor	80486SX25	80486DX33	80486DX2-66	80486DX33
Landmark speed	84MHz	168MHz	250MHz	168MHz
Hard disk	211Mb	211Mb	211Mb	211Mb
Cache controller	£125	£125	£125	1Mb
Cache memory	256Kb	256Kb	256Kb	256Kb
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△ The toolbox is customisable, new tools and controls can be added to the bottom. Custom controls can be developed using C or C++

fied, thus allowing developers to write database applications without specifying the DBMS.

The ODBC architecture has five components:

- the **Visual Basic application** performs the data definition and manipulation through the use of ODBC object properties and methods;
- the **Visual Basic ODBC Interface** submits requests from an ODBC object in a Visual Basic application to the driver manager for processing;
- the **Driver Manager** loads and routes an ODBC object request to the appropriate driver;
- the **Driver** processes ODBC function calls, submits SQL requests to a specific data source, and returns to the application. If necessary, the driver modifies an applications request so that it conforms to syntax supported by the associated DBMS, so SQL requests can be used on a 'non-SQL' DBMS; and
- the **Data Source** is the data the user wants to

access, and its associated operating system, DBMS and network platform (if any). There are a wide range of ODBC drivers available from both Microsoft and third-party database developers. ODBC and MAPI are included with the Professional version of Visual Basic, not the Standard edition.

The Professional edition of Visual Basic 2.0 includes support for serial port communications, multimedia MCI control and pen computing, allowing you to write 'pen aware' applications or even specific pen computing applications. There is even a Windows help compiler, which lets you quickly produce a conventional Windows help database for your Visual Basic applications.

Although Visual Basic will run under Windows 3.0, Windows 3.1 is required for multimedia and OLE support. Because a Visual Basic application written under Windows 3.1 may be sold to a customer using Windows 3.0, Microsoft allows developers to supply the necessary Windows 3.1 files with their applications, to allow them to run under Windows 3.0: the OLE DLL files, for example.

Visual Basic is the first Microsoft product in which the help files are exactly the same as the printed manuals, which makes finding the answer to a question much quicker: the context-sensitive help saves you wading through pages and pages of manuals. Comprehensive manuals are provided, however, useful in case you are short of disk space and haven't installed the help files.

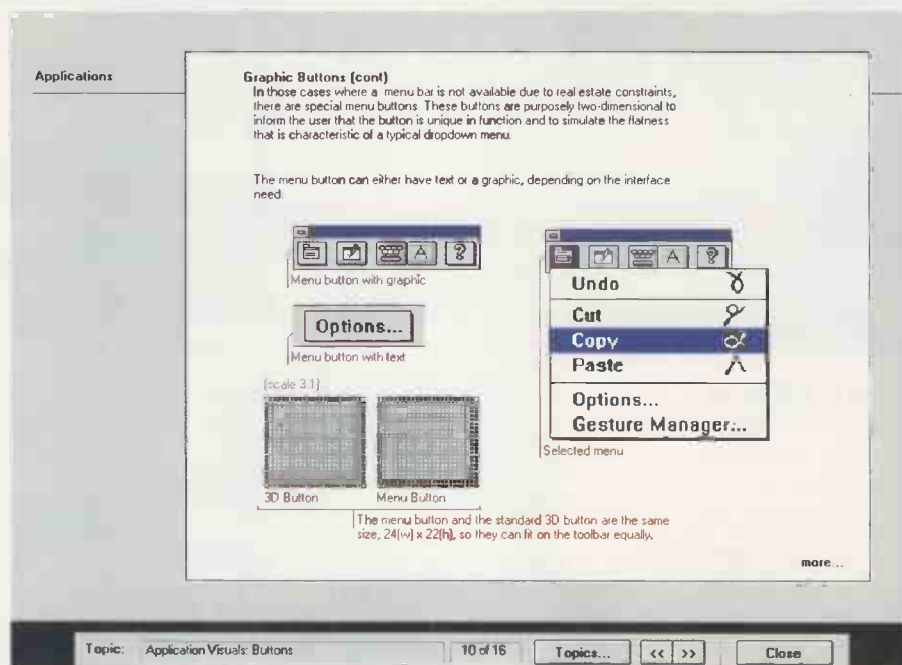
A *Visual Design Guide* covers topics such as colours and fonts, interface and icon design and the effective use of visual controls. Microsoft's VB Knowledge Base is supplied, which provides an-

swers to the most commonly asked questions on Microsoft's technical support line.

If you are still short of reading material, the Windows 3.1 API On-line Help File is included and gives detailed information about every Windows 3.1 API call including the actual code, which may be copied and pasted into your Visual Basic applications. Finally, Visual Basic is accompanied by the *Custom Control Vendor Information* booklet, which lists all the companies that develop and sell custom controls for Visual Basic.

Conclusion

If you're under the impression that Visual Basic was just for writing games and not powerful enough to produce *real* applications, you're wrong. True, it is still Basic, but it certainly isn't *basic*. If you need to write a Windows application to provide a particular solution, there's a good chance you're not a



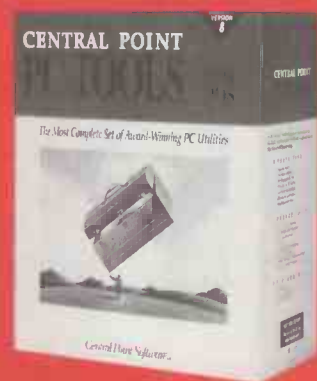
△ The learning tools are good. This screenshot shows how you can implement pen gestures for pen-centric applications

programming wizard. If that's the case, then use Visual Basic 2.0: you don't have to be a brilliant programmer because the people at Microsoft have already done most of the work for you. If you want to write software on a commercial basis, use Visual Basic 2.0 — there is no doubt that it is powerful enough; plus it has the added bonus of being much quicker than any other development tool. The quicker you can write your software, the quicker it can start to make you money — which is why Microsoft itself is using it to develop commercial software.

And then there's the price: £139 will get you the Standard edition, or you can upgrade from Visual Basic 1.0 for £79. If you want the Professional version you'll have to part with £335, or you can upgrade from 1.0 for £149 (£79 if you had the Professional Toolkit).

Microsoft is on (0734) 270000.

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PCW 01/93

Digital Chart of the World



DCW is an atlas that's fun to use, has stunning graphics and will find you everything from a kampong in Malaysia to an A-road in Essex. But such detail has a price, says Nick Edmunds: it could tie up your screen for hours.

Maps and computers are starting to talk to each other. Given the rate of change in other areas of computing, progress has been slow, but things are about to change. Just announced is the Digital Chart of the World (DCW) which advances the marriage of cartography and computing technologies another step, introducing a wholly new CD-ROM world map.

On the face of it, putting a map on a computer should be easy. Computers can handle practically any data and can display graphics in high resolution colour, so a simple map should present few problems. In practice, the vast amounts of data required create big problems.

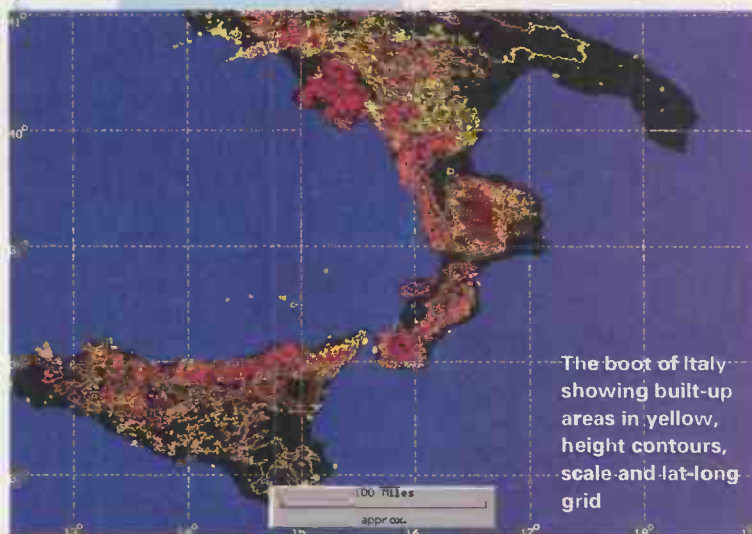
Depending on the system, map data is held in different formats. These include vector GIS (Graphical Information System) data, where individual images (bitmapped and laser disk video images, among others) are drawn. Different formats have their own benefits but are incompatible with each other. Confusingly, some map display systems use a hybrid of formats and even similar formats work in different ways.

Vector data's major benefit is that it can be scaled. Thus, the map of a country can be drawn as large — or small — as you like. The data is held as a formula and you then choose exactly the map scale to fit your requirements. Problems are twofold: getting the data in in the first place, and the processing needed to compute the displayed image. You cannot just take a paper map and scan it into a computer in a vector format as though you were scanning in a bitmapped picture. The elements of the map, the coastline, the roads, the contour lines, have to be digitised so they can be redrawn later.

Having digitised the map contents, redrawing requires the computer's CPU to process and display the data. For a simple drawing of a power line this presents no problem. For a complex mix of features using lots of data, processing time can be unacceptably long for an underpowered machine. This heavy processor requirement is the reason many industry standard GIS systems such as Intergraph, Arc/Info and SPANS run on 'workstation power' platforms, not standard PCs.

Scanned-in bitmapped images, on the other hand, are easy on the processor but terrible on disk space. Although very low-end map products use bit-mapped data, no serious mapping system can work sensibly when limited to the relatively few (and fixed scale) map images which can be squeezed onto a hard disk.

Hybrid mapping systems also exist. Action Plan, which we reviewed in September 1992, uses a mixture of GIS vector data and a laser disk containing 55,000 scanned Ordnance Survey (OS) maps of varying scales. Using an indexing system, maps can be located and displayed almost instantly through



The boot of Italy showing built-up areas in yellow, height contours, scale and lat-long grid

a Video Logic multimedia card. You could even zoom in on an area of interest but only down to the largest scale of the 'fixed' maps. Your own GIS data could then be drawn over the map picture. This combination of systems results in fast use of enormous amounts of detailed OS 'fixed' data while enabling the use of your own specific 'variable' information. Good though Action Plan is, £20,000 is expensive. You also need a 12in laser disc player and Video Logic card. Each disk, needed for different areas, will set you back another £8000.

CD-ROM maps

For the huge volumes of data required in mapping applications, CD-ROM, with its 600Mb per disk capacity looks ideal for the job. To provide a map of the whole world it would seem essential. DCW is

just such a package. On four CD-ROM disks you get the whole world at a scale of 1:1million, plus the VPFVIEW software to view it. (1:1million is about 15 miles to the inch.)

CD-ROM based maps have been around some time — census and climate data maps are two well-known applications; even the world at 1:1million has been available. But never before has the level of detail accessible in DCW been produced in this form.

DCW comes from the US Defense Mapping Agency (DMA). It is based on the DMA Operational Navigational Chart (ONC) series. These ONC charts are the only continuous series of maps which cover the entire world at this level of detail. DCW's Antarctica actually comes from the 1:2 million JNC Jet Navigation Charts.

The maps have been digitised into vector data onto the CD-ROMs using the VPF (Vector Product Format) standard. Unfortunately, VPF is not a standard widely used by GIS systems today; it is a new military standard (MIL-STD-600006) and works in a different way to existing formats. VPF is the digital data exchange standard for future military-mapping projects and the DMA wants it to become the industry standard.

Topology

VPF uses 'inherent topology' and 'winged edge' techniques. Topology is the relationship between objects: inherent topology indicates that this mapping format is object-based. An object in VPF could be a river, a coastline or a forest. With other non-object based maps you must display all the data in the area of interest you want to examine. This means both wasting time drawing unnecessary detail and cluttering the picture with unwanted data. VPF is highly structured and data is digitised with detailed display criteria in mind. Rivers in DCW, for example, aren't stored just as blue lines but as perennial streams, non-perennial streams, perennial inland shorelines, inland water, wet sand, glacier or unsurveyed perennial streams. Each or any of these different types can be displayed leaving all other confusing data off the map.

VPF map objects take the form of three types: Points, Lines and Text. Points are dots, or more usually polygonal areas. These can be areas of specific vegetation, lakes, built-up areas and so on. Lines are roads, railways, contour lines and the like. Text is just that: town and place names.

Winged edge means that the individual sheets from which the map is constructed can be overlapped: you can view an area which covers more than one sheet as though it were a sheet in its own right. Users of paperback A to Z maps will have suffered the frustration of flipping between pages using a very un-winged edge technology.

So, by combining inherent topology and winged edge techniques a very powerful mapping system can be exploited. If you are interested in land drainage, you can display different types of water courses and land contours and exclude all extraneous detail. Moreover, you can follow valleys and rivers regardless of the original map sheet and can zoom in or out as the vector data redraws to fit the view you want.

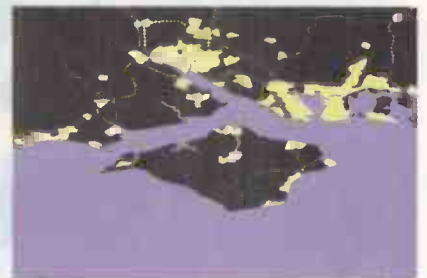
Although DCW comes with its own map viewing

program, some users may consider it just for the data on the CD-ROM disks. With the aid of a user-written program, the data could be downloaded in ASCII and converted into a format readable by an existing GIS system. VPF is so new that no commercial programs exist to import the format direct into any current vector format system. Even Arc/Info which did the original digitisation of the ONC charts for DCW is six months away from producing an importer.

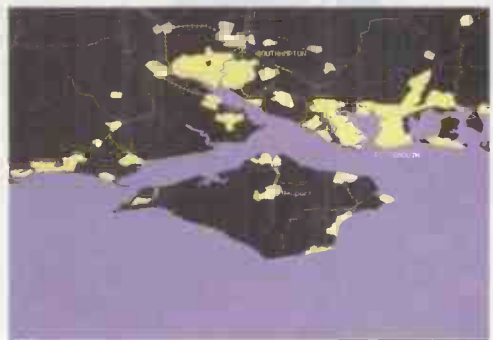
Many users will want to get at DCW's data immediately and not wait, though. Potential customers and uses are legion. They include oil companies for exploration, TV channels for graphics, environmental agencies to monitor pollution, distribution companies for the transport data, multinationals for the global marketing information. The list is endless. DCW has enormous potential but how does it fare in practice?

Inside the DCW box you find the four CD-ROM disks in a single carrier and VPFVIEW software on both 3.5in and 5.25in floppies. The accompanying documentation consists of a simple 20-page installation guide and a 70-page user's manual.

Installing VPFVIEW was as easy as pie and the expanded software took up 6.5Mb of disk space. During installation, and very unusually, you also have the opportunity to copy across the VPFVIEW source code. It is written in C and allows users to write their own access routines. According to distributors Chadwyck-Healey, the code has been placed in the public domain (you're free to copy it) as has the map data itself. This is completely different from Ordnance Survey's approach, where huge sums are required in royalties for any product based on 'its' maps, which it regards as its own property. In the US, NASA provides map data for the cost of the disks and postage. NASA

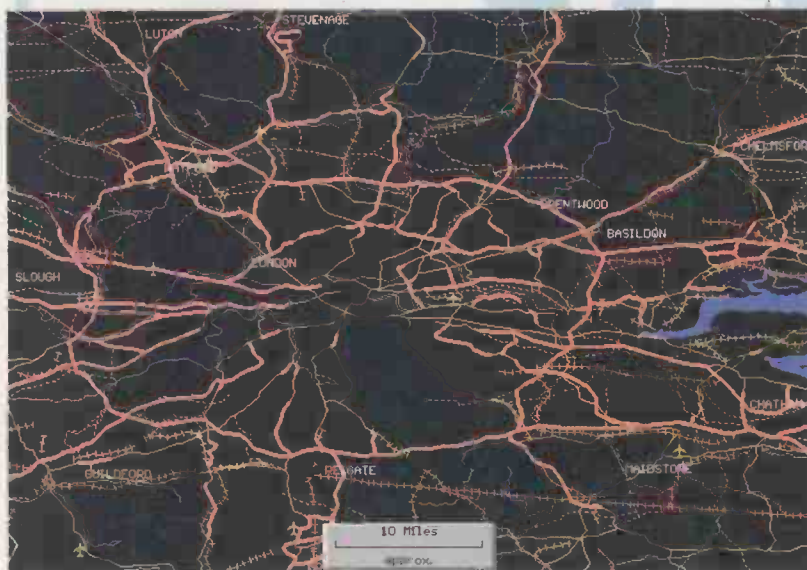
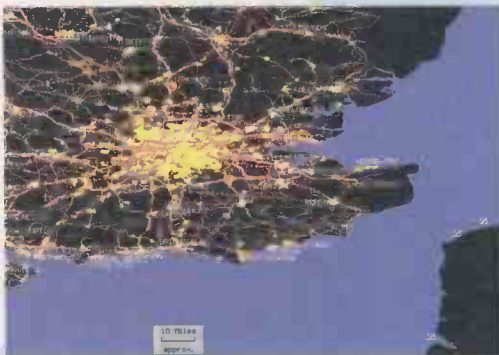


• DCW allows you to build up a map by adding detail layer by layer or all in one go. The last map in this sequence shows roads, railways, built-up areas, scale, town names, rivers and airports



takes the attitude that the public has already paid once — through taxation — for collecting and compiling the data so shouldn't be asked to pay again. In the UK, of course, we are all far too polite to object to doing just that.

With VPFVIEW in place all you need is a CD-ROM drive. If you have one installed and running you're lucky. Getting CD-ROM drives going seems an extraordinarily hit and miss affair. I gave up completely on one machine after hours of configuring system files, drivers, memory allocation and card jumper settings, but eventually got my SCSI-driven Hitachi 1750S spin-



△ You can select an area and zoom in with ease

ning and talking to a 40MHz 486.

VPFVIEW is a DOS program and at the command prompt you type the program name, followed by the path for your CD-ROM disk. You are prompted to select a database and you insert the appropriate disk in the drive. The four disks cover North America, Europe/Northern Asia, South America/Africa/Antarctica and Southern Asia/Australia. You can easily choose a different area and relevant disk when working in DCW.

The initial screen has a Windows look, with its blue and grey colours, sculptured menu bar and mouse pointer. DCW, however, certainly does not follow Windows conventions, operating in its own idiosyncratic but lucid way.

The menu bar across the top of the screen (which stays the same for all screens) lists System, VPF Contents, Feature Selection, Graphics, Text Report and Archive.

DCW requires and makes excellent use of a mouse. You point and click for almost every job and hardly need the keyboard. I'm lazy so I liked this. Up and running, your first job is to select your area of interest. You do this by pointing — with mouse-driven crosshairs — at an outline map of the entire

area covered by the current disk. One click and you zoom in to an outline of the area about 5° across. Then it's decision time and you have to decide what size area you want to examine and what detail you want displayed. For this you need the main menu. DCW is menu-driven and clicking on a menu choice produces a drop-down menu with pushbuttons that change colour. Some menu boxes can be dragged to allow you a better view of the map. Probably the features you would use most in DCW are Graphics and Feature Selection.

Graphics allows you to zoom into and out of a view. This is done wonderfully simply by pointing moving cross-hairs at your centre of search on the map and clicking the right-hand mouse button to zoom. When you're happy with the area covered, click the left-hand button and DCW starts drawing. Or at least it will once you have some features selected.

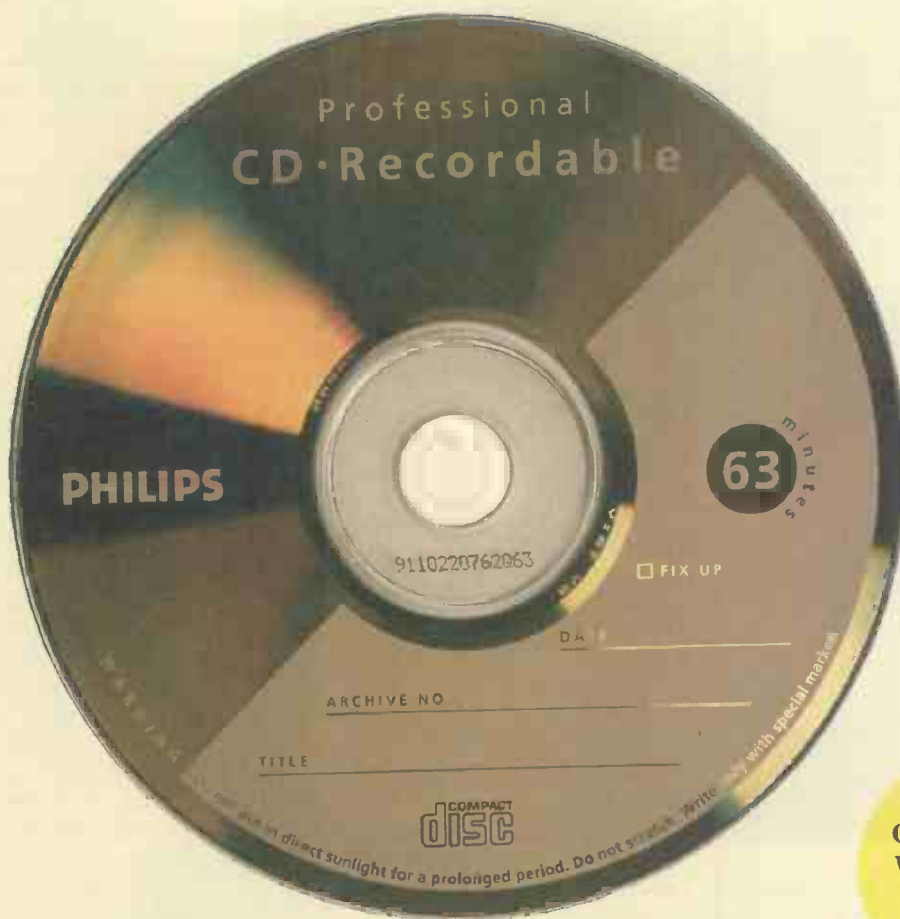
Feature selection is the heart of DCW. The drop-down menu lists Oceans/Political, Populated Places, Land Cover, Roads, Railroads, Utilities, Aeronautical, Drainage, Hypsography (contours), Cultural Landmarks, Ocean Features, Physiography (physical features) and, finally, Transportation structure. Select one of these and a submenu appears with a further detailed choice. Oceans/Political, for example, then lets you choose Ocean, Pack and shelf ice, International boundaries, Administrative boundaries, Treaty or occupancy line, Coastline, Ice and ice/water lines, Sea wall, International date line and Text.

Roads expands into Multiple lane roads, Single lane, Roads under construction (by type), Tracks, Trails and Footpaths. The contents of these submenus change depending on the map area being examined and reflect (with variable accuracy) the locality. 'Kampongs' replace 'Villages' in the Southern Asia/Australia disk (so what kampong do you come from Bruce?) and climatic changes in different geographical areas affect menu choices.

When you make a selection the text is highlighted in the menu. You can mix and match from any number of main features and submenus; you can go back and alter your choice if you change your mind. All very easy.

Having selected all the data you want displayed, you either quit — and your selections are saved — or draw. Click on the draw button and the screen goes blank. The busy light on your CD-ROM player starts flashing and the screen display is slowly built up. Watching DCW produce its displays is fascinating. Screens are built up in rows of blocks from left to right; features are drawn in order across the whole display. First, say, the coastal outline is produced and this is carefully painted block-by-block until the bottom right-hand corner has been reached. Then, country boundaries might be added, starting again at the top left of the screen. These wiggle across the map, then DCW moves on to the next feature. This process continues until the complete picture has been drawn. The final result in full-colour and absorbing detail looks great. Pictures can then be saved through the main menu's Archive facility.

Beautiful and informative as the displays are,



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they take an incredible amount of time to produce. A stunning picture of the Amazonian Basin listing all the drainage features took over two hours to complete with my (relatively quick) equipment. The more features you select, the longer DCW takes.

This slug-like speed results from a combination of things. First the storage medium itself. CD-ROM

of DCW's massive 2Gb database and it all has to be read from a CD-ROM drive, then processed before being displayed on screen; you can understand the delay.

Another time-waster is the unnecessary redrawing of displayed data when adding detail to an existing view. This happens when the user is building a picture feature-by-feature. You select a feature, draw it, view it, then add another feature. Usually DCW just adds the extra information over the top of the previous screen. Often, though, it decides to redraw the whole thing from scratch. This will definitely waste minutes and possibly, on large views with lots of features, hours.

A major omission is the ability to remove detail from a display. This could save a lot of time when you are building a picture, and mistakenly apply too much detail, obscuring existing data. Another problem is the crude way in which text (such as place names) is displayed. It's all or nothing. At some scales place names look fine, distributed sensibly around the map, while at a smaller scale the text swamps underlying detail, rendering the display useless. In addition, the software is extremely buggy. My machine frequently hung with a locked-up keyboard, the mouse sometimes refused to work, and more than once DCW rebooted my system.

Despite all these problems DCW continued to win me over when it did work properly. Other features include the ability to apply a scale to the map, to draw and measure distances and routes, to read on-line help, to save .PCX files, to point with the mouse and to display localised detail in the form of attribute data, to find your town on the globe by using the world gazetteer, to change map projections, to customise the views, and much more.

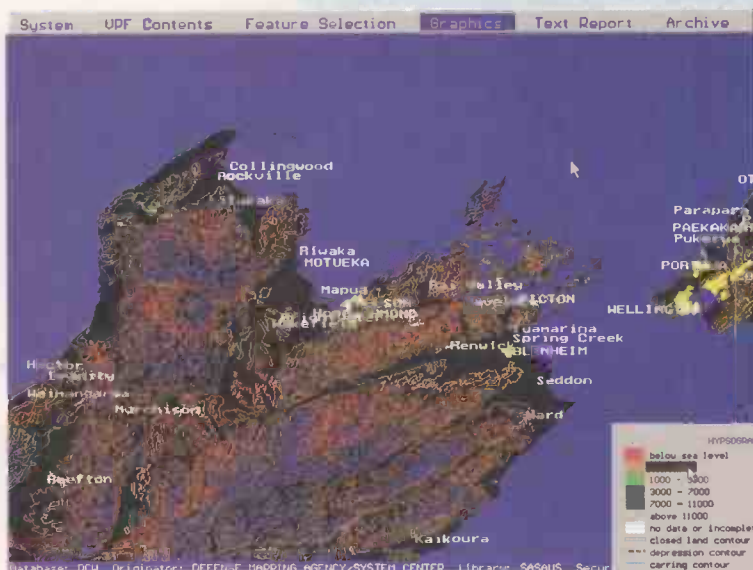
Conclusion

After playing with DCW for some time I think it is an excellent product and, like the OED published a few months ago by Oxford University Press, almost worth buying a CD-ROM drive for. It unfortunately has serious limitations. The VPFVIEWER software is buggy and could be a lot more sophisticated. The map's 1:1million scale is fine for global or even national overviews and includes a surprising amount of detail, but as you zoom in, features get a bit thin on the ground. DCW is not, therefore, much use if you're only interested in the close detail of one country, as it is more of a world atlas than a street map. And then there is the speed. DCW is painfully slow, and the more detail and larger the map area you want, the slower it becomes.

Nevertheless, DCW produces stunning views of the world crammed with extremely valuable information and it does it using just four tiny shiny disks. It is incredibly easy to use, powerful and great fun.

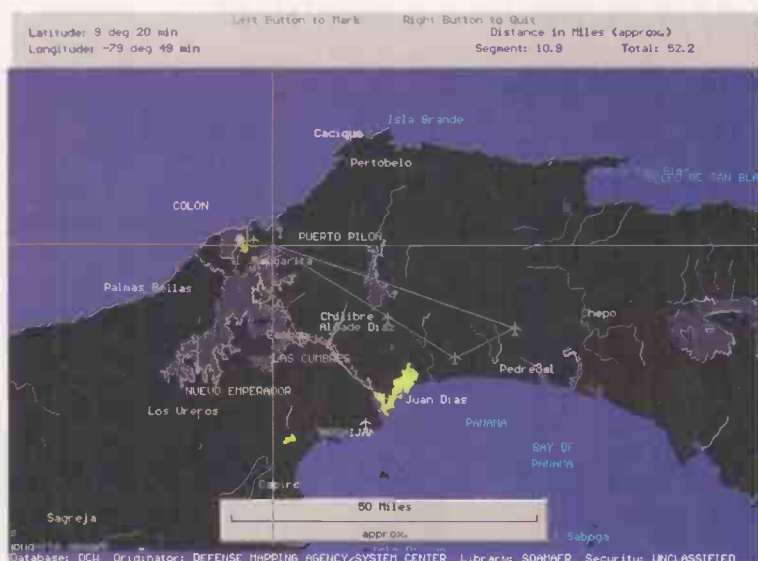
On top of all this is the price. £200 must be good value. Though there is nothing to directly compare with DCW, other GIS systems are priced in the thousands. If you can think of a use for DCW, don't hesitate. Buy it.

Chadwyck-Healey is on (0223) 31479.



△ The north of New Zealand's South Island showing one of the sub-menus

may be an excellent, reliable, high-density medium for storing data but its transfer rate is very slow. With DCW I tried tweaking buffer sizes and memory allocation, but whatever I did it was lethargic compared with hard disk. Secondly, when selecting a feature to display, you have no idea how much data is stored and therefore how long it will take to draw. If the software was more sophisticated it could give you an indication of what's in store and let the user make sensible selections. Thirdly, DCW insists on outputting all its data on a particu-



△ Using mouse-driven crosshairs you can measure distances on the map

lar feature even if the scale of the display is far too small to show all the detail. This is nuts. If coastline is included in a large map area, say the west coast of Africa, it will take forever to draw, even though your monitor doesn't have the resolution to display it. Bear in mind that coastline on its own uses 1Gb



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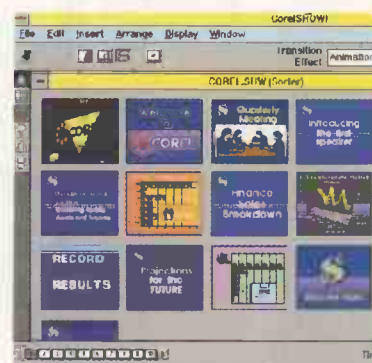
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Dan for Windows Pro 66MHz 486

Double clock speeds are becoming the rule, but chip speed isn't everything. Chris Cain views a computer aimed at Windows users, with quick processor and hard disk, and a graphics card specially designed for GUI acceleration.

With Intel's DX2 chips now available to any manufacturer that wants them, double clock speed PCs are appearing left, right and centre. Everyone from Tandon to Tulip has a system with a 66MHz processor, and soon machines that run at a whopping 100MHz will be on the market.

The future for PC compatibles is looking bright, but speeding up the processor isn't the only way to make things better. There are plenty of other elements that can be improved to make a PC more powerful, like the speed of its hard disk and the resolution of its graphics. With Windows 3.1 set to become the leading platform for application development, graphics acceleration is also a concern for potential purchasers. Programs like CorelDraw! and PhotoStyler can take ages to render images without hardware help, and even standard window movement is sluggish when you have more than 256 colours on screen. What users really need are units that aren't just fast, but specifically tailored to meet today's power requirements. In other words, machines designed especially with Windows and its future in mind.

Already well-known for its competitive pricing, Wembley-based Dan Technology is one of the first to produce and advertise a machine specifically geared for the serious Windows user. The questions are, just how far does it go to improve performance, and does a manufacturer's view of what's needed differ greatly from that of a user?

Despite the fact that the company is aiming this new product squarely at power users, it has, thankfully, left the external casing the same as on its other machines. There I was, expecting *Starsky and Hutch* go-faster stripes and flashing lights, but it's just the usual metal casing finished in a corporate cream colour scheme. The unit supplied was a desktop model, complete with 3.5in floppy disk

drive, and even to the trained eye the whole affair looks innocent enough at first glance.

As well as the floppy drive the front features Turbo, Reset and Power buttons, two drive bezels indicating room for storage expansion, and a keyboard lock. The Dan logo, a strange but attractive square yin yang, has disappeared and been replaced by a rather dull white square bearing the company name. It may be art, but I don't like it.

At the rear, the Dan for Windows Pro houses two serial sockets, one 9 and one 25-pin, a parallel port, a 5-pin DIN keyboard connector, a joystick or game port and a standard 15-way VGA connector. All are clearly labelled, and all cables connected into the relevant sockets without problem. Power ins and outs are also immediately visible, providing juice to the PC and monitor respectively.

The keyboard that came with the machine was one of the company's new, 102-key, Enhanced AT units, with a more solid feel than before and plenty of positive feedback. The keys are slightly looser than on my favourite Dell model, but not so loose as to be uncomfortable, and continued typing was pleasant. It's always difficult reviewing keyboards because they really are personal things, but I have no complaints about this one and could use it full time. Strangely, the keyboard was fitted with the old Dan logo, as was the monitor.

The display supplied was a 17in SVGA Trinitron tube, low radiation monitor, by far the most immediately impressive part of the system. When you've been using a 14in screen for the last five years, a product like this really is an eye opener. Full screen positioning and dimension controls are provided on the left-hand side, brightness and contrast dials are located at the front.

Dan also bundles a three-button, serial, opto-mechanical, Microsoft compatible mouse, com-

PHOTOGRAPHY BY JOHNNY MILLAR

plete with drivers and menu maker program for making custom pop-up mouse menus. The packaging claims it also has an 'ergonomic' design, and I'm not about to argue it hasn't.

Getting inside the Pro required quite a bit of strength, thanks to the weight of the monitor and some rather stubborn little screws. Eventually the lid came off to reveal a particularly small and tidy motherboard, and an Intel DX2 processor running at 66MHz sitting at the front. Just to the right of this is an empty gold and black chip socket, for installing an optional Weitek 4167 maths co-processor.

The positioning of this additional processor socket seems odd at first, as it sits almost on the edge of the motherboard, directly underneath the drive bays. Fitting the chip would, therefore, prove to be a lengthy affair, requiring the user to either unscrew and slide out the motherboard or remove the drive bays. In addition, the space left between the socket and the bottom of the bays is so small that at first it appears that said upgrade would actually be impossible. Closer inspection reveals that you can do it, but it will be a snug fit. To make things even faster the motherboard has a section to install processor cache RAM, and this was filled with 20ns SRAM chips to give 256K.

Moving towards the back of the casing brings you to a two-piece Contaq PC chipset, a name PCW is not familiar with. The first element is the 82C591: this handles clock generation logic for the CPU and AT bus, CPU and AT bus logic, bus arbitration logic, and control of the Turbo button, among other things. The 82C592, meanwhile, is in charge of data bus conversion, parity checking and looking after the interface to the numeric co-processor. Both are busy and a good example of integration.

Behind these is an AMI BIOS ROM and eight Single In Line Memory Module (SIMM) sockets, providing room for up to 32Mb of RAM, although the review machine was supplied with a mere eight made up of 1Mb 70ns modules. Expanding the RAM will be relatively simple, but as with the co-processor socket there isn't an abundance of space around it.

A Taiwanese multifunction I/O board provides the unit's game port and one of its serial sockets, and takes up one of the two available 8-bit expansion slots. Eight slots are provided in total, six 16-bit and two 8-bit, and five are readily available to the user. Two of the larger slots are taken up by the hard disk controller and the graphics adapter.

The disk controller used is a rather grandly-named SuperIDE DC-99M from Promise Technology; on the review machine it was fitted with 2.5Mb of cache RAM. Normally the RAM is a round number, with the memory supplied on plug-in SIMMs, but this particular model has 512K of 80ns RAM soldered on to it. The other 2Mb are standard SIMMs, and by replacing these the user can get up to 8.5Mb using 4Mb modules.

Promise's SuperIDE emulates the industry standard Western Digital (WD-1003) protocol, indicating that it could replace a built-in IDE controller on the main board if you had one. It claims to be 100% register compatible with the WD-1003 and to work with all ISA standard PCs, including network servers. The hard disk connected to the other end was a 3.5in 245Mb 15ms Seagate unit mounted on its

side at the front of the casing. Sensibly, Dan has included a sticker on the drive with all relevant setup parameters.

The graphics expansion card installed was a 16-bit S3-based unit, with 1Mb of video memory and a RAMDAC providing 262,000 colours. The maximum resolution is an impressive 1280 x 1024 pixels with 16 colours on screen, but up to 64,000 colours can be displayed simultaneously if you drop the resolution to 640 x 480 pixels. Most Windows users will want to run in the higher modes, especially in conjunction with a 17in monitor, and probably the best all-round resolution is 1024 x 768 pixels with 8-bits per pixel.

Other interesting features inside include room for two half-height 5.25in drives and a hefty 200W power supply — ideal for those who want extra storage, or a CD-ROM drive and several power hungry cards.

Setting up the Pro was a piece of cake. All I had



66MHz vs 50MHz

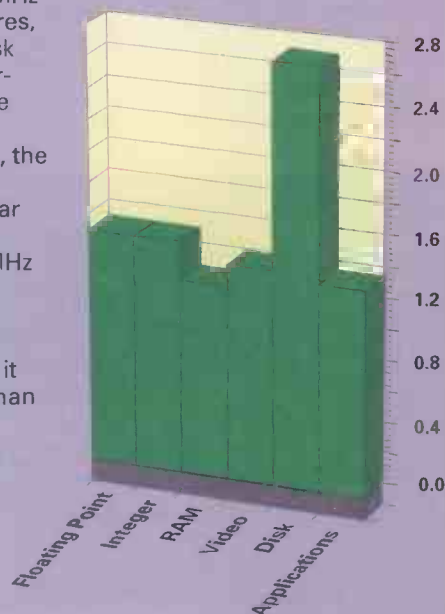
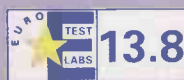
Due to the way it works, the DX2 inside the Dan for Windows Pro talks to the motherboard at 33MHz, though the processor runs at double the speed. As a genuine 50MHz 486 system can communicate at a full 50MHz, this raises the question of whether the latter would actually give a better overall performance.

As discussed in detail by Mat Beard in the November 1992 issue of *PCW*, so much of a machine's performance depends on the speed of the memory, hard disks, RAM caches and graphics cards. To find out once and for all we asked Dan to supply a second 50MHz version of the same machine with everything else remaining exactly as before.

Under our own EuroLab benchmarks the 50MHz came up with a slower overall figure of 13.8, but the individual test results were virtually identical. The 66MHz machine gave higher figures, apart from on the hard disk transfer rate, but the difference was so slight as to be almost non-existent.

Under the WinTach tests, the second unit came up with 14.51. Again, not exactly far from the first result.

All this shows that a 66MHz machine is faster than a 50MHz of the same specification, but the difference is so small that it isn't worth paying more than around £50 extra. It also pays to remember that, unless it has a strange design, the latter can always be upgraded to 100MHz at a later date.



to do was unpack and plug in. Everything assembled easily and in less than ten minutes the machine was running the Windows File Manager. Windows 3.1 and MSDOS 5.0 were already in-

Specifications**Dan for Windows Pro****66MHz 486****Processor**

486DX2 66MHz

RAM

8Mb

ROM

AMI BIOS

Interfaces

Two x serial, one x parallel

Video

1Mb S3 VGA

Mass storage

One x 3.5in 1.44Mb floppy,

one x 210Mb Seagate hard disk

Bundled extras

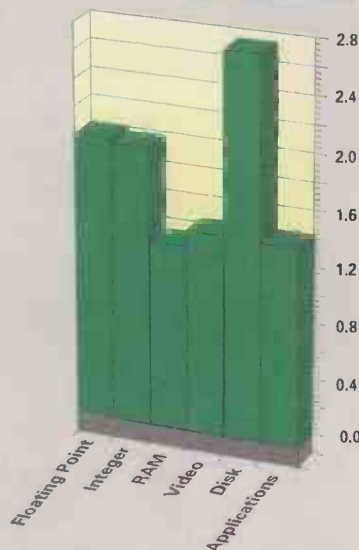
DOS, Windows, mouse

Price

The Dan for Windows Pro as reviewed costs £2276, or £1914 with a 14in monitor

Contact

Dan Technology 081-902 9922



stalled, and the review machine came with various benchmarking programs such as CORE and MIPS.

Tests with Windows seemed especially appropriate, so numerous applications were used in all modes and resolutions for a good bout of real world testing. Specific speed tests were also let loose on the hardware, including Texas Instruments' WinTach which boasts word processing, CAD, bitmapped and vector graphic routines.

Under the general desktop the speed of the system is instantly impressive, if only for the speed of redraws and window movements. Application launches were exceptionally fast thanks to a speedy hard disk and the 2.5Mb of cache RAM sitting on the end of the disk controller. Even complex wallpaper and heavy virtual memory usage didn't slow the machine to any great degree.

Using Professional Draw, Gold Disk's complex vector graphics package, performance was smooth, with quick image rendering and speedy colour fills. At 1024 x 768 pixels I was expecting the editing of 256-colour pictures to be tiresome, but with the unit's S3 chipset things didn't take that long.

Word for Windows tests also proved favourable and I have to say that the Dan is one of the most comfortable machines to work on using this product. The configuration supplied made working with a truly high-resolution desktop possible at last, the Trinitron tube making all images rock steady and pin sharp. Word processing may be a real power user application, but as a journalist I just had to do a test anyway.

With WinTach the scores were good, even for an S3-based system, they weren't the best we've ever seen. The overall figure was 16.67, which compares favourably to the 5.46 achieved by the Tseng Labs ET4000 board we use as a standard. Other cards have hit 24 and even 80 in a slower 33MHz system, though.

The machine scored 15.1 under *PCW*'s own EuroLab benchmarks. These perform a number of tests using a combination of DOS and Windows, with a standard VGA video driver at 640 x 480 pixels. Unfortunately, although the S3 chipset is good in the compatibility stakes, it isn't exactly the fastest when it comes to DOS applications.

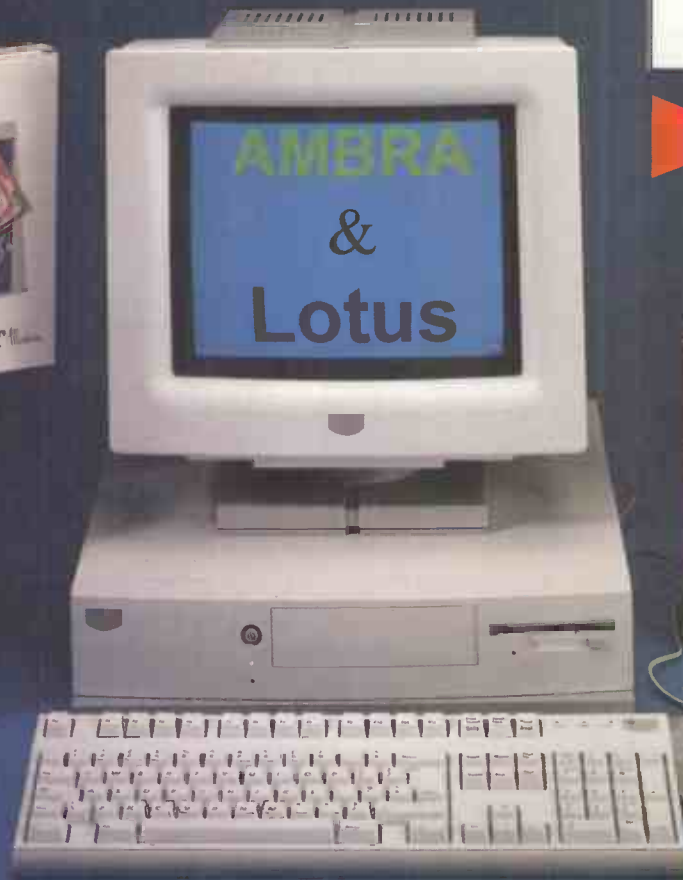
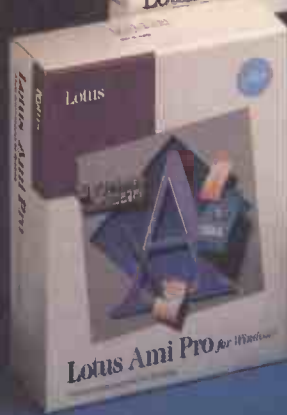
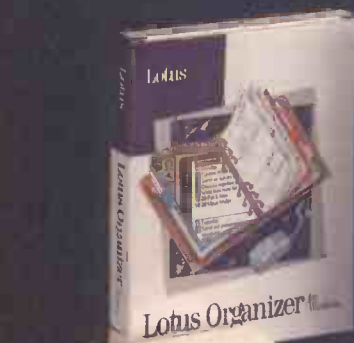
Conclusion

For Windows users, the Dan for Windows Pro is almost the perfect platform: it has a fast processor, a speedy hard disk with cacheing, and a graphics card specifically built for graphical user interface (GUI) acceleration. What's more, it has to be one of the most comfortable setups I have ever used, especially with the excellent 17in SVGA Trinitron screen. It's also good value for money. I'm sure this is exactly what 95% of people who regularly use Windows applications are looking for.

Being one of the other 5%, I'd like to have seen a few more colours on screen and, possibly, a Sound Blaster or compatible audio card. Extra bits per pixel are needed to render truly realistic images, and although the current unit can manage 64,000, it is limited to 640 x 480 pixels when doing so. As for the sound card, things just don't feel right unless I have the *Monty Python* team shouting 'Ni!' when I press the wrong key. Looks like I'll have to wait for a Dan for Multimedia.

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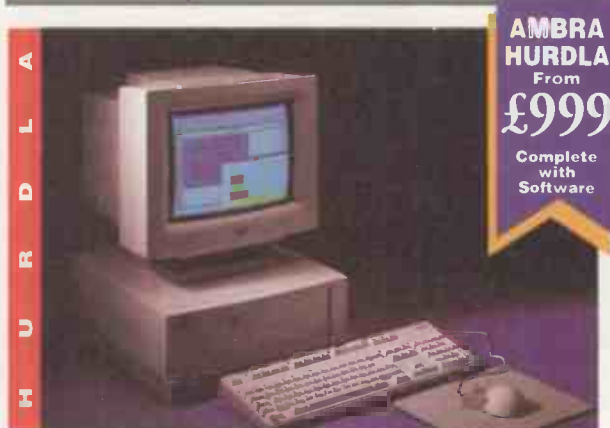
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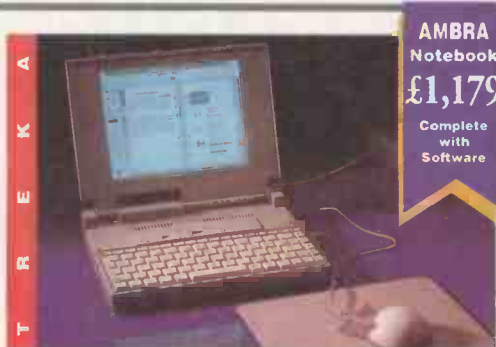
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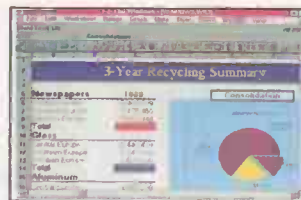
"The most powerful and enjoyable of all Windows word processors." PC Magazine, September 1992.

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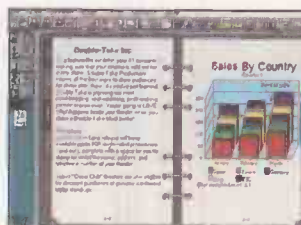
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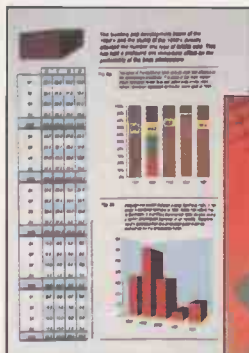
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JANUARY 1993 PERSONAL COMPUTER WORLD

267



Keeping score

With the National Curriculum demanding five-year-olds learn composition, Martin Tennant gives a definitive guide to teaching aids and looks at a piano tutor that doesn't rap your knuckles with a ruler when you make mistakes.

It must be very confusing for music teachers wanting a computer music system. The Atari seems to be the only choice offered by many music shops, the Macintosh is recognised as the industry standard machine for music, but IT departments seem to want PCs.

The main reason for the growth in interest in computer music systems for schools is, of course,

tion at GCSE and the teacher's own requirement for instrumental arrangements, and it is easy to see that the computer can be put to good use in the music classroom.

Up until recently the Atari ST was *the* music computer in Europe. The good range of music programs for it, and the prohibitive cost of the Apple Macintosh, ensured its dominance. How-

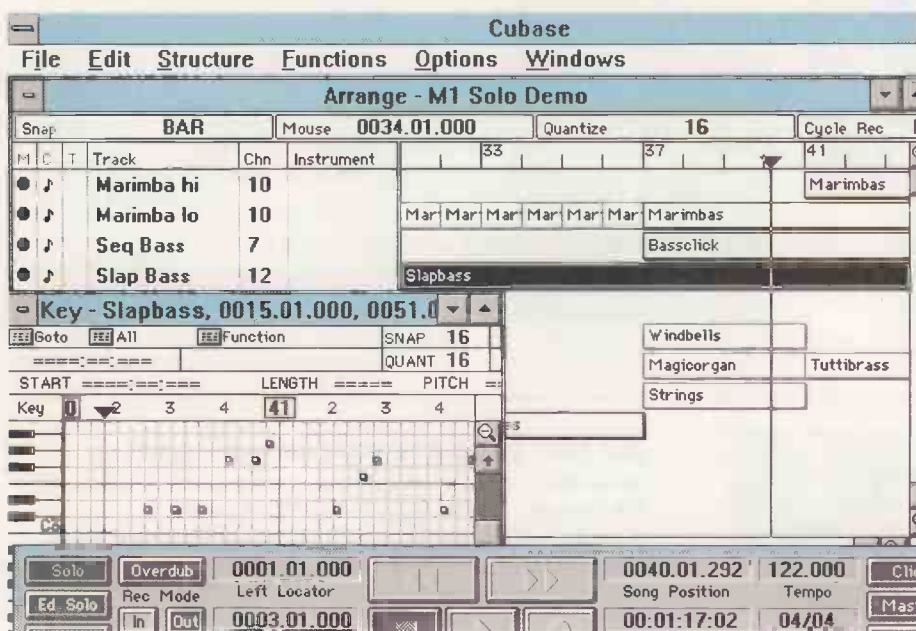
ever, interest in the Mac has grown over the last eighteen months due to new, competitively-priced models. Similarly, since the introduction of Microsoft Windows, we have seen a rapid growth in the number of music programs for the PC, not surprising considering generally tight school music budgets.

First, let me explain the difference between sequencing and notation. Both types of software let you record music in real time (as you play it) or step time (inputting notes/rests with keystrokes or the mouse) and will play the music back over MIDI.

Sequencing programs are concerned with creating a MIDI 'performance'. They are faster to use than notation because more information can be on screen at any one time. Often, sequencing software will allow the recording and arranging of patterns (musical phrases) into a song. This can be a valuable aid to compos-

ing. Professional sequencers often boast advanced features such as recordable volume faders and graphical editing of MIDI controller data such as Volume, Portamento and Vibrato. Parts can often be independently loop repeated, so creating ostinati can be extremely fast. Arranging the music can be done using copy, cut and paste techniques, like word processing.

Notation programs are concerned with producing readable and printable music notation. They are akin to DTP, as layout and musical symbol manipulation take priority over MIDI performance.



△ Steinberg's Cubase sequencer/notation program has just been released for Windows. It features an arrangement window

the National Curriculum. Even at Key Stage 1 (five- and six-year-olds) the IT requirement is that students should 'use computer-generated pictures, symbols, words or phrases to communicate meaning', and 'investigate, choose and combine sounds to produce simple compositions, record their own compositions and communicate meaning'. Key Stage 2 (seven- and eight-year-olds) asks students to record compositions through the use of notations. Key Stage 3 (nine- to twelve-year-olds) asks for composition and arrangement. Add to that the increased pressure for well-presented music nota-

You work only with music notation, and this can be slow. You can't see as much on screen, so a large monitor is highly desirable. There are a couple of good sequencer/notation programs, such as Steinberg's Cubase (£435) and C-Lab Notator (£299), but these don't offer the notational power of dedicated notation software.

The first PC to find its way into schools was the RM machine, many of which are not fully IBM PC compatible. This means without upgrading the machine it will not run much of the music software now available. But if you have the popular RM Nimbus PC-186, all is not lost: a company called Impac Resources has come to the rescue. Impac offers a unique combination of software and teaching resources. It manufactures music software to suit all three Key Stages. Melody Train (£22) is a musical phrase recognition 'game'. Packing cases contain phrases from a melody. You listen to the tune first, then by clicking with the mouse each case will play the phrase it contains. You must put the case in its correct position in the train. If you succeed the train will run, but if any case is in the wrong place it won't. Tunes are supplied with the program or are created by Tunemaker.

Musical Pairs (£22) allows one or two players to match sounds in a classic, card game situation. It combines the elements of chance, memory and recognition. Rhythm Kit (£37) includes photocopiable curriculum resources from Key Stage 1 to GCSE. These cover composing rhythm patterns for classroom performance and include non-western rhythm patterns. Tunemaker (£37) also comes with a comprehensive resource pack with 24 ready-made activities. The program restricts the student in the choice of notes and note values. This is an easy music notation program, not a sequencer, aimed at Key Stages 2 and 3. The Imp Sequencer has proved popular with PC-186 users because of its ease of use. Although limited to 12 parts it has on-screen help and Place, Select, Loop and Bounce features, and an on-screen mixing desk. The program also includes a 'baby sequencer' for absolute beginners, and the added Impac bonus of a resource pack. Disk examples, photocopiable worksheets and teachers' guides are included for many projects, suitable for Key Stages 2 to 3. Users of the Imp can now also print out their music in standard notation using the Music Printing Kit (£89) for the Imp.

Software for the PC

What about software for IBM PC compatibles? There are several programs worth considering for a PC running under DOS, notably Dr T's Music Software. For music notation the two Copyist programs are worth considering. Copyist Apprentice (£99) offers 16 staves, lyrics, MIDI files and dot matrix output, while Copyist DTP (£299) adds laser and PostScript support. Most teachers will be advised to run under Windows because of its ease of use and friendly interface. There is already a very good choice of music software available, and more is on its way.

Musical Pairs, Tunemaker and Rhythm Kit, from Impac, are all also available for Windows (Key Stage 1). Impac's Imp Sequencer should be available for Windows by the time you read this, and with its resource pack should be excellent value.

Trax (£89.95) from Passport is a simple, easy to use sequencer, ideal for beginners (Key Stages 2 to 3). Although limited to 16 MIDI channels it has 64 Tracks, can independently loop tracks and has full graphic editing. Its tape recorder button controls make it intuitive to use, as do many of the 'highlight to select', cut, copy and paste functions. Trax's big brother MasterTracks Pro (£299.95) has sophisticated features such as synchronisation to SMPTE, recordable volume faders, and full editing of all MIDI events. Because of its intuitive interface it is quick, easy to use, and good value for money.

Steinberg's Cubase (£435) has only recently been released for Windows. Although quite expensive it has the advantage of an arrangement window. It does not include notation and requires a 386SX machine. (A full review of Cubase for Windows appeared in the December 1992 issue of PCW.) Both MasterTracks Pro and Cubase are suitable for older students, Key Stage 3, GCSE and beyond. All these programs will save to the standard MIDI File format, which makes it possible to transfer recorded music from program to program so that, for instance, you could print out music notation from a notation program when the music was recorded in a sequencing program.

Like all good sequencers, these notation programs for Windows also read and write standard MIDI files. MusicTime (£199.95) from Passport encourages composition and improvisation by its ability to play back pre-recorded tracks with a metronome while you record the next track in real-time. It is very easy to use. Layout is assisted by displaying rulers on screen, and the separate Staff Sheet window lets you select voices and adjust initial volumes. It will only handle six staves at once and cannot extract orchestral parts from a score, so is not the choice for the music teacher.

Coda MusicProse Academic (£170.38) for Windows is harder to use if you want to enter music in real time, but MusicProse can handle up to 64 staves in a score and can extract orchestral parts from a full score. MusicProse can do everything the average musician would probably want in terms of music notation printout, yet it is overshadowed by its big brother, Finale, which can do much more and is only slightly more expensive. MusicTime and MusicProse Academic are suitable for Key Stage 2.

For the older student, or teacher, Coda Finale Academic (£293.75) can handle up to 128 staves in a score. It is not too user friendly but it is extremely flexible, both in what it can display, what it can print, and in its playback capabilities. It is the only program capable of displaying a trill and playing it back over MIDI, for instance. There are five different ways of entering music, including three for real-time input. It can handle different simultaneous time signatures, special staves (any number of lines), fast lyric entry via an on-screen word processor, and can flow text around the music. Symbols can be defined for MIDI playback, so when Finale sees 'f' (Forte) the music gets loud. The program can also play repeats, and can automatically extract parts from a score and group empty rests for you.

Finale Academic is only available to those who can provide proof of academic status, such as students and teachers. Finale Regular costs £729.95.

The Miracle Piano Teaching System

Comprising an electronic keyboard and interactive software, Miracle teaches you to play piano. Learning is organised into Chapters subdivided into Lessons. Chapters are graded, so important techniques aren't missed.

There are six 'rooms' to visit. Learning is done in the Classroom where a blackboard gives the information and instructions you need. Each chapter teaches you one piece of music, a chunk at a time, and standard music notation is introduced at the start.

Games are used to make learning fun. Pitch, rhythm and chords are learnt separately, so you aren't distracted, and progress is fast. If you make a mistake, exercises help you remedy the problem. Throughout you are encouraged by feedback on the blackboard, and are given certificates.

In the Administration Room you check your progress, see who has the highest score, and set up the keyboard. You can do lessons out of sequence, or use the rooms without following a specific lesson. The software remembers where you left off, if you go back to the lessons.

The Practice Room has several options. The first is to listen to a demo; then you practise. The notated music is provided and there is a visual and audio metronome guide. You can practise pitch or rhythm separately. At the end of a chapter you can perform the piece with orchestral accompaniment and

you get an appraisal. It gives you the notated music to read as you play; you predetermine the tempo. A record of appraisals is kept.

The Studio is a seven track tape recorder. You record one track at a time, but all seven can be played back simultaneously. Unfortunately the selected voice for the track is not automatically selected on the keyboard as you record, so unless you switch to the correct voice by use of the keyboard's panel switches you will hear the same sound as you record each track. I found this offputting. You can only record from the start of the tape, and there is no bounce-down or merging, so you are restricted to seven independent parts. Songs can be saved, but not exported via a MIDI file, and can't be displayed in as notation. However, this does encourage experiments in composition, arrangement and improvisation.

The keyboard is an integral part of the system, providing the instrument for learning on, input to the computer and all sound. It has 49 touch-sensitive, full-sized keys, 128 voices, is 16 note polyphonic and 8 voice multi-timbral. It comes with a sustain

pad and built-in speakers. The keyboard can be used alone, or can drive or be driven by MIDI devices. Touch sensitivity detects weak fingers, providing exercises to strengthen them. Voices are very usable, with a good selection of traditional and modern instruments. Mindscape provides a Nintendo version. The concept is the same, but the screens simpler.

Miracle can teach almost anyone to play piano, up to Grade 3 or 4, but it can't assess or teach expression, or interpretation. It is also fussy about fingering and discourages improvisation, so is no substitute for professional tuition once you get beyond the mechanics. The manual does give a lot of guidance for continued study after completing the course though. It is exceptional value. I see considerable potential in the classroom, as it has many of the core musical activities and encourages composition. It will also appeal to shy adults, or parents in remote areas, wishing to encourage children to learn the piano.

PC & Amiga versions £299, Mac version £349, Nintendo version £249, from Mindscape on (0444) 872234.



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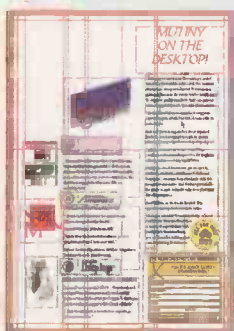
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Passport's Encore (£429.95) is much more friendly, and might be used from Key Stage 3 upwards. Encore plays pre-recorded parts back as you record a new part in real time, and this is as easy as clicking on the stave, clicking Record and playing. Encore can handle up to 64 staves in a score, with up to 4 parts per stave, but it can't play back repeats, and you can't give symbols any playback meaning.

Software for the Mac

Macintosh users should start out with the EZ Music Starter Kit, from Opcode (£229.95). This bundles three programs together with a basic Mac MIDI interface. EZ Vision (£139.95) is a powerful entry-level sequencer, with many features often found on more expensive programs. It can handle 25 sequences of 16 tracks each, and these can be arranged into a song in the arrangement window. Each track can be independently looped, and tracks and sequences can be any length. The main window is the graphic note editing window and can display one or more tracks at a time. The program does not display music notation, but uses the popular Piano Roll graphic editor. Moving and changing anything is done with the mouse, and you can hear pitch changes as you make them. You can graphically edit any MIDI controller (Volume, portamento and so on) and there is a mixer with recordable Volume faders.

Band In a Box (£69) is an easy to use, automatic accompaniment program. You type in a chord sequence, select an accompaniment 'style' from the large number provided, and record the melody in real time. Rhythms and accompaniments can also be created from scratch. It is great fun to use and encourages improvisation, practice and experimentation.

The Book of MIDI (£39.95) is a valuable MIDI information resource based on HyperCard. You can find out what MIDI is, how to connect MIDI equipment together (both Audio and MIDI connections), study the history of synths, and even listen to some of their sounds. The MIDI Translator interface (£59.95) is one of the cheapest available for the Mac. It plugs into the Mac's printer or modem socket, and doesn't need a power supply. All four products are available separately.

The most popular professional sequencer for the Mac is probably Performer (£459), with an arrangement window and the advantage of music notation display. It can't print music notation though; for this you will need Mosaic (£535). Performer has a fully integrated System Exclusive librarian which saves and loads individual and bulk voice information from more than 40 popular synths.

Opcode's Vision sequencer (£429.95) does not display music notation but is very flexible. It offers

good value as it comes bundled with Galaxy (£229.95 separately). You can arrange sequences (virtually any number) of 99 tracks, to play one after another or simultaneously. Vision will display in colour on suitable monitors. Galaxy is a universal MIDI librarian. It will help you organise your sounds, and store sound libraries. Vision and Galaxy share voice library information for instruments, so if you change the location of a sound on your synth while using Galaxy, you don't have to set up Vision again. Both Performer and Vision give you access to over 100 MIDI channels (with suitable hardware interfaces) if you should ever need them. For notation, Finale Academic (£293.75) and Encore (£429.95) are also available for the Mac.

Nearly all the programs mentioned here rely on MIDI for input and output, therefore you will need an interface. For RM Nimbus PC-186 users I suggest Impac Resources PC-186 RM06 (£99). The standard MIDI interface format for the PC is MPU 40. As most software is compatible with this standard, make sure your interface is too. The cheapest reliable MIDI interface for the PC is the MM401 (£69). If you want a built-in synth, too, there's the Roland SCC-1 card (£335) with its sampled sound synth.

For input you need a MIDI keyboard. If you chose the SCC-1 you will need speakers. Roland MA12C Stereo Speakers are £129 a pair, and you could use the Roland PC200 Mk II keyboard (£199) which offers 49 full-size, touch-sensitive keys but has no sound. Otherwise your keyboard should be capable of playing more than one instrument at a time, over MIDI (we call this multi-timbral). You may already have one of these in the classroom: examples are the Yamaha DX11, PSS170, Roland D10 and D50. If you haven't, and want full-sized, touch sensitive keys as well, I suggest the Yamaha PSR 200 (£199.95). This has built-in speakers too, so would be very cost effective.

Recommendations

Computer: IBM PC compatible with minimum 4Mb RAM, 40Mb hard disk, 14in VGA monitor, Microsoft Windows 3.1. **MIDI equipment:** MM401 MIDI interface (£69) and Yamaha PSR200 (£199.95).

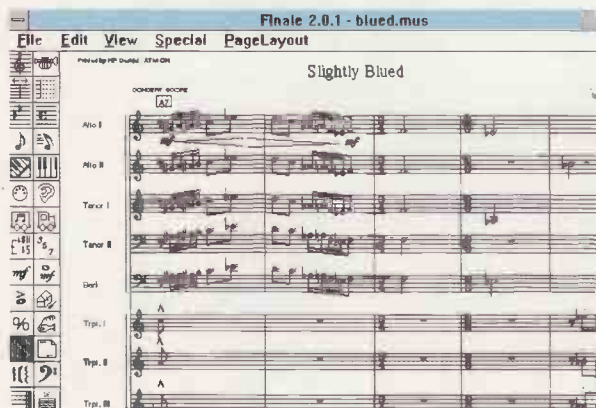
(All software requires Windows 3.0 or higher.)

Key Stage 1: Musical Pairs £29, Melody Train £22, Tunemaker / Rhythm Kit £65. **Key Stage 2:** The Imp Sequencer £75, Imp Printing Kit £89. **Key Stage 3 and beyond:** MasterTracks Pro (sequencer) £299.95, Cubase for Windows (sequencer) £435 (this requires a 386SX machine), MusicProse Academic (notation) £170.38, Encore for Windows (notation) £459.95. *For the teacher:* Coda Finale Academic (notation) £293.75.

All prices are Recommended Retail including VAT, and are correct at time of writing.

Suppliers

Impac Resources (0751) 77456. Opcode, Coda and Passport: MCMXCIX 081-963-0663. Roland (0252) 816181. C-Lab Notator, MOTU Performer & Mosaic: Sound Technology (0462) 480000. Steinberg Cubase: Harman Audio (0753) 376911. Yamaha-Kemble Music (UK) (0908) 366700. Dr T, MM401 & Band In a Box: Zone Distribution, Unit 70, Eurolink Centre, 49 Effra Road, London SW2 1BZ.



△ The Academic version of the Finale notation software is available only to those who can prove their academic status, such as students and teachers

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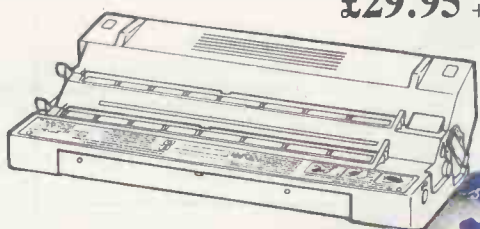
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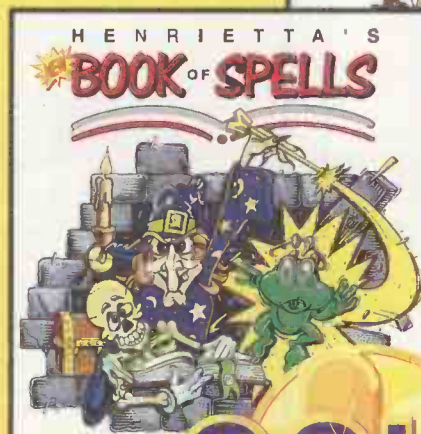
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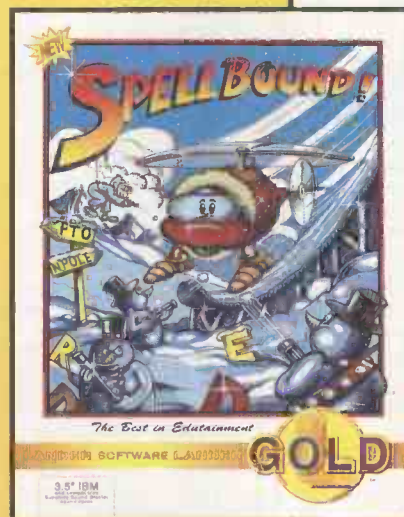
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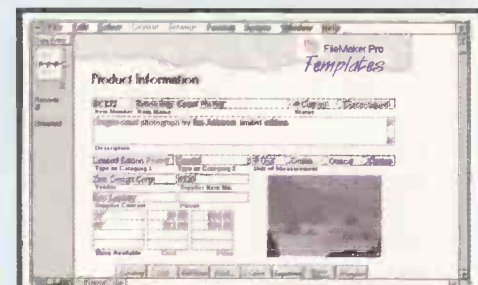
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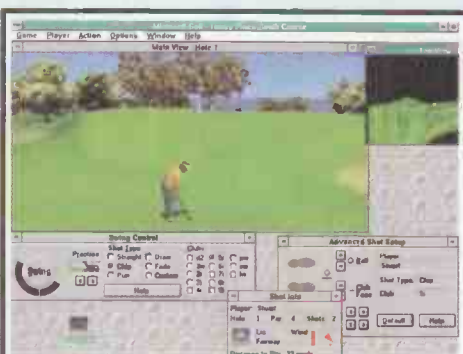
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IBM PS/2 56 486SLC2

In a market packed with cheap IBM clones, why pay a premium for the real thing? Well, this one's built to last, heavily-featured, and has a screen for sore eyes. And, says Nick Edmunds, it may not cost as much as you think.

'IBM won't start a price war, but would certainly finish one.' With these fighting words at a recent IBM press conference, Howard Ford, IBM Personal Systems Director, announced a torrent of new machines all either better or cheaper than previous models. Whether it's a price war or not, it's certainly war. Even ICPI, the new IBM subsidiary marketing the budget Ambra range, is regarded as the enemy. 'Another competitor,' said Ford dismissively.

IBM has been in serious trouble for some time. Its highly profitable mainframe sales are plunging and it is losing ground at the PC end of the market. Despite the company having invented the thing ten years ago, buyers are becoming increasingly reluctant to pay a premium for a PC with the 'original' IBM logo when they can get the same thing elsewhere for less.

IBM recognised this some time back and announced the PS/2 range of PCs with a completely different bus (the main trunk route connecting all the bits inside a PC) called Micro Channel Architecture (MCA). This design performed better than the old ISA machines but was more expensive. Most PC buyers saw the PS/2 range for what it really was, an attempt by IBM to regain control of the PC market with its own proprietary product. Although plenty of PS/2s were sold to the corporates, the strategy failed and IBM's share of PC sales continued to decline.

Today, IBM sells both ISA and MCA machines and, as elsewhere in the industry, prices are coming down fast. The three IBM PC ranges are PS/1 (all ISA machines), PS/Value Point (again all ISA machines but with higher performance), PS/2 machines and a PS/Portable range. The PS/2s represent IBM top-end PC products, most of which (but not all) are MCA machines. Depending on how you count them, there are, more or less, 28 main PS/2 models (with many sub-models), eight of which are ISA devices. The machine reviewed here is the MCA-based IBM PS/2 56 486SLC2.

The PS/2 56 486SLC2 was one of a number of models announced which use IBM's new 486SLC2 chip. The machine also has a brand-new monitor,

a SCSI disk and IBM's latest video graphics standard, XGA-2. The 486SLC2 chip first appeared on the scene around the middle of 1992. Despite its name it is not an Intel 486 chip (now called an i486). On the other hand it is not a 80386 chip either, and is probably best described as a heavily modified 386SX. There are in fact two similar chips produced by IBM, the 386SLC and the 486SLC2, and both are cached processors. Like the 386SX processor the CPU works internally at 32 bits but externally at 16 bits. Also, like the 386SX, the addressing is 24-bit which, if you know your two times table, is thus limited to 16Mb.

They both have an internal processor cache: the 386SLC is 8K and the 486SLC2 16K. The chips are also available on upgrade cards, so some existing PS/2 models can have their performance boosted in a simple plug-in operation. The chips use CMOS II triple metal technology and are based on the i386SX processor. The 386SLC can do everything a 386SX chip can, plus some additional 'go faster' ability. The 8K of internal cache memory is used as a very fast storage space, to avoid the overhead of always having to access relatively slow main memory.

To run at its optimum speed the processor does not want to wait for either data or the next instruction in the piece of code it is currently executing. The 8K of cache is split into two areas to provide two separate storage spaces. Some commonly used instructions have also been changed to execute in fewer clock cycles and thus let the processor run faster. Power management features have also been added: this helps battery life when installed in a portable machine.

The 486SLC2 chip has all the 386SLC features plus more. First off, the cache is twice the size at 16K and provides four separate fast-storage areas, particularly useful for multi-tasking. The second difference is that the processor runs internally at double speed, just like the Intel DX2 or OverDrive chips. Thus the 25MHz motherboard in the PS/2 56, reviewed here, runs a 50MHz 486SLC2 chip. Thirdly, this new chip can run at 3.3v (against the usual 5v). This is the new, low voltage standard and is very useful for battery machines. The final differ-

PHOTOGRAPH BY BRUCE MACKIE

ence is that the IBM 486SLC2 chip supports the full Intel 486SX instruction set. Neither the 386SLC nor 486SLC2 has a built-in co-processor and they require a 387SX for floating point operation.

Due to their solid angular design, IBM machines are often described as bricks. I've even heard the considerable IBM keyboard referred to as a brick. The 115mm height x 360mm width x 395mm depth of the 56 is no exception. Opening the packing case we are presented with a slab-sided metal box, the faces of which are relieved only by functional items; the stylists haven't worried too much about form here.

Personally I liked the no-nonsense brutal look: the front bearing just a floppy drive (with that almost unique 2.88Mb label on the eject button), a powerswitch, key lock, a couple of lights and the 'IBM PS/2 56 486SLC2' badge. The top and bottom of this light grey unit are flat and featureless while the sides are 50% air: the ventilation slots stretch from one end to the other.

At the back we find an unsurprising selection of connections: PS/2-style mouse and keyboard ports, two 9-pin serial ports, a parallel port, video and power in. The only unusual features — at least for one used to standard non-IBM clones — were an external SCSI adapter and three MCA card slots, currently filled with push-out plastic covers outside and screwed-in metal covers inside. Slightly surprising was the lack of a switched 'power out' socket. This means you have to run a separate lead to the monitor and then switch it on each time. Very nice to find was the 'Made in the UK' label. (Greenock, Scotland actually.)

The keyboard you either love or hate. It is a substantial piece of kit. Weighty, with click action but smooth-moving keys and a good long connection cable. It is very well made and there are many IBM users and programmers out there who wouldn't be separated from theirs.

The 14in monitor, a model 9515-002, was again a very unfussy, functional design and sat securely on a sturdy, circular-based, adjustable-height stand. The stand has a large blue lever at the front which locks the monitor in place. The IBM mouse which came with the machine looked ugly and utilitarian with its two buttons sitting well proud on the top surface, unlike most mice.

Inside

The system unit's hefty cover came off easily by undoing just one thumbscrew. This cover, which goes right round the machine (unlike most covers, which are top-and-two-sides only) is made of heavy-gauge steel, so thick it is probably bullet-proof.

Inside, the IBM is massively constructed in steel, with the minimum of plastic. What first appears a mass of impenetrable mechanics can in fact be disassembled easily. The motherboard (or planar



in IBM speak) takes up just half the base area, and despite a number of soldered-in patch wires which will no doubt disappear in later revisions, is neat and compact. All the machine's 'services' are provided on the motherboard and there are none of the expansion cards found on many budget PCs. Indeed, all the backplane ports are connected directly to the motherboard without ribbon cable.

The ribbon cables that there are serve the 100Mb SCSI hard disk and floppy drive from connectors in the centre of the motherboard. The HDD, mounted on a hinged bracket and very easy to remove, is a Japanese-built IBM using the 1in high, 3.5in format, while the 2.88Mb floppy is from Sony.

There is a reasonable amount of space inside this IBM, with room for one full-height, full-width disk drive under the Sony floppy and slots for three expansion cards. These cards do not fit straight into the motherboard like many PCs, but sit parallel to it, slotting into a daughterboard which itself slots into its mother. This daughterboard contains two standard 16-bit slots plus a slightly longer slot for higher specification cards. All three slots will take full-length cards.

Unusually, the CMOS battery is mounted on the daughterboard, although this does provide good

access at replacement time. The daughterboard itself is secured by just one screw and, like the HDD, detaches easily. The memory is mounted on three SIMM sockets staggered across the motherboard, and the review model was fitted with a standard single 8Mb, 70ns SIMM. The maximum RAM for this machine is 16Mb. Along the right-hand side (when looking from the front) is a long, 188W power supply complete with fan. The position of the fan and the ventilation slots, along with the lack of superfluous vents into the system unit, means the fan pulls cooling air over the motherboard and the hot processor chip. This is the way a machine should be designed, completely unlike many clones with badly positioned fans, random air intakes and consequently ineffective air flow. The power supply provides cabling for one other device.

The 486SLC2 processor itself is a very interesting, white-coated chip complete with an amazing, gold-coloured, heatsink tower. This little tower is made up of five 0.5in diameter discs, and the base of it is bonded to the chip surface. Next to the processor sit eight long chips which hold the 16K of processor cache. Also on the motherboard is an empty 80387 co-processor socket, the SCSI processor and IBM's latest XGA-2 video graphics. One unusual but sensible feature is a safety switch which turns off the power if you remove the system

unit cover. The main power switch is a 'real' device and not the horrible mechanical extension from the power supply that can be found on some machines.

The machine comes preloaded with OS/2, as one would expect from IBM, and presumably also comes with manuals. Unfortunately no documentation of any description arrived with our PS/2 so we can only guess at content and quality. The PS/2 gives the impression of being well designed and screwed together.

In use, the machine felt nippy and worked well. The ECP figure of 9.1 (against 10.0 for our benchmark Compaq 486/33) shows IBM has done a good job with a machine based on a chip which started life as a humble 386SX. The keyboard was nice to use with a quality feel and the mouse, though it would come bottom in any rodent beauty parade, was pleasant to operate.

It was the screen that drew most attention in the PCW office with many people admiring the well-focused, sharp image. The non-interlaced IBM (made in Finland) 9515-002 display was stable, clear and (running at 75Hz, 1024 x 768 resolution and 256 colours) free of the flicker you see on normal 60Hz displays. The refresh rate of a screen is achieved from a mixture of abilities of the monitor and the video graphics controller. Refresh rates in excess of 70Hz are markedly better on your eyes than lower rates. This is not just marketing

blurb. Compare two screens, especially when running 'lots of white space' Windows applications. The lack of flicker at 70Hz and above is quite clear. According to IBM the improvements of XGA-2 over XGA are 'up to' 2.5 times the performance plus a higher, 'flicker-free' refresh rate. Whatever the truth of this, the XGA-2 graphics built into the PS/2, combined with the brand-new 9515 IBM monitor, produced an excellent result and one I would happily stare at all day long.

This PS/2 also has VPD (Vital Product Data), a software-readable unique hardware identification. Unlike mainframes, PCs haven't had this until now. It has benefits for both software licensors and companies needing to control their hardware.

If you want the PS/2 you must open your wallet and produce £1585 for the system, £160 for the keyboard, £40 for the mouse and £490 for the monitor complete with stand. A three-year parts warranty and one-year labour warranty come free. To save you clicking your calculator icon, this totals £2275.

Conclusion

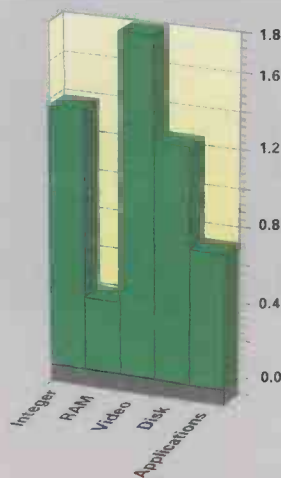
For a jumped-up 386SX box, £2275 appears ridiculously expensive. However, before you immediately look elsewhere let's look at this machine more closely. No, the processor is not a real 486DX but is certainly much faster than a 386 and under some circumstances (specifically with a co-processor installed) could be faster than an i486. The testing of many PCs at PCW has made us realise processor speed is not the be all and end all of machine performance. Hard disk and video performance is just as important (depending, of course, on the actual application running). This IBM has a fast (12ms) SCSI disk and a fast XGA-2 video.

It's built like a tank inside and out and I'm fairly happy you could stand on the system unit without even denting it. (I didn't try.) Internally it is very nicely engineered, if still at an early motherboard revision level. The machine was pleasant to use with a good display and keyboard. If you decided to buy more than one (don't forget corporates buy hundreds) then the apparently high price would come down. You could probably bargain when just buying one.

The downside with any MCA machine is the cost and availability of expansion cards. Many card manufacturers don't even bother to make an MCA version due to the limited market. In addition, this particular model appears to lock you into IBM's own upgrade path away from the industry standard Intel 486SX/OverDrive route which almost certainly has life in it yet.

If you see your future in the comforting (some would say strangling) arms of IBM, and can persuade it to heavily discount this machine, you won't be disappointed. On the other hand you could look at one of the thousands of cheap, industry standard, identi-box PC clones also on the market. Even IBM is selling them now.

This may be the machine that will help end the price war, but there are many battles to go yet, and the threat of killing the opposition on price was once made by Alan Sugar, at the height of Amstrad's success. It remains to be seen if the might of IBM can succeed where Amstrad failed.



Specifications

IBM PS/2 56 486SLC2

Processor

25/50MHz IBM 486SLC2
RAM
8Mb

Mass storage

100Mb SCSI hard disk,
2.8Mb floppy drive

Keyboard

Standard 102-key

Display

1024 x 768 XGA-2

Size

115 x 360 x 395mm

Bundled software

OS/2

Price

£2275

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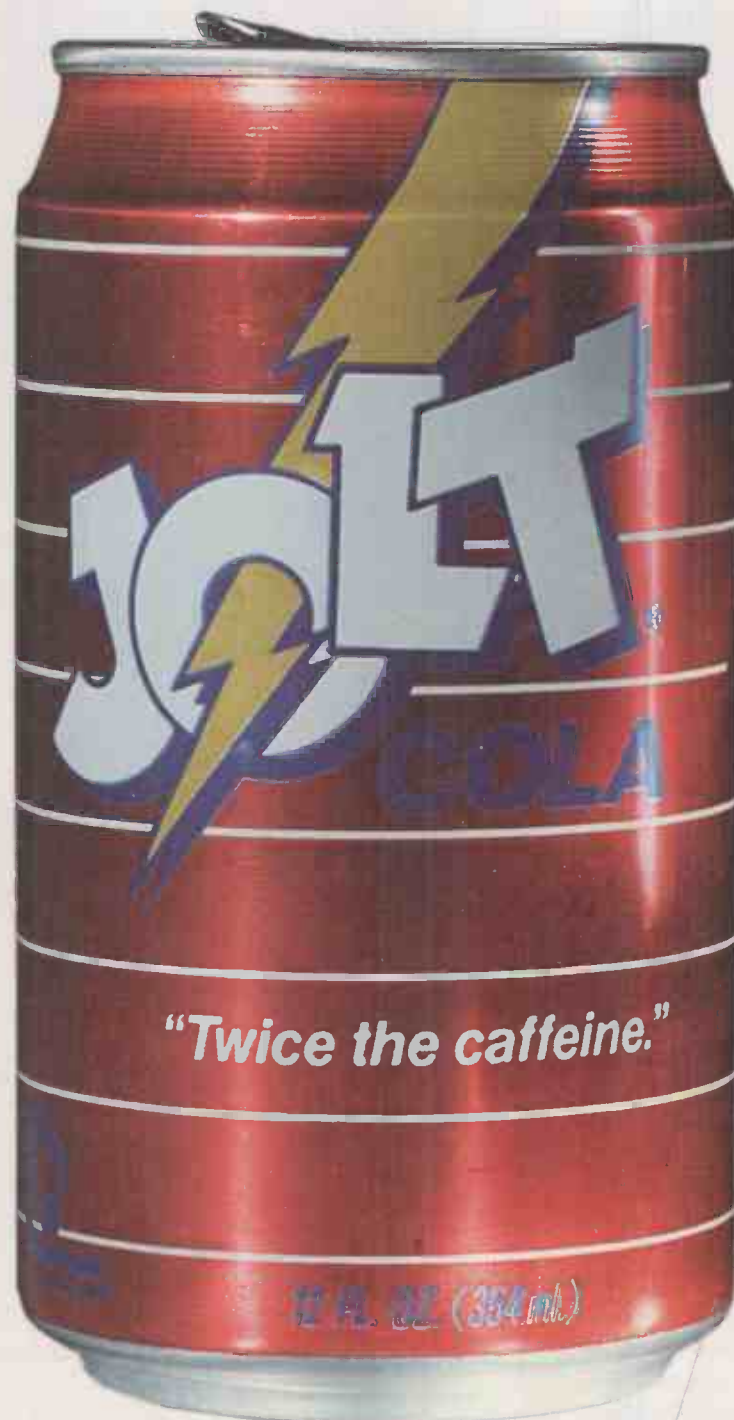
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Cache	n/a	64Kb (20ns)	64Kb (20ns)	256Kb (20ns)	256Kb (20ns)	256Kb (20ns)	n/a
RAM (max)	2Mb (5Mb)	4Mb (32Mb)	4Mb (32Mb)	4Mb (32Mb)	4Mb (32Mb)	8Mb (64Mb)	2Mb (8Mb)
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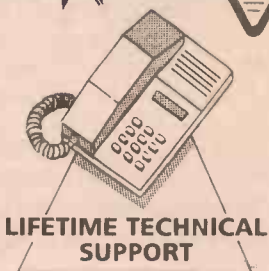


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Microsoft Access

Slick and solid, with one of the most powerful languages Guy Swarbrick has seen in a database, Access could be a very flexible friend. But packed with features as it is, will users ever work out how to get the best from it?

Microsoft is no stranger to the database business. A few years ago the company distributed Microrim's R:base to a not entirely enthusiastic public and, of course, it recently acquired FoxPro, the leading xBase product.

There's slightly more to the story than that. Microsoft has a history of developing database products and then deciding that either the time or the product is not right, and either shelving the product or rewriting it. Access is a rewrite, and while it does mean other people have been given the opportunity to get to market first, it should have given Microsoft the opportunity to produce another great application in the mould of Word and Excel.

The program spent most of its gestation under the name 'Cirrus' but this was changed because in America there is a credit card called Cirrus. So the name was changed to Access.

I upset Microsoft rather when I was first shown

Access. Not because of anything I said about the product, which as we shall see has a lot to recommend it, but because of my reaction to the company's overall strategy for the future.

Microsoft talked of basing its future development products, and indeed, the customisation aspects of its application products, around two languages. That isn't strictly true: Microsoft will continue to actively promote half a dozen languages. But, at first sight, it's an improvement.

At the moment, for example, there are over half a dozen versions of Basic still sitting on dealers' shelves in one form or another: GW Basic that was bundled with DOS before DOS 5.0, the cut-down QuickBasic which replaced it, full QuickBasic, Visual Basic for DOS which replaced QuickBasic, Visual Basic for Windows, and the applications languages: WordBasic, ExcelBasic and now Access sBasic.

The eventual aim is for them all to move towards the Visual Basic standard. Visual Basic, and xBase — which is still very much alive in the FoxPro range — were, I was told, the two languages around which Microsoft's future was to be built.

And that's where I upset Microsoft. How was I supposed to react? If a company tells me it's basing its entire future strategy on what I consider the two worst programming languages ever written, what am I supposed to do? Smile sweetly and say 'Lovely...'?

It isn't even true, unless Microsoft is planning to stop selling the SQL server, not to mention its C and C++ product. It was a little disturbing, though.

And before hordes of Visual Basic programmers write in to complain, yes, I know Visual Basic is a lot better than vanilla Basic. A poke in the eye with a sharp stick is much better than being slowly spit-roasted but I'd rather not suffer either, thank you very much. xBase programmers? Feel free to write

▽ While it is easy to produce programs that look great, it is important to remember that it is what they do that counts

Microsoft Access - [Form: CD Collection]

File Edit View Records Window Help

Filter/Sort: Field: Title

Guy's CD Collection

Title: The People Who Grinned Themselves to Death Type of CD: Pop

Compilation: No

Artist: The Housemartins Catalogue number: AGOCD 9

Tracks:

Track	Title	Notes	Min	Sec
1	The People Who Grinned Themselves to Death		0	Pop
2	I Can't Put My Finger On It		0	Pop
3	The Light Is Always Green		0	Pop
4	The World's On Fire		0	Pop
5	Pirate Appra		0	Pop

Record: 1

Record: 2

Form View

in. I'd love to hear you try to argue your case. Like DOS, the only thing xBase has in its favour is that lots of people use it. It's a dog.

In the past it didn't matter which database you chose, at least not from the aspect of being able to access your data. Your data, by and large, was new and was your own, private data. Where you put it and what it looked like was your business.

Times change. Access will happily create its own data structures, but it will just as happily look at xBase, Paradox, SQL or Btrieve data. You can only have one Access database open at a time (though that can of course consist of multiple tables) but you can have any number and combination of foreign data types. Not only is the data handled as though it were native, Access handles file and record locking properly, so accessing a foreign table while it is being used by its parent application shouldn't even cause problems.

In use

I'd better get the bad news out of the way first. Like virtually everybody else in the software industry, Microsoft has totally screwed up the process of designing a database. It isn't alone. Indeed, only DataEase comes to mind as an example of a company that has implemented database design properly, but that's no excuse.

OK, maybe I'm biased. I was a DataEase developer in the past. But the way DataEase handles the design of database structures (or, at least, the implementation of your carefully drawn up designs) is far more efficient.

Most database applications are, essentially, replacements for form-based paper systems. Indeed, many of them still rely on paper forms for the first stage of data acquisition. The DataEase approach is to reproduce your paper forms on screen. As simple as that. As you draw the form your database structure is built behind it. Automatically. The form is then your basic database unit.

Access, like most database products, takes the opposite approach. You produce a 'table' which contains the definition of each field in each record, whether it is text or a date, how long it is, and so on. Once the table is produced, Access has a go at producing a form automatically.

The upside, of course, is that you can have many different forms relating to the same table. There are better ways to achieve the same end. But I digress...

Wrong it may be, but it's actually pretty good. I'd prefer to do things the right way round, but Access is so good at producing attractive forms quickly that I found myself having trouble getting agitated about the process.

Most of you have probably always worked this way. You'll look at Access, see how well it works in relation to other table-oriented database products and wonder why I'm making all this fuss. It's your time they're wasting.

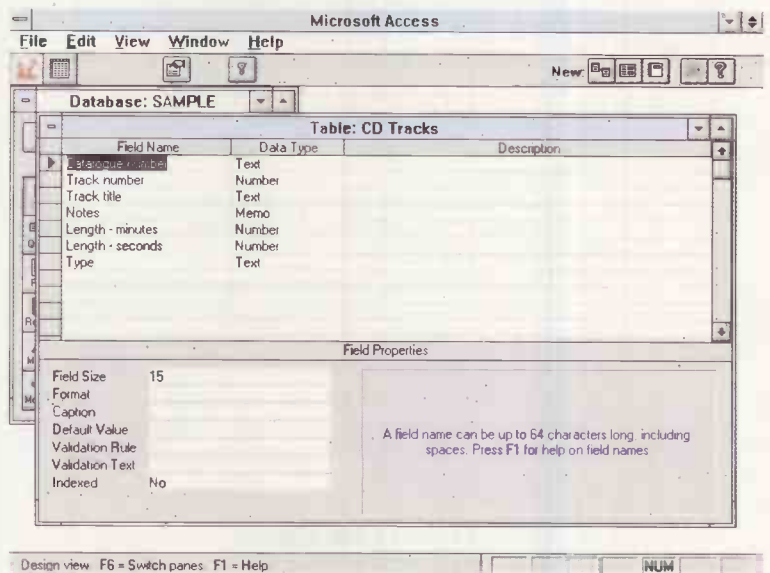
An Access database consists of tables, queries, reports, forms, macros and modules. The main menu allows you to create, use or edit them at the touch of a button. The whole lot is stored in a single .MDB (Microsoft database, novel, huh?) file which, Microsoft says, is easier to deal with and allows longer than eight-character names for table, form and query names. Which is a backhanded way of

pointing out just how lousy most xBase-oriented products are.

That's a feature of much of the documentation, telling you Access is better than xBase-centric databases. Those of us who've been using non-xBase products for years are less impressed, guys. OK, enough xBase knocking. For now.

Actually implementing a table isn't difficult. You're presented with a grid that looks like nothing so much as a spreadsheet. Microsoft calls them datasheets, to create (sorry, to avoid) confusion, and you fill it in. Field name, data type and description, that's all you get.

△ Development is very quick



The detail bits, like field length, format and defaults, are handled by a set of fields at the bottom of the screen which change as you move from one datasheet field to the next. It works well — it's a sort of mini relational database all of its own — and crops up in virtually every part of the product in one form or another.

The usual data types are there: text, numbers of various flavours, dates, memo fields, yes/no fields and OLE objects, but a couple are obviously missing. The most serious omission is the user-defined choice field.

In fact, it and several other neat types do exist but, since they aren't easy to use in datasheet view, you have to wait until the form design stage before they can be added. Yet another good reason to reverse the whole process.

When you get there though, there are a couple of neat wrinkles. Choice fields are implemented as Windows combo boxes (pop-down lists); these come either from a typed list or from a field in another table, a very powerful option.

What lets this and other parts of Access down is lack of thought by the development team. If you have a yes/no field, you have to type Yes or No: Y or N won't do. If you type the data into a combo box rather than pick it from a list, it is saved as type:

△ Access uses datasheets in its Table mode

wiDGet, rather than Widget. The whole idea of choice fields is to stop that sort of thing.

Once your table is defined you can choose a primary key and up to five additional indices. If you need more than that, get yourself a flipchart and lots of coloured pens. Your design is wrong.

Once all your tables are defined you can add relationships. It would have been sensible to implement this in the same way as the other parts of the program, with datasheets. There must have been a good reason to do it from a single dialog box, but I can't think what it is. You can't have multiple relationships between the same set of forms, but it would still be useful to be able to see all the relationships between all the forms at a glance.

The dialog lets you choose the two forms and the connected field and enforce referential integrity. That might sound like something from 1984, but it simply stops you deleting a customer in one form for whom orders exist in a related form.

Oh yes. You can choose whether the relationship is one to one (in which case it has to be primary key to primary key) or one to many. If your database calls for many to many relationships, once again get out your flipchart and coloured pens. Your design is wrong.

Datasheets are often a good way of viewing data but rarely a good way of entering it. This is where forms come in.

The key thing to remember about the forms is that they are Windows objects. You can add graphics, sound, buttons, whatever you like. Using buttons to run macros you can produce sophisticated forms-based menu systems to guide users around your applications. And adding a button is simply a matter of clicking on the button tool and placing the button on the form.

Wizards and Cue Cards

When I said earlier that Access produces forms automatically from tables I was exaggerating slightly. There are two forms of 'advanced help' within the product and it is one of these, Wizards, which produces forms, queries and reports. Wizards were first seen in Microsoft Publisher but following their debut they have appeared in Excel and now in Access.

All a Wizard really does is ask you a series of simple questions — which table you want to use and which fields from the table — and uses your answers to customise a set of standard templates.

The results can be quite sophisticated. Wizards will easily cope with a form consisting of a main form and related sub-form, but the process is straightforward.

Best of all, though, the end result is an editable form, query or report. Many people will use Wizards as the main method of form production, but even for the dedicated command line programmer they provide a prototyping tool that is simply too good to ignore.

If Wizards are more like prompted automation than enhanced help, Cue Cards are the opposite. The right-hand third of the screen is taken up with a menu that breaks down a process such as developing a macro into its component parts. You simply go through each step as you need it. Context-sensitive help is hardly an adequate description.

Microsoft is very excited about Wizards and Cue Cards and, at first, it's a little hard to see why. It's easy to think of Cue Cards and Wizards as trendy new names for existing technology, but that's a little unfair.

Cue Cards succeed where, by and large, tutorials fail. They take you through the program step by step while you build *your* applications, not while you set up a database for Pammy's Pet Store.

Wizards are more impressive while actually being less sophisticated. If you think of them as allowing you to customise a set of predefined templates, they're nothing special. The point is, you don't think of them that way.

Macros and Queries

It was inevitable, of course. This is a Microsoft product and, beneath the very successful corporate veneer, Microsoft is a corporation run by anoraks. Sooner or later we were going to discover Access had a macro language.

I'm not a great macro user. Recorded macros tend to be too limiting and macro language writers often feel the need to make *their* language as esoteric as possible. If not, simply being different from everybody else's macro language is sufficient.

Microsoft products are rather different. God knows there are enough features in them, but you always seem to want more.

Like everybody else's macro language, Access's is obscure and difficult to use. Unlike most there's an editing system (based, like much of the fancy stuff in the product, around Access datasheets) which prompts you at all the right places and generally eases your pain.

Horrible things, queries. The problem with databases, though, is that no sooner have you got the data in than someone wants to get some of it back out again. Which means you've got to dig out the query language manuals and spend the next couple of hours trying to find out how to extract the names and phone numbers of all your widget suppliers.

With most Access queries, you don't have to write any code at all. Open up the relevant tables and the field lists appear at the top of the screen, along with any relationships between them. All you have to do then is drag the fields you want to the lower half of the screen and add any conditions (like = 'Widget' under the Parts field) and run the query.

The result is another table of the relevant results. You can use it like any other table (including putting a form in front of it), as well as the more traditional use, as the basis for a report.

I mentioned earlier how you can get a combo box to display all the part names in your inventory by pointing it at the relevant table and field. Unfortunately, they'll be in record number order. Create a query that sorts the part names alphabetically and point the combo box at the query, though...

Query By Example (QBE), as this system is known, is hardly new, but it's rarely this slick. If the query isn't perfect, you can always display the underlying SQL code and modify it yourself. If things get really desperate you can even resort to Access Basic code.

It's here, though, that Access starts to show a few problems. SQL may be industry standard, but it

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isn't for the faint-hearted. The jump from QBE to SQL is enormous; the jump from SQL to Access Basic is bigger still. The last thing the world needs is yet another query language, but there has to be a way to provide an intermediate stage or two.

Reports

The big problem with database development tools in the past was that even if you had a database that could make itself look halfway presentable on screen, the printed output always looked as though it had come out of a mechanical cash register; it didn't matter what you hooked up to the back of the machine, you got a fixed size, proportional font. A small industry grew up providing horrendously complex solutions to a problem that shouldn't ever have existed. We may, with products like Access, see the end of 'Database Publishing'.

It couldn't be easier. Select the query you want and the Report Wizard lets you choose the appropriate fields. Then you select the style of report you want and the Wizard produces it. Headers, footers and fancy fonts.

Why do you need to choose the fields again? Well, suppose you wanted to know the salaries of everybody in your company called Smith. An odd thing to want to do, admittedly, but it'll demonstrate the point. The query has to have the surname field, along with the condition, or it won't work. For the report, though, you *know* the employees are called Smith, so you leave it off.

If you don't like the standard reports you can design your own from scratch, but, as always, letting the Wizard do the work and then editing the finished product is usually more productive.

It has to be said that AccessBasic is the most

database supplied with the product looks like a professionally developed application but doesn't use a single line of AccessBasic code.

I'm not going to go into the language in detail here. It is, as I said, Visual Basic with database extensions. They're pretty good, too, if you can get on with Visual Basic. Bloody horrible language, if you ask me. The trouble is Access is so damn good I might have to start using it.

Throughout Access, toolbars and the usual Windows goodies like floating toolboxes and pick lists abound. As with Visual Basic, Access uses windows with ultra-thin and ultra-difficult-to-use title bars and gadget boxes from time to time.

Otherwise, Access is a relatively well-behaved Windows application. If you haven't used Microsoft applications before, you might expect that they'd follow the rigid rules they lay down for what a Windows application should look like. They don't, of course. Microsoft argues (when it can be bothered to argue its case at all) that it experiments with new techniques in its applications, that eventually find their way into the environment itself.

Some are a definite improvement, like switching from the CUA cut, copy and paste keys to the far better (from a typist's view) Macintosh-style Ctrl-X, Ctrl-C and Ctrl-V. Others are not. None so far provide such an unquestionable advantage that they justify ignoring the standards, even if they are Microsoft's own standards.

One thing to bear in mind, though, is that while there are keyboard shortcuts available they are few, far between and inconsistent. It is the only Windows application I use regularly with which I cannot do any useful work without a mouse.

Conclusion

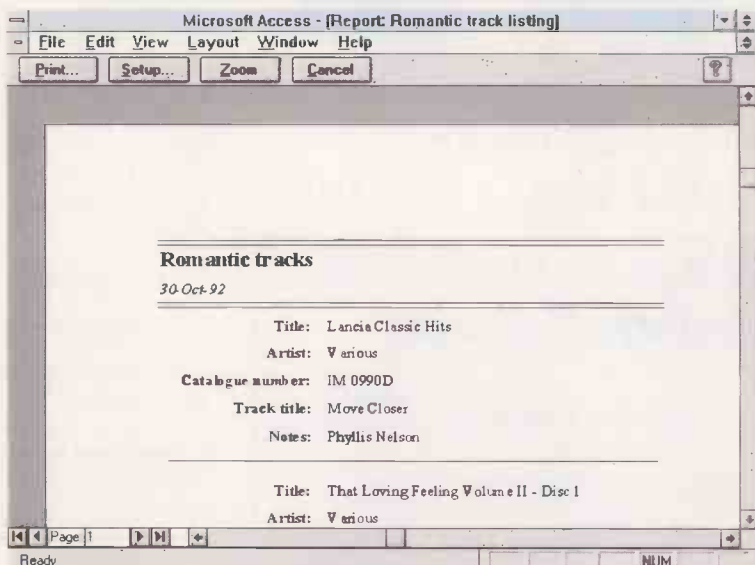
I think the positioning of Access is wrong. While there are some limitations to the program's abilities and while an intermediate back-end programming language would be nice, this is a very solid, very slick and very powerful product.

The fact that your data, be it in xBase, Paradox or SQL format, is your most important asset is not something Microsoft alone has noticed. Even more encouraging is that this is only the start. Already there is talk of an imminent, enhanced version that will read and write DataEase data — important for the UK market even if DataEase hadn't fumbled its own product introduction so badly.

The biggest problem with the product is that there are too many very low level and very high level features with little in between. The very green will get an awful lot out of Access from day one. The very experienced will get a high reward for the time they invest. But boy will they need to invest some time. I haven't even begun to scratch the surface here. I haven't mentioned the security or networking features and I skipped over AccessBasic because there simply wasn't the space.

I said earlier that Microsoft is a company run by anoraks. Long may it continue to be so. Men in suits don't produce great applications.

Access costs £495, but has an introductory price of £99 until 31 January 1993 when you use a voucher from any Microsoft sponsored event. Access Developer's Kit costs £395. Microsoft is on (0734) 270000.

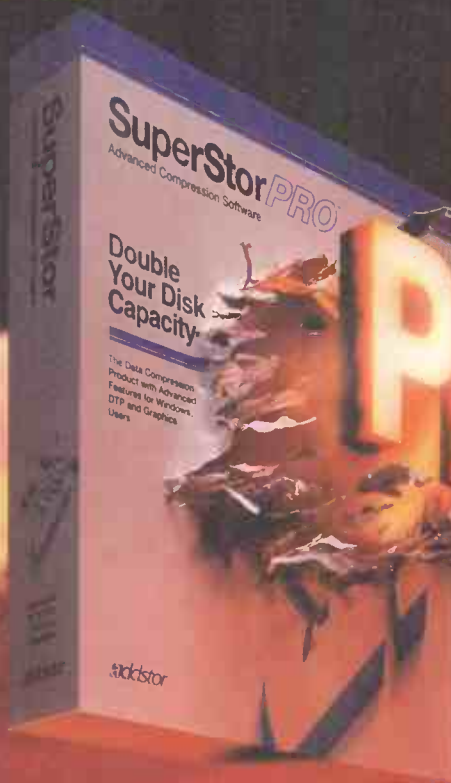


△ Report generation is made simple through Report Wizards

powerful language I have ever seen in a database product. You can manipulate every aspect of an Access database and of the Windows environment around it. This isn't cut-down Visual Basic, it's Visual Basic with knobs on. This language is Access's biggest asset. And its biggest weakness.

Most people won't get that far. The combination of the excellent QBE features and the powerful, if tortuous, macro language will allow most people to do most of the things they need. Indeed, the sample

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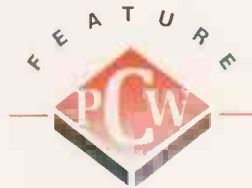
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Copy right

The copier has come a long way since it offered a dozen shades of murky grey. As it goes digital, it not only offers realistic colour copying but is fast developing into the universal desktop device, says Christopher Paine.

Digital sound, digital television, digital micro-waves, digital clocks, digital fuel injection systems, digital fax. The world is going digital, a word we can no longer avoid.

What about the ubiquitous copying machine? Yes, the familiar device is also going digital. And as it does so it is acquiring new and powerful functions that will start to impact on the way we work. Copiers will be able to do things they have never done before, which means people will be able to do things they have never done before.

So what is a digital copier, and why is its development significant? As many readers will know, today's copier contains a light-sensitive drum or belt which 'photographs' the original document and, with the help of toner powder, transfers a copy of it onto paper. The drum is like the film in a camera, except it is reusable.

A digital copier works on a different principle. The original image is not reflected directly onto the drum. It is scanned digitally, like in a fax machine, and captured as a pattern of tiny dots, usually 400 to the inch. This electronic image is then passed through an image processor, a built-in computer with the power to improve it, manipulate it or alter it in a variety of ways. When the image emerges from the processor, its dot pattern is written by laser or equivalent device onto the drum surface, and it is developed and transferred to paper as normal.

What is the significance of this? There are at least four major implications: image processing, image retention, the ability to use a wider variety of marking technologies, and multifunctionality. This article examines each in turn.

Image Processing

Canon pioneered digital technology in its colour copiers a few years ago, and now almost every copy bureau seems to have a digital colour copier. At a stroke, colour copying became good enough to satisfy, even exceed, most people's needs.

The image processor was the key. It adjusted the colour balance to remove scanning errors, thus ensuring that the copies were an acceptable reflection of the original.

Image processing has also been demonstrated in black and white copiers, where it offers amazing editing possibilities. The image can be selectively edited, stretched, squashed, multiplied in miniature on one page, blown-up to create a multi-sheet wall poster, restored from something one could barely read, and so on. The potential is only limited by what the copier's designers can think of programming the image processor to do. The copier user of tomorrow need not be content with simply making copies: he will be able to use the copier creatively to make entirely fresh originals.

Image processing will also deliver a major improvement in copy quality, especially for copies of half-tone illustrations and photographs. Conventional copiers are limited in their ability to reproduce tonal illustrations; sometimes the result is reasonable, sometimes it is clearly not. All that should now be resolved. The image processor is potentially able to vary the intensity of each separate dot the laser writes onto the drum, to create a continuous tone effect that will operate consistently time after time.

Image Retention

A digital image can be stored, and a number of interesting benefits result. Copier sorters are bulky, and their use means the first copy of a multi-page document is not available until the entire copying job is complete. A more convenient and productive solution is to use a recirculating document handler (RDH). This circulates the originals once for each copy of the report, so the finished reports can be stapled on-line and removed in sequence as they become available.

By scanning once and storing each page of a report, a digital copier can dispense with the RDH while achieving the same result. The pages are spooled or recorded in the copier's memory, then electronically circulated to produce finished sets. The originals are no longer exposed to physical stress, and the operator can file them away while the job is still running.

A second benefit of image retention is its ability to rearrange the page sequence. Nearly all of us have

experienced the frustration of trying to make double-sided booklets on a copier from A4 originals. Which page should be copied with which, so that the assembled booklet has the correct page sequence? And how do we ensure some of the pages don't emerge with the reverse side upside down?

We no longer have to worry. A digital copier can memorise the pages and automatically sort them into the correct pairs for copying. It can even ensure that new chapters always start on a right-hand page.

The colour copier is a wonderful tool, but it has, unhappily, made banknote forgery a lot easier.

ing engineering drawings, and a neat new desktop colour copier from Canon, using inkjet.

We have also seen the re-emergence of the once familiar stencil process as a digital copying technology. This now offers a clean, rapid, reliable and low-cost method of reproducing volume copies: a solution which is increasingly taking work away from conventional copiers.

Alternative technologies open up the opportunity to design new types of copier to meet a variety of needs. We can expect to see some interesting developments here.



Indeed, last year, the Bundesbank disclosed that over half the forged banknotes circulating in Germany had been made on colour copiers.

Image retention has now come to the rescue. It looks like beating the forger at his own game, providing the banks and crime prevention authorities with the safeguards they have been anxiously seeking. Earlier this year, Canon announced its solution. It consists of scanning all a country's banknotes into the memory of the colour copier before it reaches the user. If a potential forger tries to copy one of these notes, all he gets for his pains is a black sheet of paper.

Alternative Marking Technologies

Today's conventional copier uses the familiar xerographic process invented by Chester Carlson in 1938. But as we observed at the start of this article, the original document in a digital copier is no longer 'photographed' directly by the light-sensitive drum; it is written onto the drum surface by computer-operated laser. Consequently, while many digital copiers will use xerography, they no longer have to. All they need is a marking system which is able to be driven by computer.

We are already familiar with a number of alternative, computer-driven marking systems in the small desktop printers and fax machines we use every day: some employing laser xerographic technology, others using thermal, thermal transfer or inkjet. Any of these technologies can now be used for copying, and already the first wave of such copiers has appeared. We have seen pocket copiers from Japan using thermal transfer, large format thermal and thermal transfer copiers for reproduc-

Multifunctionality

Those who like to call a spade a spade and a copier a copier will soon find themselves on unsure ground. A copier will still be a copier, certainly. But why not also a printer, a fax machine and a scanner?

We have already seen that the original is scanned digitally, then reproduced by a computer controlled marking system identical to that used in laser printers, inkjet printers and plain paper fax machines. We have arrived at a position where one device has the potential to fulfill several roles.

The copier's scanner need not be used just for copying. It can capture images and transfer them to a PC screen for manipulation and integration into documents; it can serve as an input device to an electronic filing system; and it can scan and transmit faxes.

And why should the marking engine itself be restricted to copying only? Why not use it also for printing, by connecting it to a personal computer, either directly or via a local area network? And why not print incoming fax messages with it too?

Thanks to digital technology, we will soon no longer need separate products for separate functions; one integrated, space-saving device will handle all our document processing needs including composition, printing, copying and faxing, plus electronic filing and retrieval.

No revolution has failed to attract its doubters and sceptics, and the digital copier is no exception. Despite the theoretical attractions, will people really wish to have multifunctional products and elaborate editing facilities?

The evidence so far shows growing support for

△ The Xerox Docutech is the most powerful digital copier on the market today. It can print files from floppy disks or files downloaded over a LAN

digital copying, but only where the benefits offered are in tune with market needs.

Colour copying is now almost entirely digital and the benefits of this are fully accepted. More significantly, colour copiers are rapidly going multifunctional. Well over 50% of colour copiers in the USA are being sold today with full printing capability as well. An astonishing transformation in little over a year.

In the mainstream black and white area, most copiers in Europe and the US still use traditional analog technology. Compact digital copiers from

copier companies understand best, and where the market leaders have their most powerful direct sales forces, able to learn at source the selling of new applications and ideas. The leading companies are directing a lot of time and energy to listening to customers, finding out what they are using digital copiers for and how they want them improved.

Fourthly, the Japanese products are all multifunctional, either in their standard form or as an option, and at least 50% of them are bought as such. The country's high office rents and small

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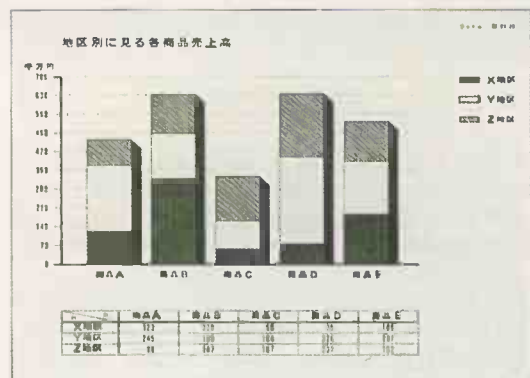
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6 千万円



Konica, Ricoh, Mita and Xerox have been available for a year or more, but are still seen as specialist niche products, not 'hot boxes' selling in quantity.

If we take a flight to Japan, however, we find an entirely different picture. Here, compact digital copiers from Fuji Xerox and Ricoh are driving the copier market. Placements are around 10,000 a month and both companies expect to have 130,000 or more installed with customers by the end of 1992. While the analog copier market in Japan is flat, digital copiers are selling in ever-growing quantities.

There are several reasons why things are so different to Europe and the US. For a start, there are far fewer personal computers in Japan than the West, so people put more value on the image editing and manipulation facilities digital copiers offer. The copier editing board is in some respects a substitute for the PC screen.

Secondly, the premium charged for digital is lower in Japan: typically 10%-15% compared to the 40%-50% we see in Europe.

Thirdly, the Japanese market is the one Japanese

work areas give multifunctionality extra appeal.

There is another reason, based on emotion more than logic. The Japanese love new products and technologies, in particular anything digital. The main vendors have played on this emotion by giving their digital copiers romantic, science fiction names: Medio, Able and Imagio.

So, are digital copiers purely a Japanese phenomenon with little hope of success in Western markets? By no means. They are already proving successful here. But the action is taking place in a different area: the large centralised and decentralised copier market.

Xerox and Kodak, market leaders in large copiers, both now sell powerful, highly productive digital copiers, and their products have met with an encouraging response. The most powerful machine is the Xerox Docutech, a 135 copies per minute, 600 dots per inch (dpi) copier/printer as long as a Ford Granada. The Docutech can print files from floppy disks (it has its own floppy disk reader) or files downloaded over a LAN. It can also copy documents, and create new pages that are half copied

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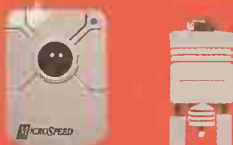
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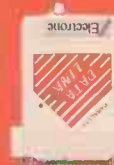
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and half laser printed.

Few managers have a document scanner at their disposal, let alone one that scans at 600dpi. If they are producing an illustrated document, they can now send the text file to the Docutech over the network, leaving gaps for the pictures. These can then be scanned in using the Docutech's copy platen, scaled, cropped, adjusted with the help of the machine's VDU (doing double duty as control panel and editing/viewing window) and merged with the text to form the final composite page. Print quality is virtually offset standard (albeit without a colour facility at present). High productivity gains are achieved, partly through the elimination of film, plates and offset make-ready, partly because of the machine's powerful document handling and finishing. Automatic page sequencing is also supported.

Kodak's 1570 series of digital copiers deliver 70 copies per minute. These are designed mainly for departmental use and offer electronic pre-collation and automatic page sequencing. Market reaction is reported to be enthusiastic.

What of the future?

In this article we have seen some of the potential consequences and benefits of copier digitisation, and some of the ways the copier industry is coming to terms with it. We have also observed major differences between the Japanese and Western markets: differences much more noticeable than ever before.

Kodak is adding a printing facility to its digital copiers. Xerox has started to extend its Docutech concept downwards in speed and price with the recent introduction of a 92 copies per minute device, and is expected to take this even further. We can expect the Japanese copier companies to bring to Europe and the States the printing, and possibly the fax functions, that its mid-range digital copiers already enjoy in Japan. And we may well see a new, ultra-compact breed of multifunctional copier replacing the desktop laser printer over the next few years.

As more of these products arrive on the scene, we will see distinct product segments emerge. The professional user (including the in-house central reproduction centre) will continue to want the power and flexibility represented by the Xerox Docutech concept. But the typical user department will want to share some of this power, just as it did with conventional copiers. This will lead to the growth of a lower-priced mid-range segment of smaller and less expensive products, most probably continuing to combine copying and LAN printing.

Our working methods today, however, are likely to be most affected by what happens on the desktop. We already see a convergence between laser printers and plain paper fax machines. Printers are adding fax receive capability, and fax machines are adding RS232 interfaces and printing. It is leading us in one clear direction: to the arrival of small universal desktop devices, offering copying, scanning, faxing and printing. In two or three years these could be well on the way to ousting the ubiquitous desktop laser printer.

The Japanese company, Okidata, has launched

just such a product in the US, offering all four functions in an 8 copies per minute, small desktop unit, for under \$5000. The machine can be operated either from its control panel or from the attached PC screen. All the regularly used functions are immediately to hand, and the price is lower than the sum of the separate products it replaces.

In the US today there is, on average, one personal computer to every two office workers, and Europe is heading in the same direction. Today's real growth product in the computer area, however, is the local area network. Eventually most desktop PCs will be linked, and as that happens the distribution of documents in offices will change. The internal mail system will give way to electronic document delivery, with printing by the receiver, not the sender. Instead of making ten copies of a report for internal circulation, the author will distribute it electronically. The recipients will read it on their PC screens, and print it only if they need a hard copy. Digital copiers will be more useful here than straight printers, because of their ability to transmit existing hardcopy as well as freshly created text and graphics.

The powerful editing facilities of a digital copier make it a lot easier to add colour to documents, and people will increasingly do so. It also becomes possible, and very easy, to convert selected areas of a black and white original to colour, for those who lack a colour printer and colour-capable software.

Kodak has shown highlight colour on its 70 copies per minute digital copiers, and Xerox now has a couple of products that apply two colours (black and one other) in a single pass of the paper in perfect register. Konica sells a digital highlight colour copier/printer, and other vendors are certain to join in.

The thoughtful use of highlight colour is an enormously powerful aid in gaining attention and comprehension, and its increasing availability can only be good news.

Significantly, Canon has announced a new digital copier/printer in Japan that can convert a multicoloured graphic, such as a pie chart, into a black and white copy that is still almost as easy to understand. Each of the colours is represented on the copy by a different black and white pattern, pre-programmed into the machine.

Artificial Intelligence

A modern digital copier scans the original document and passes the resultant electronic image to a resident computer, the image processor. Once something gets into a computer, as we all know, almost anything can happen to it. Ricoh has shown some of the tricks that can be performed by applying artificial intelligence to the process. Its latest copier, released earlier this year in Japan, can straighten out a hand-drawn diagram so that it looks totally professional. It also possesses optical character recognition; it can read a table of figures placed on the glass platen, and print out not a table — but a graph.

This takes copying into totally new realms. It illustrates better than anything the change that is coming over the copier industry, and the almost endless possibilities digital copiers have started to open up.

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Free Disk

This month's cover disk is well worth having. Not only does it contain a special version of the popular Global Effect world simulation strategy game, but it gives you a chance to win a holiday for two on the sunny island of Crete.

The winners will be staying at the Villa Olympia apartments, which are brightly furnished and surrounded by a wealth of flowers, and are just 375 yards from the beach. The terrace is shaded with bougainvillea and scented jasmine, making it ideal for dining *al-fresco*. The holiday is organised by Starvillas. Established in 1962, Starvillas was the first villa holiday company, so you will be travelling with an experienced operator.

There are also 10 runners-up prizes of World Atlas. To win, all you have to do is answer five questions (see opposite page).

Installing Global Effect is easy. Place the disk in your floppy disk drive and log on to that drive (e.g. 'A:' Return). To unpack the game files onto your hard disk type 'INSTALL A C' ('A' is the floppy drive and 'C' the hard disk drive). You may substitute these drive letters for whatever configuration your machine uses. You should not type the colon after the drive letter). Type 'Globv' to start the game.

This introduction to the game looks at some of the principles involved when creating a world and explains how to use the simple tools and menu controls. The icons and menus used in the game are shown below so that these pages can be used as a quick reference when playing the game.

The load/save options have been removed to keep things simple, as has

the battle computer. Your task is to create a thriving community with 300 or more blocks in 20 years. That doesn't mean simply adding 300 blocks, as at least 90% must be powered and there must be at least 90% coverage of all services. You are not alone on your planet either; the computer is also playing and if you step out of line it will pull out and the game will end.

How the World Works

In the beginning the world is in balance; it's only when you start playing that things begin to change. As the population grows, so does the effect on the natural world. Gradually, you will face a host of problems affecting the changes you have made. Deserts, coasts and polar caps move. Land is lost, islands are created, and forests grow or are laid waste. Unless a careful watch is kept, the environmental balance can be seriously thrown out and your civilisation will perish. Keep your eye on the environmental power indicator, and take heed of the screen messages.

Building a Civilisation

Starting with little economic power, almost everything you do reduces power levels. This limits rapid expansion and encourages a slower, more realistic development.

To start building you can use only natural power forms and two are provided: solar and wind. When a natural power station has been built, you can start your first city. Left unattended, the city will grow by itself as the people need houses and services. Treat the people badly and they will build less; this can cause problems. Unchecked

cities can quickly become very big indeed and require a well balanced supply of fresh water, farms and sewage disposal.

Sooner or later, you will take your next step in damaging the environment when you survey for alternative power sources. For coal this is simply a matter of digging a mine; for oil you will have to build a rig, on sea or land. As in 20th Century Earth, you are more likely to find coal than oil, and more likely to strike oil than uranium, and in cost it works that way too. With oil, you must refine the crude before it can be used for power generation, which will mean constructing a refinery close to the oil rig and, finally, building an oil-fired power station. For uranium, you must build the mine as near to the power station as possible and provide a constant water supply for reactor cooling.

Beware of areas of high seismic activity: should an earthquake strike, you risk damaging your power stations. If stations are destroyed, cities will die of famine and disease, forests may be contaminated with nuclear fallout and global warming may ensue.

Coal Power Stations

This is the cheapest form of manufactured energy. It is also the most polluting. It requires lots of fuel and produces high levels of waste and chemicals such as CO₂.



Chop down trees



Plant coniferous trees



Plant deciduous trees



Convert waste to grass



Oil fired power station



Coal fired power station



Solar power



Wind power



National park



Destroy man made



Nuclear power station



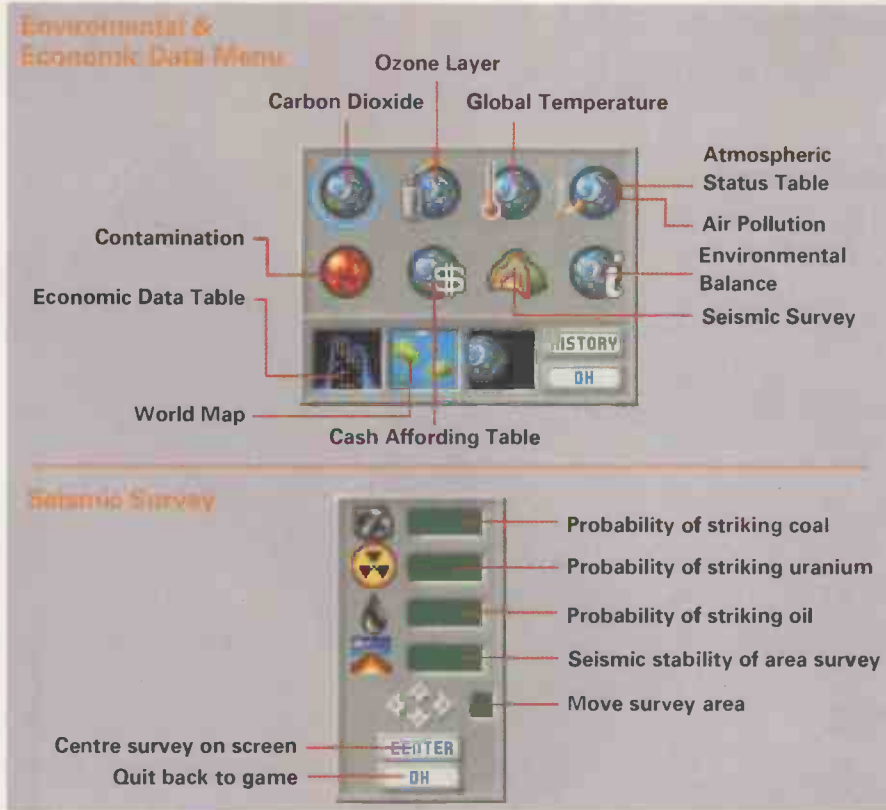
Pipelines



Power cables



City block



Nuclear Power

A nuclear power station is, environmentally, the cleanest and most productive form of power available. It requires a mine, a uranium store, a piped water supply and a reservoir for safety. A nuclear power station not only supports large cities but also makes nuclear warheads available.

Environmental Information

As you create new civilisations the environment is affected: coastlines will move; deserts, polar caps and forests will expand and retreat. When these

delicate balances are upset, environmental problems arise. Growing amounts of information are at your disposal for monitoring the world around you.

Farms and other Essential Services

Farms are a natural way of producing food supplies. Keep the people supplied with food and the cities will remain in balance. Other important services you will have to supply your growing civilisations include recycling plants, sewage disposal facilities and fresh water supplies.

The disk was virus checked by Jim Bates (0533 593010). While we take every possible precaution PCW cannot be held responsible for any damage or problems which arise from using it. Make sure you have adequate backups of important programs and data. Do not try out new programs on a networked PC.



City limit



Info. requester tool



Farm



Oil store



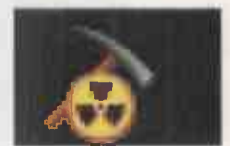
Reservoir



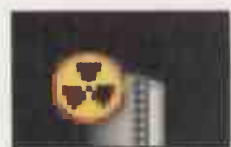
Sewage farm



Recycling plant



Uranium mine



Uranium store



Coal store



Nuclear reprocessing plant



Water purification plant



Coal mine



Oil rigs

Questions

- Which gas is recognised as the biggest contributor to global warming?
 - Carbon Monoxide
 - Carbon Dioxide
 - Sulphur Dioxide
- How far is the Earth from the Sun?
 - 15 million kilometres
 - 150 million kilometres
 - 1500 million kilometres
- What is the name of the fault line crossing San Francisco?
 - San Mateus
 - San Andreas
 - San Miguel
- What is the Tsunami?
 - A tidal wave
 - A new Japanese car which has negligible harmful exhaust emissions
 - A frequently erupting Taiwanese volcano
- What does CFC stand for?
 - Chloro-fluoro carbons
 - Clean fresh car
 - Calcium-fluoro carbonate

Send your answers to 'Global Effect Holiday Competition', *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG, to reach us by Friday 18 December 1992.

Name _____

Address _____

Postcode _____

Answers

1: _____

2: _____

3: _____

4: _____

5: _____

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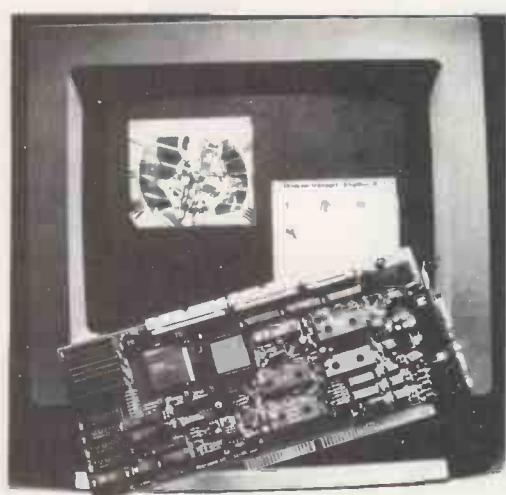
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Get the Global Effect!

Global Effect is a game of global management. You must build and maintain civilisations by exploiting the planet's resources, while managing the environmental balance. You may choose to play against different scenarios; save a polluted world; compete with another player to rule by economic or military means; create civilisations under different natural conditions. Balancing environmental care against the polluting effects of humans is vital, as is problem-solving and strategic management of the consequences of your actions.

The full version can be played in three ways: create, save or rule the world. Preset scenarios give varying environmental, economic and military conditions to manage.

Create a World

In these eight scenarios, you start with a green-field planet to build your civilisation on. Each planet has a different geography and environment, so you must adopt different strategies to build successful civilisations. This allows access to every feature of the system, including the choice of one or two players, and options to define the characteristics of a world to colonise. It includes scenarios for the following.

1. Unstable World Constant earthquakes and volcanic activity hamper successful construction. Little forest cover, large mountains and deserts make this a hostile environment.

2. Frozen World Contains a few large deserts. Huge polar caps cover vast expanses of terrain.

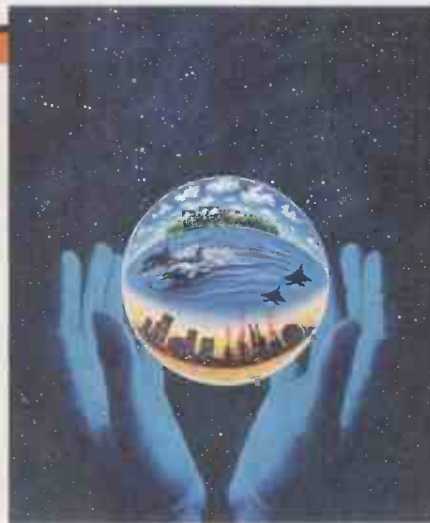
3. Archipelagos A warm, watery world of many islands.

4. Barren World. Hot, with little seismic activity. Huge deserts cover the land and forestation is scarce.

5. Pangen A very large land mass with little open sea. Lack of water in inland regions makes it difficult to establish cities. Seismic activity is prevalent here.

6. Forested World Large areas of trees will have to be cleared before effective city building can begin.

7. Mineral Rich World Abundant riches in fuel sources, both of coal and oil, make this world appear relatively easy to prosper on.



Save a World

These four scenarios set different scenes. Your must save the world from man-made crises, with limited time and economic power at your disposal.

1. Post Nuclear Few people have survived. Forests have died, large areas of the planet are contaminated, and the polar caps are expanding towards the equator. You must revive the natural environment to reverse the damage and allow civilisation to thrive once more.

2. Post Industrial High levels of CO2 and ozone depletion attest to the environmental crisis. Over-exploitation has exhausted many natural resources. You must build a new world order, based on clean, green, energy-efficient policies which in time will re-establish the world's equilibrium.

3. Global Warming Heavy industry and fossil fuels have accelerated the rise of global temperatures. The polar caps are retreating, deserts advancing and sea levels rising. Without your decisive action to reverse this, global warming will create a dead planet.

4. Spent World Farming and mining

have exhausted the world's natural resources. You must maintain the existing civilisation at the optimum level and ensure long-term survival.

Rule the World

In these two scenarios, you compete with another (human or computer) player to win domination over the world.

1. Prime Industrial A rival controller is present on this world, developing heavy industry in order to achieve economic dominance at the expense of the natural balance. You will need to contain the opposition's expansion by any available means, repair the environmental damage and construct a new, cleaner world.

2. Military Force. Your opponent is an ambitious controller with aggressive tendencies. You will have to defend yourself and engage in military combat to eliminate the threat. You must closely guard your cities from attack, while ensuring you have sufficient resources in reserve to rectify the environmental damage which may result from the conflict.

• *Personal Computer World* has made a special arrangement with Millennium, the creators of Global Effect, and can offer 30% off the recommended retail price to all our readers. This **complete version** of the exciting strategy game, which includes all the above options, can be yours for just £24.50 including postage and packing (rrp £34.99). Make your cheques payable to 'Millennium Global Effect Offer' and send them to Anne Jonas at the following address: *Personal Computer World*, Global Effect Offer, VNU House, 32-34 Broadwick Street, London W1A 2HG.

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Getting personal

Get rid of that tatty old Letts diary this Christmas and you'll never be left hunting for a pen again. Catherine Eade, Gordon Laing and their team tested 11 popular PDAs, plus some gadgets which point the way to what Santa's grotto will hold in years to come...

This is a Group Test with a difference. In fact, it's not really a Group Test at all. We've gathered together what are loosely termed Personal Digital Assistants (PDAs), to present a product round-up with Christmas in mind.

Just what, you may be wondering, is a Personal Digital Assistant? They come in many guises. They include personal organisers and communicators, electronic 'books', note-takers, display telephones, multimedia players, and myriad other all-singing all-dancing gizmos targeted at small businesses and individuals. Really, a PDA is just another TLA (Three Letter Acronym) for a little gadget that has been designed to make your life easier.

The advent of Personal Digital Assistants owes much to the recent convergence of the consumer electronics, entertainment and communications worlds with the computing industry. Many companies have found that by changing the appearance of a computer it can become successful as an entertainment device or a serious business tool.

Another major factor in the development of these technological advances is the unfulfilled promise of the 'easy to use' personal computer. Studies have revealed that a large number of computer users are not comfortable with the technology they were assured would improve their working lives. A recent MORI poll indicated that almost half of all small businesses do time-consuming administrative tasks manually, with only one in four believing that a personal computer would increase efficiency. The trend is therefore towards designing systems which don't require

a lot of time and concentration to operate, but which work with the user to get things done quickly and easily.

Many people believe we are at the start of another computing revolution: a mass market for gadgets and devices used in everyday life by people who, if not actually technophobic, were previously unconvinced of the advantages that technology could bring to them or their business. Apple CEO John Sculley recently announced plans to move into the PDA field and grab a chunk of the market. The company has set up a new division called Apple PIE (Personal Interactive Electronics) in charge of new developments in that area. Apple's researchers noted the increasing popularity of portable or handheld devices like notebook PCs and digital diaries, and the naturalness of using a pen for input. The result is a device without a keyboard or a mouse, but which recognises the operator's commands via stylus movements and 'guesses' what is needed. The much-lauded Apple Newton was shown at the Consumer Electronics Show in Chicago in May this year (in the form of a plastic shell) but it will not be available until the middle of 1993.

Apple is rumoured to have a second PDA, called Sweet Pea, in the pipeline. This is a joint venture with Toshiba and uses compact disc technology. Speech recognition is also being touted by Apple for possible incorporation into future PDA developments.

The handheld machines that are around now fall into different categories. Personal organisers come in a variety of guises such as 'digital diaries', primitive but popular; PC compatibles,

more useful and correspondingly more expensive; and non-PC compatibles. DOS and Windows based machines aren't ideally suited to the handheld concept after all, with a need for high resolution graphics, plenty of storage and some sort of pointing device. There are also some pen-based handhelds around, although they seem to be aimed mostly at sales teams, stock control and other vertical markets. More widespread use will follow in time.

There are plenty of companies apart from Apple working on the development of handheld computers. Casio and Tandy have decided to work together to exploit the personal information processor market, although it is not clear whether they will be attacking the same section of the market as Apple. GRiD and Poqet have recently produced pen-based computers, and Motorola and Samsung are working together to produce pen-based PCs connected to wireless LANs. Sharp has a similar device to the Newton in the pipeline, which goes by the charming name of My Brain.

The future does seem bright. Add-on memory, network interfaces and fax-modems should become a standard feature of handhelds within the next year or so, and all kinds of specifically designed software will start to appear. We're likely to see an increase in pen interfaces, audio recording facilities, specially designed keyboards and brand new technologies.

However advanced handhelds become, it's a safe bet that millions of new users will be brought into the computing world.

Catherine Eade

Atari Portfolio

As you probably already know, the Atari Portfolio is exactly the same machine as the DIP Pocket PC with a different price. It's not the newest handheld around, certainly; the Portfolio was first reviewed by *PCW* in the summer of 1989 and it hasn't changed much since then.

Coated in a dark grey scuff-resistant finish, it measures 19cm x 9cm x 2.5cm, with a non-PCMCIA compatible RAM card drive jutting out slightly on the left-hand side. It weighs just over 500g, including the three AA batteries which slot into the underside of the machine. A 64-pin expansion port is hidden behind a nail-fracturing cover, and an AC adapter jack hides behind the card drive slot.

Sliding the catch on the front reveals a small LCD screen, capable of displaying 8 x 40 characters. The screen takes up far less room in the lid than you would expect, measuring just 115mm x 40mm. It thankfully remains at whatever angle you tilt it to (there's nothing more annoying than a wobbly screen) and will fold completely flat if you wish. To the left of the screen sits a small speaker behind a grill.

The 73-key keyboard has small but well-spaced keys which take a while to get used to, although one member of our team was enthralled for quite some time with the pleasant rubbery feel. A 2mm rim around the keyboard makes it impossible to use your thumbs on the space bar, which is annoying. The design does not allow touch-typing, but it is surprising how fast it is possible to go when you're concentrating. The degree of accuracy is also good, which is rare

on a palmtop. A barely audible click for each key hit can be toggled on and off in the system setup.

Numeric keys are mapped over the right-hand keys, picked out in red to match the Atari function key in the bottom left-hand corner, while keys marked with blue work with the Fn key next-door to that. Pressing Fn and 'o' puts the machine into suspend mode, and this also happens automatically after a few minutes have elapsed. The Portfolio's memory is maintained at all times, which uses up a little of the battery power, so it is recommended in the manual that you carry a spare set of batteries around with you. Hitting any key awakens it from its slumber, bringing you back to where you left off.

When booting up for the first time, you are offered German, French or English language options. It is suggested that you configure the size of the Portfolio's internal RAM disk, and the CONFIG.SYS and AUTOEXEC.BAT files. The DIP operating system is not MSDOS but it is DOS-compatible with omissions and extensions specifically designed to fit the Portfolio.

The 80C88 processor, 256K ROM and 128K RAM haven't changed since the Portfolio's launch over three years ago. Extra RAM can be added using memory cards, one of which is included in the package. The Mitsubishi format RAM cards come in 64K and 128K configurations, costing £84.99 and £129.99. They are credit card size, have a write-protect switch and contain a lithium battery cell.

There are five built-in applications within the Portfolio: address book, diary, worksheet, editor and calculator. All have the same keystrokes and layout

so it doesn't take long to suss them out. The function keys F1 to F5 perform parallel functions in each application. For instance, F5 toggles the frame around the screen on and off for more room, and F3 brings the clipboard into play, although this option is not available in calculator mode.

The address book can be run in line or page mode, with seemingly unlimited lines for data and a display and search capability. You can also tone-dial phone numbers by holding the speaker next to the phone handset and typing 'enter' (if you've got three hands). The diary can be set to ring alarm bells for one-off or regular occasions, and has two view modes of month and week. The worksheet is Lotus 1-2-3 compatible, supporting the majority of Lotus functions and able to display up to 127 columns by 255 rows.

The editor is a fairly primitive looking notetaker, with word wrap and search and replace but no WYSIWYG capabilities. Its lack of advanced text editing facilities is not surprising: the Portfolio is a note-taker rather than a fully-featured word processor. Meanwhile, it's fine for storing text to be transferred to a word processor or printer.

The documentation has a large section on the operating system, with chapters on each application tool. It's not the clearest manual for new users, but the helpline support is good.

In use, the Portfolio was mostly easy to navigate around. The price means it's not out of reach for most of us and, although it's been around a long time, it's not that far behind some of the other handhelds we looked at.

Catherine Eade



Atari Portfolio

Size
190mm x 90mm x 25mm
Screen
40 x 8 characters
Weight
453g
Memory
512K
Price
£149
Contact
Atari (0753) 533344

Good Points Solid, inexpensive.

Bad Points Small screen.

Conclusion An easy to use and useful organiser.

Casio SF-9300 Digital Diary

At first glance the SF-9300 looks like the type of thing they give away with ten gallons of petrol at Texaco. After closer inspection, though, it might take as much as 30 gallons.

The case is small (about the size of a cigar case), black, and coated with a rubbery material. I'm not sure whether there is such a thing as a Yuppie in the current economic climate, but if so, this is an ideal toy for one of them.

The SF-9300 Digital Diary is the smaller of the two latest PDAs from Casio, the other of which is the higher specced SF-9600. The 'Digital Diary' is precisely that and, apart from a few other features such as alarms and a calculator, not much more. It is good at doing what it does though: store appointments and addresses.

Opening up the case reveals the display and a rather daunting array of rubber keys. There are more buttons per square inch on the SF-9300 than there are on a Boeing 747, and each button has at least four functions. The keyboard has a conventional QWERTY layout and the Shift, Space and Caps Lock are in their usual places.

If, like me, you want to be able to take notes on your pocket organiser, then the SF-9300 is not for you. Not only is the keyboard far too small (one-fingered typing only please), but the Shift keys exhibit some very strange behaviour. Unlike normal Shift keys, in order to get an upper case character you need to press and release the Shift key before

pressing the letter. The reason for this is quite obvious: if you can only use one hand (because the other is holding the machine), then how do you press two keys at once? It doesn't actually work like that though, and it is quite easy to use the same hand both to hold the machine and type.

The other reason for not using the SF-9300 to take notes is the lack of a sensible word processor. The nearest you get is Memo, which doesn't get very near it at all. There is no word wrap and it is always set to overstrike mode, which means you have to press Insert to create a space for every letter you want to insert. The maximum memo length is 384 characters, which may be okay to take a quick note on the Underground but is no good for a two-hour press conference.

If you don't need wonderful note-taking facilities, though, the SF-9300 should do everything you need. The machine is divided into eight built-in functions and there are optional IC cards available, which give extra functionality or memory. A couple of the functions are just slightly different implementations of the same thing: Tel and Business Card both store names, addresses and telephone numbers. The other functions are Schedule, Calendar, Home Time, World Time and Calculator. Certain gadgets of this type are easy and intuitive to use; you can just pick them up, turn them on and off you go. The SF-9300 is not that type of gadget: without the manuals you are up the proverbial creek without a certain paddle. This is partly Casio's fault — the user interface could use some work

— but it is also a side-effect of cramming so much functionality into such a small box.

Some of that functionality is rather obscure, though, and other quite useful features are not available. The calendar function allows you to mark dates for things such as bank holidays and birthdays, or multiple days such as every Wednesday. You can't mark the 29th of every month though, or every fourth Friday, which makes marking every pay day a problem. On the obscure side, there is a ten-phrase memory which allows you to enter ten of your most used words or phrases and recall them at the press of a couple of buttons. This may seem like a very useful function to you, but it's not at the top of my list of important features.

The optional IC cards provide a wide range of 'useful' functions, such as multi-lingual dictionaries and an English (American) thesaurus. You can also supplement the 64K of RAM that is built in with IC cards, but 64K of names and telephone numbers should suffice for most people. An optional datalink cable allows you to download information to a PC, but is unlikely that anyone would bother with it.

The SF-9300 should be powerful enough for most people, and on a power:price ratio it should be near the top. The main fault with this toy is the price: £140 plus VAT is way over the top. You may be better off saving up your petrol tokens. Even though you won't get anything as good as the SF-9300, you'll have more money left in your wallet.

Mat Beard

Casio SF-9300

Size

143mm x 79mm x 17mm

Screen

32 x 6 characters

Weight

164g

Memory

64K

Price

£140

Contact

Casio 081-450 9131

Good Points Small and fairly powerful.

Bad Points Too expensive.

Conclusion Yuppies come back: Casio has something for you.



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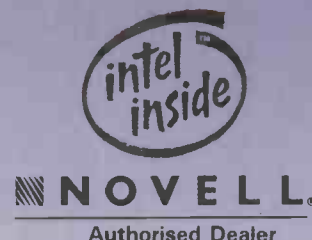
	ISA 200 Mb IDE 8Mb RAM Local Bus S3 or ET4000 Graphics 17" Sony Trinitron	ISA 400 Mb IDE 8Mb RAM Local Bus S3 or ET4000 Graphics 14" Super VGA Non/I	EISA 670Mb SCSI 16Mb RAM 8Mb Disk Cache 32 Bit Ethernet 14" Mono VGA	EISA 1Gb SCSI 16Mb RAM 8Mb Disk Cache Intelligent I/O (8 ports) 14" mono VGA
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Casio SF-R20

Everyone's heard of Casio. I think it's probably a safe bet to say that we've all owned a Casio product at some time in our lives. More specifically, we've had a digital watch by the age of ten with a calculator following a few years later. Incidentally, I'm not being ageist here since I asked a variety of people who recounted the same story.

Playground politics were rife at my school: woe betide any pupil who unwittingly arrived wearing the wrong pair of trainers. This pre-pubescent inquisition followed on ruthlessly with calculators. I once foolishly tried to impress with a far superior programmable Texas Instruments model but failed miserably: it just had to be a Casio.

These days Casio is still the major driving force in calculators and, let's face it, cheapo digital watches. But times move on and its once tried and trusted products have been joined by a range of quite respectable electronic personal organisers.

The SF-R20, a mere babe at a couple of months old, is the new kid at the top of the Casio range. Two hundred and twenty-two of your hard-earned pounds get you a somewhat sleek, rounded looking device of the clam-opening variety. When closed, the 285g digital diary measures 7in x 4in and is just under an inch thick. Unfolding it presents the inquisitor with a slightly larger than average 40 column x 10 line display which dominates the upper half. A familiar QWERTY keyboard adorns the lower half, accompanied by the 14 mode keys and the various cursor and power controls. All the keys are

small push-buttons, so I'm afraid there's no chance of any typing records being broken. While on the subject of typing, capital letters are accessed by pressing Shift, letting go and then pressing the required character. There's none of this 'hold down while pressing' business: it's a little odd at first, but you soon get used to it.

The left-hand side houses the contrast dial and a Walkman jack used for transferring information to — well, presumably anything else sporting a Walkman jack. The right-hand side looks more promising, with a ubiquitous card slot and all the associated locks and eject levers.

Anyone who's ever owned a Casio calculator (yes, that's all of you, admit it) will find the manual instantly recognisable. Casio always produces fairly large and comprehensive instruction books to accompany its products, so you'll be pleased to find that the SF-R20 is no exception. Not one, but two are included: the first details the entire unit and its operation, while the second deals exclusively with the promisingly titled Lucid 3D Spreadsheet. Don't be afraid, the manuals are clear and easy to understand; it'll just take you a while to work your way through them.

Past or present users of Casio digital diaries will feel immediately at home with this one. One such user, my friend Michael, thought he was just popping over to my place for a chat but instead found the SF-R20 thrust upon him for evaluation. Within seconds he was up, running and tapping away. I took a little longer to acquire the 'Dances with Casio' label, but I'm just about there now.

Among the 256K of memory can be found the usual telephone directory,

schedules in numerous guises, memo notepad, calculator, calendar, and world time complete with scrolling map. Of more interest is the Lucid 3D Spreadsheet, ready and waiting to process your accounts. Doing this sort of thing on a 40 x 10 display can be infuriating at times, but just keep reminding yourself that it's cheap and pocket-sized. Lucid 3D, despite its humble hardware, is quite a competent spreadsheet which provides just about all the features you're likely to want from a portable accountant.

Fancy any advice on wine buying? Are you after complex scientific functions for the calculator? Confused by foreign languages? Yes, it's time to turn to the nine currently available IC cards. If you're finding that your address book has outgrown the internal memory, then optional RAM cards may be slotted in to supplement storage space. Should your SF-R20 become lonely, it can communicate directly with many of the other models in the range or even with your PC via an optional interface: useful if you only want to enter those telephone numbers once.

Many people mock Casio, but I'll admit that after playing with the SF-R20 for a while I got real pangs of nostalgia and almost expected a crack round the ear for using the wrong model. Obviously this is the right model. Personally, I wouldn't use the spreadsheet and I would be more likely to go for the cheaper and smaller model in this test. However, if portable accounting is your thing and you've always fancied a digital diary, you may well be finding yourself creeping into Boots and asking for an SF-R20 in a brown paper bag.

Gordon Laing

Casio SF-R20

Size

180mm x 97mm x 21mm

Screen

40 x 10 characters

Weight

285g

Memory

256K

Price

£222

Contact

Casio 081-450 9131

Good Points Spreadsheet, nice display.

Bad Points Not as cheap as I'd hoped.

Conclusion It's a Casio!



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Hewlett Packard HP 95LX

Hewlett Packard's HP 95LX was released in May 1991 as a personal organiser with a difference. This is the first palmtop device from the company which can truly be called a Personal Digital Assistant; others, such as the 48LX, are really just high-end scientific calculators.

This machine was the first of its kind to be shipped with Lotus 1-2-3 as firmware. Because Lotus has the leading share of the standalone spreadsheet market (34.5%, according to Romtec), most spreadsheet-using businessmen who buy this device will be able to continue their work on the road with very little extra learning. In addition to this package, which could be seen as its flagship software, the machine also includes a telephone book, an appointments calendar, a financial calculator, a 'memo editor', a stopwatch, a world time indicator and a datacommunications editor.

The DOS-compatible computer has an NEC V20H CPU (8088 compatible). It comes with 1Mb ROM and either 1Mb or 1.5Mb RAM. It measures roughly 160mm x 86mm x 24mm, which means that it is small and light enough to carry around in your pocket. Decked out in black, the machine is a clamshell affair, with a ridged lid and a compartment at the bottom rear which houses two penlight batteries.

On the right-hand side of the unit is a PCMCIA 1.0 compatible slot for memory cards. On the left is a port accommodating the special cable used for connecting to modems or desktop

PCs. There is also an infra-red light: the 95LX can communicate data transfers using this infra-red light to avoid all that nasty cabling. This is a great idea, but I hear that it has caused some problems in school exams, where pupils have been caught using the invisible communication medium for dishonourable purposes...

Once the computer has been opened and started up, you press one of the blue buttons to start an application. Before this, however, it may ask you to enter a password, depending on whether you opted to use the password facility.

The software used within the machine is just about adequate. 1-2-3 is excepted, as it is a lot better than the rest; in fact, it led me to believe that the company must be selling the machine almost solely on the basis of the Lotus bundling deal. If it isn't emphasising this in its marketing spiel, then perhaps it should be.

The phone book has only three fields: name, telephone number and address. It omits items such as company name, title, department, fax number, email address and notes, which for a business user these days are fairly vital fields. It surely wouldn't be that difficult for a company with Hewlett Packard's expertise to design a system which allows you to define your own fields.

The appointment book is a little better, enabling you not only to enter appointments but to repeat them automatically and add notes to them. You can also define to-do lists and view your appointments in daily or monthly displays. Weekly and yearly views are only for repeating appointments, unfortunately. It would be nice if appoint-

ments could be connected to contact records, so that you could automatically call up the details of the person with whom you were due to be having a meeting.

These are probably the most important aspects of a PDA. The memo editor is also high up on the list, and this works fairly well. It's no Microsoft Word but it does the job, allowing you to cut, paste and define margins among other things. It's really for quickly preparing memo documents on the move, though, and users would undoubtedly want to transfer their prose to a more capable desktop-based word processor before finally producing hardcopy.

One of the factors limiting 95LX applications, such as the text editor, is the keyboard. Everyone accepts that keys have to be smaller on a palmtop machine, but this unit takes things a little too far and the ergonomics suffer as a result. Even so, some attention has been paid to usability as far as function keys go: each application displays function key commands at the bottom of the screen, so it's a cinch to select the functions you need without worrying about complicated ALT combinations.

For a £200 machine this would be a great deal, but for the asking price, at least £339 retail, the 95LX isn't likely to send business people into fits of excitement. I suppose the main justification of the price is the Lotus bundle, but I'm still not convinced that the level of technology and the ergonomics involved warrant such a cost. Perhaps a trip down to Tottenham Court Road to look at the bargain bucket electronic dealers might bring this product within shooting range.

Danny Bradbury

Hewlett Packard 95LX

Size

160mm x 86mm x 24mm

Screen

40 x 16 characters

Weight

303g

Memory

512K

Price

£339

Contact

Hewlett Packard (0344) 361600

Good Points Small, easy to learn, 1-2-3.

Bad Points Small keyboard, proprietary software too simple.

Conclusion The best things don't always come in small packages.





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Signed.....



Microwriter Agenda

The first British contender in this Group Test, Microwriter Systems is a small company currently based smack-bang in the centre of Surrey. Its entry here is the Agenda, or more specifically the Agenda mark two, which has been available to the UK public since the middle of 1989.

Like many other pocket organisers the Agenda is sleek, black, and small enough to fit comfortably inside the average jacket pocket. The whole thing measures a mere 175mm x 85mm x 20mm and weighs in at 275g, including a four-line 1in x 2in LCD with 20 characters per line. It has a small 64-key keyboard with the 26 letter keys laid out in a straight alphabetical fashion, while the other 38 are a mixture of numbers, dedicated functions, and five special Microwriter keys providing a unique data entry interface.

These keys, which are more like small pads, are arranged in a semi-circle on the right-hand side, one corresponding to each finger of the right hand. By pressing combinations with the appropriate digits, users can input letters just as if they had pressed one of the standard alphabet keys. The combinations have been created to coincide with the shape of each character: H is entered using the thumb and little finger, while F requires an 'everything but the little finger' routine. The advantage of this method of input is one of speed: Microwriter says that once you're familiar with the layout you can match handwriting pace in some situations. You should also be able to do this

without constantly looking down at the machine.

Other interesting external points include a small communications port which allows connection either to a PC (using an additional cable and software) or to a printer, a power switch complete with charging light, and two cartridge slots located on the underside. These act in a similar way to floppy disk drives: they're marked A and B and accept program cartridges that give the Agenda extra features. A typical program might be something like a traveller's language companion, which provides a database of commonly used phrases and expressions to help you get by on the move. Blank data storage cards can also be purchased.

A battery charger no bigger than a double plug is supplied, which can be used to power the Agenda without danger of overcharge. The battery is expected to last for around 40 hours of operation and the manual recommends charging for about an hour every day. The battery never failed during our tests, and conversations with other users revealed that power problems are rare.

The inner workings of the machine are supervised by a 4MHz Hitachi 6303 processor, backed up by either 32, 64 or 128K of RAM; PCW was lucky enough to be supplied with the 128K model. The CPU speed seems rather slow when compared with the specifications we're used to seeing on other products, but for a unit of this size and complexity it's perfectly adequate.

Getting started with the Agenda is as easy as switching it on. As soon as you do so the screen springs to life and a Start menu with three options ap-

pears. The initial choices are New, Find and Diary, each prefaced with a line of text clearly explaining its operation.

The prime function of the unit is to act as a portable freeform database for names, addresses, important notes and the like. Anything can be entered into the unit and the information can be retrieved in the blink of an eye. The Agenda's retrieve function is certainly one of its major plus points: give it any clue, even the first letter, and 99 times out of 100 it comes up with what you're after.

Despite the keyboard layout, entering data is surprisingly easy, although I must confess to resorting to the standard keys most of the time. I managed to learn a few Microwriter combinations off by heart, but on the whole I think it would take some time to get to grips with them properly. Full cut, copy and paste modes are provided, although using them is difficult the first few times.

The Agenda also includes a diary, which is accessed by pressing Diary. It allows you to store information, complete with time alarms, and assign it to a certain date. A calculator lets you add up your weekly shopping bill and a handy to-do or Action list can be set up to remind you to buy something for tea tomorrow. All of these are simple to use and you can understand virtually every feature in a section with just ten minutes' study.

The Microwriter Agenda is an excellent data retrieval system with a few other bits and bobs thrown in. Its filing system is simplicity itself, it has an excellent battery life and it looks the business. What more could you want?

Chris Cain

Microwriter Agenda

Size

180mm x 85mm x 20mm

Screen

20 x 4 characters

Weight

275g

Memory

128K

Price

£195

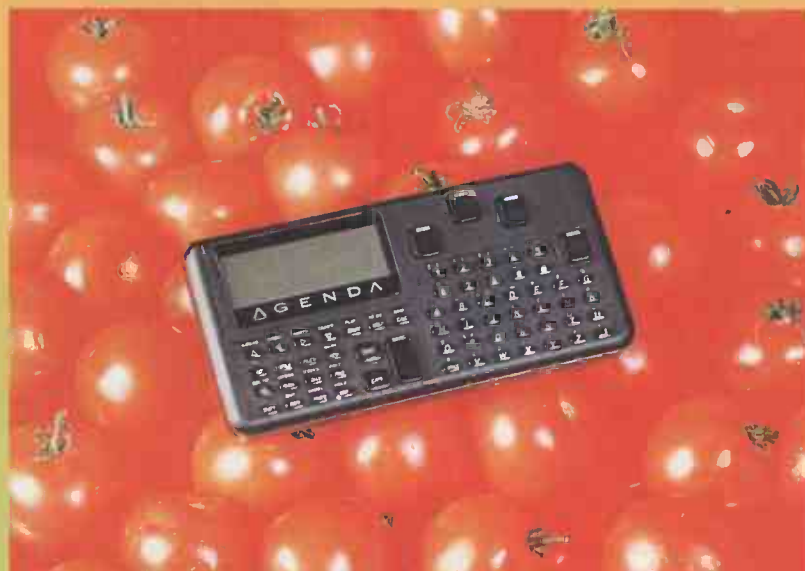
Contact

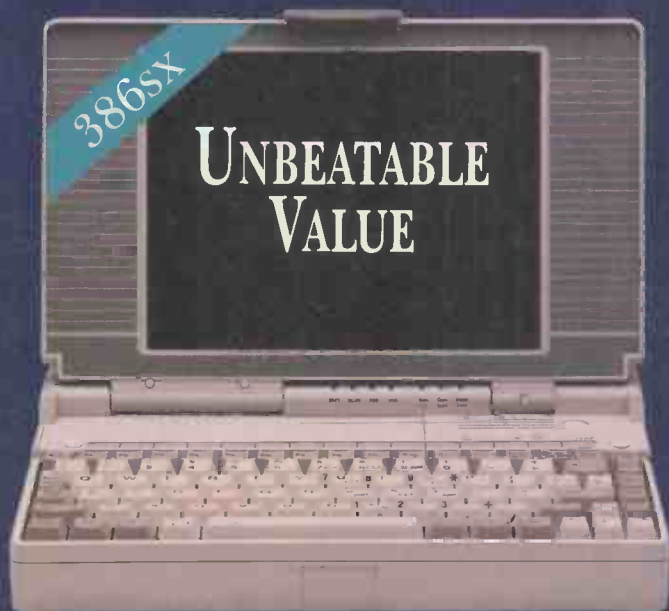
Microwriter 081-715 1023

Good Points Smart, easy to use.

Bad Points Non-QWERTY keyboard, Microwriter keys difficult at first.

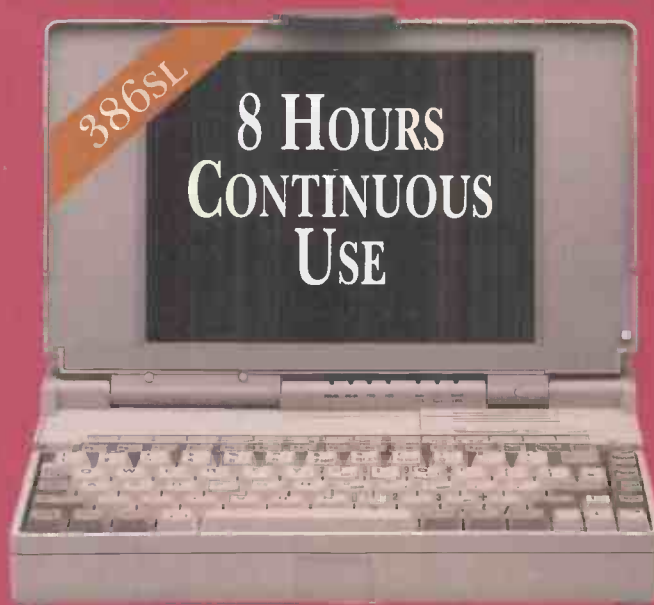
Conclusion An odd but good organiser.





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386sl 25MHz
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OBODEX POWERSAVER 386SL 25MHz NOTEBOOK

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OBODEX POUNDSAVER 386sx 25MHz NOTEBOOK

The Obodex NB386sx-25 offers unrivalled 25MHz performance with unbeatable price performance. Built to the same exacting Obodex standards, the NB386sx-25 is a premium specification product at an entry level price. Standard features include 2Mb RAM, 60Mb fast access 2.5" Hard Drive and 1.44Mb 3.5" Floppy Drive and an 8.5" VGA CCFT backlit LCD Display. An internal (removable) battery unit will power the notebook for up to three hours continuously, only requiring 2.5 hours of 'fast-charge' to restore full power status. The power management system includes a low battery power warning light, an audible warning chime and an overcharge protection feature. The NB386sx-25 features the same compact & lightweight design as the NB386sl, measuring just 280mm x 216mm x 50mm and weighing just 2.9Kg with the battery unit. The Obodex NB386sx-25, a high performance notebook with unbeatable price performance.



MODEL	SPEED	RAM	HDD	PRICE
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386dx	33MHz	4Mb	120Mb	£ 1249
486sx	25MHz	4Mb	120Mb	£ 1349
486dx	33MHz	4Mb	120Mb	£ 1549

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Mitac 1600A

The Mitac 1600A is a very new product. It has only been available since the beginning of November, which makes it one of the most up to date PDAs in our test. Not just a digital diary, the Mitac machine is PC compatible, with a fairly impressive range of functions.

It's larger than your average organiser, being more the size of a paperback book than pocket size. Measuring 23cm x 12cm x 3cm and weighing 550g with batteries, the unit has a shiny dark grey coating with designer grooves running along the top of a single hinge, and a small Mitac logo in the bottom right corner. Batteries consist of four AA and one Lithium cell.

Pressing the small button on the front releases the catch for opening up the machine. The 183mm x 71mm liquid crystal screen is slightly off-centre and capable of displaying up to 80 rows of text at a resolution of 640 x 200. The 78-key keyboard has the usual QWERTY layout, with ten function keys, a Fn key and full numeric keyboard emulation. A row of illustrated icons runs over the top of the function keys for quick reference.

All the keys are a good size, making it possible to type at a fair speed without too many errors. One very annoying feature I noticed immediately, however, was the way the screen couldn't support itself at a useful angle. Also annoying was its inability to lie completely flat on the desk or on my knee, so typing was difficult. In the end I used my Mini Oxford Dictionary to prop it up — not exactly a long-term solution.

The backspace key sits directly below the on/off button and I often switched the thing off when I made a mistake. It's still too easy to mis-key on most handhelds, although this model is one of the better ones. If you do power off mid-sentence, though, there's no need to panic: when you switch on again you're back at the point where you left off. Power management means the machine switches off automatically after a certain amount of time. The CPU, screen and serial/parallel port are all shut down after a period of inactivity, which you can control in the System Setup.

Underneath the machine, two IC 68-pin card slots conforming to PCMCIA 1.0 sit on either side, along with an AC power connector, main and backup battery power compartments, and a PIO/SIO connector for an optional connectivity pack. This last allows you to connect your palmtop to a printer, mouse, external modem, external floppy disk drive and PC. The cost of the connectivity pack and IC cards with extra RAM were not available at time of going to press.

The system has an 8086 compatible microprocessor, 2.25Mb ROM and 1Mb RAM, divided into system memory and RAM disk. The ROM disk is designated as drive D: and the RAM drive C:.

The palmtop has built-in Personal Information Manager (PIM) software which consists of seven tools. These are: a clock, with the time in 68 cities around the world and room to add more; Schedule, for appointments within a calendar-style environment; phone book; business card record facility; calculator; memo editor and PC

link, for manipulation on local palmtop and remote PC.

I'm not convinced that it's necessary to have a business card facility as well as a phone book, but there it is. There are twenty categories for storing phone and business records, and you can store frequently used numbers in the Favourite list for quick reference and make some records secret. The scheduler is designed to help you organise your time, with monthly or weekly views of appointments, repeating alarms and more 'secret settings'.

The clock, memo editor and calculator options are standard. What makes this handheld desirable (for me, anyway) is Microsoft Works. This gives you the option of a word processor, spreadsheet and database within one application. The communications tool can be used to connect to on-line information services and exchange information with other computers. I've never worked on such a small scale before, but there are no immediate problems with the size; it's just a matter of getting used to the screen.

What it all comes down to in the end is whether it's worth burning your trusty Filofax and giving your portable PC to Oxfam. Mitac's handheld is certainly impressive if you really need a PC compatible machine this small. I know I couldn't give up leafing through my Filofax to see where I'd planned to meet someone next Wednesday, and I'd rather type on something without having to resort to a magnifying glass. But if you're keen on pocket computing on the move or in the boardroom, you could certainly do worse than this.

Catherine Eade

Mitac 1600A

Size

230mm x 120mm x 30mm

Screen

80 x 25 characters

Weight

550g

Memory

1Mb

Price

£399

Contact

Mitac (0952) 676676

Good Points Much more than a digital diary, expansion options good.

Bad Points Floppy lid.

Conclusion Good for a user of personal organiser-type machine wanting more functions.





Sycero from System C. The best thing on the programmer's menu

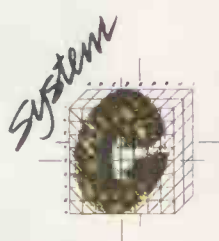
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Olivetti Quaderno

The Quaderno is a unique machine in that it was designed to bridge the gap between a notebook and a palmtop. When Olivetti launched it in the summer of 1992, it was one of the first machines, if not the very first, to be based on an A5 format.

The computer is DOS-compatible, but in practical terms it's probably not feasible to try running anything too heavy on it because it only has an NEC V20HL processor (equivalent to an antiquated 8086 CPU). Does this mean that we should wind it up to make it work? It also has 1Mb memory as standard, although this is soon gobbled up by the built-in applications when you start to load them.

Apart from its size, the main attraction of the Quaderno is the built-in voice recorder which enables you to use it as a sort of digital cassette, recording sound on the 20Mb hard disk which also comes as standard. The voice utility is better than one would think, packing in up to ten minutes of recording per megabyte.

Aesthetically, the Quaderno is superb. Whereas most PDA devices look dorky and seriously detract from your credibility if you use them anywhere other than the office, this machine looks the biz. On many occasions I have been in interviews which have reversed, so that I am questioned enthusiastically about my computer by wide-eyed marketing managers. Inset into the lid are six buttons which you can use to control the digital voice recorder, and there's a small LCD which either shows you

information on the recording or simply displays the time. There is also a PCMCIA 1.0 slot on the left side of the machine which takes the relevant RAM cards. On the right-hand side are the speaker, volume control, serial and printer ports, and headphone and microphone sockets.

When opened the machine shows its range of keys, which are arranged in standard PC keyboard style. Although the main keys are plastic, the function ones across the top are rubber. There is also a single rubber power switch inset into the top half of the keyboard.

The Quaderno's display could do with a bit of work, though. The primary problem with it is that it isn't backlit, so when I'm word processing I find it hard to find the cursor. The contrast control helps but doesn't redeem the fault.

The software provided with the machine is sufficient. You get a text editor, a calculator, a scheduler, a phone book, a file manager, an organiser and the voice recorder application. The latter enables you to mess around with voice files, moving them around and typing in comments about them. One of my favourite Quaderno features is the way it allows you to include voice annotations in the word processor. Having said this, however, I really don't think people will use this facility. Although the applications are there for such a feature, setting it all up is probably too tiresome to bother with.

The rest of the software is reasonable, apart from the organiser... which doesn't, really. It's essentially a card index file, which is something entirely different. The word processor does all

the normal cutting and pasting bits that you'd expect of a word processor, and the calculator trundles along in its own calculatory-type way. (It does have a strange Reverse Polish Notation calculation option, though, which is supposed to save memory when performing complex operations. Personally, I think it's a private perversion that a warped designer forgot to take out.)

The appointment calendar is very intuitive although a little inflexible. It only allows about sixty characters to be typed in to describe the appointment, so if you want to type in an address and a brief list of things to discuss, you'll have problems. The telephone book, meanwhile, is similar in layout to the appointments book. It displays an index to the right with individual record details to the left, and allows you to search for any string of text within any field.

As a PDA, the Quaderno seems to have hit just the right spot, looking attractive and functioning reasonably well. However, the processing power and memory are too low to load in many programs from other PCs. If you're using it simply as a PDA, that's fine, but just because it's DOS-compatible doesn't mean you should try running any demanding DOS software on it.

Olivetti is planning to launch an upgrade any time now, and although the company says that this one will be fairly mundane, we know that over the next year there will be some sort of device to rival the EO personal communications unit which is coming up for launch early next year.

Danny Bradbury

Olivetti Quaderno

Size

210mm x 148mm x 32mm

Screen

80 x 25 characters

Weight

1.5kg

Memory

1Mb

Price

£680

Contact

Olivetti 081-785 6666

Good Points Good looking, good size, voice recording.

Bad Points Processor could be meatier, screen too dark.

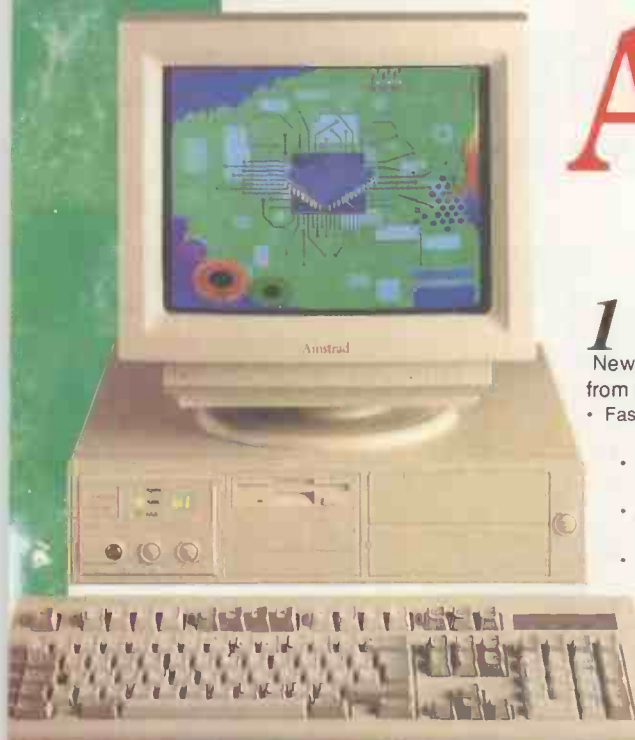
Conclusion A good buy, but wait for the next release 'real soon now'.



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Pen technologies

The pen will never replace the keyboard as the main human to computer interface, but for certain applications where fumbling with a keyboard won't do, pen-based computers are just the job. One of the machines reviewed here helps flight attendants, with a few strokes of the pen, take duty free orders from their thirsty charges. Imagine standing in the aisle with a keyboard computer: where do you balance it while you type?

All pen machines operate in the same way. A pen is used, like your finger on a touch screen, either to select and click boxes or, much more cleverly, to input written text. Internally though, pen computers use many different methods to read the pen input movements on the screen and even the pens themselves are different depending on the technology used. The old GRiDPAD and the now defunct Momena use a 'tethered' pen with a very thin transparent variable resistive layer of metal (often Indium Tin Oxide) applied to the screen. The pen has a copper tip and the tether makes the electrical connection. By measuring the voltage in the x and y axis, the position of the pen can be calculated and a dot (or line of dots) can then be displayed.

Another screen technology doesn't even need a pen: your fingernail will do. By using two layers of transparent variable resistor placed

over the screen, pressing on the top surface will squeeze the layers together to form a circuit. Again by measuring the voltage on each axis, the position of the pen can be established. The PoqetPad reviewed here uses this type of screen.

A more sophisticated pen reading system uses untethered (cordless) pens which can be passive or active (battery powered). Buried beneath the LCD panel is a grid of tiny coils which can be energised to produce an electromagnetic field or in turn can sense an induced field. A passive pen contains an inductive circuit which, when energised by the field emitted from the screen, can itself induce a tiny field in the matrix of coils. The coils are packed much more closely than the LCD resolution and the pen position can therefore be measured very accurately. Active pens can produce their own electromagnetic field, reducing the power consumption of the machine's display.

The inductive system has another benefit. By attaching a spring-loaded ferrite core to the pen's 'nib', the thickness of a line drawn on the screen can be varied. The pressure applied on the pen changes the frequency of the field and this is registered in the coil matrix. A thicker or thinner line results. All pen-based portables use LCD panels driven by standard controllers as the basis of their displays and in this respect the two pen machines reviewed here are

no different from the other machines in this Group Test.

Working out the position of the pen is one thing, but interpreting its movements is something else altogether. There are a number of character recognition software products on the market and it is always fascinating to watch your scrawled letters being considered by the machine and turned into real text. However, the main pen applications today concentrate more on tick boxes and 'radio' buttons, keeping slow and error-prone character recognition to a minimum.

Grid PalmPAD

When you first see the pen-based GRiD PalmPAD, you want to pick it up. It's one of those hi-tech, whizzy-looking gadgets that you immediately want to fire up and try out. The PalmPAD is designed to work in a tough environment and can withstand 439g while operating, the equivalent of a three foot drop onto concrete.

GRiD has been making pen-based computers since 1979 and this latest machine (only just shipping at the time of writing) is its smallest and most portable. It is not classed as a PDA, for organising your life and writing letters, but as a mobile computing device designed for data collection. You would use a PalmPAD for wandering around a warehouse checking inventories, or walking through a forest noting the condition of trees. Just strap it to your hand and off you go.

The PalmPAD measures 9in x 6.2in x 1.9in and weighs only 2.8lb. This is half the size and weight of a light notebook and this lack of bulk combined with its strap-on design makes it extremely easy to carry. It is built from tough black and grey plastic mouldings with a 6.5in diagonal pen-sensitive 640 x 400 pixel LCD screen occupying half the front face. The pen is clipped to the top of the unit but despite its connecting wire it is not a 'tethered' design. The inductive screen uses an active, self-powered pen (which takes two watch batteries), with a side button and a depressable pressure-sensitive stylus.

The front face also contains four buttons for suspend, backlight,



brightness and contrast. The sides are made of softer plastic, which helps secure your grip when using the machine. The top contains a PCMCIA slot and the bottom has ports for serial connection, charging and external keyboard. The tiny non-standard connectors and the PCMCIA slot are covered by heavy-duty waterproof rubber covers. The sculptured back of the machine contains an on/off switch, the NiCad battery pack and space for a modem as well as the adjustable strap. The overall look and feel of the machine is well engineered with a no-nonsense yet leading edge design.

The PalmPAD is based on a NEC V20 processor which can run at 9.54MHz or 4.77MHz. The machine has 2Mb of system memory and DOS 5.0 in ROM. The battery pack is claimed to run for eight hours with a one and a half hour charge time.

The display was rather indistinct in 'unlit' mode but switching on the backlight improved contrast and clarity enormously. Using the handstrap, the PalmPAD rests comfortably betwixt hand and forearm and is thus ideally positioned for use with the pen. The pen has a nylon stylus which, combined with the finish on the screen glass, provides quite a good pen to screen feel.

Booting the PalmPAD takes you into a DOS shell from which you can choose various menu options, from file transfer to entering DOS with an on-screen keyboard. The latter allows you to 'type' at the DOS command line using the pen but only a limited DOS command subset is available. Testing the pen-screen interface was difficult due to the lack of applications or character recognition software loaded on the machine, but the pen's selection action did work well on the shell options. Usable pen machines are still in their early days but the PalmPAD is getting there.

Fujitsu PoqetPad

Fujitsu's PoqetPad weighs only 1.2lb (a fifth of a light notebook) and its front face is practically all screen. While some question the future of pen machines like the PoqetPad, this Japanese computer giant has increased its share in Poqet (and now owns it outright) in a vote of confidence in pen computing. The brand name survives but the company, now just a division of its parent, has the new title of Fujitsu Personal Systems. Its only pen machine to date, the lightweight PoqetPad was announced in January 1992 and became available in May.

This easily handheld black plastic



device measures 9.6in x 4.5in x 1.25in and the 600 x 200 pixel LCD takes up a huge 7in x 3in. Above the screen a telescopic pen is attached by a nylon cord. The screen itself can display 80 x 25 characters. Described as a 'resistive film digitising tablet', it falls into the 'two variable resistive layers' category of pen technology. The pen is therefore dumb and you can, if you so desire, write on the screen with your thumbnail. Alongside the screen are contrast controls, a charging light, a type of menu bar of printed symbols along one edge and an 'on/off' button. (This last button does not completely power off the machine as the 640K RAM is kept alive at all times.) Around other parts of the PoqetPad casing are two PCMCIA 2.0 slots, a large combined parallel/serial connector, a DC input for charging, a reset button, a handstrap and a battery compartment. The machine will apparently run for 48 hours on just two AA sized batteries.

The PoqetPad is based on a NECV20HL (8088 equivalent) chip which can run at 7MHz or 3.5MHz. The machine runs DOS 3.3, held on its 1Mb ROM which also contains 'NestorWriter' character recognition software and MS mouse/pen emulation. Battery life is naturally important with portables and the PoqetPad has a power management feature which switches off the display and slows down the processor to save power when not in use.

By pressing the pen on the screen above the appropriate menu bar symbol, you can bring up different

built-in functions such as a graphical keyboard, handwriting trainer (to teach the software to recognise your script) and a character input. This latter feature uses the Nestor character recognition software to allow handwritten commands to be entered at the DOS prompt. It's fun but slow. The two PCMCIA slots are referred to as A: and B: drives, the ROM is regarded as drive C:.

The large (80-pin) multi-purpose connector can be used to access devices from printers to modems as well as provide power to a peripheral. This last function would be useful connected to a barcode scanner when on the move.

The review PoqetPad had one application (for airline flight attendants) already installed and this worked well by minimising handwritten input and making full use of simple tick boxes. Application development can be carried out using optional SDKs. These include GRiD's PenRight! which produces code in C, a more simple high level scripting language called PenPal or a dBase Clipper compatible product called PadBase.

Around £1500 will get you the PoqetPad, including run-time software licences and a couple of RAM cards. The machine works reasonably well in a neat, tough package which will withstand 100g operating shock. The display is just acceptable in text mode but fine when using bold graphics. It's a good start in the pen-based market.

Nick Edmunds

Poqet PC

Poqet first reared its head in May 1990. It was the first company to release a fully IBM compatible PC which was small enough to fit in your pocket. There are now lots of pocket PCs on the market and new ones are being released all the time. This is rather strange, as the market for them is diminishing and it wasn't very big to start with.

The Poqet is not enormous but it is one of the biggest machines in this test. The attractive black case (with red go-faster stripe) measures 220mm x 110mm x 25mm when closed and will open up to any angle revealing the large 70mm x 175mm screen. The 640 x 400 resolution means that displayed text is small, but this is better than only being able to see about two lines of text at a time.

The sleek and minimalist design of the exterior is not continued inside: the mixture of colours and symbols on and above the keys makes it look like a Fisher Price toy (many a true word spoken in jest).

The Poqet has a few advantages over many of the other PDAs in this Group Test. One is its keyboard, which is almost big enough to touch-type on, and it is certainly large enough to do the kind of two-finger typing of which I'm capable. Then there is the software — it's no good having a usable keyboard if you don't have usable software. The Poqet is supplied with WordPerfect 5.1 and Lotus 1-2-3 on PCMCIA 1.0 cards.

There is a full set of function keys which perform normally when running applications, but call up machine-

specific functions when pressed in conjunction with the 'Poqet' key. These functions range from power management controls (F4) to screen contrast controls (F6/F7) and keyboard lock (F5).

The function that qualifies the Poqet for this Group Test is obtained via the Esc key. This calls up Poqet Tools, a TSR program which is loaded into ROM when the system boots. It includes a text editor, calculator, communications program, diary and address book. These utilities are extremely basic, and if it was a choice between using Poqet Tools or the back of an envelope, the envelope wins hands down. Something like Borland's SideKick 2.0 on a PCMCIA card would be much more useful and most people would probably prefer it to Lotus 1-2-3.

Expansion is achieved through the edge connector and two drawers which hold RAM or ROM cards. The edge connector allows the Poqet to connect to a PC via a special cable which emulates an RS232 port, while the PQlink software supplied provides 115,200bps file transfer. There is also an optional external 1.44Mb floppy drive.

The RAM and ROM cards can be either PCMCIA 1.0 or JEIDA. Those currently available come in two forms: battery-driven static RAM cards (512K, 1Mb and 2Mb) and Flash EPROM (1Mb, 2Mb and 4Mb). Commercial software is distributed on the latter type to prevent you deleting it, and it is also much cheaper.

Power is supplied by two AA batteries, and if you aren't impressed by anything else about the machine then

you should be by the power management. Poqet claims that two Duracell batteries will provide 100 hours of use but I can't guarantee that to be true: you can't expect me to look at a screen like that for 100 hours.

The Poqet has undergone some changes since its release in 1990, but these have been slight and haven't altered the machine's appeal that much. The RAM has been increased from 512K to 640K and the ROM from 640K to 768K.

While the Poqet PC is PC compatible, it is only compatible with PCs that were laid to rest years ago; Poqet's dream of having a desktop PC in your pocket it's not. There are few modern applications that will run on the Poqet, and those that do are unlikely to be the same as the ones running on your desktop. For a project that started in 1982, the Poqet PC may have seemed like a good idea, but in the last ten years technology has raced ahead and left the Poqet way behind. In the age of the 486 and the Pentium, nobody wants an 8088 running at 7MHz.

The Poqet PC has a very limited future as it stands. The advances that have been made in hard disk sizes and capacity have led to PCMCIA 2.0 drives up to 100Mb, while Intel and IBM are working on a joint venture to produce a low-power PC on a chip based on a 486 processor. It won't be long before a machine the size of the Poqet will be capable of running Windows for 100 hours. Units like the Poqet will be obsolete by the end of next year.

Mat Beard

Poqet PC

Size

220mm x 110mm x 25mm

Screen

80 x 25 characters

Weight

540g

Memory

640K

Price

£799

Contact

Fujitsu (0895) 430001

Good Points Usable keyboard.

Bad Points The utilities are very, very basic.

Conclusion Underpowered and overpriced.



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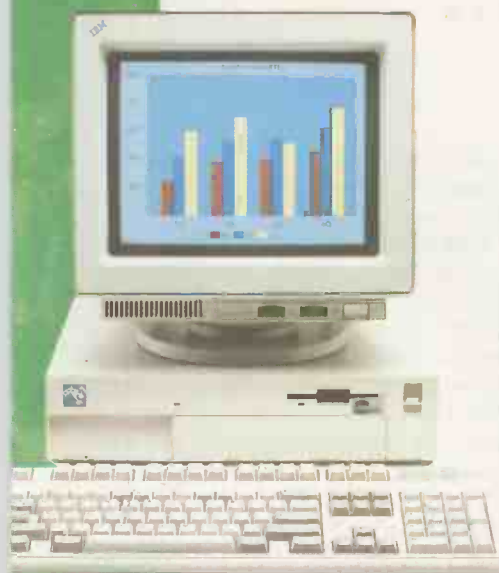
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Computer Systems Ltd. BB2 1EJ

Psion Organiser II LZ-64

Does anyone remember that classic Spectrum game, 'Horace goes Skiing'? Psion was wholly responsible for that. Back in the very early eighties, Sinclair commissioned Psion to produce loads of software for its new ZX Spectrum computer. Each machine came bundled with the timeless Horizons tape and those users who yearned for more could later acquire Flight Simulator or the curiously redundant VU-3D.

Those initial Spectrum games were responsible for my first encounter with Psion, but since then I've rarely run into them. Despite my personal lack of commitment, the company has scored massive hits with its range of electronic personal organisers, especially the Series 3 covered elsewhere in this feature. In fact, good old British Psion was one of the first on the market with the concept of a pocket computer. It all began several years ago with the Organiser, seen here in its most recent incarnation, the LZ-64.

Since its release in the mid-eighties, the Organiser has evolved internally but remained essentially the same on the outside. With the protective case fully slid on, covering the keyboard but paradoxically leaving the screen exposed, the 210g LZ-64 measures 5.5in tall, 3in wide and just over 1in thick. Sliding the case down to the reassuring click reveals the keyboard and extends the device a further three inches. Tugging a little harder disconcertingly removes the entire thing, although it quite happily clips back on again.

The 60mm x 20mm screen is possibly the smallest in the test with a mere 20 x 4 characters displayed. It's certainly not suitable for spreadsheets. The alphabetically arranged keyboard, with its 36 squidgy buttons, confused me, but I doubt anyone will be speed-typing on this kind of machine. However, you can use the machine one-handed by typing with your thumb.

Round the back are two covered slots for the Psion Datapaks. These provide additional RAM starting at 16K for £19.95 and going all the way to 256K at £149.95. The LZ-64, as its name implies, contains 64K of memory.

Hidden behind a sliding door at the top of the case is an expansion port. Psion provides various add-ons including a printer, RS232 interface and barcode reader. Power is provided by a single PP-3 battery, fitted in the underside. Overall the LZ-64 doesn't look dissimilar to one of those Tri-corders used by the crew of Star Trek to survey unknown worlds. It's certainly solid and feels like it could confidently survive any knocks in the field — even alien ones.

We have regions that could be described as unknown worlds on our very own planet Earth: I'm referring to none other than the shop floors of Marks and Spencer. Any eagle-eyed consumers out there may have noticed Psion Organisers being utilised by staff, presumably for chicken tikka stocktaking purposes. Apparently British Telecom also has over 20,000 units in current use for data collection by travelling engineers. In fact the Organiser is ideally suited to customisation, physically by numerous third parties or by pro-

gramming, using the built-in and imaginatively titled Organiser Programming Language, OPL.

OPL is like a cut-down BASIC without the line numbers, and in many ways it's not dissimilar to C. If any of the provided applications aren't entirely suitable, you can write your own. Before you reel in horror at the thought of programming an electronic personal organiser and grab hold of a pad and pen instead, there is the usual array of clocks and phone directories on offer. The world time feature is neat too. Not only does it include the names of the city and country, but it also has the international dialling code. Very handy.

All the applications are accessed from an initial menu and further options are presented in the same manner as subdirectories, so anyone familiar with DOS directories or the Windows File Manager tree concepts will feel at home. Notes may be taken in this manner by creating new folders into which specific items are placed. To complete the picture, there are comprehensive alarm facilities and of course a calculator with elementary scientific functions.

The approach of programming your own customised applications, along with the ruggedness of the Organiser II series, has made it a particular hit with organisations rather than individuals. Logical and serious, yes; user friendly, no. If you're part of a company looking for an efficient and safe choice in electronic organising, there's unlikely to be a better choice. After all, 20,000 BT engineers can't be wrong, can they? But if you're just after an easy to use diary/database, I'd look elsewhere.

Gordon Laing

Psion Organiser II LZ-64

Size

130mm x 75mm x 30mm

Screen

20 x 4 characters

Weight

210g

Memory

64K

Price

£136

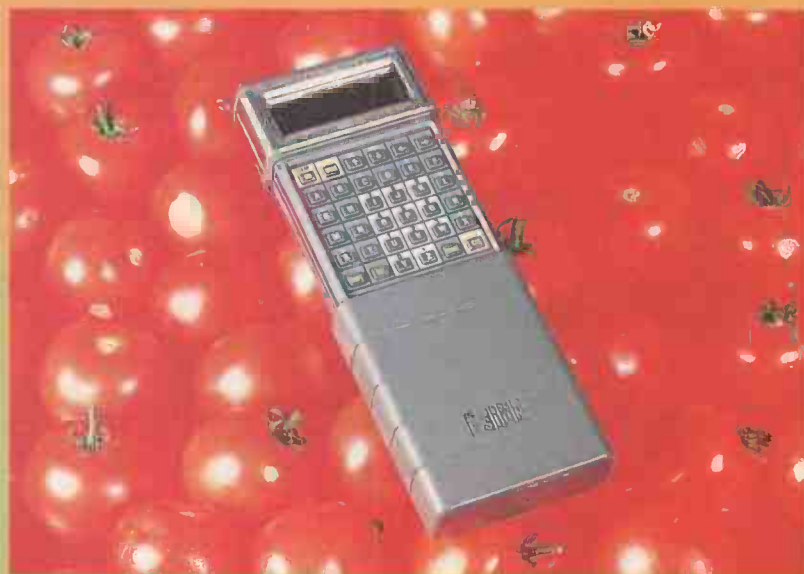
Contact

Psion 071-262 5580

Good Points Established and well-built.

Bad Points Small screen and lack of user friendliness.

Conclusion Ideal choice for company use only.



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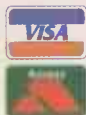
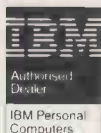


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Psion Series 3

Psion was one of the first companies to promote handheld computing and its Series 3 is still the handheld to have. It was launched in September 1991, which in this industry makes it pretty old. Although we expected plenty of exciting products to emerge from larger companies by now, much of the anticipated competition has failed to arrive.

The Series 3 has the usual assortment of built-in functions: a database, diary and word processor, plus accessories like a calculator with basic scientific functions, a world clock and a programming language, OPL, which you can use to make your own applications. To its credit, Psion includes a 250-page programmer's manual with every machine, although serious program writers would probably need more info. Several pieces of third party software are already available, plus Psion's own applications.

MSDOS was never designed for palmtops, and the applications that run on it these days tend to assume memory and hard disk configurations that are very costly to put into your pocket. The Series 3's proprietary operating system can run several applications simultaneously and switch between them instantly, despite having as little as 128K RAM and 256K ROM to work with. Applications are generally shipped on 128K Flash RAM cards, and I have found that I can store all the data I need to carry around with me on a single 512K card, with space to spare.

The merits of the OS also ensure that the applications written for it are some of the best I've ever seen on a palmtop.

It has a pull-down menu interface and the menu bar appears in any application when you press the Menu key.

The application that will probably be used most is the agenda, which is very flexible but easy to use. With it you can enter events, give them durations, set alarms and make them repeat daily, weekly, every weekday or even every seven years. It also includes a to-do list where each item can be given a numerical priority.

The word processor includes most of the features of Microsoft Word 5.0 for DOS, including outlining, line spacing adjustable in points, and headers and footers. There is limited WYSIWYG: you can see text as bold, italic or underlined (but only in a choice of three on-screen fonts), and aligned left-right or centre on-screen. Page breaks are also visible. It probably has more features than any text editor bundled with a palmtop (even a spell checker and thesaurus are now available), although you wouldn't want to type in documents more than a page long on the naff keyboard if you were on the move.

Palmtop keyboards are never really satisfactory, since they have to be squeezed into such a small area. The one on the Series 3 keyboard is, alas, no exception. Those with small fingers like myself can manage perhaps 35 words a minute, but this is slow in practice because the Psion's keyboard sometimes registers letters twice and sometimes drops them.

The database is a grand name for a common or garden text search filing system, but it is pretty fast. I can search an 811-record contact database in less than six seconds. (On average, of course,

it would take less than three.)

So far, so excellent but be warned, hardware reliability can be a problem. I've had to send my Series 3 to Psion for repairs at least four times in the last 14 months and other Psion owners have complained of similar problems. To be fair, though, the first two I had were early production units and the latest one has worked continuously for several months without complaint. Because data is stored on solid-state removable cards, even if the machine dies you won't lose much, if any, of it. If your dealer is understanding you can swap machines and be back at work right away. Two AA batteries and a backup lithium cell provide the power.

The only other drawback is the price. As with other handhelds, a fully featured system will cost more than you expect. If you plan to use it seriously, you want the 256K memory model which costs £213, especially if you are planning to buy the optional spreadsheet (£59). At least one Solid State Disk (SSD) is a good investment as well, since in addition to providing more storage space they give you a nearly indestructible removable place to keep your data in case your Series 3 stops working. A 256K Flash disk costs £59. If Flash disks aren't backed up and reformatted periodically they fill up, so you'll either need a second disk for backup or a serial link for another £59 to share data with your PC or Mac.

The total list price of a spreadsheet equipped Series 3, then, with a connection to a PC and a 256K Flash RAM card is £391 plus VAT. But it's worth every penny.

David Brake

Psion Series 3

Size

165mm x 85mm x 22mm

Screen

40 x 8 characters

Weight

240g

Memory

256K

Price

£205

Contact

Psion 071-262 5580

Good Points Excellent software.

Bad Points Naff keyboard, can be unreliable.

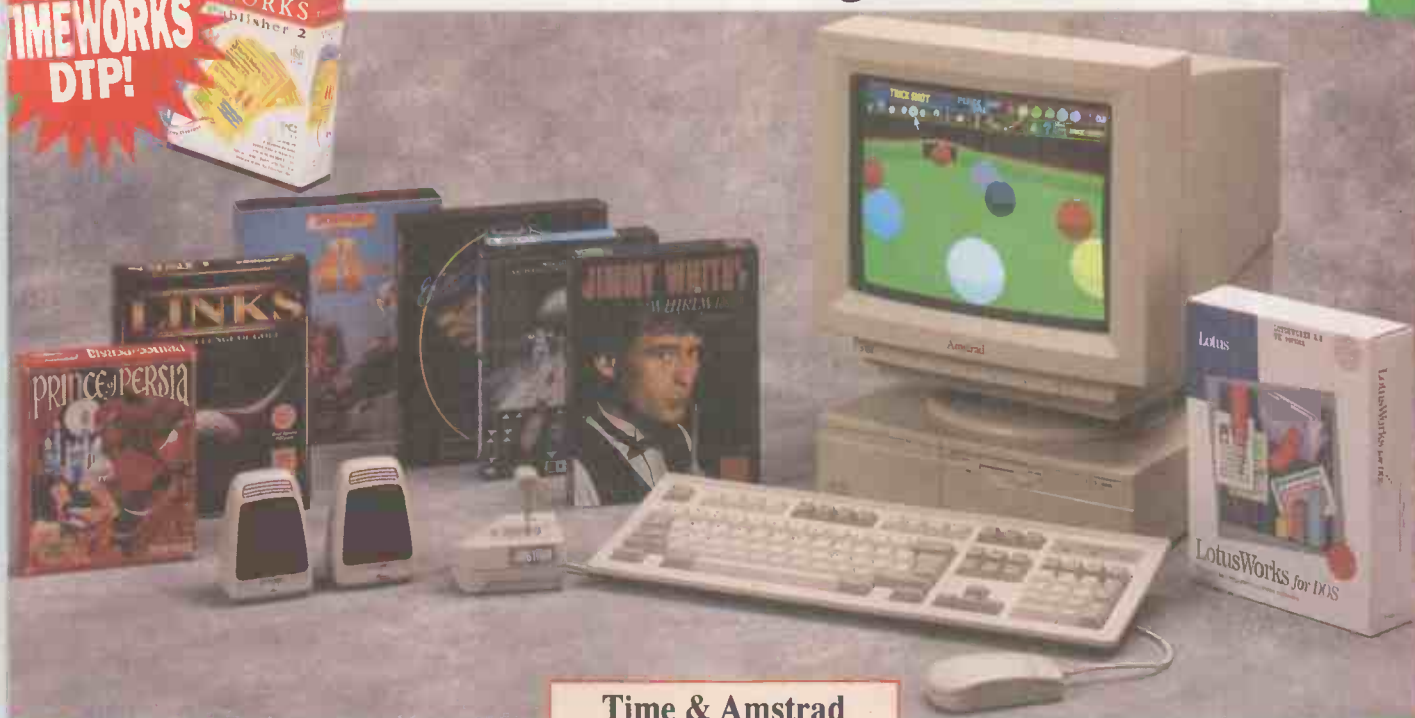
Conclusion The best available pocket machine for the next year at least.



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A PDA in the hand...

Unlike previous Group Tests, there were no tests or benchmarks run on any of the machines reviewed here. They were all so different that finding some technical ground on which they could be compared was impossible. Our only criteria were that they had to be smaller than A5 and sport some kind of memory which could be written to. Already you've seen the flaw in our plan: the optical disc-based systems are read-only, the pen-based ones are larger than A5 and the portable CD-i fails on both counts. These devices offer specialised and quite different facilities from the diaries and organisers; consequently, they are considered individually on their own merits. The features of the remaining 11 are similar enough for them to be considered as a group, but since the prices and designs vary so considerably we'll cover their pros and cons one at a time. All prices are excluding VAT.

The Atari Portfolio at £150 is a bargain compared with the identical £400 DIP machine covered in the last PDA test [March 1992]. It runs fairly convincing DOS, is sturdy and has a promising future in expansion. Shame about its looks, though.

The SF-R20 is classic Casio design: lots of buttons and symbols everywhere. There's a great variety of applications on-board including an adequate spreadsheet. At £222 it's not cheap but it's recommended if you're after good overall facilities in a neat case. The smaller SF-9300 offers comprehensive diary facilities and little else. It's very compact, but again at £140 it's pricey. Neither of the Casios offers DOS or a programming language, but they can communicate with your PC via an optional adapter.

Hewlett Packard's 95LX boasts genuine Lotus 1-2-3 and DOS and doesn't look dissimilar to the lovely Psion Series 3. But at £339, even with these features it's overpriced.

If you're looking for something a bit different, then the Microwriter Agenda is ideal. It may not have a spreadsheet or a large screen but for note-taking it rules supreme with its unique 'microwriting' facilities. For £195 you get a good filing system and a neat looking machine that will surely be a talking point when produced at the dinner table.

The Mitac 1600A is pretty much a self-contained computer, complete with DOS 5.0 and even a copy of MS Works. The screen is large and you could even attempt to type quickly

on the keyboard. Excellent for £399. Sadly, not so for the similar-looking Poqet PC which, despite including WordPerfect 5.1 and Lotus 1-2-3 on cards, doesn't represent value for money at £799. Poqet recommends the machine for corporate use rather than for the individual and it's worth bearing this in mind.

Psion's £136 LZ-64 Organiser II is established if nothing else. Thankfully it also sports a programming language to accompany its logically utilised diary facilities. The Organiser really has carved a niche for itself in customised company environments but as a consequence it isn't everyone's cup of tea as a standard pocket assistant.

At £680, it's a good job that the Olivetti Quaderno runs DOS and has a usable keyboard, a big (but not backlit) screen, digital voice recording facility and great looks. The processor is undoubtedly slow but the Quaderno is a complete A5-sized notebook computer.

Also at £680, the Sharp PC-3100 is supposed to be a complete, small, notebook computer; indeed it comes with DOS and has a useful laplink facility. But the screen isn't up to much in low light, the keyboard's not as good as on proper notebooks, and it goes through batteries as if there were no tomorrow. The first two

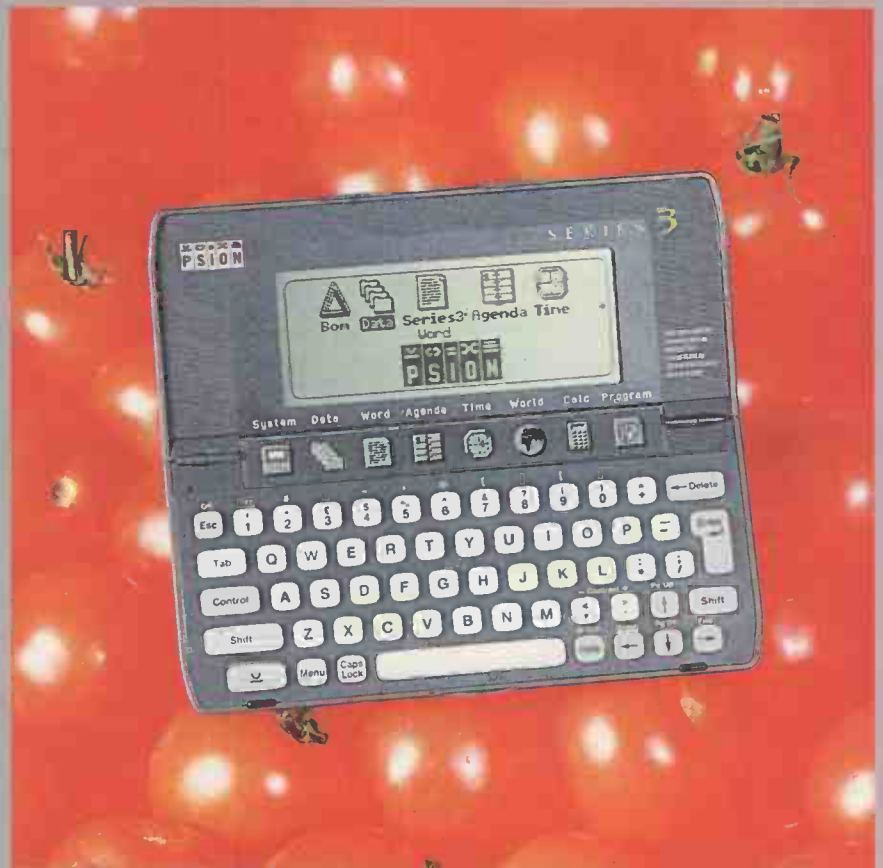
points are common on the smaller PDAs and are expected in something their size, but the Sharp has notebook aspirations.

Despite the fact that everyone looks for something different in a PDA and the manufacturers cater for this diverse demand, we do have an overall winner. Congratulations once again to **Psion** for its eternally popular **Series 3**. No DOS, I'm afraid, but it's got great software and even some third party developments, a programming language and superb looks all for £205. (Just under £60 extra gets you the spreadsheet.) You've probably seen the advertisements, now buy the T-shirt.

While it's true to say that the Series 3 has gained a reputation for being rather temperamental in the past, all the problems seem to have been ironed out. The machine opens out into the perfect angle for typing and viewing, and touch-sensitive buttons for different applications running beneath the screen add to the overall user friendly feel. And as our reviewer pointed out, Psion is a British company so our hearts should swell with pride.

So, for many reasons, the Psion Series 3 receives our **Seal of Approval** for the second time running. I'm writing to Santa today...

Gordon Laing



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The UK's Best Notebooks

PC Magazine

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PC User

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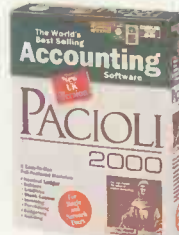


The Best Business Software

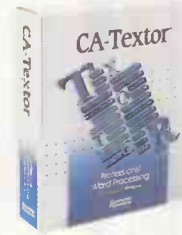
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Sharp PC-3100

The Ford Escort was a phenomenal success. Like almost everything else in the car industry in the seventies and eighties, it evolved from a cheap and cheerful rear wheel drive family saloon to a well-equipped and well-built rep-mobile.

When it came to redesigning it for the fourth time, Ford did something radical: it went to its customers and asked them what they wanted. They, unsurprisingly in this increasingly eco-conscious society of ours, eschewed handling and performance and asked for safety and comfort. Ford listened to them. The result was an evolutionary shape — bland, but inoffensive — and a class-beating interior. The motoring press slated this car like no other before and the customers stayed away in droves. Why? The engines were gutless and the handling soggy.

You have to ask people what they want. You have to be prepared to accept that they may not want what you thought they wanted. But you also have to accept that they may not know what they want. Ask people exactly what they want from a pocket PC and a large percentage will say they need DOS compatibility. Machines like the DIP/Portfolio, the Poqet and the PC-3100 exist to meet those people's requirements. (DIP, incidentally, was responsible for the operating system and much of the design of the original PC-3000, which differs from the PC-3100 only in the size of its memory.)

The problem is, when they're faced with the poor performance, poor software and design compromises that DOS

compatibility forces on the designers, most will point out that this isn't what they wanted. And the Sharp PC-3100, for all its impressive spec and good early reviews, isn't what people want. Yes, a DOS compatible with a full keyboard that runs off three AA batteries for ten hours or so seems like an ideal travelling companion.

But there are one or two problems. The 8-bit processor and CGA display restrict you to running old, character-based DOS applications. That might not have been a problem a couple of years ago, and indeed it shouldn't be a problem now, but with the popularity of Windows, the Macintosh, OS/2 *et al*, who wants to go back to WordPerfect for DOS?

Does it really matter if you only use the PC-3100 on the move? No, it shouldn't. Most of us could, if we could be bothered, make do. But history shows we won't. Besides, there are more fundamental problems with the PC-3100. The screen is one. A CGA display with no descenders on its ill-defined character set would have been bad enough in itself. The lack of a backlight and the tiny cursor make the thing impossible to use in all but the most favourable lighting conditions.

Even then, the default cursor is so small that as soon as it moves from the end of the line you're working on it disappears. You can change the cursor size using any one of a dozen PD utilities, but that's hardly the point. Graphics aren't much better either. The PC-3100 uses the standard pixel flickering system to produce shades of grey, but you've never seen flicker like this.

The keyboard looks good, at first

glance. Try using it in the dealer's showroom or on your lap and you'll be surprised at the ease with which typing, or even touch-typing after a fashion, can be accomplished. Try using it on the train and you'll discover just how much easier a full-size keyboard makes life. If your fingers wander by a millimetre or so on a normal keyboard, at least you still hit the target...

So, we've got a feeble processor, a poor screen, and a keyboard barely fit for its purpose. Does the PC-3100 have any redeeming features? Well, the screen on a Psion Series 3 is smaller and similarly non-backlit. The Series 3 has a less complete keyboard which is harder to type on, yet everybody seems to love it.

The reason for the success of the Series 3, and ultimately for the failure of the Sharp, is the built-in software. Sharp gives you everything you would expect: diary, notebook, calendar, to-do list and more. It even provides these features as a pop-up utility suite that will work happily in conjunction with your standard DOS applications. The problem is, they are so badly put together that the interface is inconsistent, and they are so unproductive that you could barely bring yourself to use them.

If you must have a PC-compatible pocket PC, the Sharp is no worse than most. Go for the PC-3100 because the extra memory, used as a pseudo drive, does at least enable a couple of more frugal DOS applications to run — and you get two Flash cards, the biggest you can find.

For all its faults, the Escort is Britain's best-selling car...

Guy Swarbrick

Sharp PC-3100

Size

222mm x 112mm x 25mm

Screen

80 x 25 characters

Weight

280g

Memory

1Mb

Price

£680

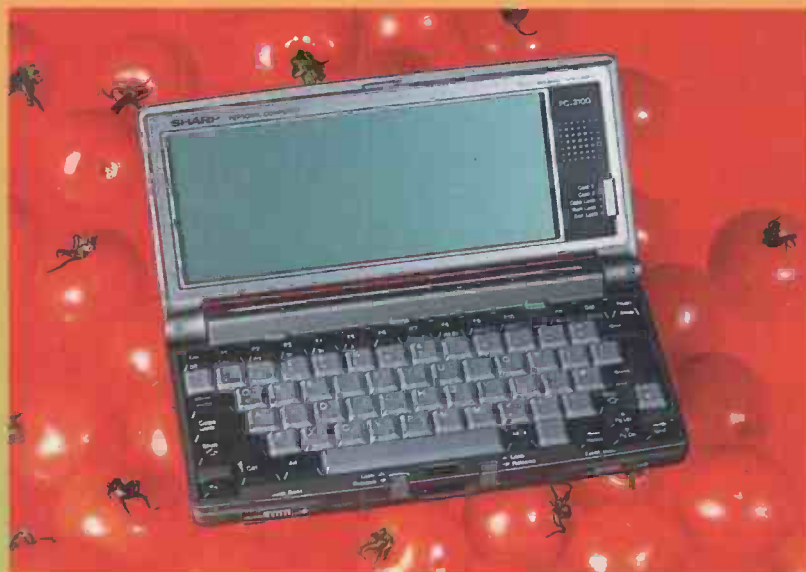
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Conclusion The result of exhaustive market research...



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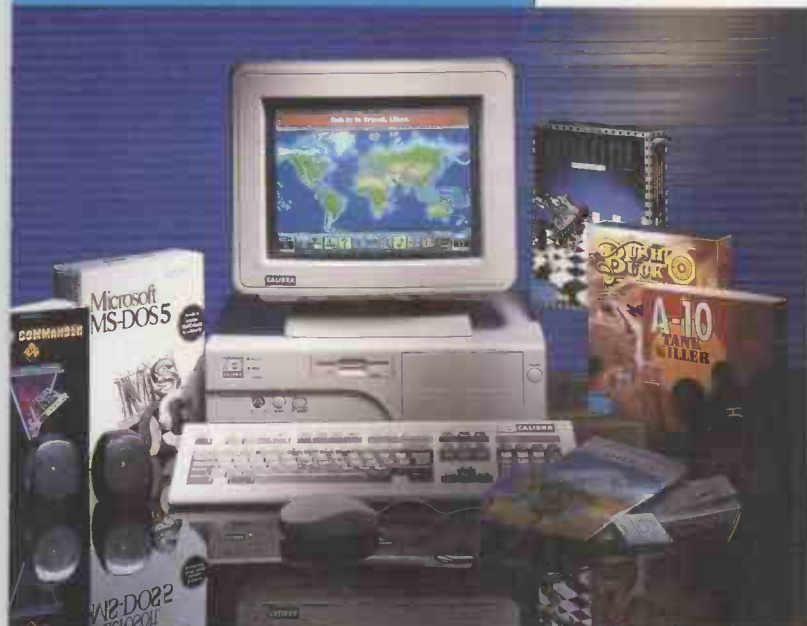
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Sony DD1-EX Data DiscMan and electronic books

If you want a high resolution display in a portable format with pictures and text, you could do worse than buy a book. Not a Sony Electronic Book but a real paperback. A real book has advantages over an electronic one: its batteries never go flat, its resolution is infinite and the contrast ratio is better than even monochrome TFT can manage. What it can't do is present you with just the information you want, or speak to you.

And this is where an electronic book comes into its own. The actual book is heavier than a paper version but the disks are small and will cram 200Mb into a cartridge which is the size and thickness of two floppy disks. With a couple of disks you are rapidly ahead of the paper equivalent. You do have to find two disks you want, but that is a separate problem which we'll come to later.

For the upwardly mobile bookworm, the Sony DD-1EX looks like a pregnant version of a standard DiscMan but direct comparison reveals that it will only play 8cm discs and so is a bit narrower. Its height gives it an old-fashioned look and a glance through the glass in Tottenham Court Road reveals that audio DiscMans have become much thinner: one model is the same height as the crystal cases which house the CDs on your shelf. So at 108mm x 43mm x 159mm, the Data DiscMan is chunky.

The increased surface area provides housing for a selection of ports, knobs and buttons, as befits a machine which combines a computer with a CD-ROM drive. The play and stop buttons double as on and off switches and the hold lock disables these buttons to prevent a hapless commuter from switching the machine off by mistake. (Fast forward, rewind and volume controls only make sense when playing audio CDs.) One side has a socket for the

shaky, composite video out, while the other takes the headphones and power jack and has a contrast control for the LCD screen. That screen is inside. It measures 67mm x 56mm and with its ISO 8859 font (8 x 16 spindly pixels) it can display ten lines of 30 characters. It is backlit, but to stretch the rechargeable NiCad to its full two and a half hours you'll have to do without this facility.

Pressing the catch to open the lid reveals the screen, a QWERTY keyboard which is every bit as unusable as it looks, and five function keys. The keyboard lacks a space bar, so this function is catered for by pressing cursor right on the joypad-like cursor pad. Deleting is also catered for by cursoring back over your text and up and down takes you between fields. If all this sounds like a GUI from hell it's not quite that bad, but it's close. A large, friendly button says Yes, while a smaller, rather less friendly one says No.

The overall effect is inescapably *Hitchhiker's Guide to the Galaxy*. Lifting the keyboard, Bacon Double Cheeseburger style, reveals a second layer and ejects the disk. This is protected in a caddy with a metal shutter, although occasionally it misses and the whole lot jams. Audio CDs can be fitted into a special caddy or played on the machine naked. There are four audio playing modes: straightforward play, repeat a section, all repeat and shuffle.

The machine is desperately weak in trying to resolve its schizophrenic nature. It either wants to be a data retrieval device or play music: it can't do both. That will come with the next generation of Sony players but for the moment you have one or the other. I was especially disappointed by the lack of a soundtrack on the multilingual dictionary. A man from Sony says this is because the player can't cope with pulling sound and video from the disc but that later machines will be able to do this. His defence was that no software supported this mini-multimedia. I suspect the lack of a player may have influenced the software house in this direction.

The book is very much query-

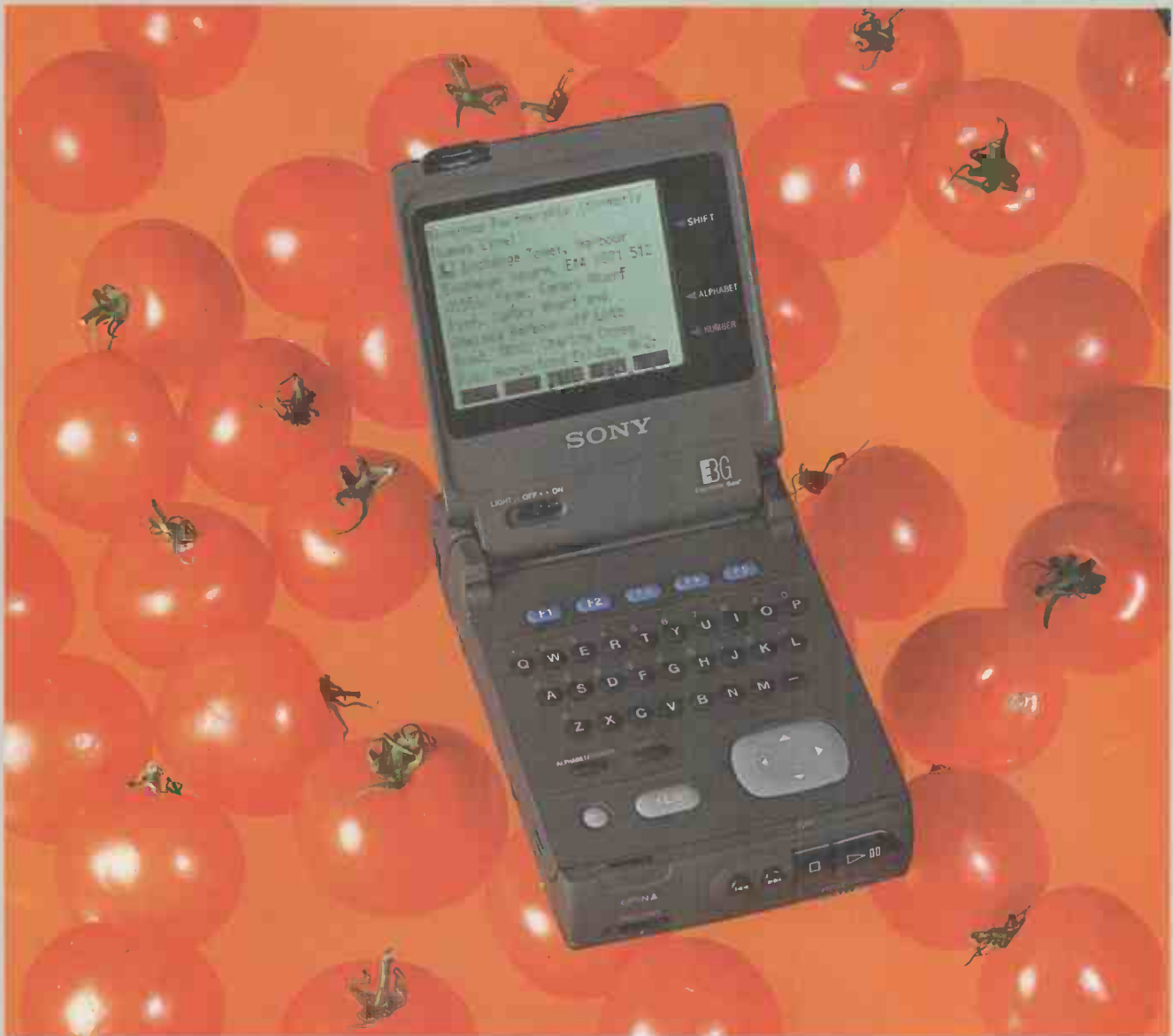
based. You type in a string and it matches, or as often as not fails to match, the text. It is very crude and the lack of a browse makes it more of a novelty than a useful tool for most people. I understand that in Japan it is a popular device among translators, but for ordinary people there is little software.

The machine is supplied with three discs as standard but the review model came with four, including the Time Out Guide to Eating in London. It suffers badly from the 'Harmless' effect, by which our whole planet was summed up in *The Hitchhiker's Guide* in a single word. None of the pubs and restaurants get much copy, I didn't find any damning reviews and some of the places receive sparse coverage: no Italian restaurants in Golders Green for instance. I'd also worry about spending £40 on a disc with prices which are subject to change.

I was even more disappointed by the Chambers Science Guide, which seemed a little out of date. Asking about references to 'Transistor' produced a screen of data, while asking for more modern things like 'Intel' yielded nothing. Things got worse with *The European Golf Guide* which was very light on information about holes. I would have hoped for a description and maybe a diagram of each hole but information on minor courses was limited to '18 Holes'.

But my greatest disappointment was reserved for the multilingual dictionary. I know enough about natural language translation to realise that it's unrealistic to expect to type a string in and get a sensible translation back, but it should be possible to do something more useful than a hunt and peck at individual words. There is a motto mode, but it's merely interesting. There is so much scope for the software, it could be much much more than a paper book, and it is all unexploited.

Sony is not the only company to have an electronic book; Sanyo has a player on sale in Japan, which may be destined for these shores, while Panasonic has recently launched the KX-EBP1. The latter conforms to the same text and graphics standards as the



Sony DD1-EX, as well as the new EB-XA sound, text and graphics standard which is also supported by the new Sony DD-10 (which was not available for review).

The Panasonic is similar to the Sony but is wider with a bigger screen. By necessity, the keyboard is similar in design but it copies the titchy size of the Sony one. It also offers roman and sans serif fonts. While Sony remains coy about the processor in the DD-1EX, Panasonic is happy to reveal that its player uses a V20, NEC's licensed clone of the 8088. The Panasonic measures 150mm x 53mm x 127mm and weighs 830g. It is supplied complete with headphones and a cable to connect to a NTSC or PAL monitor.

With two major players in the

market, the future looks a bit brighter for electronic book publishing. More than 74 publishers have joined the International Electronic Book Publishers Committee (IEBPC) and in the UK electronic publishers have formed the Electronic Book Committee of the United Kingdom. Worldwide, 15 different companies have taken out licences to make players but many are probably waiting to see what happens with the recordable Mini-Disc format launched by Sony as a new music format to compete with Philips' DCC.

Electronic books are suffering badly from the chicken and egg problem of introducing any new format. Until the software problem is cracked with a must-have killer application there will

only be limited demand. Both Sony and Panasonic see translation as the key but the multilingual dictionary is so far off being adequate it is a waste of time. With some serious investment in software, things could be very different.

The alternative market is a vertical one. If the device were aimed at pharmacists, record shops or bookshops, or anyone who needed regular updates of stock lists and didn't want to buy a microfiche reader or computer and CD-ROM drive, then this is ideal. Sony and the IEBPC will offer anyone with any electronic book proposal a lot of support. *For more details contact Sony on (0784) 467000 or Panasonic on (0344) 853683.*

Simon Rockman

CD-i on the move

Although it doesn't really belong in a group test of pocket organisers, Philips' as yet unreleased portable CD-i player provides a glimpse into the future of these devices. Along with products like Sony's Data DiscMan, featured on page 334, it shows just how advanced transportable technology can be.

At first glance the CD-i 360 is a smart-looking beast, finished in the dark coating that matches most hi-fi components. The unit is split into two parts, a full-colour 6in Thin Film Transistor (TFT) non-passive video screen and the CD player, which are held together at the back by a strong hinge. When closed, it isn't pocket-sized but it will easily fit inside the average briefcase, so in theory you could use it on the train without any problem. Dealing with curious stares from other passengers is, of course, another matter.

External controls include brightness and contrast, volume for an in-built speaker, an eject button that pops the lid off the CD player, and a set of interaction buttons. The interaction controls comprise a small eight-way joystick for moving a cursor about the screen, and two buttons marked I and II which are for selecting options. The pad and buttons are quite

stiff, making them difficult to use at first, but continued pressing is likely to make things more comfortable.

An 8-pin round socket that acts like an RS232 can be found on the back, with an even more intriguing expansion connector. This allows the unit's features to be upgraded in the future, and the first peripheral available to fit it will be a Full Screen Full Motion Video (FSFMV) module. With this fitted, the player will be able to make use of discs with up to 72 minutes long digital MPEG video recordings stored on them.

The inside of the player is by far the most interesting aspect, if only because of the sheer amount of hardware crammed into the space. The portable offers every feature available on the large standalone unit currently selling for £499 in high street shops such as Alders, Laskys and Harrods.

At the heart of the unit is a Motorola 68070 16/32-bit processor, a variation on the 68000 used in computers such as the Mac Classic, the Commodore Amiga and the Atari ST. Running at 15MHz, it features advanced serial communication capabilities as well as all the usual features and functions you expect to find on a CPU. Backing this up is a positive horde of custom

chippery dedicated to video and audio, the latter being handled by a Philips' SA730.

This chip is a 16-bit Bitstream Adaptive Differential Pulse Code Modulation (ADPCM)

digital to analog convertor, as found in some of the company's high-end CD audio products. It provides the kind of crystal clear sound we've all come to expect, although the internal speaker isn't going to do the system any justice. The hardware can fully reproduce music, speech, sound effects, and in fact any audio you can put on a compact disc.

The video side of things boasts 1Mb RAM, a palette of 16.7 million colours and a maximum resolution of 768 x 560 pixels. Images displayed at this resolution, such as Photo-CD pictures, are extremely impressive. There are three main display modes: CLUT, RGB and Delta YUV, each suited to specific applications and used in a different way. The first works in a similar fashion to a VGA adapter, with a maximum of 256 colours on screen at any one time. The second allows for 32,000 and the last can be used to get the whole job lot, but more CLUT than Delta YUV images can be stored in memory and on disc.

The software built into the unit gives a full point and click interface to control audio, CD-i and Photo-CD features. The audio side gives a simple track selector and a Favourite Track Selection (FTS) routine, and information for the latter can be saved to a small EPROM. The CD-i section lets you execute a program disc and interact with it, which could mean anything from walking around the Smithsonian Museum in Boston and playing with its exhibits to learning about the lives of Mozart and Beethoven or the history of Golf. When a Photo-CD is inserted into the drive the user can view images, zoom in on them and flip them.

At present, the CD-360 is being aimed at the corporate market. The idea is that companies will record client presentations with whizzy graphics and astounding soundtracks on disc. Whether this idea will catch on remains to be seen, but the consumer interest in the product is certainly high.

Philips is estimating an RRP of £1299, and the company claims it is already receiving orders left, right and centre.

Philips is on (0800) 885885.

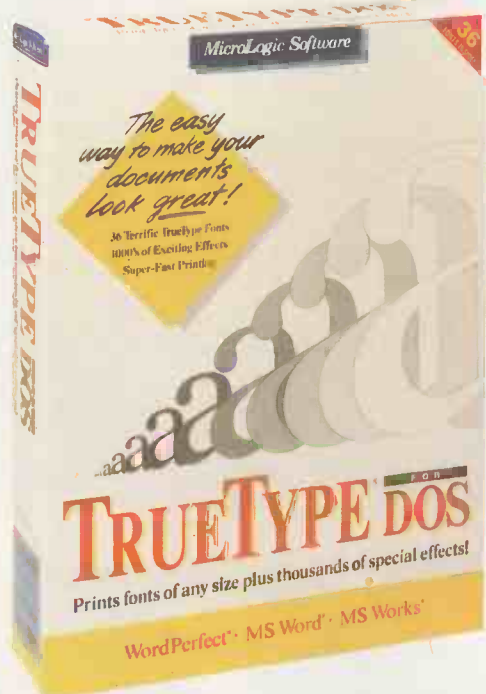
Chris Cain



Use TrueType fonts in DOS without the need for Windows

*using non-Windows versions of WordPerfect, Word, Works, LetterPerfect and PlanPerfect
in combination with*

TrueType FOR DOS



TrueType for DOS £69.95

Plus £5 p&p + VAT

Total Price = £88.07

Using the same TrueType font scaling technology used by Windows 3.1, TrueType for DOS allows any TrueType fonts to be used from within DOS WordPerfect, MS Word, MS Works, LetterPerfect and Plan Perfect. Using the normal method for selecting type styles in the word processing software, TrueType for DOS gives the user practically unlimited access to a wide range of affordable high quality fonts with the additional ability to produce some 50,000 possible effects including combinations of outline, reverse, shadow, shading and background patterns. Text can be scaled from 2 to 999 point and only those characters used are sent to the printer producing blindingly fast output.

Printers supported by TrueType for DOS include the complete HP LaserJet range from the LaserJet Plus onwards; all the HP DeskJets and PaintJets; the Canon LBP-8II, III and 4; the Canon BubbleJets and just about any dot matrix printer.

To use such software does not require a high spec PC either, an IBM PC, XT, AT, PS/2 or Compatible with 640K memory is all that is required to run TrueType for DOS provided the machine has a hard disk with at least 3MBytes of free space.

150 Quality TrueType fonts £69.95

Plus £5 p&p + VAT Total Price = £88.07

For use with TrueType for DOS and Windows 3.1 this high quality set of 150 TrueType fonts gives you all the outlines you're ever likely to need. Ranging from the classic body text styles through to decorative outlines each font in the Quality TrueType font Pack contains the complete ANSI character set. The data contained on the disks is uncompressed and therefore each font can be individually loaded without the need to run an installation program.

Laser Solutions supplies many laser related products - call for a catalogue

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WordPerfect, LetterPerfect and PlanPerfect are trademarks of WordPerfect (UK) Limited
Windows 3.1, MS Word and MS Works are trademarks of Microsoft (UK) Limited
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150 Quality TrueType fonts

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Plus £5 p&p + VAT


Total Price = £123.16

Laser Solutions Limited

3 Brownlow Road, Redhill, Surrey, RH1 6AW
Tel: 0737 778114 Fax: 0737 778090

PERSONAL DIGITAL ASSISTANTS

Machine	Processor	Internal RAM	Storage Options	No. of keys	QWERTY	Chars on screen	Screen Size	Dimensions	Weight	Batteries
Atari Portfolio	80C88	512K	IC cards	63	Yes	40x8	115x40mm	190x89x25mm	453g	3AA, 1 cell
Casio SF-9300	Proprietary	64K	IC cards	60	Yes	32x6	90x30mm	143x79x17mm	164g	2 CR2032, 1 cell
Casio SF-R20	Proprietary	256K	IC cards	72	Yes	40x10	120x42mm	180x97x21mm	285g	2AAA, 1cell
Hewlett Packard 95LX	V20H	512K	PCMCIA cards	72	Yes	40x16	120x50mm	160x86x24mm	303g	2AA
Microwriter Agenda	6303	128K	IC cards	54	No	20x4	70x20mm	180x85x20mm	275g	4 lithium cells
Mitac 1600A	8086	1Mb	PCMCIA cards	78	Yes	80x25	183x71mm	230x120x30mm	550g	4AA, 1 cell
Olivetti Quaderno	V30HL	1Mb	20Mb HD, PCMCIA cards	94	Yes	80x25	144x106mm	210x148x32mm	1.5Kg	6AA, 1cell
Poqet PC	80C88	640K	PCMCIA cards	77	Yes	80x25	175x72mm	220x110x25mm	540g	2 AA
Psion Organiser II LZ 64	6303	64K	2 RAM Datapaks	36	No	20x4	60x20mm	130x75x30mm	210g	1 PP3
Psion Series 3 	V30H	256K	Flash RAM cards	58	Yes	40x8	95x35mm	165x85x22mm	240g	2AA, 1cell
Sharp PC -3100	80C88A	1Mb	PCMCIA Cards	77	Yes	80x25	175x68mm	222x112x25mm	280g	3AA, 1 cell

Machine	Diary	Text Editor	Spreadsheet	Database	World Time	Calculator	Comms Option	Other	Price (excl. VAT)	Contact
Atari Portfolio	Yes	Yes	Yes	Yes	No	Yes	Optional serial and parallel	DIP OS, AC adaptor	£ 149	Atari (0753) 533344
Casio SF-9300	Yes	Yes	No	Yes	Yes	Yes	Optional PC interface	None	£ 140	Casio 081-450 9131
Casio SF-R20	Yes	Yes	Yes	Yes	Yes	Yes	Optional PC interface	None	£ 222	Casio 081-450 9131
Hewlett Packard 95LX	Yes	Yes	Yes	Yes	Yes	Yes	Terminal emulator	DOS, Lotus 123	£ 339	Hewlett Packard (0344) 361600
Microwriter Agenda	Yes	Yes	Yes	Yes	No	Yes	PC & Mac options & port	Microwriting	£ 195	Microwriter 081-715 1023
Mitac 1600A	Yes	Yes	Yes	Yes	Yes	Yes	Connectivity pack	DOS, MS Works	£ 399	Mitac (0952) 676676
Olivetti Quaderno	Yes	Yes	No	Yes	No	Yes	Serial & parallel port	DOS, digital voice recorder	£ 680	Olivetti 081-785 6666
Poqet PC	Yes	Yes	No	Yes	No	Yes	Optional RS232	DOS, Lotus 123, WordPerfect	£ 799	Fujitsu PS (0895) 430001
Psion Organiser II LZ 64	Yes	Yes	No	Yes	Yes	Yes	Optional RS232	Programming language	£ 136	Psion 071-262 5580
Psion Series 3 	Yes	Yes	No	Yes	Yes	Yes	PC & Mac options	Programming language	£ 205	Psion 071-262 5580
Sharp PC -3100	Yes	Yes	Yes	Yes	No	Yes	RS232C port	DOS, multi-lingual capacity	£ 680	Sharp (0800) 262958

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DON'T TAKE CHANCES ON QUALITY

Convenient
750mm (29") height
with 675mm (26½")
keyboard shelf, and
plenty of knee-room

Roomy 906 x 466mm
(36 x 18½") top



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QUALITY...

Some of the finest quality proven components from suppliers like NEC, Citizen, Intel, Seagate, Paradise and Mitsubishi have been carefully selected to achieve a high performance product that is built up to a high quality, not down to the minimum cost.

OUR SECRET IS SERVICE...

In a recent poll the readers of *Computer Shopper* magazine voted *Evesham Micros* joint winner of "Best Customer Service" award. Need we say more? Our customers have done it for us.

CUSTOMER CARE...

Don't forget that *Evesham Micros* has been looking after its customers for over nine years, has won several consumer awards and intends to win more. An example of our attention to detail is that we never charge credit cards until the goods are actually despatched.

READY TO RUN...

All our systems have been fully 'burned in' and subjected to a rigorous test procedure. We even format the hard disk and load DOS and Windows so that you can get down to serious business without delay.

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Our face-to-face retail experience has made us never forget that *the customer comes first*. That's why we offer such a vast range of hardware and software at competitive prices.

FAST DESPATCH & DELIVERY...

We endeavour to despatch all orders as quickly as possible. To this end, we try to maintain a buffer stock of popular configurations to be shipped immediately. Others we aim to despatch in days, not weeks. All systems are shipped by *EXPRESS COURIER* at no extra charge.

FIRST CLASS WARRANTY...

Our guarantee is quite simple, but very friendly. All PCs include on-site maintenance; 1 year for the *Prestige* range and 2 years for the *Premier* ranges. They also include lifetime warranty on labour (return to Evesham) and extendable on-site maintenance at realistic prices.

30 DAY MONEY BACK GUARANTEE...

We are so confident that you will be delighted with your Vale PC that should you, for any reason at all, find that it does not satisfy your needs, we will *COLLECT* it and refund your money in full.

Which Vale PC suits your needs?

All Vale PCs are built to a standard that is causing concern to many of our competitors. At no stage is quality of performance or construction compromised for outright economy reasons. We could build and sell all models at a lower cost without any problem, but that would not be true to our objective. The Vale range has always been planned as "more than just a great price" and we therefore insist on using quality components from reputable suppliers, rather than those of lowest cost.

Prestige ...economy without compromise

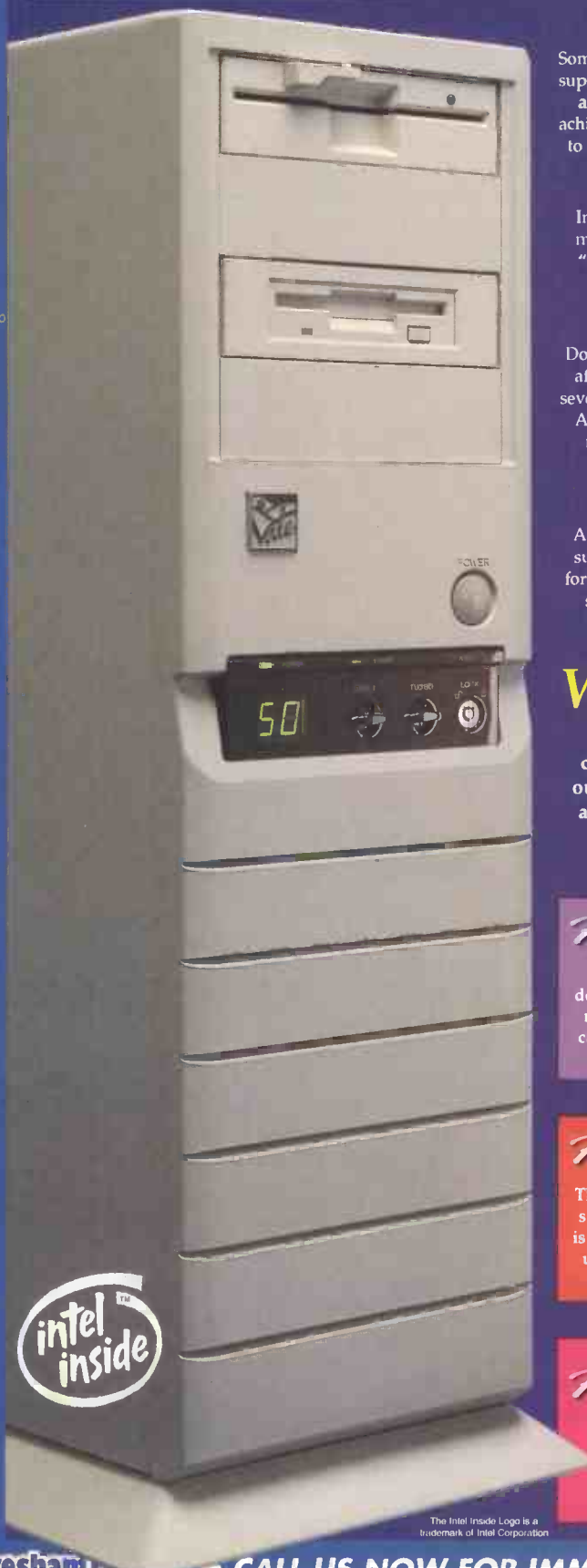
Although the *Prestige* models have been designed to fill the role of our lower priced systems, don't assume that corners have been cut. The specification is complete and the component list still reads like a 'Who's who' of the computer industry. All models include a high speed 1Mb SVGA card and Monitor, and most feature our processor upgradeable motherboard. Our normal level of Support and Warranty is, of course, standard.

Premier ...watch windows perform

The *Premier* range offers a level of specification, performance and flexibility that we feel sets new standards for the price. Who else offers a machine with a genuine *Windows Accelerator* (and this is the latest thing, recently given an award in PC User Magazine), a Caching Hard Disk Controller, upgradeable processor technology and two years On-site Maintenance at these sort of prices? If you want a computer to breeze through your *Windows* tasks then this is the one you need.

Premier Plus ...pure indulgence

Featuring a 15" FST monitor that provides upto 20% more usable screen area than a 14" model. When coupled with the extra speed of the *Diamond Stealth VRAM*, more System RAM and more RAM for the Hard Disk Cache, the *Premier Plus* has taken the principle of the *Premier* and stretched it to offer a level of specification that is astounding. When you take into account the price at which we are offering this technology, then astounding becomes *astounding*.



The Intel Inside Logo is a trademark of Intel Corporation

Standard Features

All Vale systems feature the following:

MS-DOS 5, MOUSE AND WINDOWS 3.1

MS-DOS 5
- and -
WINDOWS 3.1
installed
ready for use

With smooth, high quality MOUSE

Alternatively, we can supply DR-DOS 6 and Novell NetWare Lite 1.1 network software as a no-cost option

ON-SITE MAINTENANCE

All systems are covered by on-site maintenance. This agreement is with A.E.M. who operate to BS5750 standard. In the unlikely event of a problem arising you can be sure it will be dealt with efficiently. Prestige systems are covered for 1 year, and all Premier systems for 2 years.

LIFETIME TECHNICAL SUPPORT

As an owner, you will be provided with access to an exclusive VALE HOTLINE support number, staffed by knowledgeable people with a full record of your system and customer history. Lines open 9am until 6pm.

30 DAYS MONEY BACK GUARANTEE

We are so confident that you will be delighted with your Vale PC that should you, for any reason at all, find that it does not satisfy your needs, we will COLLECT it and refund your money in full.

CHOICE OF CASES

All systems are available in your choice of Desktop, Slimline Desktop or Mini Tower case. The Big Tower case is available at extra cost (see options).

PROCESSOR UPGRADEABLE MOTHERBOARDS



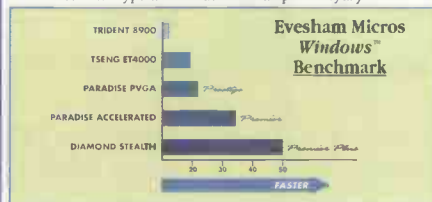
Plan for the future!

The Motherboard we use on most of our models features the ultimate in ease and economy of upgrading. Quite simply the only part that needs changing is the CPU!! No expensive modules, no soldering, no complicated installation - just remove the old CPU, plug in the new one, change a few DIP switches, and that's it. You can choose from any 386dx or 486 model (yes any, right up to 486dx-50MHz or 486dx2-66MHz).

HIGH SPEED SVGA VIDEO CARDS



In line with our policy of using components of the best quality and performance, all Vale models are fitted with class leading video cards. The SVGA cards in our Prestige models include the latest Paradise chip, Premier models now include the new Paradise Accelerator chip, and the Premier Plus has it's top end Diamond Stealth VRAM. Unlike many suppliers, we have selected the model that we feel offers the best performance in it's category - not the lowest cost. The following Graph shows the relative performance running Microsoft Excel for Windows application in real time, so we are talking about genuine operational differences that really affect you - not technical hypertext that doesn't add up in everyday use.



The real differences are quite an eye opener and yes, the Stealth VRAM will run an application around 4 times faster than a Trident product, on the same computer!



Prestige

MONITOR



This SUPERB quality dark screen, Low Emission 14" SVGA COLOUR monitor is non-interlaced in all modes except 1024x768 (which is really designed for use on large screen, 17" plus, monitors). The clarity and pin point precision of this monitor, manufactured for us by Tatung, really are at the top of its class. Display quality is visibly superior to most screens offered with competitive systems. It betters TÜV and EN55022 emission standards. With its maximum 87Hz vertical refresh rate & dot pitch of 0.28mm, your eyes won't suffer.

The Vale Prestige: a high specification PC with an upgradeable future, at a sensible price.

SVGA CARD



We use a Super VGA video card which incorporates the latest Paradise WD90C30 chip and 1Mb video RAM. It offers performance advantages over Tseng Labs and Trident based products (particularly in bit-block transfer operations), resulting in superb Windows performance. A variety of screen drivers are provided.

OTHER FEATURES

Your choice of either Slimline, Desktop or Mini-Tower case • Big Tower case available as an option • High density 3.5" 1.44Mb Floppy drive • 102-Key Enhanced Keyboard • Digital Display with Turbo/Reset Switches • 2 Serial, 1 Parallel & 1 Game port • 5x16-bit expansion slots free (1x16-bit & 1x8-bit expansion slots free with Slimline case • AMI PRO BIOS • MS-DOS Version 5 and Windows 3.1 • Mouse • 12 Months on-site maintenance

PRESTIGE

386sx 33

- Genuine 33Mhz 386sx CPU
- 1Mb SVGA Video Card
- 2Mb RAM (max. 16Mb)
- 1 year On-Site Maintenance
- Includes MS-DOS 5, Windows 3.1 and Mouse
- Processor Upgradeable Motherboard

42MB £699.00 +VAT
= £821.33 INC.
105MB £799.00 +VAT
= £938.83 INC.
245MB £999.00 +VAT
= £1173.83 INC.

PRESTIGE

386dx 40 128K CACHE

- 40Mhz AMD 386sx CPU
- 128K Cache RAM on board
- 1Mb SVGA Video Card
- 4Mb RAM (max. 32Mb)
- 1 year On-Site Maintenance
- Includes MS-DOS 5, Windows 3.1 and Mouse
- Processor Upgradeable Motherboard

42MB £819.00 +VAT
= £962.33 INC.
105MB £919.00 +VAT
= £1079.83 INC.
245MB £1119.00 +VAT
= £1314.83 INC.

PRESTIGE

486sx 25 128K CACHE

- 25Mhz Intel 486sx CPU
- 128K Cache RAM on board
- 1Mb SVGA Video Card
- 4Mb RAM (max. 32Mb)
- 1 year On-Site Maintenance
- Includes MS-DOS 5, Windows 3.1 and Mouse
- Processor Upgradeable Motherboard

42MB £849.00 +VAT
= £997.58 INC.
105MB £949.00 +VAT
= £1115.08 INC.
245MB £1149.00 +VAT
= £1350.08 INC.

PRESTIGE

486dx 33 128K CACHE

- 33Mhz Intel 486dx CPU
- 128K Cache RAM on board
- 1Mb SVGA Video Card
- 4Mb RAM (max. 32Mb)
- 1 year On-Site Maintenance
- Includes MS-DOS 5, Windows 3.1 and Mouse
- Processor Upgradeable Motherboard

42MB £1049.00 +VAT
= £1232.58 INC.
105MB £1149.00 +VAT
= £1350.08 INC.
245MB £1349.00 +VAT
= £1585.08 INC.

PRESTIGE

486dx 50 256K CACHE

- 50Mhz Intel 486dx CPU
- 256K Cache RAM on board
- 1Mb SVGA Video Card
- 4Mb RAM (max. 32Mb)
- 1 year On-Site Maintenance
- Includes MS-DOS 5, Windows 3.1 and Mouse
- Processor Upgradeable Motherboard

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105MB £1319.00 +VAT
= £1549.83 INC.
245MB £1519.00 +VAT
= £1764.83 INC.

OPTIONS

Big Tower Case instead of Slimline / Desktop /

Mini Tower style case, add £50.00 +VAT= £58.75

420Mb Hard Drive, add to 245Mb price £340.00 +VAT= £399.50

Non-interlaced 14" monitor (as Premier range, see next page)

Instead of Tatung monitor, add £75.00 +VAT= £88.13

Prestige 386sx-33 RAM Upgrade to 4Mb £51.06 +VAT= £60.00

RAM Upgrade beyond 4Mb, per 2Mb add £51.06 +VAT= £60.00

Internal High Density 5.25" 1.2Mb Drive £51.06 +VAT= £60.00

Maths Co-Processor for 386sx-33 £99.00 +VAT= £116.33

Premier Plus

Our Premier Plus range offers all the advantages of the Premier range, with the following enhancements:

PREMIER PLUS

486sx 25
256K CACHE

- 25MHz Intel 486sx CPU
- 256K Cache RAM on board
- Diamond Stealth VRAM
- SVGA Video Card with non-interlaced 15" Monitor
- 8Mb high speed (70ns) RAM
- 2.5Mb Caching Hard Disk Controller
- 2 years On-Site Maintenance
- MS-DOS 5, Windows 3.1 and mouse
- Processor Upgradeable Motherboard

105MB £1449.00 +VAT
= £1937.58 INC.

245MB £1649.00 +VAT
= £2197.58 INC.

420MB £1989.00 +VAT
= £2537.08 INC.

3rd Year O.S.M. £199.00 +VAT = £233.83

PREMIER PLUS

486DX 33
256K CACHE

- 33MHz Intel 486DX CPU
- 256K Cache RAM on board
- Diamond Stealth VRAM
- SVGA Video Card with non-interlaced 15" Monitor
- 8Mb high speed (70ns) RAM
- 2.5Mb Caching Hard Disk Controller
- 2 years On-Site Maintenance
- MS-DOS 5, Windows 3.1 and mouse
- Processor Upgradeable Motherboard

105MB £1649.00 +VAT
= £2197.58 INC.

245MB £1849.00 +VAT
= £2417.58 INC.

420MB £2189.00 +VAT
= £2727.08 INC.

3rd Year O.S.M. £199.00 +VAT = £233.83

PREMIER PLUS

486DX 50
256K CACHE

- 50MHz Intel 486DX CPU
- 8K Primary Cache in CPU
- 256K Cache RAM on board
- Diamond Stealth VRAM
- SVGA Video Card with non-interlaced 15" Monitor
- 8Mb high speed (60ns) RAM
- 2.5Mb Caching Hard Disk Controller
- 2 years On-Site Maintenance
- MS-DOS 5, Windows 3.1 and mouse
- Processor Upgradeable Motherboard

105MB £1799.00 +VAT
= £2413.83 INC.

245MB £1999.00 +VAT
= £2648.83 INC.

420MB £2339.00 +VAT
= £2748.33 INC.

3rd Year O.S.M. £199.00 +VAT = £233.83

PREMIER PLUS

486DX2 66
256K CACHE

- 66MHz Intel 486DX CPU
- 8K Primary Cache in CPU
- 256K Cache RAM on board
- Diamond Stealth VRAM
- SVGA Video Card with non-interlaced 15" Monitor
- 8Mb high speed (60ns) RAM
- 2.5Mb Caching Hard Disk Controller
- 2 years On-Site Maintenance
- MS-DOS 5, Windows 3.1 and mouse
- Processor Upgradeable Motherboard

107MB £1899.00 +VAT
= £2523.33 INC.

245MB £2099.00 +VAT
= £2748.33 INC.

420MB £2439.00 +VAT
= £2865.83 INC.

3rd Year O.S.M. £199.00 +VAT = £233.83

PREMIER PLUS OPTIONS

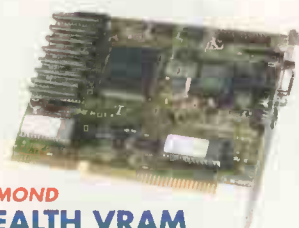
- 17" AlphaScan Colour Monitor (1024x768 non-int.) instead of 15", add £349.00 +VAT = £410.08
- 17" Tatung Col. monitor (1280x1024 non-int.) instead of 15", add £449.00 +VAT = £527.58
- 20" Tatung Col. monitor (1280x1024 non-int.) instead of 15", add £749.00 +VAT = £880.08
- 16Mb RAM option instead of standard 8Mb RAM installation, add £199.00 +VAT = £233.83

FOR OTHER OPTIONS PLEASE REFER TO OUR PREMIER SECTION

WINDOWS ACCELERATED SVGA VIDEO CARD



The March issue of PC Magazine conducted a very competitive group test that included Orchid Fahrenheit and ATI adapters. Awarded Editor's Choice, Diamond Stealth was commented on as offering "...leading edge performance under Windows ... well written drivers run on sturdy hardware ... you won't find a better price/performance bargain than the Diamond..."



DIAMOND STEALTH VRAM

Based on the S3 Accelerator chip and using the Sierra RAMDAC, the Diamond Stealth VRAM Video Card recently won the coveted 'Editors Choice' accolade in the American PC Magazine. Up to 25 times faster than Super VGA, the card has many of its own specially developed, enhanced S3 software drivers included for superlative acceleration and compatibility particularly in Windows 3 and AutoCAD.

The resultant speed of screen manipulation in graphics intensive applications is simply stunning. Many SVGA resolutions are supported, which include 1280 x 1024 with 16 colours, and 640 x 480 fully non-interlaced with 32,768 colours.

It conforms to VESA monitor and graphics standards with a 72Hz refresh rate, and is compatible with standard variable frequency or VGA fixed frequency Analog compatible monitors.

Latest software includes Windows 3.1 drivers and WINRIX DCS, professional 24-bit Colour Paint software for Windows.

15" MONITOR



For the Premier Plus range we have selected a 15" version of the monitor which accompanies the Premier range, with its superb flicker-free performance and low radiation standard (see previous page). A 15" tube typically gives about 20% more viewable screen area, making the use of the 1024x768 mode entirely practical. We consider that given the design brief for the Premier Plus of building a high end Windows/CAD workstation that a monitor of this size and quality is a minimum requirement. However, should funds be adequate, we would be delighted to supply a 17" or 20" model as an option.

8MB HIGH SPEED RAM

Premier Plus models include 8Mb high speed RAM. 16Mb RAM available as an option.

2.5Mb CACHING HDD CONTROLLER

Hard Disk performance is improved even further with 2.5Mb RAM fitted to Premier Plus models.



Photograph shows the Vale Premier Plus with Mini Tower case and 15" Monitor



Twinhead Slim Note

Powerful 486 Notebook

featuring BUILT-IN Trackball and advanced power management.

At 386 prices!

- Choice of 25MHz '486sx or 33MHz '486dx CPU
- 10" LCD VGA display with 64 Greyscales
- 4Mb RAM (expandable to 8Mb or 20Mb)
- 80Mb or 120Mb Hard Disk (19ms)
- Internal 3.5" 1.44Mb Floppy Drive
- Built-in trackball for convenience
- Serial, Parallel, Video & Keyboard ports
- Suspend & Resume power saving feature
- Over 2 hours battery life
- 280 x 220 x 42mm, approx. 2.5kgs
- Includes AC Mains adaptor, Ni-Cad battery, 'TH Link' file transfer kit, MS-DOS 5, Windows 3.1 and mouse



486sx 25MHZ

80MB £1549.00 +VAT
= £1820.08 INC.

120MB £1749.00 +VAT
= £2055.08 INC.

486dx 33MHZ

80MB £1899.00 +VAT
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120MB £2099.00 +VAT
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SlimNote RAM expansion to 8Mb £200.00 +VAT = £235.00

NEW! COLOUR HANDY SCANNER

Providing powerful colour scanning tools, this package enables high quality colour images to be generated for use in professional graphics presentations.

- **HAND-HELD COLOUR SCANNER & INTERFACE CARD**
- **'SCANKIT'** Colour Scanning / Image Edit *Windows* software
- **'PICTURE PUBLISHER LE'** top professional *Windows* based Image Scanning and Photograph re-touching software
- **'PERCEIVE PERSONAL'** powerful OCR *Windows* software, giving simple, efficient operation with highly effective results

- **Super Color Gray** mode for 262,144 colours per dot at up to 200dpi
- **Color Gray** mode for 12-bit file format colour image generation
- **Mono Gray** mode with true 64 greyscales at up to 400dpi
- **Dithered Color** mode with 3 selectable patterns between 100-400dpi
- **Line-art** mode for monochrome pictures at up to 400dpi

ONLY (£299.00^{+VAT=}) £351.33

Requires '286 or higher, Windows 3 or higher, 1Mb RAM or greater, Mouse, Hard Drive and EGA graphics or higher.

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**AT LAST! SENSIBLY
PRICED FAX/MODEMS
AVAILABLE AS
POCKET UNIT OR
EXPANSION CARD**

- Sends and Receives Group 3 faxes at up to 9600 bps, to any Fax machine or Fax board
- Compatible to CCITT Group 3, V21 Channel 2, V29 and V27ter modes
- Professional Fax operations easily achieved under *Windows 3.x* or DOS with software supplied

- Transmits laser-sharp 200dpi outgoing faxes
- With WINFAX for Windows 3.x, sending faxes is as easy as selecting PRINT from any application !
- WINFAX receives faxes in background, which are stored automatically and can be viewed at any time.
- Phonebook entry and administration facilities
- DOSFAX allows you to hotkey out of DOS for quick and easy transmissions of faxes, or capture faxes as a background task

B.A.B.T. APPROVED

ONLY £199.00 +VAT=

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State INTERNAL or EXTERNAL when ordering

- Tiny sized, truly portable and high quality unit
- Compact, stylish, attractive, hard-wearing case
- Powered by AC adapter or a battery (both supplied), with 3 hours typical battery operation
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- MNP10 allows reliable Cellular communications

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- Features MNP2-4, V42 and MNP10 error correction, for absolute data integrity
- V42bis & MNP5 for up to 4x data compression
- Compatible to CCITT V21, V22 & V22bis
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- Full speed buffering with selectable flow control
- Non-volatile storage of 20 telephone numbers

**QUALITY 400dpi
SCANNING -
AT THE
RIGHT PRICE!**



- Superb quality, genuine 400dpi Scanning resolution
- Full 105mm wide scanning head with illuminated scan window
- Four selectable scanning resolutions between 100 and 400dpi
- Variable brightness control ● Built-In scan speed indicator
- Choice of either 64-Halftone or True 256-Greyscale models

These hand-held units produce truly superb quality scans. Full software even includes high speed, fully trainable OCR utility which converts scanned text images into text files, saving hours of retyping!

Works with any PC (including Amstrad PC1512 or PC1640) with 640K RAM. Hard Drive and Mouse highly recommended.

- Three 8x8 halftone patterns supported as well as line-art
- PC Paintbrush Plus versatile image scanning / editing software provided to directly scan any image & integrate additional text + graphics with 14 drawing tools. Allows adding of colour to black and white images.
- ScanIt! enhanced scanning utility allows scanning, image merging, pixel editing, image printing. Saves using most popular file formats including CUT, IMG, PCX, MSP, .TIF & .PIX

(£85.10^{+VAT})

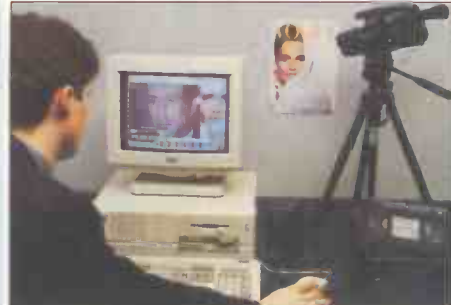
Only £99.99

- Now features 800 dpi resolution
- With true 256 greyscales capability, this scanner captures photorealistic quality monochrome scans, with actual shades and shadows.
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VIDI-PC Video Digitisers

**VIDI-PC and MEDIA-PRO Plus allow you
to capture images from almost any
video source, with outstanding results!**



N.B. Requires a 286 PC or higher with at least 1Mb RAM, Windows 3.1 & DOS installed, and one unoccupied expansion slot available.

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- 12-Bit Capture system
- Up to 4096 colours
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- Free 'PHOTOFINISH' powerful Image edit software supplied
- Load/Save 24-bit RGB TIFF, BMP

- 24-Bit Capture system
- Up to 16.7 million colours
- Takes less than one second to capture one full colour picture
- 256 Greyscale images can be grabbed from moving video
- PAL/NTSC Composite/S-Video Inputs with on-screen controls
- Free 'PHOTOFINISH' powerful image edit software supplied
- Load/Save 24-bit RGB TIFF BMP

- Perfect for multimedia and image capture applications
- Full motion TV/Video & Sound on your Windows 3.1 screen
- Up to 16.7 million colours
- Takes less than one second to capture one full colour picture
- 256 Greyscale Images can be grabbed from moving video
- PAL/NTSC Composite/S-Video inputs and R.G.B. output
- Free 'PHOTOFINISH' software, plus 2 Speakers & Headphones

VIDI-Chrome PC colour splitting software for B&W camera users	(£42.51 ^{VAT})	£ 49.95
VIDI-RGB PC colour splitting hardware for colour camera users	(£59.53 ^{VAT})	£ 69.95

ANALOG EDGE Joystick by Suncom Technologies



Suncom's analogue joysticks always set new standards in quality and performance. The *Edge* represents terrific value, incorporating *Injected Resistor Technology*, resulting in a product with unmatched simplicity and breakdown resistance. Features two-way switchable fire buttons, and Aircraft-style grip, with game optimised ergonomics. Complete with 'Gameport 2' dual input gameboard halfcard.

(£25.52+VAT=) **£ 29.99**
INCLUDING CONTROLLER CARD

Joystick or Controller card supplied separately for (£15.31+VAT=) **£17.99**

ANALOG XTRA Joystick



Featuring the same *Injected Resistor Technology* that gives the *Edge* uncommon durability and capability, the *Xtra* is possibly the most advanced flight sim. joystick on the market! With variable autofire, throttle control, 4 switchable fire buttons and Aircraft-style grip. Accuracy and flexibility like nothing you've experienced before! Supplied with 'Gameport 2+' variable speed dual input gameboard halfcard.

(£34.03+VAT=) **£ 39.99**
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Joystick or Controller card supplied separately for (£21.27+VAT=) **£24.99**

NEW! FLIGHTSTICK



THE NEW FLIGHTSTICK HAS TO BE THE ULTIMATE, TOP QUALITY JOYSTICK FOR COMPUTER PILOTS!

Test fly a Flightstick with your favourite simulator and you will know the meaning of control. Whether you're a novice or experienced combat pilot, flying skills will be improved and enemy kill rate will increase. Excellent construction - looks and feels like the real thing! Includes throttle control and 7ft long connection cable.

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Controller card available for Flightstick for only (£21.27+VAT=) **£24.99**

NEW! HANDY MOUSE



TOTAL ONE-HANDED CURSOR CONTROL - PERFECT FOR ALL YOUR PORTABLE PC APPLICATIONS!

Slim, comfortable and easy to use, this new specially designed controller is suitable for both left and right handed users! Features a clever 'Ball Button' which gives one-finger cursor control, clicking and click'n'drag, all in one control. Feather-touch button control (variable resolution 80-500dpi). Stylish in design, with a glossy finish. Microsoft serial compatible - driver software supplied.

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TRACKBALL



Excellent high performance trackball, directly compatible to any PC, operating via the serial port. Super-smooth, accurate and versatile - perfect for WIMP environment and graphics intensive operations, as well as games! With its featured locking drag button and line hold facilities, accurate total one-handed control is a doddle. Top quality construction and opto-mechanical design, delivering high speed and accuracy every time. Full Microsoft compatible driver software supplied.

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WE GUARANTEE that this is the smoothest, most responsive and accurate mouse you can buy for the PC. Excellent performance, amazing low price! 3-Button Serial (9-way & 25-way), PS/2 and 2-button Amstrad PC compatible versions available - please state which version is required when ordering.

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COMPLETE PC SOUND PACKAGE



SOUNDBLASTER

Digital Sound Output • 11 Voice FM Synthesizer (fully ADLIB compatible) • Digital Sampling capabilities • On-board Analog Joystick I/O port • On-board Stereo Power Amplifier with external stereo speaker connections & volume control • Software includes FM organ, Text to Speech & more • Fully ADLIB compatible - WORKS WITH LOTS OF GAMES!



PACK ALSO FEATURES 'MONKEY ISLAND 2', STEREO AMPLIFIED SPEAKERS & ANALOGUE JOYSTICK!



Specially compiled package features the very high specification **SOUNDBLASTER VERSION 2** - a sophisticated digital hi-fi Sound Expansion card with on-board Power Amplifier and Games Joystick Port. Software includes the adventure **MONKEY ISLAND 2** - Fantastic Sound and Graphics! ZY-FI Amplified stereo speaker system also included, plus **QUICKSHOT JOYSTICK** which interfaces directly to Soundblaster.

PC SOUND PACKAGE INCLUDES :

- ☆ **SOUNDBLASTER VERSION 2** Digital Sound Card
- ☆ ZY-FI New Design Amplified Stereo Twin Speaker System
- ☆ Excellent **QUICKSHOT QS-123** Analogue Joystick
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Includes **WINDOWS 3.1** with Music Clips, **MICROSOFT BOOKSHELF**, **SHERLOCK HOLMES** and **EURO CD DISK** (£349.00+VAT=) **£410.08**

COMPLETE MULTIMEDIA PACKAGE

EVERYTHING YOU NEED FOR MULTIMEDIA - PLUS MUCH MORE!



ZY-FI STEREO SPEAKERS
With built-in power amplifier & volume controls.

SOUNDBLASTER PRO
Fantastic Digital Stereo Sound expansion card with an amazing array of musical capabilities! Includes built-in stereo power amplifier with volume control and digital sound sampler. Card also has built-in analogue games port for connection of up to two games joysticks.

FAST CD-ROM DRIVE
Performance optimised CD-ROM drive connects directly to the Soundblaster card's interface.

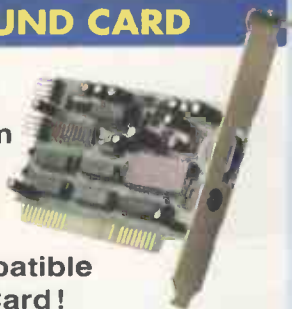
PLUS! WINDOWS 3.1 AND PLENTY OF CD-ROM DISK SOFTWARE, INCLUDING:
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FANTASTIC VALUE! ALL THIS FOR ONLY (£424.68+VAT=) £ 499.00

Also available with External CD-ROM Drive for only (£509.79+VAT=) **£599.00**

ADLIB COMPATIBLE PC SOUND CARD

GET AMAZING SOUND from your PC games with this fully ADLIB compatible PC Sound Card!



Capable of generating fantastic music and sound effects, this Sound Card incorporates an 11-voice FM synthesizer for realistic, good quality output. Its full ADLIB compatibility gives PC games and entertainment software a new dimension, because lots of titles are directly ADLIB compatible. Features an on-board 4w/ch amplifier with volume control, which outputs to external speakers or headphones directly, or can be wired to the PC's own internal speaker.

Only (£42.54+VAT=) **£ 49.99**

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ZY-FI Stereo Speakers

POWER AMPLIFIED STEREO SPEAKERS - IDEAL FOR ALL PC SOUND CARDS AND MULTIMEDIA SYSTEMS!



Includes built-in power amplifier with separate L/R volume controls and stereo jack/phone inputs.

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NEW! LOW COST ETHERNET CARD

Novell compatible 16-bit network card.

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Faster than and compatible with NE2000 cards • Thick and thin I/O ports • 10Mbps • NETBIOS compatible

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Borland Paradox 4.0	£274.00+VAT=	£321.95
Borland Quattro Professional v4.0	£164.00+VAT=	£192.70
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Microsoft Windows Entertainment Pack 1, 2 or 3	£ 25.49+VAT=	£29.95
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1Mb SVGA Card (with Paradise 90C30 chip)	£89.00+VAT=	£104.58
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HEWLETT-PACKARD DESKJET SERIES PRINTERS

NEW! DESKJET 550C COLOUR

Quiet and reliable, the Deskjet 500 series inkjet printers give excellent laser-like output quality - at dot matrix prices! The new Deskjet 550C has all the benefits of HP's proven colour inkjet technology, in a more user friendly package. It holds two ink cartridges, one for black and one for colour, and is thus particularly suitable for those who want frequent colour printing. It also features support for a wide range of DOS and Windows software. All models are covered by a Three Year 'Return To Manufacturer' warranty.



DESKJET 500 (MONO VERSION)	£279.00+VAT=	£327.83
DESKJET 500C (COLOUR VERSION)	£349.00+VAT=	£410.08
DESKJET 550C	£449.00+VAT=	£527.58

Deskjet Long Life black ink cartridge	£21.27+VAT=	£24.99
Deskjet colour ink cartridge	£22.12+VAT=	£25.99
256K RAM Cartridge for Deskjet Plus / Deskjet 500	£68.04+VAT=	£79.95
Deskjet 500 Three Year On-Site Warranty Agreement	£50.21+VAT=	£59.00

NEW! Hewlett-Packard Laserjet IV	£1049.00+VAT=	£1232.58
Postscript Level 2 upgrade for Laserjet IV	£229.00+VAT=	£269.08

Olivetti JP350 Inkjet, 300dpi, 150 cap sheet feeder, 360/120cps, 1 year on-site maintenance	£297.86+VAT=	£349.99
Olivetti JP150 inkjet, small desktop footprint (just 15x35cm), 160/80cps, 1 year on-site maintenance	£212.76+VAT=	£249.99
Epson LX400 budget 10" 9pin 180/25cps	£118.30+VAT=	£139.00
Epson LQ450 24pin 180/60cps, 8k buffer	£208.51+VAT=	£245.00
Epson LQ570 24pin printer 150/50cps	£242.55+VAT=	£285.00
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NEC P20 24pin printer	£195.00+VAT=	£229.13
Citizen 224 COLOUR Printer	£212.76+VAT=	£249.99
Citizen Swift 24-E COLOUR Printer	£255.31+VAT=	£299.99
Panasonic KXP1123 good value 24 pin model	£182.99+VAT=	£215.00
Panasonic KXP1124 updated 24pin model 300/100cps	£237.45+VAT=	£279.00
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Canon BJ-10EX Portable Inkjet Printer Epson Compatible	£189.00+VAT=	£222.08
Hewlett-Packard Laserjet IILP, replaces IIP model	£778.72+VAT=	£915.00
RAMJET RAM Upgrade board for HP-IILP & HP-Laserjet IILP	£ 58.72+VAT=	£69.00
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STAR LC20 9-Pin Printer

SUCCESSOR TO THE
BEST SELLING LC-10,
WITH MANY FEATURES
AND A FAST OUTPUT



Providing superlative paper handling, four excellent NLQ fonts and a new super-fast print speed of 180cps in draft and 44 cps in NLQ, the LC20 appropriately supercedes the phenomenally successful LC10!

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SPECIAL!! STAR FR-15

PROFESSIONAL SERIES COLOUR PRINTER

PROFESSIONAL SERIES 9-PIN 136-COLUMN PRINTER INCLUDING COLOUR UPGRADE II

□ Versatile and rugged □ High Performance Professional Series 9-Pin Printer with Colour Upgrade □ 300 cps output in draft, 76 cps in NLQ mode (16 resident NLQ fonts!)

□ Full control from front panel □ Huge 31k buffer □ Advanced Paper Parking □ Optional Sheet Feeder



(£212.76+VAT=) £249.99

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NEW! Star LC100 COLOUR Entry level 9-pin colour	£143.00+VAT=	£168.03
Star LC200 COLOUR (Colour version of LC-10)	£165.00+VAT=	£193.88
NEW! Star LC24-100 Good low price 24pin printer	£167.00+VAT=	£196.23
Star LC24-20 24pin printer, excellent features	£174.00+VAT=	£204.45
Star LC24-200C 7-colour version of above	£229.00+VAT=	£269.08
Sheet feeder for any of the above (please state model)	£ 55.28+VAT=	£64.95
Star LC15 wide carriage, faster version of LC-10	£200.00+VAT=	£235.00
Star LC24-15 wide, faster version of LC24-10	£269.00+VAT=	£316.08
Star XB24-200 Hi-Performance Professional Colour 24-Pin 300/100cps, 29K buffer, 14 LQ + 4 LQ Fonts & more	£314.04+VAT=	£369.00
Star XB24-250 Professional Wide Carriage Colour 24-Pin like XB24-200 but with 76K buffer. Excellent features	£373.00+VAT=	£438.28
Star SJ-48 Inkjet Printer	£228.94+VAT=	£269.00
Star Laserprinter 4 Ilt 1Mb RAM, RISC CPU, 14 fonts	£676.00+VAT=	£794.30
Star Laserprinter 4 Ilt STARSCRIPT 2Mb RAM, dual vface	£856.00+VAT=	£1008.15

MONITORS



Tatum 14" SVGA Monochrome	£99.00+VAT=	£116.33
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SPECIAL! Tatum 14" SVGA Colour with Paradise Super VGA Card	£299.00+VAT=	£351.33
14" SVGA Colour monitor (as Vale Premier)	£259.00+VAT=	£304.33
72Hz refresh rate in all modes • Fully Non-interlaced • MPR II low emission standards		
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1280x1024 max resolution (non-interlaced) • 0.28mm dot pitch • Auto 29-65KHz horiz scan		
Tatum 20" SVGA Colour Non-Interlaced	£1099.00+VAT=	£1291.33
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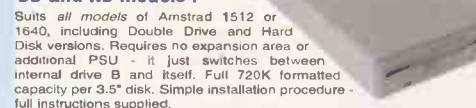
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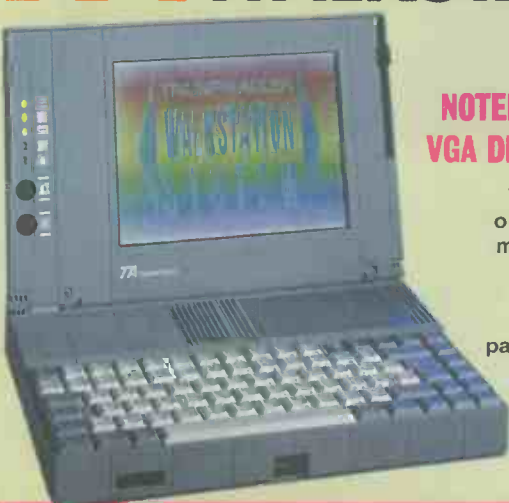


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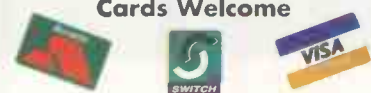
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For Pete's sake



Joining Apricot when it was the number one computer company in the UK, MD Peter Horn is sceptical of today's 'technology for the sake of it' industry. He told Wendy M Grossman about networking, compatibility, and working in a less than perfect world.



Managing Director of Apricot, Peter Horn started in the computer industry on a camp bed in the Zoo. This is less quirky than it sounds: the Zoo was for some years the in-house name for Apricot's research and development department. The camp bed was an outgrowth of the fact that during his first year at Apricot Horn was living away from home: camping out in the place where he worked all day was just sensible. But times have changed since those days in 1982. Apricot has grown, acquired Mitsubishi as an investor, and gone compatible.

But, says Horn, 'The fact is that the usefulness of computing has not been as great as everybody thought it should be. If you measure it in terms of the profitability of companies, then it's very difficult to say it's actually achieved anything.'

Horn's background is strong on technology. He took his degree in electrical and electronic engineering, then did a PhD in statistical pattern recog-

nition, which he explains meant image analysis and speech recognition. Then he went to Geneva to CERN, the European Centre for Nuclear Research, where from 1975 to 1976 he was part of a team that developed a control system built on 8080 microprocessors. 'We had hundreds of them controlling the magnets around the ring.' This was in the early days of networks and PCs; the team wrote its own software and its own version of Basic.

CERN, although Horn found it fascinating, had more in common with an academic institution than a job. 'There were 4000 researchers there from twelve nations,' he says. 'It's one of the few truly international organisations where languages don't matter too much as long as you speak English or French. It's an opportunity to meet people from all round the world and the technology is state of the art. It's a bit like NASA projects: there's huge money being poured into it.'

PHOTOGRAPH BY JOHNNY MILLAR

His three years there brought his time in education to 21 years. Horn felt that was enough. 'I thought I'd come back to the UK and earn my keep,' he says, admitting ruefully that this didn't work out quite the way he had in mind. 'I came back for one-third of the salary I had in Geneva, and it was taxed as well.' After two years at Cambridge Scientific Instruments, designing a multiple-processor system (including hardware, software and languages) to analyse images from chest X-rays and satellite photographs, he left to start his own business in contract hardware and software design.

About a year later, he added consulting work for Philips to his list, recommending how to change products to make them suitable for the UK market. 'This is where I got all my marketing knowledge and customer skills,' he says. At the same time, he had his own business which involved early forms of networking and a lot of hard work.

'I had more computers in the loft than anywhere else,' he says. 'One of the jobs I was doing at the time was a distributed computer system for fibre optic manufacturers, like GEC or Siemens, pulling fibre from glass rods at high speed and winding it onto drums. The computer system controlled the lathe, pulling, winding... basically, I was doing all the work for that. I had four computers in the loft with a network between them, and some problems we had might take 24 hours before the glitch in the system would pop out. Clearly some of the big companies wouldn't be very happy if halfway through pulling the cable the parameters of the glass changed, so it was sometimes a fraught period. But you learned the complexity of a system the hard way, even a simple system.'

Cut to 1992, and Horn sees the same problems with today's networks — and says the industry isn't really equipped to handle them. 'I've just been through Japan, Taiwan and Australia,' he says, 'and over a number of years I've come to realise there's a dearth of knowledge in the whole channel, whether they're systems integrators or VARs.' He feels this has become apparent as more and more large corporations want to downsize from mainframes and minis to PC networks.

The reason, he thinks, is that traditionally all the complexities of wiring things together were left to the major manufacturers, like IBM, DEC and ICL. The smaller organisations handled bespoke software and project management, but Horn reckons their familiarity with overall systems integration, middleware software and how to make it work for an organisation is fairly poor.

The answers needed are different now, he says. 'When you come to our world, it isn't "go out and design another bespoke program to solve the problem"; it's saying, "somewhere in the world is a solution to this problem, where do I find it?" This is a big cultural change.'

As soon as you try to move a system from a mainframe and mini-based setup onto 10,000 PCs with 500 servers, says Horn, a customer wants to know who's going to manage it and make it work. This, he argues, is a widespread problem which affects all the major companies. He considers consulting to be everybody's answer to some extent; Apricot will have to do more than it thought.

Horn talks about the PC world as the 'open

systems market', referring to the phenomenon of different companies supplying hardware, operating systems and languages. He contrasts this with Apple, or the mainframe and mini with the proprietary operating systems divisions of companies like IBM and DEC. This is where he sees integration causing trouble.

'This is the problem of the open systems world: one, lack of skills; two, it's very, very open, and it's difficult to prove anything works with anything until you put it all together.'

Horn was just discovering this sort of problem when, in 1982, he saw what he describes even now as 'a strange job ad'. A company in Birmingham was looking for a chief engineer, and the remuneration included shares in the company.

'I already knew of the company — it was the only likely company in Birmingham — because I had bought a product called the Sirius from them for my own business.'

He joined on 1 February 1983, when Apricot was the number one computer manufacturer in the UK. IBM hadn't started selling here yet, and Apricot's computers were Sirius compatible. The US market leaders were Tandy and Apple. Apricot, still known as ACT, discussed with Tandy the possibility of launching an Apple-beater in the US; Tandy declined to get involved and Apricot had a go by itself, unsuccessfully. 'The US market had gone compatible by then so we didn't sell many products,' he says.

In 1984 Apricot (as it was renamed) introduced early 286s, but even these were Sirius compatible. 'By then we knew it was too late,' says Horn frankly. 'They should not have been Sirius compatible, they should have been IBM compatible, so we were a year late.' It was June 1986 before Apricot started selling IBM compatible PCs.

'We were pretty successful with the product despite that, but many of our larger resellers had by that time shifted away and were carrying Compaq and IBM, so we'd lost a lot of our channel. We ended up with a very interesting channel of resellers in the UK, very competitive and VAR-like compared with the one that had gone the box-shifting route with the PC.'

These resellers were very profitable compared with the rest of the industry, which is why they stayed alive so long. 'However,' he says, 'they're now suffering a lot because margins are coming down for them, and for us to be competitive like everybody else, one of the things that's being squeezed is the resellers' margins. They just have to keep adding more and more value or they just won't survive.'

Compatibility remained an issue at Apricot. 'Like a smoker giving up smoking' is how Horn describes it. The company wasn't just going to be compatible, it was going to be really compatible. And that's how it came to make MCA computers instead of ISA.

'We had been incompatible once, so in 1987, when IBM introduced new products, it was very obvious we had to be compatible and we chose MCA products.' Horn believes Apricot is almost the last company making its own PS/2 clones. 'We waited too long, and once you've made a mistake you try not to make it again. But the whole industry

flipped. Today, we take a pragmatic approach; we listen more to customers, like everybody else.'

Selling MCA clones, while not a mainstream choice, did have some benefits. Like Compaq in 1984 and 1985, Apricot was the only company offering complete compatibility. That helped open the way into some of IBM's accounts.

There is a common impression that PS/2 architecture is somehow proprietary, or at least more expensive to license. Horn reckons this is abso-



lutely untrue. 'There is so much bunkum and bullshit about licensing. There is no such thing as licensing MCA. IBM has a straightforward patent licensing policy that covers three major areas and categories. One category covers about 9000 patents, and you take out one licence which covers everything.'

'Anybody can take it out; it costs maybe \$25,000; it's not expensive. It's no more expensive to make PS/2 clones than PC clones.'

Horn admits people behave as if it were more expensive but says, 'The press got it wrong. One of the problems is accounts managers spreading the story. At the top IBM said it was open and you can licence it. It really buggered up the whole market.'

Once you get past the licensing, PCs are cheaper, if only because there are more parts available from more suppliers, which drives their price down. Apricot now makes a line of clones, too. In any case, says Horn, to most users the architecture of their PCs is unimportant.

'If all a person wants is a desktop computer, an ISA compatible does the job. For the desktop user, neither MCA nor EISA has any benefit for the customer that you can clearly see today. Now, when it comes to needing a real 32-bit bus, the story changes. But most desktop users are plugging in very low performance devices. Even a ten megabit per second Ethernet can go on the AT bus without a problem. We design ours on the motherboard, and it goes over the local bus to get other benefits.'

The argument over which architecture to use is as unimportant to Horn as the arguments he used to listen to ten years ago between Ethernet and Token

Ring. 'It was a holy battle, a war of attrition between the two markets. But ten or twelve years on, people say, what was the argument? You like Ethernet, use Ethernet. You like Token Ring, use Token Ring. But who cares? It really makes very little difference to the overall IT strategy of a company.'

'The same is true if you try to make a decision based on a bus. Buying a product because of the bus is a nonsensical decision, but the popular press, as well as technologists, have forced that on the customer and made him think it's an important decision when it's not.'

The exception to this, he says, is servers. 'In the server you do need a decent bus, because you'll be connecting a lot of high performance peripherals to it. You may be controlling four or five Ethernet or Token Ring networks and the throughput may be compounded to ten or twenty megabytes, and then the AT bus can't handle it. EISA can, and MCA can. So you have two buses competing where you actually need more throughput, and each has its pluses and minuses.'

Most customers, he says, base their decision on price, performance and functionality, as opposed to what the little piece inside the engine does. 'Look, after all, at Apple's machines: what Mac user makes an issue of the bus inside of the machine?'

The way Horn tells it, Apricot has something in common with Apple: it tries to put as much as possible in the computer so that all the customer has to do is plug it in. The company started building in networking in 1984, and its recent multimedia machines come complete with built-in sound. But trying to get customers to see the benefits of that is uphill work in a market which has been trained to consider price first, second and third. Horn believes this emphasis is killing innovation.

'The bad news for the compatibility market is that innovation is almost out. As a small company, it's difficult to sell innovation because, the customer says, the standard machine looks like this, and it has eight slots, and unless I can plug cards in it's not a PC, is it?'

These days, he says, small companies have to conform, and the only hope for change is if the larger manufacturers do the innovating. Unfortunately, IBM and Compaq, who could lead the way to change, are following the trend by launching low-cost lines.

'We feel we're a lone voice in the world saying, there's a better way of doing this, because the world at large doesn't want to listen. The only thing it can think about is price, and therefore innovation is getting pushed even further away.'

Products are being driven down in all aspects of quality for the customer, he says. There is a plus side, in that the customer can now buy great technology at a low price, but there will be penalties to pay for this in the future. Apple has an advantage in the plug-and-play area, in that the hardware and operating system are made by the same manufacturer. Horn wants to see that simplicity of use come to the PC world, where things don't automatically work together, however much people would like to believe they do.

'Only a few companies, and we're one, are looking at that seriously. The problem is that the customer doesn't value that in today's market because

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we've educated them to think price, price and price. The industry is going to hang around and wait until one of the really big players decides it can afford to take the risk. The problem within the price-decreasing market is that they don't want to take the risk. They say, look, the customer doesn't want any of this, he just wants a cheaper machine.'



In this sort of area, Horn believes that having Mitsubishi as a parent helps Apricot. 'We can afford the investments and the time to start the education, but it's a tough battle. I do see that the next couple of years are going to be really traumatic for the industry but unless it does change, in two years' time a lot of customers are going to be really pissed off with the industry.'

Then there's multi-processing. Horn doesn't think it works as promised, with the reality in most cases coming nowhere near the customer's expectation. 'In the open systems world it's even worse, again because of this mismatch of operating system and hardware: when the two come together it's fairly inefficient. We had one two years ago, and we withdrew it, not because it didn't work but because we said the customer who really understands this is not going to be very happy.'

He has problems with an even more basic tenet of computing marketing, the idea that people throw out computers every couple of years and buy new ones. 'You go to a corporate customer and see computers that are eight or nine years old. Nobody throws computers away. None of them upgrade them, either, and they won't, because you can't upgrade part of a PC if you're going to use the whole thing.' When people talk to him about upgrading every two years, Horn asks them: 'Look at that chair. Do you throw it away every two years?'

Besides, upgrading is uneven: you put in a faster processor and you need more memory, a bigger hard disk and a faster video card. In a large organisation you would just move the computer to a suitable function, he says. People say the 386 is dead but Horn says most of his customers, those in

government included, are still specifying 386s.

He himself has been using a 25MHz 386 for the last four years, even working under Windows. 'It's fast enough because I can't type faster than I can think, and for the type of things I do, I don't need to be running words at the speed of light.' When travelling and making presentations, he uses a 386SX notebook, saying that the limiting factor is the speed at which he can work rather than that of the processor. 'We're creating a demand and expectation, and worrying about the computer being superseded the day after you buy it is unreal.'

The obsession with speed carries over into the way the industry produces software. By now, he thinks, we should have an accepted level of inefficiency. 'With the power we have now and the amount of memory, do we really have to rewrite every service routine and interrupt routine every time we change the operating system?' he asks. Several organisations have goals to produce libraries of standard routines, but he feels that's still a long way off.

There is a tendency to improve, he says. 'Every time, someone says, "But if I change a byte there I can make it go so much faster." That introduces the next problem.' Somehow, he says, we need to hang on to the reusable part that doesn't change. 'You're not going to get it dramatically wrong. It's like a 747. That's been going for years with only minor refinements, and you've got all

that history of reliability behind you, whereas software basically gets rewritten every time.'

Despite all this, with regard to today's programming languages he says: 'We're still in the Stone Age. I played around, six or seven months ago, with Visual Basic. Are we getting better? Can I now draw the program I want? I just want to do something simple. It's on the way but we're still a long way off providing better tools so that people don't have to worry about these low levels.' And, he admits, when you go that far you need huge amounts of computer power to keep performance respectable.

What we really have are highly graphical environments trying to make life easier, he says, while what we need are reusable models, even if they're not quite as efficient as we'd like. In his view, the idea that you somehow need to exploit 32-bit hardware is 'almost another meaningless quantity.'

All this goes back to Horn's original point: what matters is business problems and finding the right solutions to them, not the technology itself. 'Particularly in the Far East, as people downsize, they are looking much more than we do in the West at how best to use and apply technology to improve business. But the East doesn't spend money as wildly as we do on new technologies unless they're serious and really can solve problems that a human being couldn't do better.'

Meanwhile, he says there's a reassessment in the West on IT in general, to use it effectively and not spend money unless it will bring real business benefits. All we've done in most cases, he says, is make word processing prettier. And still, he asks: 'Are the words any better, or the quality of the information coming out?'

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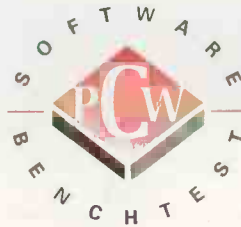
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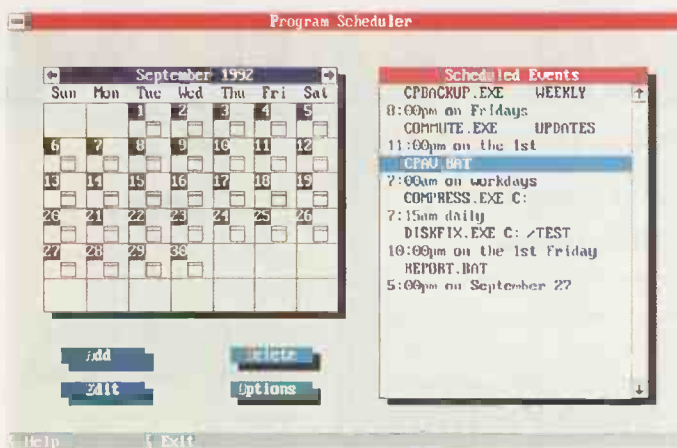
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PC Tools 8.0

Central Point's upgrade to PC Tools takes on Norton Desktop head to head with over 100 new utilities aimed squarely at business users. Disaster-prone Paul Begg wouldn't swap it, but wonders just what DOS 6.0 will offer.

God provided me with few talents, but I have been graced with the ability to make the most mind bogglingly stupid computing mistakes. If a mistake can be made, no matter how impossible it might be deemed, I can make it with consummate ease. If you can crash a program by simultaneously pressing Ctrl, F12 and the letter H while standing with one foot in a bucket of pink blancmange, fate will contrive to provide buckets full of the milk pudding and an irresistible urge to press Ctrl-F12-H.



△ The Program Scheduler is a great way to make the most of PC Tools' other features

This gift has few practical uses and is a liability in an office environment, but it's useful when evaluating software. A program could work perfectly for every reviewer, but if it has a weakness I often feel that Begg has been singled out to stumble across it. I am writing this just after something, I don't know what, wiped all my CMOS information.

I've never felt entirely secure using a computer since I deleted, or somehow corrupted, an 11,000 word article on the eve of a deadline. It had no backup and no undelete utility — it happened when I was new to my computer and didn't even know that such a thing as undelete existed — and it was a Sunday so I couldn't contact anyone for help. I never found out precisely what I did to cause that disaster, but I soon found out about PC Tools and it's saved my bacon many times since then.

Central Point's PC Tools and Symantec's Norton Utilities are the best-known and probably the best utilities packages available. Over the past months the computer press has given a lot of attention to both the Windows and DOS versions of Symantec's Norton Desktop. Barely a word has been said of PC Tools, but version 8.0 has recently been released and we'll probably see a flurry of head to head comparative reviews in the months to come. The results will probably be the same as always, namely that both have different strengths and weaknesses and it is ultimately a matter of personal preference as to which you install.

Often described as the Swiss Army knife of utilities, PC Tools was launched in 1985. Norton Utilities had been around for several years by this time and was established as a must-have program, but PC Tools scored a success because it matched Norton's utilities, made most common DOS functions easier to use and integrated them into an easy to use interface called PC Tools Shell.

With each successive upgrade, PC Tools has gained new features and utilities. Central Point boasts more than 100 new features and enhancements for version 8.0, but most are not immediately apparent. This upgrade is primarily designed to benefit business users, and according to Central Point it is in direct response to their requests. The improvements address the needs of network users, growing memory demands and the growth of portable computing.

The main new additions are anti-virus protection, a memory optimiser for users of 386s and above, version 8.0 of Central Point Backup which now supports SCSI tape drives, and improved remote computing and communications features. It also boasts improved data recovery, an integrated program scheduler, a defragmenter for high capacity drives, expanded FileFix functionality, a disk editor emergency disk creation and an improved installation process. Gone are the six small manuals that I rather liked. Instead there are two big ones, plus a fold-out Quick Reference sheet.

Unlike Norton Desktop, which comes in both DOS and Windows flavours, PC Tools 8.0 remains

firmly DOS-oriented. However, most PC Tools utilities can be run from Windows and there are two Windows-specific utilities, Scheduler for Windows and TSR Manager. During installation a PC Tools program group is created for all the tools that can be run from Windows. Several utilities should not be run from within Windows, however. These include Compress, a disk optimiser that defragments your hard disk and can be used to rearrange files, and DiskFix, a disk analysis and repair utility. You can analyse your hard disk from within Windows using DiskFix, but it will not let you execute any repairs; to do so could result in data loss when a multi-tasking program like Windows is running.

To run PC Tools 8.0 you'll need DOS 3.3 or higher, 640K RAM, a high-density floppy drive, a hard disk and plenty of space, and a Hayes-compatible modem for remote computing and/or communications functions. A mouse is optional but highly recommended.

According to Central Point, installation has been simplified. Since I didn't find installing version 7.0 difficult, I can't really say that I noted any significant difference. Certainly 8.0 is quick and easy to install. There are prompts to guide new users while advanced users are given options to install all or a selection of the programs.

Hitherto, all PC Tools features were accessed from PC Tools Shell. This is now called PC Tools Desktop, which may well be a response to Norton's renaming. The default colour scheme is slightly different from version 7.0, as is the content of the pull-down menus, although you can elect to configure the menus to look like those in 7.0. User control over the menus, function keys and colours provides extensive customisation possibilities.

The Desktop incorporates Windows-like drag and drop for moving windows. You can also drag a file, group of files or directory to a drive icon, which simplifies the transfer of files from a hard disk to a floppy, and move files from one program to another or move files for backup.

PC Tools Desktop is much easier to use than the DOS Shell. It simplifies most housekeeping chores and provides access to all PC Tools programs and their functions, along with all the critical DOS maintenance commands. You can use the Desktop to copy, move, delete, view and compare files, edit files and disks, manage directories, format disks and launch programs.

The Desktop Manager, now called The Desktop Accessories, provides access to a text editor, database, outliner, appointment scheduler, notepads, four types of calculator (algebraic, scientific, financial and programmer's), task switcher, individual and workgroup scheduler, macro editor, and email, fax, and telecommunications capabilities. The DOS command line is available at all times.

Perhaps the most significant introduction for many users is the inclusion for the first time of Central Point Anti-Virus. This set of anti-virus utilities always performs well in tests and comprises two memory resident programs, VWatch and VSafe, to monitor your system. BootSafe is specifically aimed at detecting viruses that attack the boot sectors or partition tables of disks. It will recognise (or so it claims) more than 1300 viruses, including boot sector, polymorphic (self-modifying) and

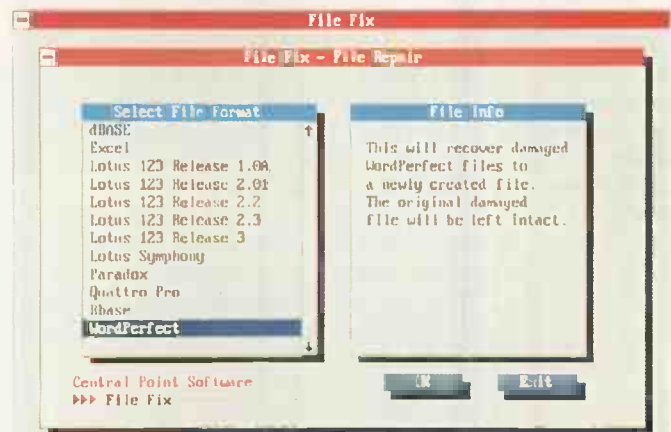
stealth (self-concealing) ones. Central Point also says it is the only anti-virus product to clean mutation engine viruses, of which the most famous is Michelangelo.

Central Point Anti-Virus offers continuous virus detection, removal and immunisation. Users can schedule virus scans, scan on demand using drag and drop, and update virus signatures from a DOS-based network server. There's also a 24-hour anti-virus hotline for update information.

Central Point Backup has also been enhanced. New features enable automatic and transparent backup to any DOS device, including SCSI tape drives such as DAT and 8mm drives. New Tape Tools allows users to format, erase and re-tension tapes. Users can now get a directory of files on the tape, as well as specific information about it. An improved scheduler permits more flexible scheduling of unattended backups.

Central Point Commute 2.0 is included, which lets you use another computer's applications and files while at your own computer. This can be achieved by modem, LAN or a direct cable connection. It effectively provides the means to communicate from a laptop to your office via modem, bypass a server on a LAN, or link two computers so that information on one can be accessed by another. Commute also lets you operate Windows applications over a Novell or NetBIOS network.

Improvements have been made to Commute. It is particularly useful for accessing a large database on your office computer and running it via a modem from your travelling laptop. It is fully Windows-



compatible, so a 286 could access and control Windows programs on a 386 or 486.

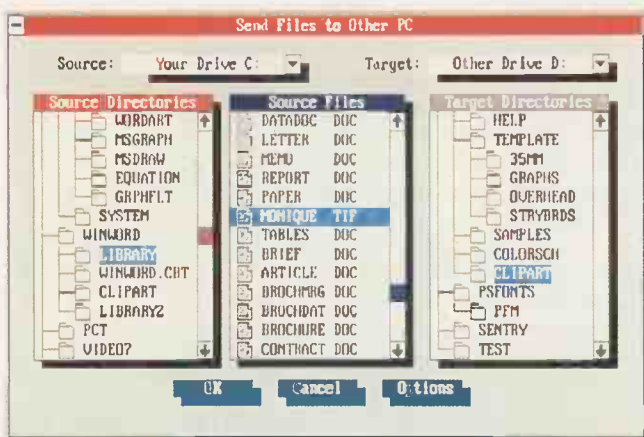
New to PC Tools 8.0 is the RAMBoost upper memory optimiser, which manages the area of memory between 640K and 1024K, called UMBs (Upper Memory Blocks). The free space in upper memory is in pieces of different sizes. RAMBoost analyses your PC's device drivers and TSRs, selects the optimal loading configuration and loads them into upper memory blocks to give maximum free conventional memory. It automatically detects software that might cause incompatibilities when loaded high. Just when you'd become used to MSDOS's DeviceHigh and LoadHigh commands, you don't have to use them any more.

RAMBoost is not a memory manager in itself. It improves the memory utilisation of existing memory

△ The flexible FileFix is great for the clumsy user

managers, working with HIMEM.SYS and EMM386.Exe provided with DOS 5.0 or Windows 3.x, Quarterdeck QEMM-386, Qualitas 386MAX and BlueMAX, and Helix Netroom and. The amount of upper memory that RAMBoost makes available is determined by the expanded memory specifications (EMS) manager used with it. If you use the DOS 5.0 EMM386, the upper limit varies from 64K to 160K, depending on your BIOS and peripherals. If you are familiar with memory management techniques, you can manually edit the settings in the RAMBOOST.INI file to customise RAMBoost's performance.

RAMBoost requires a minimum of 1Mb RAM, a 386 or 486, MSDOS 3.3 or higher or DRDOS 6.0, and a memory manager. Running DOS 5.0 without RAMBoost, my available conventional memory according to the DOS MEM command was 568,768



△ Commute provides remote access so that you can get in when you're out

bytes. With RAMBoost this increased to 608,592.

Apart from these new additions, many of PC Tools' tools have been enhanced. This is a big package, and if you load them all you'll need at least 10Mb of hard disk space.

The data recovery and system utilities include a new disk editor, which you can use to explore the entire contents of your disk and edit and repair floppy or hard disks, including the partition table, file allocation table and boot sector. The disk editor can do serious damage and is designed (and best reserved) for experienced users. A new emergency disk utility lets you create, update and configure a fully-featured floppy disk containing DiskFix and all the critical data recovery utilities needed to 'clean boot' for system recovery or troubleshooting your hard drive. The emergency disk is run automatically during installation and FileFix has been enhanced to repair corrupted files from Paradox, R:Base, dBase, Quattro Pro, Excel, 1-2-3, Symphony and WordPerfect.

Data Monitor lets you attach delete/write protection to files to prevent them from being accidentally deleted or overwritten. Disk Light provides on-screen indication when a floppy, hard or network drive is being accessed, and Directory Lock encrypts or decrypts a directory so that it can only be accessed with a password.

I was relieved to find that two of PC Tools' best features, System Information and Directory Maintenance, are unaltered. The former displays three windows containing information about your com-

puter's hardware configuration, CPU performance and memory use. I use the latter a lot and I'm forever checking hard disk space, being shocked at what a little-used application or utility is taking up and dumping it. System Information provides a quick and easy way to check AUTOEXEC.BAT and CONFIG.SYS files, and get network information. You can also get more detailed, specific information and print a report.

Directory Maintenance, as the name suggests, lets you maintain directories on local or network drives, and I use it from time to time to print a list of directories and sub-directories. I also like the facility, available with Windows but not under DOS, to delete a whole directory and all its sub-directories with a single command. Best of all, though, is the ability to view in graphic form the size of individual directories and sub-directories.

PC Tools' Undelete recovers files that have been deleted on DOS, DRDOS or Novell NetWare systems. Fortunately, and somewhat surprisingly, I have not yet accidentally formatted my hard disk or a floppy crammed full of irreplaceable data, but it's nice to know I have PC-Unformat ready for when I do. PC Tools also comes with PC Format to format hard and floppy disks.

Network users and administrators can install PC Tools on a Novell NetWare server (version 2.12 or later) or an IBM PC LAN server. A new feature is DriveMap, a remote device mapper that lets users share their disk drives and printers with other DriveMap users, using a network, or serial or parallel cables. Mapping network servers, workstation drives and printers makes sharing resources more flexible. Commute can be used in conjunction with PC Tools' Program Scheduler, which lets you schedule programs such as Backup, Compress, DiskFix, Anti-Virus, System Information and other applications in either DOS or Windows.

Add PC Tools' electronic mail capabilities and laptop users will feel that the office is never far away. I regard this as a dubious benefit, but from time to time it can be a lifesaver. The email has been expanded to include the ability to attach files to messages sent via MCI Mail, CompuServe, EasyLink and other services.

Conclusion

Dwindling disk space compelled me to remove PC Tools 7.1 some time ago. I missed it a lot. Version 8.0 is still big, but the inclusion of Central Point Anti-Virus and the memory benefits of RAMBoost, with the ability to uninstall unwanted utilities, makes it a worthwhile buy. My only thought about upgrading is that DOS 6.0 is expected to ship early next year. In certain quarters it's said to have enhanced memory management, backup and anti-virus capabilities, network and Windows integration and defragmentation, as well as coming bundled with disk compression. If DOS 6.0 sounds like it has most of what's exciting about PC Tools 8.0, it might be better to wait and see what it is like. But PC Tools has got me out of more messes than I care to think about and version 8.0 is a solid and remarkably inexpensive safety net for the cack-handed..

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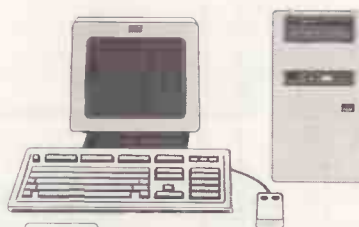
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Miracom DS+ (HST)	£549		✓		✓	✓	✓	✓	✓	✓	✓				✓	19200

V23 = 1200/75bps, V21 = 300bps, V22 = 1200bps, V22.bis = 2400bps, V32 = 9600bps, V32.bis = 14,400bps, MNP 4 = error correction, MNP 5 = 2/1 data compression, V42 = CCITT error correction, V42.bis = 4/1 CCITT data compression. All modems V21/V22/Bell 212/Bell 103, Hayes compatible, auto answer, auto dial (pulse and tone) and have monitor speaker. S = Software error correction. Our non BABT approved units are designed for international use, including the UK. All modems supplied with RJ11/BT lead.

Software

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QuickLink for Windows	£19	Fax & Modem Software for Windows
QuickLink for Apple Macintosh	£25	Fax & Modem Software. Includes serial cable
QuickLink Gold (OCR)	£79	Windows 3 Fax & Modem Software. Includes OCR Software
HotFax for DOS	£99	Brilliant Fax & Modem Software for DOS. Includes ZModem
Eclipse Fax for Windows	£99	Windows 3 Fax Software. Much faster than WinFax Pro
Network Fax	£149	DOS & Windows Network Fax Software
Network Modem	£149	DOS Network Modem Software
Network Lite	£49	Novell Network Lite. Includes DR-DOS 6

Peripherals

NE2000 Compatible, 16 bit Network Cards	£69	Sound Blaster Compatible Cards	£99
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GW964/1



For the novice, user friendliness is the key. As applications get more feature-intensive, Robert Bradley asks whether companies should take a more object-oriented approach.

Even in these days of a computer literate populace and user friendly machines and applications, asking a complete novice who has just bought a PC running Windows to perform some simple tasks is likely to have a predictable result. That is, no result at all, as the unfortunate consumer exhibits a complete inability even to work out where to start.

After working out what the basic functions are and looking at the notepad or paintbrush, the average user gets adventurous and starts installing a few shareware programs. No harm in that is there? Well, no-one wants to spend hundreds of pounds on application software, do they? After all, a 'no-name' PC only costs £600.

Surprise, surprise then when a few strange things start happening. After much puzzlement and some head scratching the user digs Microsoft's telephone number out from under all the bumph that came with the PC. The friendly man at Microsoft listens carefully to the customer's litany of problems and wonders first whether he has been 'experimenting' with shareware, and secondly, whether his system files have been modified in any way since Windows was installed.

All reasonable questions. The only problem here is that our novice is unlikely to know a CONFIG.SYS file from a WIN.INI file, and why should he? The reason he has the problem in the first place is that he doesn't know his way round the computer. If he knew his way from A to B he wouldn't have got himself into this mess in the first place.

And herein lies the problem. Windows is probably quite user friendly... if, that is, you've previously been through the DOS mill. But to the absolute beginner it is a foreign language. The illogical file structures of hard disks and the relevance of system files may seem incomprehensible to the novice,

but it doesn't stop there. Even relatively inexperienced DOS to Windows converts such as myself will reap benefits from any effort they make to understand these concepts before they try to take on board Windows with all its benefits and potential pitfalls.

My own, fairly recent introduction to DOS was, like an awful lot of people's, an alarming experience. I still fondly remember assiduously trying to delete Word from my hard disk, only to find that the nice, helpful man from Microsoft kept on at me about some nasty things which he called 'read-write attributes'.

Windows users who are newcomers to computers could well be forgiven for thinking they have been launched into a world which is partly friendly but, to a much larger degree, distinctly hostile. The burning question to be addressed here, then, is whether the answer lies in a more object-oriented approach to application software in general and to operating systems in particular.

Will Cairo be similar to the workplace shell of OS/2? More to the point, do we want it to be? At least the workplace shell appears to give us a shield from the worst excesses of system files. After all, if things do go wrong — and things being what they are, you know that they will — only one application will crash at a time. That's the theory at any rate.

Windows application software, meanwhile, continues to get more and

more feature-intensive. This is despite the fact that the vast majority of users will only ever use a small proportion of the features on offer.

You might argue that there is a very good reason for that, namely that we only actually need a small proportion of the features on offer. The marketing men of course will tackle this one from the other angle. They will tell us that as they make software easier to use, we will start using more of the features. Back to user friendliness again.

However, something tells me that this is a rather too convenient argument. Don't we simply need some good, cheap, low-end Windows programs so that users can concentrate on getting up and running with what they actually want, or need to do? Just such a need arose for DOS packages with DTP applications and our needs were answered by the likes of Timeworks. So roll on more products like Serif's Page Plus for Windows.

Most software developers are concentrating on developing Windows applications. This can only be good news for Windows users in terms of what the developers like to call usability standards.

This is evident in the 'me too' battle being waged between Word for Windows and Ami Pro. Microsoft and Lotus seem to be trying to outdo each other, at present, in their implementation of what are essentially the same features. It would be nice to see some good, user friendly, 32-bit OS/2 applications to shake things up a bit.

The shrinkwrapped software which has been developed for OS/2 has so far been disappointing; this would seem to be largely responsible for its low take-up by non-corporate users.

Code inconsistencies which don't even allow the current OS/2 version of Freelance to run under OS/2 2.0 don't exactly inspire confidence either. Let us hope the offerings that Lotus produces for OS/2 2.0 can take on the object-oriented approach of the workplace shell and not simply be a part of the Windows code. In the meantime, we will continue to watch the Windows hourglass and wonder what all this multi-tasking is about.

Speaker's Corner is a regular column written by readers on issues which affect the computer industry. If you would like to submit a column with a view to publication, send it to: Speaker's Corner, *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG. Articles should be around 800 words long and submitted with two copies on an MSDOS format disk, one in straight ASCII and one in any popular word processor format. This opportunity is not open to anyone working in the industry who wishes to promote their own products or services, although we are interested in hearing from anyone who has strong views. Include a brief biography if you think it will strengthen your argument.



Amiga 1200

Commodore is out to recapture its glory days with this cut-down version of the A4000, with three custom chips, multi-tasking and compatibility with almost all Amiga software. And at under £400, it will just sell and sell, says Jeff Walker.

The Amiga 500, now at the witching hour of its life, is still the world's best-selling home computer. In the five years since it was launched it has

changed little — some OS upgrades, a new chipset or three, but **nothing** that could be called new. As a consequence, what was once the world's most



innovative computer in 1987 became, in 1992, an expensive and not particularly impressive games machine.

In mid 1992 the Amiga 500 was replaced with the A600, a smaller, cheaper, redesigned model that gave a clue to where Commodore intended to go with the range. An AT IDE hard disk interface was fitted as standard and the old Amiga expansion bus was replaced with a PCMCIA card slot. Its reception by the Amiga press was at best lukewarm and at worst, positively hostile. Nobody would make cards for the PCMCIA slot, they said: too expensive. Very little expansion hardware developed for the Amiga 500 would fit to the A600, and it was difficult to expand the machine past 2Mb of memory. It didn't even have a numeric keypad...

The Amiga, they concluded, if not quite dead, was dying fast. Had Commodore shot itself in the foot? How did Commodore find its foot? Did Commodore know that it had a foot?

When news of the Amiga 4000 broke, a new £2000 top of the range machine that featured a 68040 CPU and a completely different chipset that could display up to 256 colours from a palette of 16.8 million in all screen modes, billions of hair follicles decided to jump scalp of their own accord

before their keepers could get their hands on them. This new Amiga was so different from the other new one, the A600, that there could be serious software compatibility problems. What on earth was Commodore playing at?

The A1200 was what Commodore was playing at. It came as a bolt from the blue. While a cheaper, cut-down version of the A4000 was being taken for granted, nobody expected another new Amiga featuring the 4000's Advanced Graphics Architecture chipset to look similar to the old Amiga 500 and sell for under £400.

Commodore's marketing strategy for the Amiga has changed significantly. There's just the one TV advert this Christmas but it sends two obvious messages: you can play games on it and you can use it productively. And there is a third, more subtle, message: you can do both these activities at the same time.

The A1200 is stylishly designed, coloured a very light hue of cream that is almost, but not quite, white. Shaped like a wedge, thin edge to the front, the keyboard is tilted at a decent typing angle. The numeric keypad, removed amid uproar from the A600, has made a comeback for the A1200. All the I/O ports are hidden from sight at the back, along the thick end of the wedge. On the right-hand side, tilted at the same angle as the keyboard, is the single internal 3.5in disk drive. On the left-hand side, towards the front, is

a narrow PCMCIA card slot. The machine is powered by a separate PSU brick, which has long cables so that it can be tucked away under the table. The big on/off switch is on the PSU, and responds well to a sharp prod of the toe.

Putting the machine together and booting it for the first time is not a complicated procedure. The power supply plugs into one hole, the monitor or TV plugs into another. Switch on the power and after a short delay an animation appears, prompting you to put a disk in the drive. In with the bootup disk, and about a minute later it's all systems go.

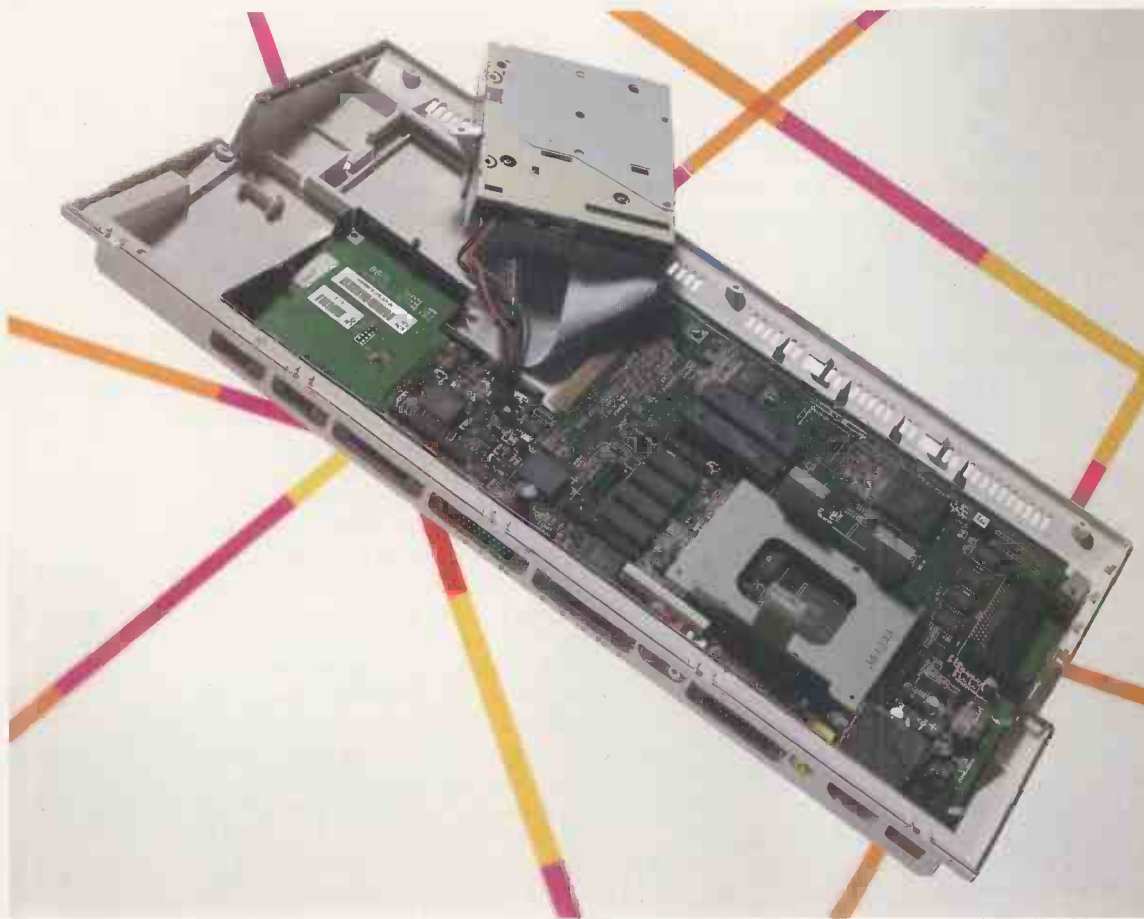
Right at this moment, the A1200 is being sold without a hard drive. But there is an AT IDE hard drive interface and mounting frame fitted inside, and HD models of the A1200 will be produced. If you want a hard drive right now, you will need to buy and have fitted a separate 2.5in IDE one and then install the system software. Leafing through advertisements in *PCW* shows that a suitable drive will cost around £200. As the plain A1200 is not an HD model, no automatic hard drive installation software is provided and a real Amiga expert will be needed to get the hard drive running and bootable. Even a user experienced with Release 2 of AmigaDOS will be taken aback by Release 3 because it now comes on five disks and more than a few of the Amiga conventions have been changed.

With the HD models, the system software will be already installed and when you switch on the power the hard drive will boot automatically. The Amiga's GUI is called Workbench, and like all GUIs it can place heavy demands on the system. But thanks to the combination of the 68020 CPU, the custom graphics chips and the true 32-bit architecture, the A1200 copes well. Windows open instantly and icons appear fast. Screen refresh after moving a window is also fast.

For these 'new generation' Amigas — the 600, 1200 and 4000 so far — Commodore has adopted a surface-mount policy which has already proved with the A600 to be more reliable. There are rumours that the faster CPU and 32-bit architecture will cause some established Amiga software to fail, but this is nonsense. Amiga developers have been writing software with 68020/30 and 32-bit memory in mind for years, mainly because the Amiga 3000 is 030-based. While there may be some very old versions of some applications that won't load or run correctly, almost every current Amiga application will have been made compatible long ago. When you hear talk of A1200 incompatibility problems, it is in the games market where programmers tend to 'break the rules', either in ignorance or in an attempt to get even better performance from the Amiga.

There is also criticism that the 68020 should have been a 68030. But the Amiga does not depend utterly upon the CPU: the three custom chips share between them the handling of screen display, sound generation, disk access and much more. The CPU can almost always access memory, with no loss of speed, at the same time as the custom chips are updating the screen display, playing a tune, reading a file... In practice, this means the A1200 offers you greater productivity and performance than a similarly priced 386SX. Commodore has chosen the 68EC020, where the EC stands for Embedded

PHOTOGRAPH BY BRUCE MACKIE



Controller because Motorola expected the chip to be used in washing machines. The EC doesn't have the MMU (Memory Management Unit) which is built into the standard 68020 and can't run Unix or some Amiga development tools.

The A1200 has two types of memory, Chip and Fast. Chip memory is so named because it is the only type of memory that can be addressed by the custom chips. Consequently all data to do with graphics and sound, the two most important aspects handled by the custom chips, must be held in Chip memory. Fast memory is any expansion memory you fit. Both types of memory are 32-bit, but the Fast gets its name because the CPU can access it much more quickly than the Chip. The A1200 comes with 2Mb of Chip memory fitted as standard and will run at about 2.5 times the speed of the old 68000-based, 16-bit Amiga 500/1500/2000. Fit some 32-bit Fast memory and you can expect to double that to four or five times faster than the old Amigas, or about half the speed of the 25MHz 68030-based 3000.

Memory can be expanded in two ways, the most obvious of which is a PCMCIA 2.0 memory card. This is 16-bit memory, and the A1200 can take up to 4Mb of it in the single PCMCIA card slot. It can be treated as normal volatile memory, or the card can be prepared as a disk and treated as such so that the contents remain even when you remove the card or turn off the Amiga. PCMCIA cards may be inserted or removed while the Amiga is switched on.

The other way to expand is via the 150-pin CPU slot situated in a trap-door underneath the compu-

ter. Up to 4Mb of 32-bit Fast memory can be slotted in here although a board that had its own CPU, a 68030 or 68040 accelerator for example, could contain more than 4Mb. (The 68020 can address up to 4Gb of memory, so the A1200 can theoretically be expanded this far.) The CPU slot is for any peripheral that needs direct access to the Amiga's internal hardware, but there's only one slot. If you wanted to fit both an accelerator board and a PC emulator board, it can't be done in the A1200.

The Amiga has always been a multi-tasking machine. Long ago, when the big noises in computing were saying that nobody really wanted multi-tasking, the Amiga community took it for granted and was lapping it up. Being pre-emptive multi-tasking, of the kind Unix users are used to and Windows users will have to wait for until NT, it works wonderfully. The operating system takes it all in its stride, running as many programs at the same time as memory allows, and it will simultaneously read from many input devices and write to many output devices.

Using the Amiga's built-in hotlinks clipboard device, or the supplied ARexx software, many applications can interchange information freely. These days an Amiga program is not properly dressed unless it supports ARexx. And as well as enabling programs to interchange information, ARexx can be used to automate the operation of programs; scripts can be written in a simple BASIC-like language to access the menu items or other functions of any program that has an ARexx port built into it. All the important software does this, including thousands of public domain and shareware programs. (The abundance and quality of these PD and shareware programs is one of the best reasons to buy an Amiga.)

Each multi-tasking program will normally want to open on its own screen, although many can be configured to open in a window on the Workbench screen if you prefer to work that way. Each screen may be of a different resolution and display a different number of colours.

The new Advanced Graphics Architecture chipset — AGA for short, although it is generally

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Average Street Price (excl. VAT) (*expected)	£569	£699	£699*	£750	£699
Official RRP (excl. VAT)	£945	£1,179	£1,099	£1,099	£1,195
Maximum resolution in dots per inch	300 x 300	300 x 300	300 x 300	300 x 300	400 x 400
Windows 3 Driver @ 400 dpi	-	-	-	-	YES
Print Speed	6ppm	4ppm	4ppm	5ppm	6ppm
Straight Paper Path	YES	-	-	-	YES
PCL 5 Printer Command Language	-	YES	YES	YES	YES
HP-GL/2 Vector Graphics Included	-	YES	YES	YES	YES
Resolution Improvement/Enhancement	YES	YES	YES	YES	YES
Standard RAM	0.5Mb	1Mb	1Mb	1Mb	2Mb
Full A4/300 dpi graphics with standard RAM	-	-	-	-	YES
Warm Up Time	<45 secs	<60 secs	60 secs	33 secs	45 secs
First Page of Text Output	<20 secs	<40 secs	34 secs	20 secs	<15 secs
Document Description Language included	-	-	-	-	YES
Flash ROM	-	-	-	-	YES
Upgradable Firmware	-	-	-	-	YES
IC Card Slot	YES	-	-	YES	YES
Scalable Resident Fonts - in HP LJ III Emulation	-	8	8	0	8
Resident Bit-Mapped Fonts	11	14	14	16	14
AGFA Intellifont Scalable Font Technology	-	YES	-	-	YES
HP LaserJet II: Emulation Included	-	YES	YES	-	YES
EPSON FX Emulation Included	YES	-	YES	-	YES
IBM ProPrinter Emulation Included	-	-	YES	-	YES
Standard Tray Capacity	100	70	100	200	100
Protective cover on standard tray	YES	-	YES	YES	YES
Cost per copy**	1.65p	2.00p	1.71p	1.84p	1.65p
Min-Max Paper Weight in gsm	60-157	60-105	60-120	60-131	60-157
Ability to print on OHP Film	YES	YES	YES	YES	YES
Ability to print on card (157gsm - Manual Feed)	YES	-	-	-	YES
Standby - Noise Level	<40dB	31.7dB	<35dB	38 dB	<38dB
Printing - Noise Level	<50dB	43.3dB	<46dB	50 dB	<48dB

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LAA 5262	2Mb RAM Module	£149.00
LAA 5210	Developer/Toner Cartridge	£65.00
LAA 5225	OPC Cartridge (Drum)	£89.00
LAA 5334	Letter Paper Tray (100 Sheets)	£35.00
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being called the AA or Double-A chipset — sports a wide variety of screen resolutions. Low Res is 320 x 256, High Res is 640 x 256, Super-High Res is 1280 x 256, and there are interlaced versions of each that double the vertical resolution to 512 pixels. The VGA resolutions of 160/320/640 x 480 are also supported, along with 640 x 960 and 800 x 600. All these resolutions are in up to 256 colours from a palette of 16.8 million.

But that's not the end of the story. There's HAM8, Hold And Modify mode, which has been enhanced to eight bitplanes and 64 24-bit base registers instead of the old six bitplanes and 16 12-bit registers. This effectively eradicates the 'fringing' that the HAM6 used to suffer, and now every pixel on the screen can be a different colour. Commodore is bandying about a figure of 256,000 colours on screen at once, but that's a lie: on a Super-High Res interlaced screen (1280 x 512) we're talking a possible 655,360 colours. The bigger the screen, the more colours HAM8 can display.

The A1200 can cope with horizontal scan rates from 15.6kHz to 31.4kHz, and vertical scan rates from 50kHz to 73kHz. A wide variety of monitors can be plugged into it but not all the screen modes work at all scan rates. Low Res, High Res and Super-High Res modes require a scan rate of 15.6kHz, so you can't expect these to work on a VGA monitor. And vice versa, of course.

With a cheap 15.6kHz monitor you can have Low Res, High Res and Super-High Res screens, in up to 256 normal colours or however many colours in HAM8. Interlaced screens flicker at 15.6kHz and to eradicate the flicker you need to double the scan rate: a multiscreen monitor is the ideal choice, enabling you to work in almost all of the umpteen screen modes on offer. There is a special handler for the Commodore A2024 monitor, which allows a 1024 x 1024 resolution in four colours.

The serial port is standard RS232, and standard accessories like printers and modems can be run from it. The parallel port is also standard except that pin 14 supplies +5v of power. Accessories that use the parallel port, typically sound samplers, can draw their power from the Amiga if they like.

The disk drive port is standard Amiga, allowing for 880K formatted floppies. If data needs to be transferred between Amiga and MSDOS machines, a supplied utility, CrossDOS, enables you to read and write MSDOS 720K formatted disks. High Density disk drives for the Amiga are already being advertised.

There is no SCSI-2 support so some sort of adapter will be required, either in the CPU or PCMCIA slot. Audio is 8-bit on four channels, the same as it has always been; Commodore is promising 16-bit on eight channels on future models. The A570 CD-ROM drive that was built for the Amiga 500 will not connect to the A1200, so a redesigned model will have to be built for the

PCMCIA slot. Commodore says it has this in hand, already naming it the A670, but nobody at the company will tell you any more than that. It may be a while coming and it might not happen at all; instead, CDTV support may be added by way of a CPU slot board.

Amiga application software is mostly of a high quality and often comparatively inexpensive, although you don't always get much of a choice. If you want a powerful database system, SuperBase Professional is the only player in the game, probably because it is hard to better. Word processing is well supported, with three or four major packages costing under £150, all supporting graphics import and either the Amiga adopted Agfa Intellifont scalable typefaces or another type of scalable typeface. Desktop publishing is dominated by Gold Disk's Professional Page and Professional Draw, a double package that can be bought for under £200 and is capable of completely professional results. There are perhaps a dozen choices for the spreadsheet user, but nothing, sadly, to match the top MSDOS packages. Accounting software is sparse, with perhaps only Arena Accounts shaping up properly.

But at heart the Amiga wants desperately to be a professional graphics workstation, and in this area you are spoilt for choice for both hardware and software. From the ubiquitous Deluxe Paint IV paint and animation program (an AA version will be released before Christmas to support the new screen modes) to presentation programs like Scala, specialised and extremely powerful image processing software like Art Department Professional and MorphPlus from ASDG, video editing software, 24-bit ray-tracers, modellers and animators... the list really does go on and on and on.

In this respect the A1200, with its 68020 CPU, is a great step forward for the Amiga, giving people with small pockets the opportunity to use truly powerful software productively at an affordable price. This can only result in the software getting better and probably cheaper as more and more A1200s are sold.

Conclusion

At the moment Commodore sees the A1200 as an enthusiast's Amiga. Most will be sold to existing 500/600 owners who want the new features. This is exactly how the Amiga 500 started out in 1987, selling something like only 12,000 in that first year. It ended up selling over a million in this country alone, and the A1200 is destined for the same fate. Many developers will tell you the Amiga needs a DSP chip if it is to survive and Commodore might well tell you the same if you ask quietly. But the AA chipset and 32-bit architecture alone have breathed new life into the range: it can only get better, faster and cheaper from hereon in.

Commodore is confident that this is the machine that will keep it going through the rest of the decade. High hopes, you might think, but after you've used the A1200 and some decent software for a while, you kinda get the feeling that history might be repeating itself.

Thanks to Almathera Systems of London (081-683 6418) for its help in researching this article.

Specifications

Amiga 1200

Processor

Motorola 68EC020 at 14.19MHz, optional 68881/68882 FPU

RAM

2Mb graphics RAM

ROM

Kickstart 3.0

Keyboard

96-keys (configurable keypad)

Expansion

4Mb 32-bit RAM in CPU slot,

4Mb 16-bit RAM in PCMCIA slot

OS

AmigaDOS Release 3.0

Price

£399 inc VAT

Contact

Commodore UK (0628) 770088

"FastCAD Scores Every Time"

"FastCAD has changed my life" said Bryan Mitchell, Systems Development Manager of Dorman Smith, manufacturers of industrial and commercial low voltage electrical distribution equipment, and a member of the Scholes Group Plc.

"With the multitude of PC CAD packages on the market we needed to find a system which could be easily customised, easily mastered, was fast and cost effective. FastCAD scored all the way.



At only a quarter of the cost of major competitive packages, FastCAD was still very easy to learn. It's superb menus and macros allowed us to customise exactly what we wanted and screen redraws were incredibly fast.

Now, razor blades, wasted paper and bad tempers have disappeared from our drawing office. Seventeen FastCAD packages, all networked, are used daily and we shall probably be buying more."

EasyCAD 2

EasyCAD 2 offers first time and expert CAD users advantages usually found in software costing thousands of pounds more. Written in assembly language, EasyCAD 2 is faster than many high-end programs. It is easy to learn, so you can tap the productive power of CAD almost immediately.

Hardware requirements are minimal, and so is the price. EasyCAD 2 provides all the tools necessary for professional quality detail drawings for £125.00.

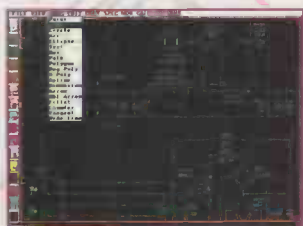
FastCAD

FastCAD offers no compromise functionality, combined with an easy to use & learn user-interface. Operating speed, even with basic hardware, is breath taking.

At £599, FastCAD is an extremely cost effective solution. Complete environments are available for Mechanical, Electrical, Electronic, Architectural, GIS and CAM disciplines. NEDO conformant DXF translator available.

Windows 3.1 Support

Both EasyCAD and FastCAD offer the same blistering speed in Windows® when running as a full screen application. EasyCAD screen redraws occur at up to 60 times faster than AutoSketch® for Windows®. Alternatively with our new drawing viewer, EasyCAD and FastCAD drawings can be viewed in Windows® with full support for Printing and OLE. Priced at £60 RRP, £40 for existing users.



EasyCAD Electrical



EasyCAD Mechanical



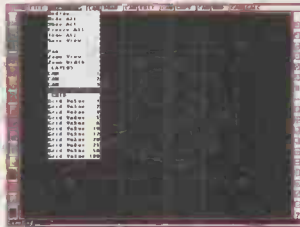
FastCAD Mechanical



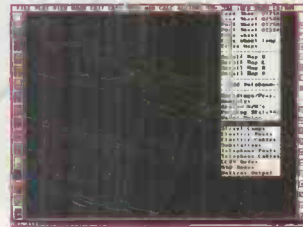
FastCAD Architectural

Corporate users of FastCAD and EasyCAD include.

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Jaguar Sport Ltd
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The Open University
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CAM



GIS

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FastCAD

EUROPE LTD

26 Greenhill Crescent, Watford Business Park, Watford, Hertfordshire, WD1 8XG, England.

Tel (0923) 240272 Fax (0923) 228796

® All trademarks acknowledged.

Money Manager PC

The UK's best-selling small business & personal accounts system – Your questions answered

What does it do?

Money Manager is an accounting program which is particularly easy to use and quick to set up. With it you can record all your financial transactions, and produce a wide variety of reports which will keep you well informed and totally in control of your financial situation.

How easy is it to use?

If you can read a bank statement and load a disk into your computer, then you can use Money Manager. You do not need specialised accounting or computing knowledge, just common sense. Feedback over the years from thousands of users of all kinds has been incorporated into the program, the manual and the on-screen help facility, making the program exceptionally user-friendly.

Who uses it?

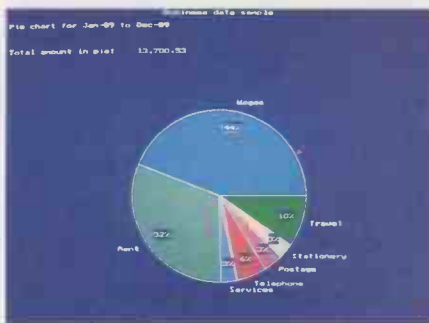
By mid-1991 there were over 50,000 users of Money Manager. Businessmen, doctors, architects, self-employed tradesmen, consultants, solicitors, company department managers, banks, book-keepers, accountants, club treasurers, farmers, schools, expense-account holders etc. Roughly one third of users use it for organising their personal finances.

At such a low price, can it be any good?

The cheaper the software, the better it has to be in order to succeed. At £250 you can afford a few unhappy customers, but at our price we cannot afford hundreds of them.

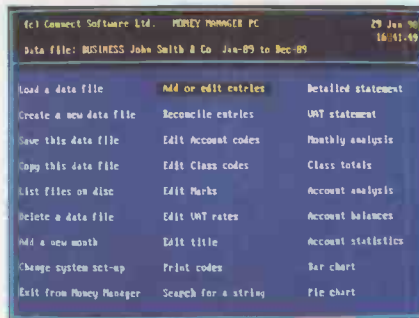
How does it compare with other software?

With enough time, patience and skill, you might set up a spreadsheet and database to do some of what Money Manager does. We think you probably have better uses for your time, patience and skill! Traditional accounting software has its place, but many users like you find it far more difficult, expensive, time consuming and frustrating than they can afford or are willing to tolerate.



Will it run on my computer?

Money Manager will run on all IBM-compatible PCs, from a single floppy-disk mono machine upwards. You can install the program on your hard disk, choose your own colour scheme and use a mouse. Versions of the program are also available for other computers (please call).



How do I run it?

Simply type MONEY, and this menu will appear on the screen. "Point" at what you want to do to make it happen. If you do anything wrong, the program will gently tell you so. If you get stuck, press the F1 key for helpful and relevant information to appear in a window on the screen. If you get lost, pressing the Esc key will always bring you safely back to base.

Can I set up the system to suit my own requirements?

Of course! Everyone tends to see and do things in their own individual way, and we have made it very easy to set up the system to suit your own circumstances and preferences.

How many different sets of accounts may I have?

Most other accounting systems restrict you to the accounts of just one company. With Money Manager you may have as many different sets of accounts as you need – business, personal, special projects etc.

How much information can I work on and see at one go?

Each set of accounts contains twelve months' information, with up to 500 entries per month. You can advance the file a month at a time, so that you always have the last twelve months' information at your fingertips to browse through and analyse. All your previous years' accounts will also be readily available on your disk.

How many bank accounts will it handle?

You may define up to 20, which may be bank accounts, or deposit accounts, petty cash, credit cards, trading accounts or general sales and purchase accounts. A special routine allows for the transfer of money from one account to another.

How many types of income & expenditure can it analyse?

You can define up to 50 "Classes" of income and expenditure, and arrange them in groups. You may for example have a group for Overheads comprising Electricity, Rent, Stationery, Travel, Wages etc., or a group for Motoring comprising Petrol, Maintenance, Insurance, Tax etc.

How do I actually enter data?

Select the appropriate menu item, and you can scroll up and down through the entries to remind yourself of what has already been entered (see below). Then simply open up a new line and type in the new entry. The computer will check the data as you put it in, and sort the entries into date order if you wish.

Day	Ac	Ref	Cl	Description	PL	Rec	Sep	Oct	Nov	Dec	29	entries
1	1	101	02	Rest		360.00						
2	1	102	11	Sales							1654.38	s
2	1	103	05	Postage		7.00						
2	1	104	06	Stationery		19.95						
5	2	105	07	Travel		15.52						
7	1	106	12	Archer & Co.							109.00	s
8	1	106	04	Telephone		296.40						
8	1	107	11	Sales							233.35	s
9	1	108	01	Journal ad		372.50						
9	1	109	02	Leaflets		233.27						

Can I correct mistakes and omissions?

Unlike most other accounting systems, Money Manager is very forgiving, and understands that people make mistakes or forget things. It allows you to correct errors at any time after the entry has been made. You can also enter data for previous months at any time.

How do I produce a report?

Select the appropriate item from the menu, and answer a simple series of questions. You can be as selective as you like – anything from "show me a brief summary of all my transactions" to "list in detail all entries concerning purchases of petrol for personal use using a credit card".

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
STAT balance	1400	1172	1101	3777-2693	283	694	1542	1819	2204	2073	2571	1600	
INCOME	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	18000
EXPENDITURE	316	349	270	457	775	513	508	446	422	343	438	415	5200
PROFIT	1184	1151	831	1043	725	987	992	1054	1082	1157	1062	1085	12800
CASH FLOW	1284	1093	1351	1170	1824	1892	1288	1835	1770	1350	174	1836	13640
PRODUCTION	253	170	327	8	587	464	78	198	166	187	149	266	2853
STOCK balance	1172	1101	3777-2693	283	694	1542	1819	2204	2073	2571	1600	4283	
INCOME	3802	3764	3363	4777	6704	5372	4484	4033	4157	3855	4085	5566	54080
EXPENDITURE	4230	3875	7040	4292	4214	4475	3638	3756	3772	3986	3587	3133	51477
CASH FLOW	420	72	4477	684	2489	897	848	277	385	131	498	1633	2640

What sorts of reports does it produce?

The information can be displayed in a wide variety of ways to suit your varying requirements. There are detailed statements, showing each entry individually as in a bank statement, with the running balance in the right-hand column. There are various spreadsheet-style reports showing for example a column of totals for each month or for each account, reports showing income, expenditure and cash-flow month by month, etc. And of course there are the graphical bar-charts and pie-charts which can often reveal so much more than the bare figures. The variety of reports is one of the strong features of Money Manager – far more than can be shown here, but if it is useful it is probably included!

Connect
Software Ltd.



Filling a tool bag

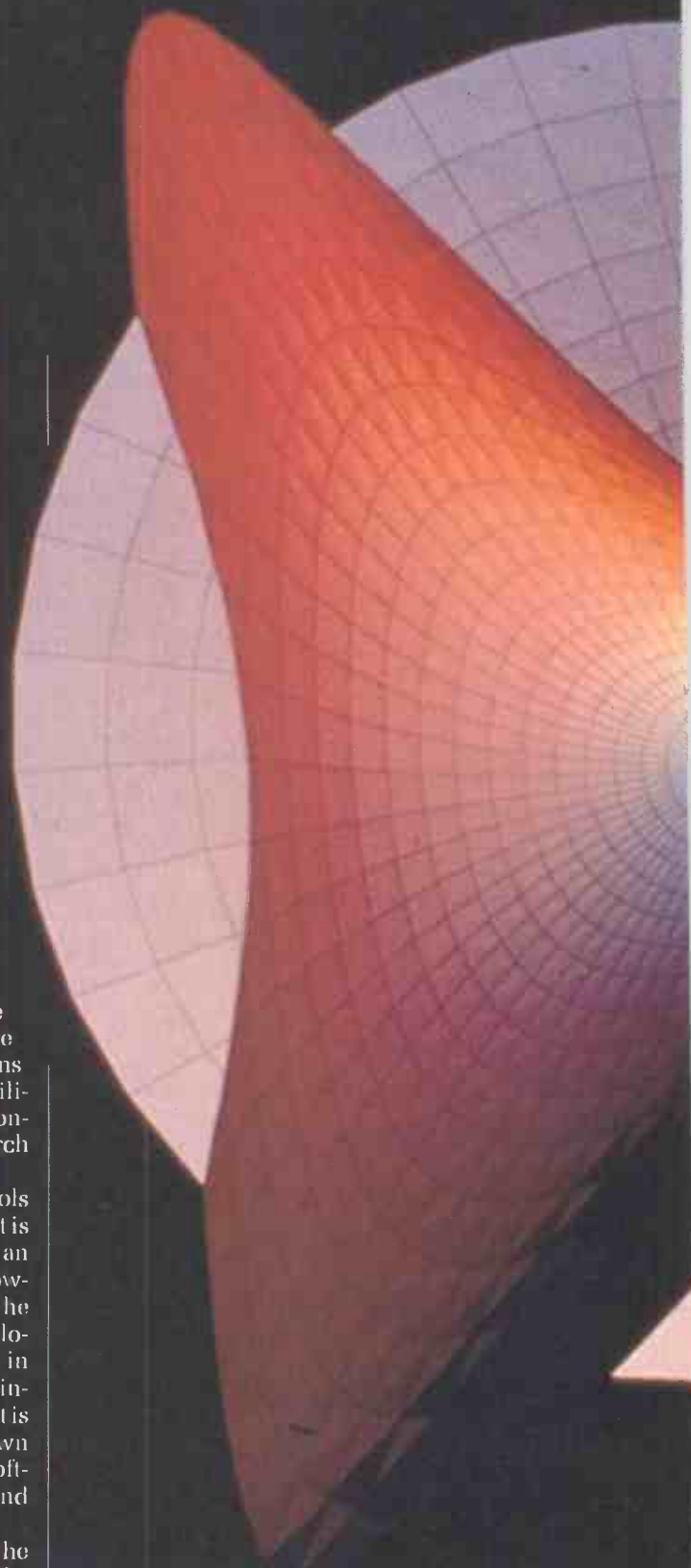
Visualisation is about turning numbers into graphics, but that's not much good if your computer hasn't got all the right equipment. Nick Beard takes a look at tools that put both you and your machine in the picture.

The purpose of computing is insight, not numbers', wrote Richard Hamming in 1962. Visualisation clearly offers important research opportunities for scientists and engineers, but it also promises to bring a deeper grasp of the meaning of systems and data to a wider range of people. Philip Davis, speaking at a conference on mathematics and education, said: 'Students fooling around with, say, orbits in the many body problem that have been displayed graphically, have found periodic solutions whose existence defies our keenest analytical analysis.'

In part one of this series we examined some of the applications of visualisation, in the science and engineering communities as well as the business world. Part two examined some of the specific hardware requirements such applications can demand, focusing on the extraordinary facilities which have been developed, and which continue to be improved, at the NASA Ames research laboratories.

This month we look at some of the software tools with which data visualisation can be achieved. It is (hopefully!) clear by now that visualisation is an important thrust in contemporary computing. However, if it is so important, it cannot be left in the hands of computer programmers alone. Technologies which require users to possess degrees in software engineering will not get far into the mainstream world of business computing. Similarly, it is unrealistic to expect people to program their own visualisation routines: good and important software is rarely an amateur enterprise. Packages and tools are required.

As we saw last month, when we looked at the power of NASA's systems, some of the problems for



which visualisation is suitable chew up vast amounts of computing resource. Heavy duty computing frequently points to special purpose computers: highly parallel systems, specialised processors and novel types of supercomputer. Fine, but who wants to program these things? As is discussed in 'Frontiers' this month [page 409], programming is a painful process, fraught with opportunities for errors. To bring visualisation to a wider range of users and a wider range of machines, we need tools. Here we look at the visualisation products market-place, and describe the best of the tools, whether they are avail-

able for PCs or not (and many of them are not...yet). We will also focus on those for which the PC (IBM compatible, Intel 80x86 based machines) connection is strongest.

Painting by numbers

Visualisation involves three steps: getting the data, selecting 'patterns' with which to display it, and squirting the data onto a screen in a visually valuable fashion. First, getting the data. Raw data is *transformed* into a form suitable for subsequent processing, such as by smoothing or interpolating. This involves capturing data from sensors, such as on satellites or on exploration pods on wires miles beneath the sea, and cleaning it up.

Next is the principal step in visualisation: the *mapping* of data items to graphical primitives. 'Primitives' include positional parameters, texture and colours. Just as there are many ways to get from Braithwell Rotherham to Bognor Regis, there are many ways to link variables in a dataset to elements defining a picture. These mapping relationships define the route from numbers to pictures: they describe how the data is to be visualised, and so the quality and usability of the eventual image is vitally dependent on decisions made at this stage.

Finally, the 'conceptual map' of the data generated by the mapping process is *rendered* visual. The process of rendering converts the numbers into pictures, through processes such as projection, shading and hidden surface removal.

In many businesses, visual data analysis software (visualisation tools) will be a strategic purchase. The hardware demands are significant, usually starting with a workstation and rising rapidly from there. Indeed, many tools are now available for the Cray range of supercomputers. However, while hardware power is important, initial cost of computing systems is often easily lost in the total amount of time and effort invested in its use after purchase. It is critical the software does its job well. There are a number of valuable criteria to use in selecting visualisation software: these are listed on page 374. It is important to stress that these are not thorough and painstaking reviews. This type of software is too complex and the uses to which it can be put are so many, yet potentially so specialised, as to preclude a sensible ranking here. The purpose of the listings is to give readers a feel for the kinds of capabilities these packages have, and to point to where to find further information.

Freeware

An early decision will probably be whether to pay for any software at all: there are a number of free

packages available over academic networks.

Khoros aims to provide a flexible user-interface development system, including many sophisticated subsystems. The Khoros system includes five main elements: a general visual language (Cantata); a user-interface development system; a data exchange format (viff); application-specific data processing libraries; and interactive data display/visualisation toolkits.

Khoros runs on SUN, DEC, SGI, IBM, NeXT and Cray platforms. Significantly for PCW readers, there are efforts in progress to port the suite to the 386/

interactively create wireframe, shaded and function-mapped parts to view, and output the results to the Graphics Animation System (GAS).

The tools market

Two companies figure heavily in the visualisation tools world, with significant co-operations between them. Cray Research produces the world's most famous supercomputers, and is a significant force in the world of visual data analysis. Alongside Cray Research is Silicon Graphics Incorporated (SGI), in its own right a producer of important visualisation hardware, and also a developer of visualisation tools.

Cray Research, now teamed with Digital, produces an 'entry level' machine, the Cray Y-MP EL Supercomputer. It collaborated with SGI to release Cray Research IRIS Explorer, a visualisation toolkit which enables custom applications to be engineered quickly and easily.

The product, called Cray Research IRIS Explorer 1.0, provides numerous software modules, enabling users to visually program the Cray by chaining icons together in the SGI GUI environment. 'Visualisation is important for our customers,' says Steve Conway of Cray Research. 'Our goal is to provide complete visualisation solutions, which means working closely with workstation vendors.'

SGI is frequently the first workstation vendor to spring to mind when visual applications are mentioned. Its Explorer tool, enhanced for the supercomputer environment in collaboration with Cray Research, is also available for workstations which are *not* connected to a supercomputer. 'Explorer blurs the distinction between writing and using applications,' says SGI.

Explorer is a modular, object-oriented system that enables users to build applications with modules from SGI or third-party vendors. The resultant applications are not restricted to single machines, they can draw data from locations distributed across networks too. Applications are *maps*, built in the Map Editor work area, linking modules which perform functions such as data reading or transformation, isosurface generation, or equation solving.

Precision Visuals offers PV-Wave, a flexible visualisation tool which runs on many workstation platforms. First introduced in 1988, PV-Wave is a highly-regarded product which successfully straddles the false dividing line between scientific and commercial environments.

The PV-Wave family is available for Sun, DEC, HP-9000, SGI and other systems running Unix. The family comprises PV-Wave Command Language, a 4GL for VDA applications development; NAG, a numerical analysis bolt-on; GT Grid, providing gridding techniques; and Point & Click, which provides a GUI front-end for OpenLook and Motif-based Unix systems.

Precision Visuals is committed to porting PV-Wave to Windows NT, to enable users of more powerful PCs (whether based on the Intel line or the DEC Alpha architecture) to exploit PV-Wave.

Many software products have family trees, and PV-Wave shares its ancestry with another: Interactive Data Language (IDL) from Research Systems Inc. The original kernel for PV-Wave is IDL, though the two are now quite separate products and have

The Four-Dimensional Hypercube

We live in a three-dimensional world, surely? Although that is (probably?) true, *dimension* turns out to be a rather bizarre notion. There are few places within the realm of experimental mathematics where computers are more valuable than in visualising high dimensional things. Not only can we *meaningfully* discuss four or more dimensional objects, we can have fractional dimensions too. *Fractional* dimensions are the origins of fractals, the swirling paisley patterns we now see on so many album covers and tee-shirts. These are precisely the types of shape or object we could not see without the aid of computers. Computers can also generate the lower dimensional projections of higher dimensional shapes.

One such program is The Four Dimensional Hypercube, from Lascaux Graphics. We cannot draw four, or even three, dimensions directly onto a computer screen. A 'cube' on a screen is a 2D projection, rather like an X-ray is a 2D projection of our innards. The Four Dimensional Hypercube operates in CGA graphics (even on EGA or VGA screens) but gives adequate detail.

When loaded, the screen shows an animation area which displays the 2D projection of the 4D hypercube, and a range of buttons. These control the recording process. Once started, the computer remembers the various shapes the 2D projection displays, as the viewing angle for the 4D cube is altered. The viewing angle is altered simply by pressing keys. This generates animation sequences which can be played back. For users intrigued by the underlying maths, which is not especially horrific, the full Pascal source code of the program is included along with the manual, which adds helpful suggestions.

The Four Dimensional Hypercube is a cheap and cheerful introduction to the peculiar world of high dimensional objects.

The Four Dimensional Hypercube is available from Lascaux Graphics in the US on 800-338 0993.

486 range. It is available free of charge via anonymous ftp (file transfer protocol), or a tape and printed manuals can be ordered for \$250.

The American NCSA (National Center for Supercomputing Applications) offers a number of public domain tools, including the NCSA Distributed Datascope, NCSA Image, NCSA Layout and NCSA Telnet. They are all available free over Internet, or for purchase with documentation from the NCSA Technical Resources Catalog.

Another source is NASA Ames Software. Last month we looked at the work in progress at Ames. You can have access to some of the software developed there. Plot3D is a graphics program designed to visualise the grids and solutions of computational fluid dynamics (CFD) problems. It can work in conjunction with SURF, which allows users to input Plot3D solution files, and work with SURF to

"The importance of the program cannot be overlooked ... it so fundamentally alters the mechanics of mathematics."
New York Times

"Mathematica is a startlingly good tool."
Nature

"Mathematica has the potential to change the world of science at least as much as word processing has changed the world of writing."
InfoWorld

Mathematica®

A System for Doing Mathematics by Computer

Function: Numerical, symbolic, graphical computation, interactive programming. Integrated technical computing environment.

Numerical Computation: Arbitrary-precision arithmetic, complex numbers, special functions (hypergeometric, elliptic, etc.), combinatorial and integer functions. Matrix operations, root finding, function fitting, Fourier transforms, numerical integration, numerical solution of differential equations, function minimization, linear programming.

```
In[1]:=
3^70
Out[1]=
2503155504993241601315571986085849
In[2]:=
Hypergeometric2F1[7,5,4,1,3-I]
Out[2]=
-0.00403761 - 0.00295663 I
```

Numerical Computation

Symbolic Computation: Equation solving, symbolic integration, differentiation, power series, limits. Algebraic operations, polynomial expansion, factorization, simplification. Operations on matrices, tensors, lists, strings.

Graphics and Sound: 2D, 3D plots of functions, data, geometrical objects. Contour, density plots. 3D rendering with intersecting surfaces, lighting models, symbolic descriptions. Combining and labeling graphics. Color PostScript output, publication quality graphics, animation (most versions). Sampled sound generation from functions and lists.

```
In[1]:=
Integrate[x/(a + Exp[x]), x]
Out[1]=

$$\frac{x^2}{2a} - \frac{x \operatorname{Log}\left[1 + \frac{e^x}{a}\right]}{a} - \frac{\operatorname{PolyLog}\left[2, -\left(\frac{e^x}{a}\right)\right]}{a}$$

```

Symbolic Computation

Programming: High-level, interactive, symbolic system. Full procedural language, functional programming constructs. General transformation rule paradigm based on pattern matching.

External Interface: Input from external files, programs. Expressions, strings, words, records, numbers (in *Mathematica* or Fortran format), with arbitrary word and record delimiters. Output in TeX.



Graphics and Visualization

C, Fortran, PostScript. System functions, file manipulation. External function calls, general inter-process communication, and data exchange via *MathLink™*.

Notebook Front End (Macintosh, NeXT, Microsoft Windows): Based on word processor analogy. Notebook interactive documents mixing text, graphics, animations, *Mathematica* input, output. On NeXT and Macintosh, front ends can be used with kernels on other computers, and support sound.

Documentation: *Mathematica: A System for Doing Mathematics by Computer*, Second Edition, by Stephen Wolfram (Addison-Wesley, 1991) available at bookstores. Additional documentation supplied with specific versions. *The Mathematica Journal* published quarterly by Miller Freeman. Many other *Mathematica* books also now available.

Versions Available: Macintosh • MS-DOS • Microsoft Windows • CONVEX • DG AViiON • Digital Equipment Corporation VAX/VMS, RISC ULTRIX • HP 9000 • HP Apollo • IBM RISC System/6000 • MIPS • NeXT • Silicon Graphics • Sony • Sun-3 and SPARCstations • Educational, volume, reseller, and other discounts available • Now shipping Version 2.

Implementation: 843 pre-defined *Mathematica* functions (kernel C source 330,000 lines).

```
log[1] = 0
log[E] = 1
log[x_ y_] := log[x] + log[y]
log[x_^n_] := n log[x]
log'[x_] := 1/x (* derivative *)
log/: InverseFunction[log] = exp
log/:
Series[log[x_], {x_, 1, n_}] :=
Sum[(-1)^k (x-1)^k/k, {k, 1, n}] +
0[x, 1]^(n+1)
```

High-Level Programming

Typical Applications: Research, engineering, education, mathematical modeling, publication graphics, data analysis, visualization, systems analysis, algorithm development.

Awards: MacWelt, 1991 • Macworld, 1990-91 • Discover, 1990 • BYTE, 1989 • MacUser, 1989 • Business Week, 1988 • InfoWorld, 1988

Wolfram Research (UK) Ltd.
Evenlode Court, Main Road, Long Hanborough
Oxon OX8 2LA, UNITED KINGDOM
+44-(0)993-883400; fax: +44-(0)993-883800
email: info-uk@wri.com

Wolfram Research, Inc.
100 Trade Center Drive, Champaign, IL 61820-7237, USA
+1-217-398-0700; fax: +1-217-398-0747
email: info@wri.com

Or visit your local software dealer.

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been changed significantly since they were split. Running in environments such as DEC VMS and Ultrix, HP 9000, IBM RS/6000, MIPS, Sun and SGI, IDL is also available for Microsoft Windows and the Convex supercomputer family.

Straddling such a wide range of platforms is no mean feat. RSI stresses that IDL has been substan-

focus remains the scientific community, though, as with PV, it has a significant business user base.

Gaining Insight

A company with a long and highly-regarded track record in data analysis and presentation is the SAS Institute. The SAS system is a comprehensive suite of information processing tools which has been supplemented recently by SAS/Insight and SAS/Nvision.

Insight is a data exploration package which combines classical statistical techniques with interactive graphics. It involves three types of window: the data window, which looks a bit like a standard spreadsheet approach to data handling; a graphics window, in which many different forms of plots and images are available; and an analysis window, which combines elements of both to combine graphics with tables of statistics. It is a highly effective and intuitive tool which can dramatically simplify the process of getting to grips with a batch of numbers.

Soon to be announced is SAS/Nvision, which will provide three-dimensional modelling, rendering and animation capabilities to aid visualisation of data. Data dredging was largely impossible prior to computers, and graphical environments such as Insight allow computers to be exploited further. This enables the inductive portion of analysis, hunting and hypothesis formulation, to precede the development of experiments to test these hypotheses. Insight for Windows, for 486 machines, will appear in the first quarter of 1993.

Big Blue has joined the fray with its POWER Visualisation System. This incorporates a specialised visualisation server, with up to 32 parallel processors, which supports the Data Explorer environment through the X Window or OSF/Motif display standards. If required, the IBM disk array subsystem is available, which enables very large quantities of data to be held. With a capacity of up to 170Gb, this component of the system can shift very large chunks of data to the visualisation server. Users without the need or budget for the specialised hardware IBM offers can run the same package on RISC System/6000.

Sterling Software offers Sterling Scientific Visualisation System (SSV). Don't ask me, I didn't make up the acronym. Available for the SGI 4D and IBM RS/6000 workstation series, these are rooted in the NASA Ames Plot3D, GAS and SURF products.

A PC future?

Most of these tools need more computational power than PCs have been traditionally able to deliver. Consequently, most are mainframe, supercomputer or Unix workstation-based. However, as PC power continues to rise, and the workstation market merges with the PC world, expect to see increasing numbers of these packages ported to systems based on the Intel 80x86 range of microprocessors. Already, SAS and RSI have recognised the potential market represented by the Windows environment.

In addition, as Windows NT becomes established, increasing numbers of DOS users will be able to migrate to a more serious operating system than DOS. Windows NT will run on DEC Alpha-based machines, and as the DEC Alpha chip enters

Visualising mathematical spaces

Mathematics has been one of the most productive realms for computers and visualisation. Fractals are an obvious example. It was the power of computers that brought a visible shine to previously dull pages of equations.

The vital and sometimes analytically intractable world of chaos is another example. Experimental mathematics seeks to use computers to illuminate general principles about problems, to display types of behaviour through computer modelling of the underlying mathematical processes, and thus to gain insights into their behaviour. Here we examine tools for visualising the subtle, inaccessible spaces which lie hidden, deep inside mathematical functions and formulae.

Until recently, computers were used for doing *arithmetic*: calculating the results of simple sums over and over again. However, computing power has increased, and a subtle change in their role has taken place: computers can now be used for *mathematics*. They can be used to generate visual representations of problems being studied, leading to deeper understanding of their geometry through a process known as computer-enhanced analysis. Two products stand out in this realm: MATLAB and Mathematica.

MATLAB is an interactive program for scientific and engineering numerical calculations (MATLAB stands for MATrix LABoratory). The basic element of the program is a matrix which does not require dimensioning. Merely discussing the visualisation capabilities of MATLAB does not do the product justice: this is a suite of tools with huge scope. In addition to the core product (MATLAB) there are toolboxes for neural network design and construction, system identification, signal processing, splines, and much more.

The MATLAB for the PC is only one version, supporting various workstation platforms. The graphics system of MATLAB allows you to open many graphics windows simultaneously, place axes anywhere within a window, and control almost all the attributes of an image: axis direction, colours, grid colour and so on. MATLAB images can be recorded and played back as animated sequences. MATLAB is a toolkit of remarkable power and flexibility, and warrants serious consideration.

Developer Wolfram Research describes Mathematica as 'a system for doing mathematics by computer'. As with MATLAB, to view Mathematica simply as a visualisation tool is to ignore great chunks of sophisticated mathematical functionality. Nevertheless, it possesses sophisticated graphical analytical capabilities, and would-be visualisers with a more mathematical bent would be well advised to look closely at this product.

Mathematica offers a simple Windows interface, whether running on Mac, NeXT or PC. A rich array of graphical options is available, including simple 2D plots, colour 3D plots, variable light source shading, and animation.

Data import facilities are comprehensive, and the options for data processing and presentation are almost endless.

Mathematica is remarkably flexible, a consequence of its programming language. This enables the user to construct compact 'packages', which encapsulate the processes required for a specific problem, presenting the output in a range of graphical or other formats.

tially enhanced since the split with PV, adding statistical routines, maps (such as for remote sensing applications) and complex 3D routines not included in the IDL originally licensed to PV. RSI's

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What to look for in tools

Precision Visuals, manufacturer of PV-Wave, produces a guide to selecting visual data analysis (VDA) software. Naturally, it believes its product will stack up well against the criteria. The guide offers a useful checklist to assess VDA software. The following guidelines are drawn from the PV booklet.

The supplier

You should check the size of the installed user base. In general, the larger the user base the better, unless you are truly certain that your needs are unique, in which case package customisability is perhaps more important. How good is its customer support service? What about the quality of product documentation? Even if a package looks good, beware suppliers who score poorly on these criteria.

The product

Data import/export capabilities Data visualisation tools are useless unless they can get at data. VDA software must therefore have exhaustive read/write utilities for data capture from virtually any source, not just other software formats. Consider also test instruments, data acquisition devices and analog to digital converters of various sorts.

Data analysis capabilities Pictures produced by visualisation tools are at best attractively worthless and at worst dangerous if the underlying data is corrupt, irrelevant, or otherwise flawed in its ability to represent the business being considered. Built-in analysis routines (statistical and other types) are essential. Perhaps more important, though, is the ability for users to construct their own routines, in C or Fortran for example, and have them link to the VDA package.

User interface issues This is perhaps the most important element, yet the hardest to assess before purchase. Features to look for include built-in GUI, support for windowing standards such as X Windows, SunView, Motif and OpenLook, context-sensitive help, and macro facilities.

Data display techniques Look for fast 2D plotting, with controls over image elements such as line thickness, fast contouring, 3D and N-dimensional surface displays for representation of multidimensional data. Light source shading, animation, raster display techniques, standard image output formats (such as PostScript, TIFF, and PICT), hardcopy device support.

Image analysis Pan zoom and copy facilities, projection of surfaces onto 3D objects, ability to indicate localities in the image and zoom in and dig behind the picture to see the data.

Volumetrics Ability to display 3D volumetric data as surfaces, with user-defined translucency, rotation in 3D space.

Resource Guide

An Introductory Guide to Scientific Computing

RA Earnshaw and N Wiseman

An excellent and readable book, aimed at non-computing specialists. Includes a practical guide to facilities required to do visualisation work, and a thorough, though not exhaustive discussion of visualisation tools. Very highly recommended.

Visualisation in Scientific Computing

Gregory Nelson & Bruce Shiver (editors), IEEE Press

A glossily illustrated series of features and essays from the journal *IEEE Computer*, including many not previously published. Includes introductory overviews, foundations, techniques and applications. Clearly written, and ranging from beginners' to advanced practitioners' material. Recommended.

Numerical Methods for Scientists and Engineers

Richard Hamming (McGraw-Hill, 1962)

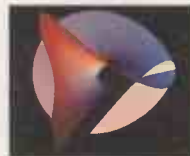
Visual Geometry, Computer Graphics and Theorems of Perceived Type

Philip Davis, August 1973. Missoula Conference on Computing and Mathematical Research and Education

the PC field, will be allowed to do so by the 'openness' NT promises. Open systems' principal benefit is the dissociation of hardware and software, enabling portability of applications, scalability, and freedom from specific hardware suppliers' dominance.

Many of these products will move an operating system which offers an inherently graphical world and a wide range of hardware platform powers. The Intel '586' (P5) should offer power of similar magnitude. Additionally, high-speed networks should enable the development of true, client-server architecture, data analysis applications. Such packages will inevitably tap the under-used processing power of corporate as well as scientific desktops to provide *distributed* and *visual* access to huge quantities of data.

It seems that Silicon Graphics was right when it forecast that the 1990s would be the decade of visual processing. The technology is now available.



Supplier Details

Khoros

Fax orders to (USA) 505-277 1439, or the ftp address is: pprg.eece.unm.edu (129.24.24.10)

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FoxPro 2.5 for Windows

Developed only to the point of cross-platform development, the new version of Microsoft's newly-acquired heavyweight database represents evolution rather than revolution. This beta gave Jon Silver some cause for concern.

It has been an eventful year for FoxPro. This young upstart, this candidate for the xBASE throne, has taken over data-crunching duties in many of Britain's corporates. Its windowed interface has helped towards making xBASE accessible to newcomers

other DOS packages are so un-Windows-like that they are either completely redesigned for the environment or fail miserably. But FoxPro hasn't had to change much at all in order to fit comfortably into Windows.

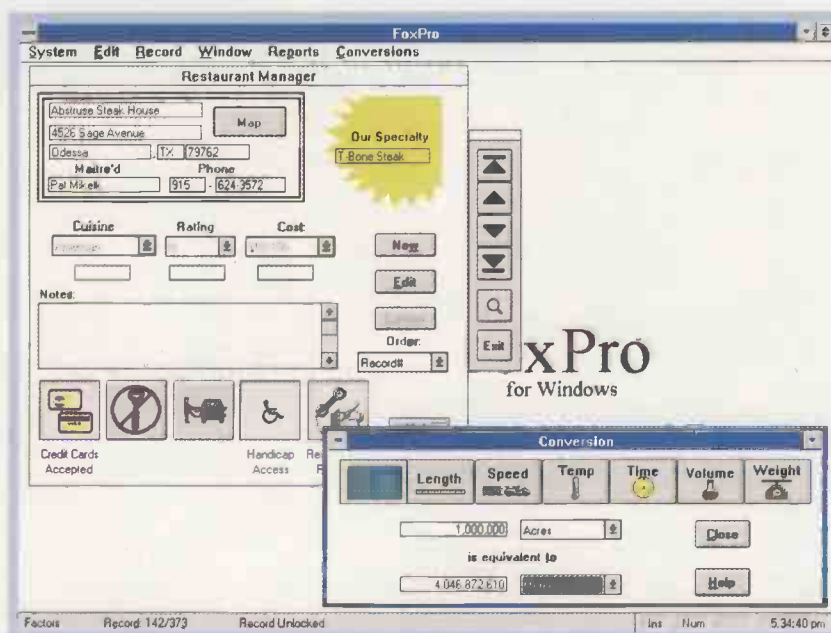
I reviewed FoxPro 2.0 when it came out, and as you may recall I am a great exponent of FoxPro. Here I am reviewing a beta-test copy of version 2.5 for Windows. While operation is stable and quick, some aspects of the package are clearly not finished. I have therefore tried to be objective in my assessment, seeking confirmation of the product's direction from Microsoft. The company itself does not have a white paper defining the direction of version 2.5 and so has not been able to categorically confirm or deny the likely presence of features or omissions.

What is FoxPro?

FoxPro is basically a Relational Database Management System (RDBMS) combined with a programming language. The language is a dialect of the xBASE language first seen in Ashton-Tate's dBASE family of products; a procedural 3GL (Third Generation Language). Fox Software started out years ago by producing more bug-free and faster clones of the Ashton-Tate products, and augmenting the language with

useful enhancements, so much so that the company soon became the main driving force in the evolution of the xBASE language. Fox made it more of a three-and-a-half generation language, introducing event-driven programming facilities to get around the constraints of a procedural program flow while keeping away from the rather inflexible 4GL territory.

Fox products were always faster than their counterparts while retaining a high degree of code compatibility. FoxPro took the character-based interface to its limits by including a fully windowed,



△ The Organizer application shows how the developer can exploit the graphical environment of Windows

and old hands alike. FoxPro 2's success was also fuelled by Ashton-Tate's dBASE IV cock-up, Borland's takeover of Ashton-Tate and its dBASE product, and finally by Nantucket pulling Clipper out of the xBASE world.

Oh, and Fox Software got taken over by a small Seattle-based software company. Well, rather a large one actually. Even before Microsoft's takeover, Fox Software was busy working on a Windows version. As I write, the finishing touches are being put to FoxPro 2.5 for Windows. It is a relatively easy job, making FoxPro run under Windows; most

mouse-driven environment permitting plain, ordinary users to use the software quite effectively. FoxPro 2.0 introduced two patent-pending technologies: Rushmore, a query-optimiser, allowed FoxPro to compete with mainframe DBMS programs in many operations; and an index-compression technique which reduced the size of indexes by up to 80%.

Version 2.0 also saw the introduction of the so-called PowerTools, comprising the Screen Builder, Menu Builder and Project Manager. These work with code generation programs which are themselves written in FoxPro. For the ordinary user there is also FoxApp, which guides the user through creating and generating screen forms. The latest version permits development of fairly impressive multiple-database programs without much programming. Any code needed should only normally take the form of validation expressions which are fairly easy to learn.

This new version of FoxPro is to be the cross-platform version. In 1993 we will also see version 2.5 for Unix and 2.5 for the Mac. To me, the term cross-platform means that a FoxPro developer will be able to run code, unmodified, on any supported platform. As I write this, I cannot see how this will happen. The graphical environment of Windows makes possible many things which are impossible on other platforms. What happens when you run your FoxPro for Windows code on FoxPro for DOS? Will picture buttons appear blank? Will bitmaps just not appear? Or will the code need adaptation to run on a different platform? The official word from Microsoft at the moment is that programs, screens and menus will have to undergo some sort of conversion in order to work on other platforms. If this is so, then the poor developer will have to maintain different versions of the same software for each platform.

A possible clue to Microsoft's approach to cross-platform code development is that version 2.5 introduces a handful of system memory variables (`_DOS`, `_WINDOWS`, `_MAC`, `_UNIX`) which indicate the host operating system. Maybe the developer is expected to place conditional code into a system to take advantage of the host environment or to avoid errors.

The only trouble with this approach is the power tools like the Screen Builder and the Menu Builder. These do not allow conditional controls, making their use for cross-platform development almost impossible.

Microsoft has taken on a massive task by even attempting to produce a cross-platform release of a package like FoxPro. Even so, if there is any company which has even the slightest chance of doing it, that company is Microsoft.

Politics is a dangerous game

FoxPro has attained a sort of cult status with many organisations and individuals. There are few products which have such a loyal and devoted following, and so it is quite natural that many people should have despaired at the thought of the Microsoft takeover. To add to this concern, Microsoft is a very much larger organisation than was Fox Software, with all the bureaucratic paraphernalia that goes with size. Larger organisations are more diffi-

cult to talk to, or at least it is more difficult to get through to the people who matter. In the past, Fox Software has had very good relations with both the user and developer communities which led to an excellent end-product, with many publicly gathered wish-list items being included in each new release.

The politics of a takeover like this one is a dangerous thing; the cynical can convince themselves to go for an inferior product instead of their favourite, and the Microsoft devotees might be persuaded to go for FoxPro solely because it is now owned by their favourite monolithic corporation. The sensible money goes with the best product for the job, and to hell with corporate politics.

In use

FoxPro for Windows is installed by means of the standard Microsoft setup program for Windows. It's quick and easy, and all over in about ten minutes. Along the way you can choose whether to use FoxPro for DOS keys or Windows-style keys. The setup program allows you to specify which bits of the package to install; in this way you can stop it annexing too much of that precious hard disk capacity. It is difficult to tell with this early beta version what the eventual disk space requirements will be, but as I write, the core of FoxPro is occupying just about 7Mb of my disk.

The `CONFIG.FP` file from FoxPro 2 has become the `CONFIG.FPW` file in the Windows product. This is one of the things that belies its DOS origins; I am sure many people would rather it was changed to `FOXPROW.INI` or something in keeping with Windows conventions. This is a fairly minor hangover from FoxPro's earlier lives. Others are not so easily waived...

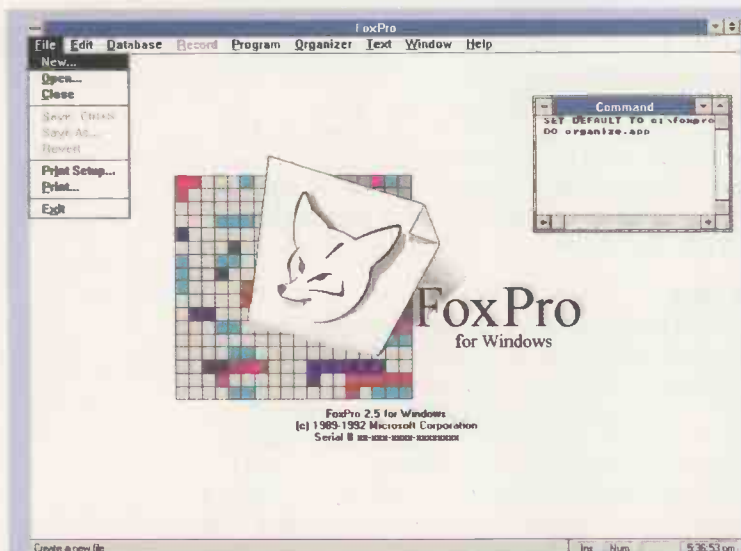
This beta copy of FoxPro for Windows has impressive memory requirements: 6Mb extended RAM if no virtual memory, or 4Mb if you have a swap file. I suspect that this will change in the final product but maybe not significantly. I have been running FoxPro for Windows on a 486/50 with an Actix S3 graphics card, 20Mb of RAM and 1.5Gb of hard disk. By default the package uses 90% of available memory, although a `MEMLIMIT` parameter in the configuration file allows you to change this. Setting this parameter to 40% caused a fair amount of disk-thrashing.

The speed of the software is good, though slightly slower than FoxPro 2.0 for DOS. Early reports that it was faster than the DOS version struck me as being strange, since virtually nothing is faster under Windows than in DOS. Microsoft, however, still claims that the speed of FoxPro for Windows will be as good as FoxPro 2.0. Database handling speed is just about on a par with FoxPro 2.0. Screen handling speed is about the same too, though in this beta version, text scrolling speed is abysmal. It scrolled at the same snail's pace on two different varieties of graphics card. Microsoft assured me that the text-scrolling speed will be substantially improved by the release date.

During installation, the setup program installs a new font entitled FoxFont which is small and monospaced. This is used as the default font throughout the package, allowing as much compatibility with the DOS version as possible at the

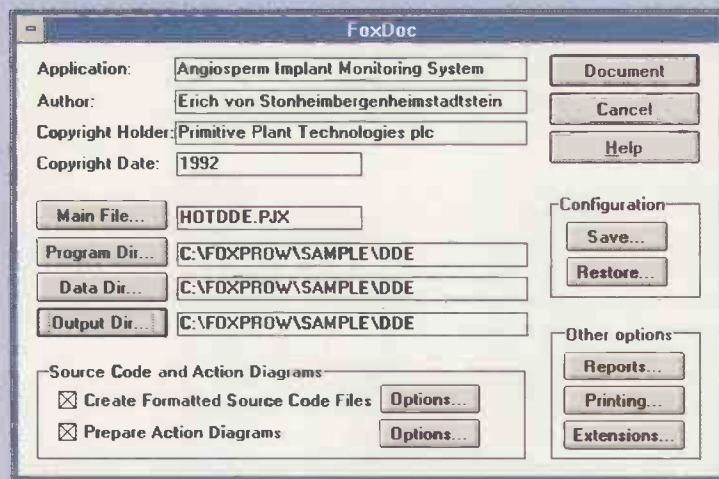
expense of aesthetics.

Even with the holes present in the beta software, I managed to get one of my applications up and running very quickly. The end result was quite pleasing, even without much modification.



△ The standard menu now conforms to the Windows standard. You can also use the FoxPro 2.0 menu

▽ FoxDoc, the application documentor, brings a new look to Windows



Extras

The Organizer application, which started life as a demonstration of FoxPro 2.0's capabilities, has been greatly updated for FoxPro for Windows. It consists of a menu which bolts onto the FoxPro system menu, giving access to Units Conversion, Restaurant Manager, Client Manager, Money Manager and Family & Friends Manager programs. The most flashy modules are the Restaurant Manager and the Conversions program; numerous picture buttons and bitmaps have greatly enhanced the look and feel of the programs at the expense of speed. Once again, all the source for the Organizer application is provided, giving the learner a great means of exploring the advanced techniques of programming in FoxPro.

One of the example applications is a multimedia

Family Album, with photographs of the main people at Microsoft and sound samples of music and speech. I loaded it up, turned the page, and there was Dave Fulton in his office, staring at me and talking to me. This is a great example of what is in store for FoxPro once it gets into the rich environment of Windows.

FoxPro for Windows comes with two types of help: the older database-type help found in FoxPro 2.0, and native Windows help. You can switch between these at will. The help appears to have been prepared to the same high standards as in FoxPro 2.0, though the help texts in this beta release are nowhere near complete. The developer has historically been able to prepare a help database to go with an application, accessed through the built-in help engine. I do not know whether Microsoft will supply the tools necessary to create native Windows help files or whether the developer will have to turn to one of the other products available for this task.

FoxPro's API (Application Program Interface) is once again present in FoxPro for Windows. Old libraries constructed under FoxPro 2.0 for DOS have to be re-linked to incorporate a special Windows library. This is fine for your own API routines but will create difficulties if you want to use a third-party library. Many people will undoubtedly be waiting for many months for their vendors to release new versions, and may be caught by unfavourable cross-platform upgrade policies. It is no great surprise that under Microsoft, the move to Microsoft C from Watcom C has begun; by the release, FoxPro's API will support both.

FoxDoc has been carried over to the Windows version, complete with a new look. FoxDoc is an application documentor, able to parse through an entire application and produce piles of useful technical documentation. Also included is a cut-down version of FoxDoc called Beautify, which just goes through a program file inserting the correct capitalisation and indentation.

Being an early beta release, only a small amount of very provisional documentation was provided. This uses exactly the same format as Fox Software's documentation, though it is not clear whether this will be the final format of the manuals. Fox Software's documentation was always of a high standard relative to the industry norm, and Microsoft's recent efforts have been great improvements on its previous rubbish. It should therefore be interesting to see what this marriage does for this much-neglected area of software production. One can only hope that the enormous Commands and Functions reference manual that I complained about when I reviewed FoxPro 2.0 is cut down to more manageable proportions.

Big changes

The screen controls in FoxPro for Windows have been extensively updated to reflect the graphical nature of the environment. For instance, as well as placing push-buttons on a form with the usual text label, you can now specify between one and three bitmaps in Windows BMP format to be placed on each button. Each bitmap is used according to whether the button is enabled, selected or disabled. This gives the developer enormous flexibility in

making an application look good, very much as with Visual Basic. Hopefully Microsoft will add support for other graphics formats like Windows Metafile and PCX before release.

Naturally, screen positions in FoxPro for DOS are specified by row and column number. However, Windows is a graphical environment which operates on a pixel level. Additionally, fonts are generally proportionally spaced, making it impossible to say that a given column or row position will point to a particular screen position. So FoxPro for Windows lets you specify screen positions and control sizes in fractional increments instead of just whole numbers of rows and columns.

Because of the inherent difficulties in translating a text-based application to a pixel-based environment, FoxPro for Windows has various new functions to aid the programmer in finding out what is what. The FONTMETRIC() function returns font attribute information, SYSMETRIC() returns the size of a display element and TXTWIDTH() returns the width of a given piece of text in a given font. These can be tricky to use, especially for anyone coming directly from DOS.

The size of push-buttons and other screen controls is specified in exactly the same way as in FoxPro for DOS except, as I have said, the numbers may be fractional, giving more precise positioning and sizing. The sizes and screen co-ordinates all operate in relation to the font used, which confuses me no end. It is hard to think of any other way of doing it though. I just hope that Microsoft see fit to devote a large chunk of help and documentation to aiding character-based developers to understand what exactly is happening in the graphical product.

The editor now supports drag and drop: just highlight a piece of text and drag it to where you want it, *à la* Word for Windows. Other than this, the editor is much the same, apart from the ubiquitous font support.

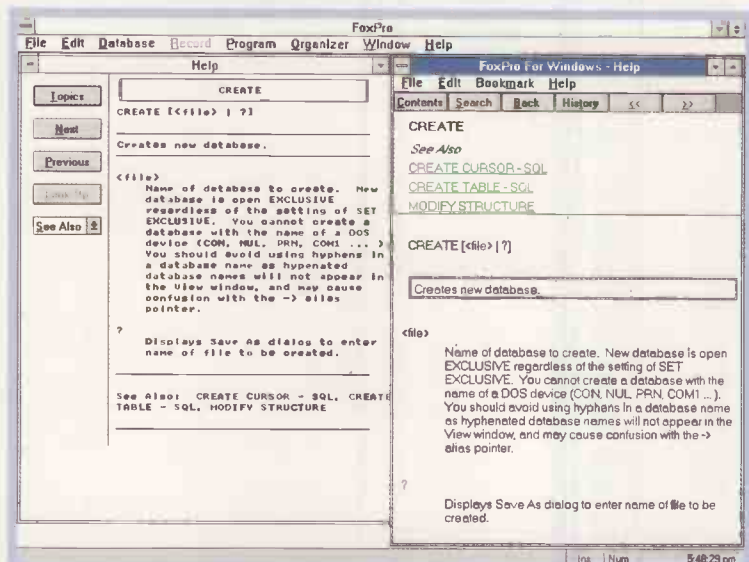
A new keyword for the @ ... SAY command, BITMAP, allows you to place a bitmap or an OLE Object on a form. The keywords ISOMETRIC and STRETCH are included to allow different methods of scaling. You can also specify that the bitmap should be transparent instead of the default, opaque.

Another new command, @ ... GET ... SPINNER, offers the facility of a spinner control for numeric data. These can be seen in other Windows applications; to the right of the text field displaying the field's value, there are two push-buttons to increase or decrease the number. The SPINNER keyword takes three numeric arguments specifying the increment, minimum value and maximum value.

Since this product is a native Windows program, DDE (Dynamic Data Exchange) is fully supported. The language now contains a full range of DDE-related functions that the programmer can use to communicate with the outside world of Windows applications. These include DDEInitiate(), DDETerminate(), DDERequest(), DDEExecute(), DDEAdvise(), DDESetService(), DDESetTopic(), DDEEnabled(), DDEPoke() and DDELastError(). Already, with the beta release there are example programs that use DDE calls.

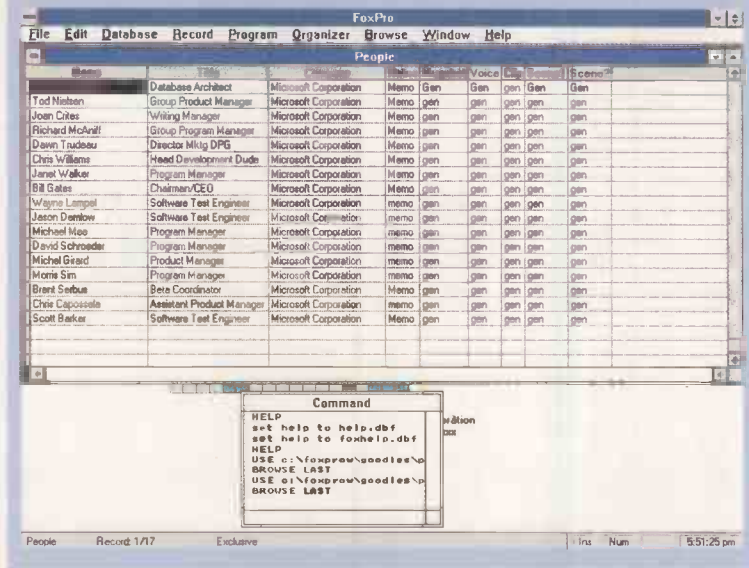
OLE (Object Linking & Embedding) is also fully supported. OLE is a technology which enables objects (packets) of data of various types to be

embedded within an application's data files, and optionally hot-linked to the object's source application. The database DBF format has once again been updated to include a new General field data type. A field of the General type can be used to store



△ FoxPro's on-line help now comes in two flavours: DBF-style on the left, native Windows on the right

▽ The browse window is unchanged. Note the general field type for OLE Objects



OLE Objects such as graphics and sampled sounds, opening up the possibilities for using FoxPro for Windows as a multimedia database. Apart from this, FoxPro 2.5 database files appear to be unchanged from version 2.0. Additionally, OLE objects can be placed on screens constructed with the Screen Builder. A new LINK keyword has been added to a number of commands to maintain a link between the object and its source.

The file formats for Screen Builder, Menu Builder and Project Manager files have all changed. Upon opening a FoxPro 2.0 file, FoxPro asks you whether or not to convert it to the new format. The 2.0 generated screens will still operate in FoxPro for Windows, but converting them will give a more

aesthetically pleasing appearance to push-buttons and other controls, as well as allowing you to specify the fonts for text labels and data-entry fields. If you do convert the files, they will no longer

next, so it is difficult to describe them in further detail with any degree of certainty.

Conclusion

Version 2.5 represents evolution rather than revolution. The object is to develop the product only to the point where it will suit cross-platform development. A FoxPro 3.0 is already in the design stage and is likely to include major new features. Although version 2.5 contains some important enhancements, the aim of the game is compatibility.

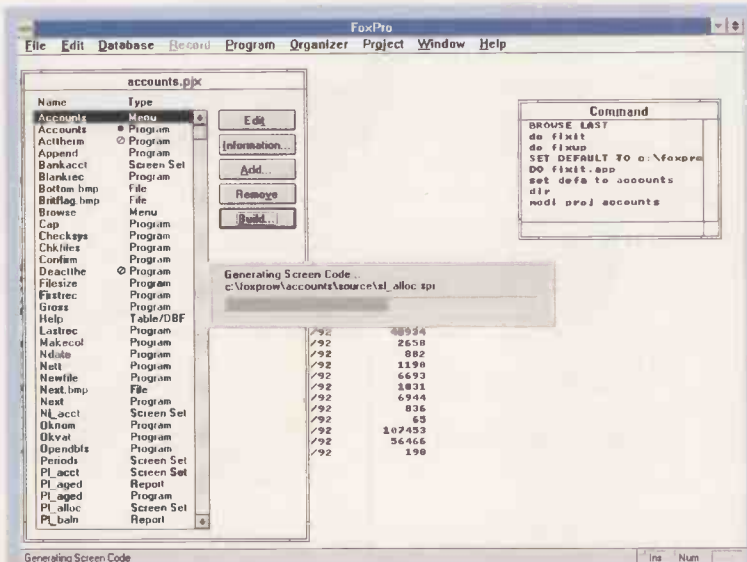
I am a little worried about FoxPro for Windows. The product being reviewed here is quite an early beta release, and as always it is difficult to judge a final product from such an early preview. At the time of writing (last week of October), the product has quite a few significant holes which Microsoft says will be plugged before the product is released. Picture buttons are not properly supported in the Screen Builder, printer support is awful, scrolling speed is pathetic, the memory requirements are overweight and there are numerous language incompatibilities. This is not to say that any of these traits will remain in the final release, because knowing Microsoft, most will not.

The only question remaining is that of the xBASE language. Its roots are firmly seated in the deep, dark recesses of computing history, but that is precisely why it has become a standard; a standard that is too important to ignore. Adapting it to the modern world can be tricky. It was stretching the language far enough to adapt it to the character-oriented windowed environment of FoxPro 2.0, but getting it to the stage where the same code will serve environments of differing characteristics is a task of mammoth proportions. Undoubtedly Microsoft will crack it, though some commands and functions will inevitably become cumbersome, much as they did in support of FoxPro 2.0's new screen controls. The forthcoming ANSI standard, in which Microsoft is playing a major part, may at least stabilise the language between the disparate xBASE products from various vendors.

Together with Microsoft's other database product, Access [see page 284, this issue], FoxPro for Windows looks set to take the number one position as the best heavyweight database product for Windows. Fears that Access is going to take priority over FoxPro in Microsoft's game plan appear to be largely unfounded: Access is better suited to the areas between the user and the power-user, though FoxPro could sit in this marketplace quite happily. FoxPro is definitely the best for the developer. It is far better suited to application development than any of the existing Windows database products such as SuperBase 4, and is certainly quicker in operation and easier to program than, for example, a combination of Visual Basic and QE/VB.

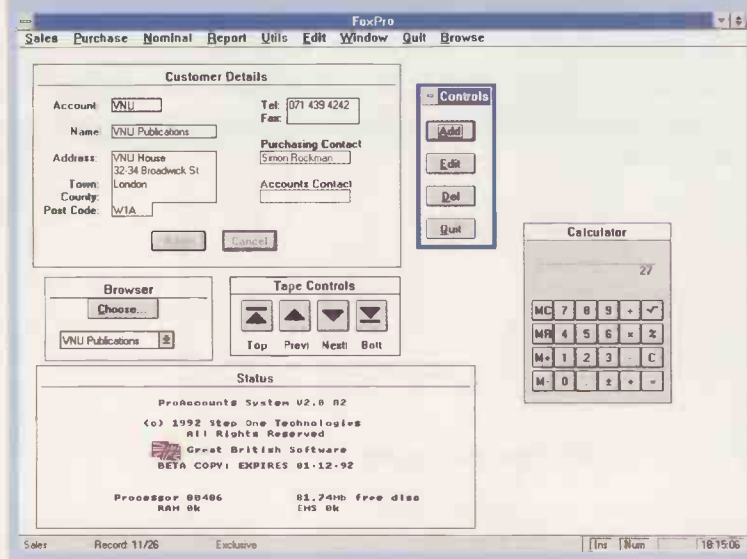
It will be interesting to see how Microsoft responds to the criticisms of the user and developer community. FoxPro has been a phenomenal success story so far. The same applied to WordPerfect 5.1, an excellent DOS product although a poor Windows version has begun to erode its success. Microsoft has all the necessary marketing resources; it just has to get the product right.

Microsoft is on (0734) 270000.



▲ Building a project into an APP file. Windows turns utility into aesthetics

▼ One of my applications, ProAccounts, partially converted for Windows and running perfectly



operate in FoxPro 2.0. However, since version 2.5 is intended to be cross-platform compatible, I fully expect that the new formats will be directly usable by FoxPro 2.5 for DOS.

The Power Tools (the Screen Builder, Menu Builder and Project Manager) have been extensively updated although they are still recognisable if you have used the FoxPro 2.0 ones. The main enhancements are in support of some of the new graphical features, for instance the Screen Builder: when you specify a screen form as being a window, you can specify an icon file which is shown when the window is minimised. The Screen Builder also offers the new picture buttons. The Project Manager now picks up the newly supported files such as bitmaps from your code and automatically includes them in the project build. All the Power Tools are changing from one beta release to the

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- ☐ A Guide To Kill A Mockingbird
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- ☐ Documents - Text of the USA constitution.

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- ☐ PC Fasttype VGA - Exc. progressive typing teacher.
- ☐ PC Fasttype Mono - As above but for monochrome.
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Dataproducts LZR 960

Seven months trouble-free use has kept Steve Burrows loyal to the 960 laser printer. But the announcement of the new, improved 600dpi 965 has made him greedy for more.

At the end of 1991 I had just become self-employed and was looking for a laser printer to produce quality training notes. I had made the decision that PostScript was a must, as I was producing training material for various Windows packages including CorelDraw!, which has a series of PostScript fill patterns not seen on screen but which do appear on the printout: on a PostScript printer, of course.

My first port of call was the printer reviews in the last twelve issues of *PCW*. I reckoned any printer released before then had probably been superseded in capability and I knew I would want something that would be up to software packages coming onto the market over the next few years.

The review of the Dataproducts printer in *PCW* November 1991 caught my eye. I wasn't so much interested in the nine pages per minute engine speed as Level 2.0 PostScript with data compression for transmitting bitmaps from the PC to the printer, and the fast processor. When it came out top of the Group Test the following month, that clinched it. On the strength of the written word alone and without having seen one, I parted with the cash.

Opening it up and getting it started was no more than 30 minutes work, despite the fact that there were several parts to put together. I loaded the printer driver supplied for Windows 3.0 with its option to select whether to use Level 2.0 or not (you bet I did) and it performed. Well, actually the first three pieces of paper jammed, but since then I have had totally trouble-free service

from it, the only other jam being caused by me shoving a piece of paper in the manual feed slot when it had already grabbed one from the tray: foresight and incompetent operator correction aren't among the features of Level 2.0. I also had some initial problems getting its print registration correct. A rectangle drawn in PageMaker, one inch from the edge of the paper all round, came out on the printout at different dis-

know just how fast it was in comparison to its rivals; or at least other PostScript offerings. I produced a very simple A4 page with a Corel fountain fill and bitmap and printed the page from Corel 2.0. You may think my choice of printer was designed to show up the 960 in its best light. It does, but the choice was entirely governed by who else I knew with a PostScript laser and CorelDraw! 2.0. Anyway, for what they are worth here are the results. The HP LaserJet III with PostScript cartridge took 6 minutes 35 seconds; the IBM 4019E took 5 minutes 20 seconds; while the Dataproducts LZR 960 took 1 minute 15 seconds. Needless to say, I was pretty pleased with my choice.

Upgrading to Windows 3.1 has brought its own problems. TrueType fonts are not available in Word for Windows and PageMaker, although they are in Excel 4 and CorelDraw!. Calls to Microsoft and Dataproducts indicated that a new printer driver would be the solution and at the time of writing I am expecting one within the week.

So after using it for seven months what do I think? It does a first-rate job for me: it's trouble-free, quick and produces good quality print, accepting cheap photocopier paper and heavy Conqueror for letters, without complaint. Would I buy one again if I was spending the money now? Until last week I would have said 'Yes, definitely,' but then last week I read of the release of the LZR 965 working at 600 dots per inch!

Dataproducts is on (0734) 884777.



tances from the four edges. Dataproducts' technical support was superb, taking a copy of my PageMaker file and trying its best to sort out the problem. Imagine my embarrassment when I realised that although I had told PageMaker it was working on A4, the printer driver was set to Letter.

It has so far printed everything I have thrown at it, with complex Corel pictures, and PageMaker pages covered in bitmaps, all produced quickly and neatly. I suppose it is human nature, but having been told I have one of the fastest printers around, I wanted to

CorelDraw! 3.0

Paul Ockenden loves that CorelDraw!'s three programs comprise an excellent drawing package but hates the fact the three have difficulty communicating with each other.

In the four months or so I've been using CorelDraw! I've come to both love the program and loathe it. I love it for its many features, the plethora of facilities, and the sheer number of options. I loathe it because when I try and use some of these features I find strange limitations and inconsistencies.

The biggest problem is probably the inconsistency between the various programs that make up CorelDraw!, no doubt because the three main programs within the package were written by different companies. Draw was written by Corel itself, but Corel Paint is a customised version of ZSoft's Publisher's Paintbrush, and Corel Chart is licensed from Three D Graphics. Each company seems to have its own house-style user interface; unfortunately this means switching from one package to another can be fairly awkward.

Let's take a simple example. Suppose we want to change the font used to display some text. To select a new font in CorelDraw! itself we would probably use the Character item from the Text menu. In Paint however we would have to use the Select item from the Fonts menu. In Corel Chart there is no access at all to fonts from the menus, and we have to use a font list on the toolbar. Things are complicated further by the fact that as well as using standard Windows fonts (including TrueType and ATM) CorelDraw! can use Corel's own WFN font files while Paint and Chart cannot. This is just one inconsistency: there are countless others.

However, all is not gloom and doom: there are many things the various packages do very well indeed. CorelDraw! itself is an excellent vector-drawing package. I knocked up a copy of my company logo in about 20 minutes, a job that previously took at least four times as long using Microsoft's own Draw applet (the one supplied with Word for Windows, among other packages). I've heard people complain that the screen can be slow to update, but on

my system it's fine. Likewise, I've found Corel Paint great for retouching scanned images; it is a little slow when manipulating very large bitmaps, but apart from that I have few complaints.

I'm not such a fan of Corel Chart. I find the graphs produced generally look good on screen but pretty appalling printed out. Also, the facilities for ex-

Corel Chart.

I own a CD-ROM drive, so can use the masses of extra fonts and clip-art supplied with the package. The fonts themselves are variable: some are excellent at all point sizes, but others appear to be scanned from low resolution bitmapped fonts. As the point size increases some become very jagged indeed, just what scalable fonts are supposed to avoid.

The clip-art is generally of a high standard, but on the several occasions I've tried to find a particular type of image I've found it difficult to locate one. For a start, the grouping of clips isn't always entirely logical, and the selection of clips available is heavily US-biased.

The manuals are generally excellent and are complemented by a rather good tutorial video which skims the surface of each product enough to give a general idea of how things work, and to whet your appetite to start experimenting. I have found the on-line help in both Draw and Paint to be sufficiently good that I've hardly touched the manuals themselves. The on-line help within Chart is again not up to the standard of the rest of the package though.

Maybe I've concentrated too much on the negative aspects of the package during this test, but I guess most prospective purchasers would rather know what to beware of than what works well. Let me counter this by saying that I still feel CorelDraw! is a fine package; it does most things (except produce charts) very well, very easily, and it is still probably the finest drawing package available. It represents excellent value for money considering all of the goodies crammed into the box. I'm still glad I bought it, without doubt, but Corel must watch out — other packages are slowly catching up.

CorelDraw! 3.0 costs £395 from Xitan on (0703) 899113. It is currently available as a competitive upgrade against one of 14 other art packages for £169.



changing and linking information with other packages are very half-baked. Quick example: cut some text in Word for Windows and try and paste it onto a Corel Chart. You end up with a nice little Word for Windows logo pasted into your chart. Not exactly the desired effect.

I stick with Excel 4.0 to produce graphs. If I didn't have Excel 4.0 I'd probably use Microsoft's Chart applet, again supplied with Word for Windows. Both the above run rings round

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'We brought you Procomm Plus – now we bring you Odyssey'



Odd job man

After more than four years at *PCW*, Guy Swarbrick at last sees people appreciating the value of software, rather than judging everything by the price of hardware. And his flight from the Editor's chair sees him in Seattle piloting a Cessna round the Grand Canyon.

It's an odd job this. You lose touch with reality. It used to be that you lost track of hardware prices. You'd always have the latest machine — a fast 286 (or very slow 386) when I first came to *PCW*, a 50 or 66MHz 486 today — and you'd forget how much they cost.

Unlike the mainframe and mini industries where for years your most valuable asset was your data, followed by your software and then your hardware (and the *hardware* was phenomenally expensive) for most people involved with PCs the hardware was their most expensive acquisition. Most people used only one application but, while a good word processor or database might set you back £500, the hardware to run it could cost 10 or even 20 times that amount.

Times change. Shop around and you can get change from £1000 for a 33MHz 486DX these days. And Windows has encouraged the Macintosh way — more than one application per user. Applications have come down in price slightly, but we use more of them. Most people now use a word processor and one other major application, be it a spreadsheet or a database or even a CAD application. An increasingly large number use a drawing package, an art package and a DTP package as well. And we're back to the situation where the cost of your hardware is outstripped by the cost of your software. Which is how it should be: the software *is* more important, even if it isn't as important as the data it manipulates.

PCW has long encouraged people to find the software to solve their problems, then buy the hardware necessary to run it. Take my portable, the Toshiba T4400SXC, as an example. It's a good example, because it's the kind of hardware that's bought for its own sake: fast processor (50MHz 486DX2), TFT col-



our screen, big hard disk, long battery life. Cutting edge technology. On the 120Mb hard disk you'll find SuperStor Pro, Word for Windows, Excel, Access, Borland Pascal 7, Battery Watch, the Windows Entertainment Pack (the first, and by far the best of them), PowerPoint, a PD genealogy program and ACT! for Windows. Plus, of course, DOS and Windows (for Workgroups in this case). The best part of £2000; or the worst part, depending on who's paying.

At *PCW* we always cried out for bigger hard disks and more RAM but until recently it's been because we use lots of applications, not because you do. These days, although we probably still have higher than average applications populations, we're nowhere near as far out of step with the people who actually pay for software as we used to be. Yes, that's only just over half the cost of the hardware, but this is some of the most expensive PC hardware you can buy these days.

The point I'm trying to make is that people attach much more importance to hardware than to software. We are never asked to send software back. Hardware, though, is different. For some

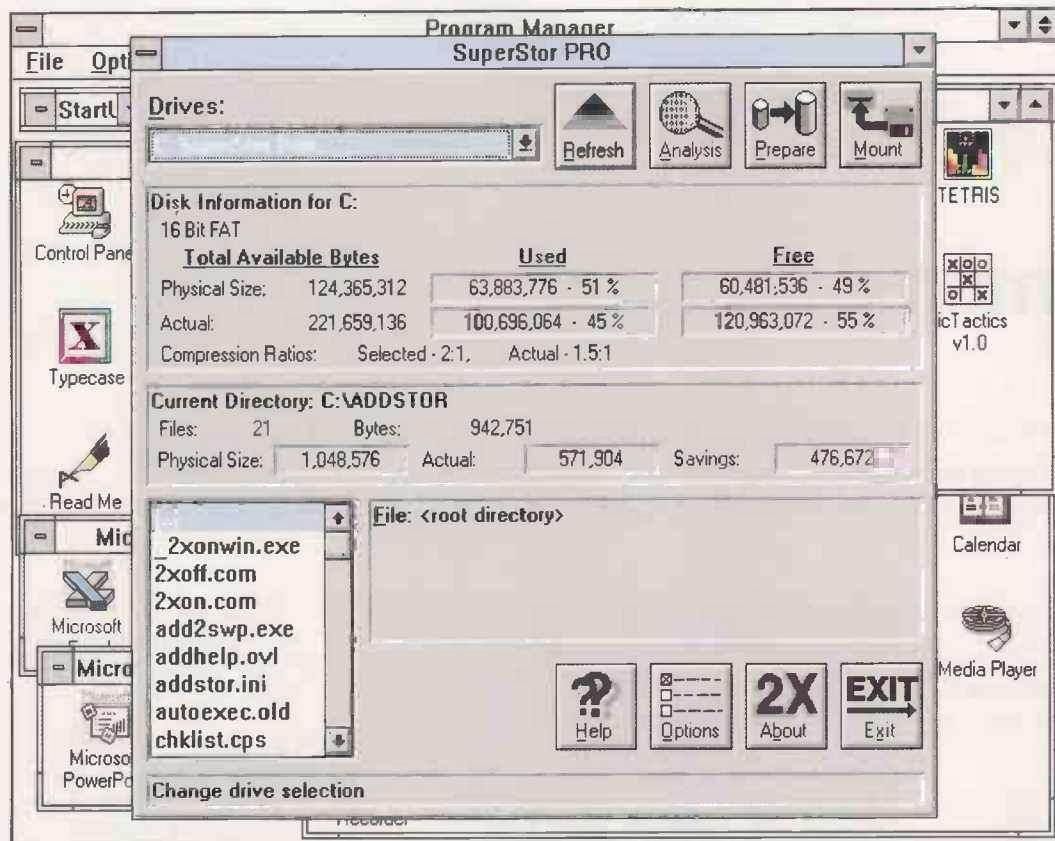
reason a £99 add-in card is more 'valuable' to its supplier than a £500 software package. And that attitude has extended to both the PC press and to customers.

But that's all changing — and not before time. People are beginning to realise that not only is the software on their PC worth more in monetary terms than the hardware it runs on, but it is worth more *to them* than the hardware it runs on.

SuperStor

I've always been reluctant to use disk compression software. I heard so many stories about problems in the early days, I steered clear of it. Latterly, though, I'd heard nothing but good things and *PCW* (among others) carried out extensive testing of the two market-leading products and concluded that both were safe. Greedily, I decided that the 120Mb hard disk on my notebook would be better as a 240Mb unit. I had a few problems setting everything up but essentially everything was fine. And, I have to say, SuperStor Pro — for it was that that I used — didn't eat any of my data. But lose it I did.

The problem first surfaced when I tried to install PowerPoint. My hard disk was well populated, but using SuperStor meant that there was still a lot of room left. About 40Mb — more than enough, even for a Microsoft application. It just wouldn't install. I'd had the problem before, with HP's excellent Dashboard and WordStar's not so excellent WordStar for Windows, but had assumed there was something wrong with the install disks. This was just too much of a coincidence. Not sure what was wrong I started deleting a few things, just in case there really wasn't enough room. Then I tried installing PowerPoint into a directory



other than the default. That didn't help either.

I explained the problem to a friend only to discover she'd stopped using the previous version of SuperStor because installation programs had stopped working. Something clicked... What had annoyed her was the lack of a SuperStor de-installation program. I rather smugly announced that this problem, at least, had been fixed. SuperStor only needs about 4Mb free to compress your disk. I'd rather hoped 8Mb or so would be enough to reverse the process. I had plenty free, so I ran the utility. It's a pig to use, but I suppose that's a good thing — you couldn't do it by mistake. In the end, the 'secure' user interface is unnecessary: the de-installation program doesn't work.

I was desperate to get PowerPoint working so I deleted more and more files, some of which I would rather not have deleted, to reach the undefined amount of free space SuperStor said it needed. When 150Mb free wasn't enough I gave up; if I'd taken much more off it would have taken weeks to get things back to normal.

Just on the off-chance I tried installing PowerPoint again, this time using a minimal install in the hope that the file which failed to copy before would be skipped this time. It wasn't, but the install did work.

The Toshiba is moving on: Simon Rockman will be its next keeper. Before

▲ SuperStor: problems galore?

I hand it over I'm going to format the hard disk. And I'm going to enjoy it.

Last Flight of the Old Dog

On a recent trip to Seattle, I visited a couple of computer stores. You'll be pleased to know that the huge gap between UK and US prices has narrowed, but it hasn't gone completely. Take modems, for example. The best offer I saw was a subscription to Prodigy, a US on-line service, for \$39.95. Stuck to the back of the manual/access software package was a 2400 baud modem...

But the best thing about the US is the software you can buy that hasn't reached these shores yet. There isn't as much of it as there used to be, but there are still gems to be found. The only ones to tempt me to part with my hard-earned were a pair of new Flight Simulator scenery disks. Not, like those that have been released in the past, from subLogic but from Mallard, the people who brought us the sensational Aircraft, Sound and Graphics upgrade.

I saw three scenery disks, but only had the cash for two. You'll just have to assume the third, Tahiti, is as good as the other two. Hawaii seems an odd choice: there's already a Hawaiian Scenery Disk from subLogic. The original isn't that good, though, even if it does include a bizarre virtual reality world

inside a volcano.

The new disk is excellent. The level of detail is superb, and little touches like the US Navy carrier group leaving Pearl Harbor certainly justify the price. But then, it would be hard not to justify the price at \$29.95.

The second disk is unbelievable. By far the best Flight Simulator add-on I've come across. But then, the *real* Grand Canyon is pretty good, too. Take off from Page, Arizona, the site of the Glenn Canyon dam and one end of the scenery's extent, and head for the dam itself. Over the reservoir and down over the lip of the dam and under the nearby bridge and you're in for the flight of your life.

Flying the entire canyon takes a while. I used the Cessna with gear down and full flaps to

keep the speed to a manageable 70 knots, but some of the turns are still very tight. Banking hard and using the ailerons as a big rudder seems to be the only way around some of them. A little over two hours later, in this configuration, you come out the other end.

It isn't perfect. Flight Simulator uses only 16 colours and that makes the rendering of the canyon walls a little tricky, but even with the limited colour range the effect is pretty good. Where you do lose out is in depth perception: it can be hard to tell the difference between the left and right-hand walls on tight turns.

Collision detection isn't perfect, either, and Mallard admits as much in the documentation. They probably couldn't have provided detection for all the surfaces and the more they added, the slower the frame rate got. The compromise is a good one: the canyon floor and the plateaux beyond its rim are solid and so are many of the vertical surfaces. If you do fly through a wall you get so disoriented you eventually hit something solid anyway.

The impressive thing, though, is the three-dimensional nature of it all. Yes, you get the odd hill in Flight Simulator but essentially it's a flat universe. With the Grand Canyon scenery there are plateaux two miles above the deck.

Mallard also does a range of scenery disks for the Macintosh version of Flight Simulator. Well worth a look.

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Visual Quickstart Guide, Quark XPress 3.1 Mac Edition

Author: Elaine Weinmann

Publisher: Peachpit Press (Longmans)

Price: £13.99

ISBN: 0-938151-011-3

Anyone who frequents computer departments of book shops will have seen the enormous number of how-to guides on the shelves. Typical titles are teach yourself C, learn Windows in an afternoon, and become super-proficient at opto-electronics over breakfast. Also to be found are numerous guiding through the complexities of the well-known workhorse applications such as Word, WordPerfect and Excel.

Over the last few years, desktop publishing has joined the ranks of word processors, databases and spreadsheets as an essential qualification for computer operators: consequently the book market has been flooded with volumes on the market leaders, Quark XPress and PageMaker. The fact that there is a market for such manuals is surely evidence of mass pirating, since the perpetrators require instruction. This fortunately is not entirely the case as there are also two large, honest groups of users out there: registered owners who have found the provided manuals unsuitable for various reasons; and those who use the packages at work, where the original documentation may be inaccessible.

The documentation accompanying Quark XPress is among the best I have seen. Along with a dedicated tutorial booklet, there is a reference and an 'in use' manual. The manuals cover similar territory but take different approaches; the combination is most helpful, but obligingly comprehensive and frequently technical. Often a user wants something a little simpler.

The Visual Quickstart range from Peachpit Press are not all-encompassing encyclopedias; rather, they explain the everyday features clearly with lots of pictures. The back cover asks: 'Need to learn Quark XPress fast? Try a Visual Quickstart!' This is no fabrication of the truth: at 190 clearly-presented pages, this will take you little time to work through. Being a bit of a fan, I have read many books on XPress, several of which have been small, pocket-book affairs. Tiny books may be convenient to carry around, but XPress is a feature-packed

program and requires more than a noddy-guide. Pleasingly there are no big ears on the Visual Quickstart: it's short enough to be accessible and easily read, while long enough to cover the main functions in helpful detail.

It starts with the XPress display, covers the basic controls such as clicking, selecting and re-sizing, and follows with a list of menus and their contents. A brief mention of keyboard shortcuts and the most-used palettes and it's straight onto the everyday features with no further ado.

Don't assume that the everyday features description suggests neglect of the more complex aspects. This guide covers just about the entire package; the only parts missing are very specialised. The rare occasions on which you'd want this information would justify returning to the main manuals, or a trip back to the book shop for a comprehensive browse.

This Visual Quickstart guide manages to cover a lot of ground, and coherently to boot. If you're in need of a small book on the subject and don't need to know absolutely all the details, consider this one.

Gordon Laing

Virtual Worlds: A Journey in Hype and Hyper-reality

Author: Benjamin Woolley

Publisher: Blackwell

Price: £16.95

ISBN: 0-631-18214-4

This frustrating book promises much and delivers little. Risking a little unoriginality, I might paraphrase Johnson and suggest there is much in this book that is good and original. However, that which is good is not original, and that which is original is no good. The title, and indeed the blurb, promise an analysis of virtual reality. 'He [Benjamin Woolley] looks at the dramatic intellectual and cultural upheavals that gave birth to it, at the hype which surrounds it, at the people who have promoted it, and the dramatic implication of its development,' says the blurb.

Woolley contributes more to the hype; indeed, it is doubtful that his book would sell at all without the VR hype which has already been generated by others. The author's introduction (not the blurb writer's) tells us that the book will examine the way VR forces a fundamental reappraisal of the very

notion of reality. That it forces such a reappraisal is doubtful, but even if we accept that it does, Woolley does not deliver one. His discussion of the philosophical questions surrounding reality (real or virtual) is lightweight, tired and clichéd. He writes: 'The sight of someone wearing a VR headset is the ultimate image of solipsistic self-absorption, their movements and gestures meaningless to those left outside.' Really? This is hardly any more solipsistic than the person performing Tai Chi under a tree in Hyde Park.

Neither the title nor the introduction give any hint of the great tracts of irrelevant padding to follow. The book hardly discusses the impact of VR, which is not a *bad* thing since VR has had almost no impact and will probably have none of note for many years. What it provides instead is a pedestrian and derivate history of randomly chosen lumps of computing science and technology.

Woolley makes remarks of breathtaking triviality: 'Wittgenstein, the Cambridge philosopher whose ideas were as wild as his eyes'; and astounding ignorance: 'Why no room for astrology in cosmology? Why are no scientific research funds spent on investigating ESP, out of body experiences and telekinesis? The simple answer is that if any of these are right, then all of science is wrong.'

He fails to grasp the value of scientific research. Commenting on the search for V computers, he writes: 'One could argue that this is simply another excursion in science's mission to discover ever more expensive instrumentation to make ever less relevant observations.' One could, if one were unconcerned about the quality of one's arguments.

Woolley also misuses phrases: 'Should an exception be discovered (to a universal theory of the behaviour of molecules) it would not be the exception that proves the rule, it would prove the rule false.' Except that is what 'to prove' means here, since 'prove' is an old word for test.

In a manoeuvre common in people arguing from a weak fact base, he invents Aunt Sallys — they make easier targets. He invents the 'philosophical' position of *computationalism*, which he defines as 'the belief that the entire Universe could be simulated and our destiny calculated', suggesting that 'some computer researchers believe it to be true.' Who believes this? But he does not use the term *computationalist* consistently, instead lumping together subtle variants in a stance on artificial intelligence, ontology and linguistics

under the same dubious banner.

He utterly misunderstands the motives and significance of neural networks research, attributing it to merely the allure of prevailing technology, in this case global telecommunications systems. Nonsense.

There *is* material here of interest, though most of it is available elsewhere in a form far better told. The running theme is barely discernible through most of the book, however, and when it arises, it does so with no depth or subtlety. The final conclusions, four short paragraphs on the last page, are unremarkable, and would add nothing that a moderately well read reader would not have seen in many places before. Spend your money on something else.

Nick Beard

Computer Viruses and Anti-Virus Warfare, 2nd Edition

Author: Jan Hruska
Publisher: Ellis Horwood
Price: £19.95
ISBN: 0-13-036377-4

A lot has happened in the virus world since 1990, when the first edition of Hruska's book on fighting virus attacks was published. Hruska is in a position to know: he is technical director at Abingdon-based Sophos, one of the

better known UK anti-virus software vendors, and gets to see some 100 new viruses a month.

Naturally, the basics of fighting and preventing virus attacks haven't changed. Keeping backups and a write-protected system floppy disk, controlling access to the computer system, and not spreading infections once they're discovered are as important as they ever were. The biggest new topic in the book is networks, which get a whole chapter to themselves. In addition, there are new bits and pieces added throughout on things like the Mutation Engine, which creates encrypted variants of existing viruses, and figures from Sophos showing which viruses have been most commonly reported over the last couple of years.

Hruska's focus is technical and preventive, like his background and Sophos itself: the company began life as a data security firm. Unlike *Approaching Zero*, therefore, this is not a book you read for sensationalist entertainment or discussions of civil liberties and the rights and wrongs of hacking. On the other hand, his chapter explaining the types of viruses goes into much more low-level detail than most books; instead of telling you that a virus can use 'stealth' to hide itself, he tells you how it preempts system interrupts and draws you a memory diagram.

A lot of Hruska's information is practical even if you don't want to know specifically that the virus 4K intercepts 18 functions of the 21H interrupt. Particularly useful are the table of dates on which common viruses trigger and the lists of the most-reported viruses (to

Sophos) during 1991 and the first half of 1992. Along the way, Hruska stops to question the standard methods of testing used in reviewing anti-virus products; tests run against huge libraries of virus-infected files, he argues, are less important than making sure the package spots the 50 or so viruses commonly found 'in the wild'. The statistics Hruska quotes help put things like this in perspective. For all that there are 1500 or so known viruses, only 36 caused all the attacks reported to Sophos in the first half of 1992.

Also worth mentioning along these lines is the survey of sources infection, originally carried out by Dataquest in October 1991. People worry a lot, for example, about downloaded files from bulletin boards, but those only account for 7 percent of attacks in the Dataquest survey; a far bigger problem is employees bringing disks into work from their home PCs, which accounted for 43 percent of infections.

Hruska makes his living selling anti-virus software, but in his book he stresses prevention. Always take backups. Make sure you have a write-protected system floppy disk available. These things sound like standard stuff, but unlike most writers on the subject, Hruska remembers to tell you to include the device drivers called up in CONFIG.SYS and AUTOEXEC.BAT on your bootable disk. He also, of course, suggests that anti-virus software has an important role to play in preventing attacks.

Some of his prevention measures are a bit harsh, although sound if you're serious about security: don't use software from bulletin boards; don't use shareware; don't use public domain software; scan diagnostic disks brought in by service engineers or consultants; watch out for disks brought in from home. He also recommends not using cover disks on magazines.

Hruska also includes a very useful bibliography of sources of information about viruses, a list of anti-virus software vendors, plus code for two virus detection programs, one virus-specific and one generic, and a list of virus hex patterns known in June 1992 to be used with it. Besides that, there's a glossary of terms and a long appendix listing known PC viruses and their main characteristics.

One area Hruska doesn't talk about at all is the important role online services play in technical support and updates. Most major vendors of anti-virus software maintain their own bulletin boards and/or forums on CompuServe, but you'd never know it from this book.

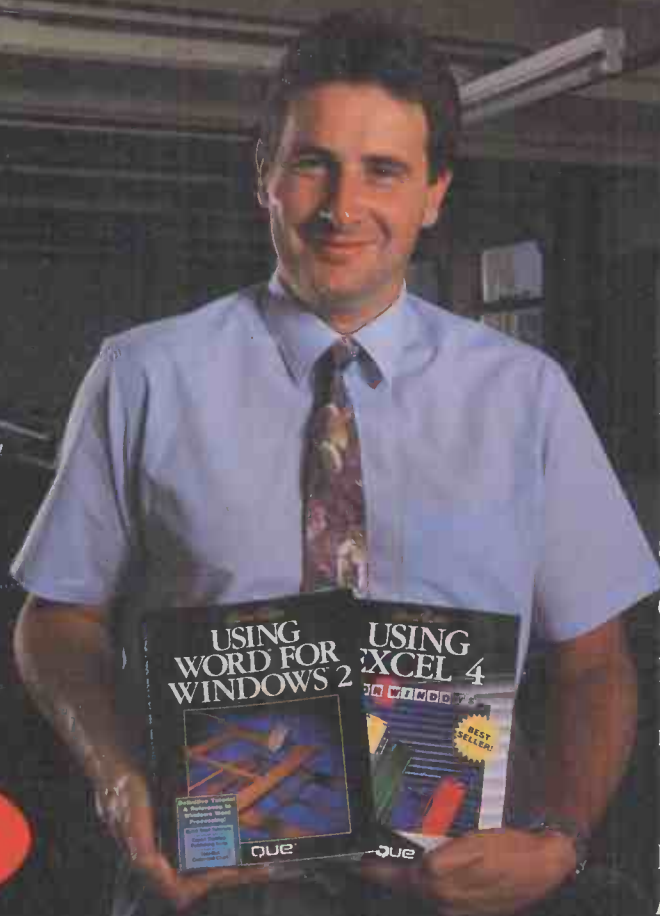
Wendy M Grossman

Top Ten Books: October 1992

Author	Title	Publisher	Price	This	Last
Petzold C	Programming Windows 3.1	Microsoft	£39.95	1	—
Simpson A	Mastering WordPerfect 5.1	Sybox	£25.50	2	6
Leonhard W	Windows Programming for Mere Mortals	Addison-Wesley	£30.95	3	—
Microsoft	Microsoft Excel 4 Macros Step by Step	Microsoft	£29.95	4	—
Schulman D	Undocumented Windows	Addison-Wesley	£33.95	5	—
Cobb D	Running Microsoft Excel 4	Microsoft	£26.95	6	—
Microsoft	Windows Interface	Microsoft	£29.95	7	—
Gookin D	DOS for Dummies	IDG	£15.45	8	—
Livingston B	Windows 3.1 Secrets	IDG	£36.95	9	1
Person R	Using Excel 4 for Windows	Que	£27.45	10	—

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Rex Nebular and the Cosmic Gender Bender

Computer: PC
Supplier: Microprose
Price: £44.95



'Here it is, Stone. Now where's my money?'

'Rex Nebular! What a pleasant surprise. I must have poor

sources. I was informed you were... how do you say... dead.'

'Can it, Stone. It hasn't been a fun trip. Just give me my money and I'll be on my way. Right now I'm a little late for a date with a mattress.'

'Would you like a drink, as if I don't know the answer.'

'Yeah, I'll take 75,000 galactars on the rocks. Straight up hard currency.'

'I hope you don't have any problem taking a cheque?'

'Sure. As long as you own the bank they're drawn on I'll take your cheques.'

'What a fine piece of art. Such fond memories. So tell me, Rex, did you have any trouble finding it?'

'Did I have any trouble! You just sit there and I'll tell you about the so-called piece-of-cake job you sent me on. Finding the planet was easy... too easy.'

'Me and the Pig had just jumped warp to check out a promising scanner trace when this big son-of-a-starship cruiser de-cloaks and starts shooting at us. The captain's one real sister with a screw loose, a leggy loon — you know the type — and before long she starts talking about secret planets and how she deals with intruders. The Pig could only take so much, she's getting on a bit after all, and I ended up trapped at the

bottom of a deep pool with few immediate options.

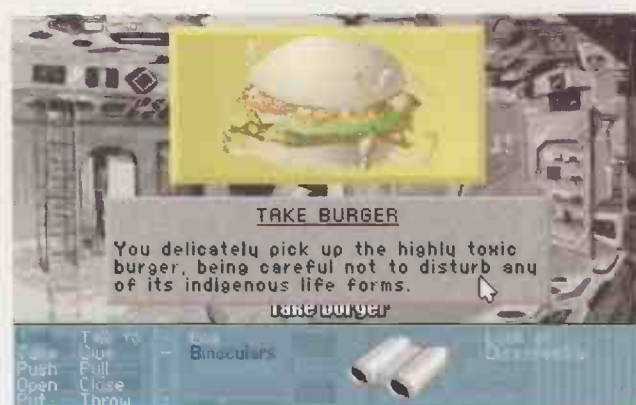
'I eventually managed to get to the surface without being blown up, after dealing with a sneaky sea snake and a stone age refugee

from McDonalds. Thing is it turns out that I was better off being under the water, as the first thing I have to do is avoid becoming a large lady's lunch. Bouncing over the horizon she came, enough to put the wind up a T1000, and it was only my sheer ingenuity and pure skill that stopped me from being sautéed.

'Not that everything on the planet was hostile, though. I met this one dame who, well, let's just say she hadn't seen a man in a while. Strange thing is she wasn't the only one, all the men were wiped out over a dozen years ago in an almighty battle of the sexes. The whole place is run by women now, and the ones that shot me down were the Guardians, a band of psycho skirts that govern and dominate the population. It was gals like this that started the war and invented the Gender Bender — with no males around they have to change sex temporarily to reproduce. I actually went through the machine myself, things shrivelled up... Start writing that cheque, Stone!

'Mind you, I have to say it was an experience, and the hardware inside their complex would have cut me down if I hadn't been a busty beauty. I searched for the vase while I was there, but to no avail — all the art that survived the war was distributed far and wide. I got this one lead that took me through a bunch of crazy teleports. I zapped from one part of the planet to another in the blink of an eye.

'Picked up a partner along the way, an eight-foot alien



with an attitude, but we got separated when he went off to discuss business with the main maid — mascara all over the place, along with the odd arm and leg.

'I finally found the vase in... Hey! Hold on. This would make a great idea for a video game. We'll get in lots of excellent animation and a terrific soundtrack, Roland LAPC1 and Sound Blaster — the whole shebang. If we code it right it'll make about nine disks' worth of action adventure, with plenty of perplexing puzzles and speech that'll knock them PC users for six. I'll work in good playability, a full point and click interface, and finish it off with a startling intro that puts the player in the mood.

'Yeah, that's it. Now where did I put the number for those people at Microprose?'

Chris Cain

The Lost Files of Sherlock Holmes: The Case of the Serrated Scalpel

Computer: PC
Supplier: Electronic Arts
Price: £39.99

A greasy yellow fog had settled thickly over London. My friend, Sherlock





Holmes, fretted at the enforced inactivity and I feared he would resort to the harmful narcotic of which I strongly suspected he was an habitué. He stood now at the table, at his feet a small and untidy pile of the morning's newspapers, each studied for evidence of the fog having given cover to a crime that betrayed a more sinister hand than a common housebreaker.

'Unless I am mistaken, Watson, Scotland Yard is about to call upon our services,' murmured Holmes suddenly. Within moments a heavy knock on the front door was followed by Mrs Hudson's feet sounding on the stairs. 'A police constable brought this for you, sir,' said Mrs Hudson and handed Holmes a note from Inspector Lestrade of Scotland Yard.

'But how...?' I began as soon as Mrs Hudson had left our room.

'Even with the fog dulling sounds from below, the measured tread of a policeman is unmistakable,' said Holmes distractedly as he read the note, 'and the footsteps ceased outside the front door. A constable would not come here unless our services were required. Elementary.'

And so began the remarkable case of the serrated scalpel.

As Holmes aficionados will know, this case does not appear in the canon (as the collected works of Dr Watson are known). It is the first in what seems intended as a series of Holmes stories issued as interactive computer games, under the generic title *The Lost Files of Sherlock Holmes*. Some people will call into question the authenticity of the stories, but by 1889, a dozen years after beginning his career as a professional detective, Holmes claimed to have investigated five hundred cases 'of capital importance', only a mere handful of which were laid before the public. But Watson once wrote that he had 'preserved very full notes' of all the cases with which he had been involved.

He kept them 'in a travel-worn and battered dispatch box' in the vaults of Cox and Co, in Charing Cross (an agent and banker to most Army regiments and actually located in Albemarle Street). What happened to these notes is not known,

but all or some may have surfaced in the United States.

One of the cases revealed is 'The Case of the Serrated Scalpel'. This took place in 1888, a year notorious in the criminal history of London and evi-

dently a busy one for Holmes. We know from allusions in the doctor's writings of the affair of the Vatican cameos in May and his exposure in November of the atrocious conduct of Colonel Upwood in connection with the Nonpareil Club. 'The Case of the Serrated Scalpel' also took place in November 1888 and began with the discovery of a murdered actress in an alley behind the Regency Theatre in Oxford Street. Inspector Lestrade is convinced she was a victim of Jack the Ripper. Holmes has his doubts — so we know from the outset that the actress was not a Ripper victim. Lestrade couldn't be right, could he? Or could he?

You take the role of Holmes, donning the deerstalker and putting your powers of deductive analysis to the test, and criss-cross London in a hansom cab to collect information, talk to witnesses, gather clues and run into a few familiar Holmesian characters —

Charts: week commencing 26 October 1992

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Charts supplied by Software Circus, The Plaza, Oxford Street, London W1 (071-436 2811), 282 High Holborn, London WC1 (071-404 4492), 33 Palmer Street, London SW1 (071-976 8587), and 17 Bloomfield Street, London EC2 (071-628 8881).

Wiggins of the Baker Street Irregulars, Inspector Lestrade, of course, and his rival Inspector Gregson. Not everyone is helpful or inclined to tell all they know. Even getting into Scotland Yard to consult Lestrade can be a problem you have to solve.

The Lost Files is a straightforward interactive story. The lower part of the game screen has the usual command buttons — look, pick up, use. Click the button with a mouse, click the appropriate object or person and the required action takes place.

There's an optional auto-help feature which suggests a command. Also, as with most games of this type, you can take objects for future use or for analysis at 221B Baker Street. You can also review Dr Watson's notes at any time.

On leaving a location you are presented with a street map of London. Generally, if you have collected the right clue, an icon marks a new location where you can pursue your investigation. But collecting the evidence is not easy. Sometimes you don't realise that a clue is a clue, and even when you do

it is often unclear what should be done with it. Much time can be wasted on a wild goose chase trying to find what turns out to be irrelevant information, and witnesses can be unhelpful. There are plenty of brick walls where the investigation grinds to a halt. You've missed something. But what? This can make the investigation slow, dull and tedious — just like real detective work!

The graphics are superb, particularly the opening animated sequence. There are 256-colour VGA graphics covering 50 'authentic locations', by which the designers evidently mean that the locations are set in real parts of London. A sound card — AdLib, Roland and Sound Blaster are supported — opens a world of digitised voices, classical music and sound effects. But be prepared to say goodbye to 29Mb of hard disk real estate. If this is more than you can afford there is an option during installation to compress the files to occupy 15Mb, but the penalty is a slower-running game.

The program comes from the States, so one must expect various errors to

have crept in. The Constable who arrives at Baker Street to request Holmes' presence at the murder scene saunters along swinging his truncheon like some 1920s cop in New York's Bowery, and the victim's body is taken to an American morgue instead of the British mortuary. The 'morgue' is also located in Southwark, which as far as I know would not have been where someone murdered in Oxford Street would have been taken. The author of the program has done *some* research, however, knowing about the Fenian bombing of Scotland Yard for example, but the manual gives a wonderfully ignorant account of a selection of Ripper suspects, conflating suspects Montague Druitt and JK Stephen, and assigning to American multi-murderer HH Holmes the words 'I am Jack the...' as the gallows door opened beneath his feet. They were allegedly spoken by poisoner Neill Cream. But these are nit-picking observations. Sometimes tedious, often frustrating, but a pleasant change from simulated sport.

Paul Begg

LEISURE LINES

Brainteasers courtesy of JJ Clessa.

Quickie

No answers, no prizes. If I gave each person in my office £7, I would have £24 left over. If I had £32 more, I could give them £9 each. How many people are in my office and how much money have I?

Prize Puzzle

A number puzzle to give you something that's not too strenuous while you convalesce from the Christmas and New Year binge.

Fit all the numbers (below) into the grid (alongside), some Across, some Down. You must decide which.

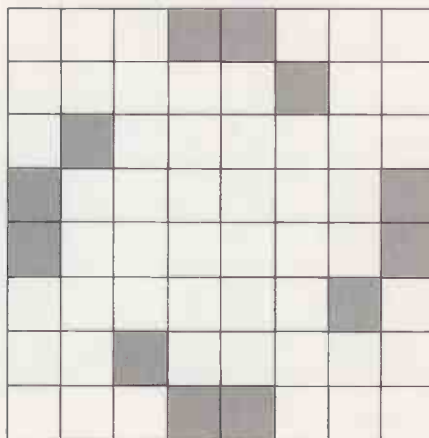
Answers on postcards please — no letters — to: December Prize Puzzle, *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG, to arrive not later than 20 January 1993. Good Luck!

Winner, October 1992 Prize Puzzle

Only 32 entries received this month — sure sign of a difficult problem. Of these few, only six had the correct solution — 3,770,060 or 4,770,060. (Since we did not specify that the integers in the sets had to be different, either solution was accepted.) Many wrongly assumed that if the 3 numbers in a set were integers in geometric pro-

gression, then the common ratio was also integral. This is not the case.

The winning card, chosen at random, came from George Mathieson of Strood in Kent. Well done, George, your prize is on its way. And as usual, to all you others, keep trying — it could be your turn to win next!



21	38	52	57	175
224	516	633	664	676
921	952	25465	64827	68551
73722	149024	224945	352198	394045
522426	712946	944385	978223	

Special Christmas Prize Puzzle 1992

As we promised last month, we are giving everyone a chance to win a prize. No need for computers or mathematical skill. All you have to do is write any number you wish on a postcard (or back of an envelope) and send it, marked SPECIAL XMAS PRIZE PUZZLE, to the usual *Personal Computer World* Editorial address, to arrive before last post on 6 January 1993 (Twelfth Night). Nothing else is needed except your name and address.

The number must be a positive whole number. The prize will be awarded to the person sending in the LOWEST number which no other reader sends in. In other words, if you choose a number which someone else also chooses, then you can't win.

If no-one submits a unique entry, the competition will be declared void. So, start thinking logically and get the cards in.

Happy Christmas!

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Copying on to floppies

A simple partitioning problem, or how to copy from a hard disk sub-directory onto one or more floppies, investigated by Mike Mudge.

The area of investigation this month, which is more on the practical side (or at least almost so!) than those usually to be found in Numbers Count, is due to Michael Meieruth of Milan who describes the level of difficulty as 'relatively low'.

The background concerns the inadequacy of utility programs to efficiently copy the contents of a hard disk sub-directory onto one or more floppy disks. These all do the

calculation time.

Consider floppy disks having 3600-byte capacity and ask what is the arrangement of files needed on each disk to accommodate the 17 files below on no more than 3 floppy disks: 63, 127, 175, 190, 215, 311, 407, 463, 517, 537, 711, 801, 827, 1019, 1251, 1272, 1914.

This is a simple partitioning problem which, due to its nature, is subject to the time-consuming difficulties of typical combinatorial problems.

A further complication may also arise if not all the floppy disks have the same capacity, and further if the problem has not been set up so as to fill all of the floppies exactly. (Note: the above problem, being artificial, does indeed fill all of the floppies. However, the odds are very much against this occurring in a practical situation.)

The unique answer to the above problem is:

Floppy 1: 63, 311, 463, 711, 801, 1251. Total: 3600.

Floppy 2: 127, 215, 517, 827, 1914. Total: 3600.

Floppy 3: 175, 190, 407, 537, 1019, 1272. Total: 3600.

This solution was obtained by an exhaustive search, readily seen to require an excessive amount of calculation time when the number of files is large and/or when either of the above-mentioned complications are present.

One possibly promising algorithm involves ordering the files by size and then starting to copy from the side with the smallest files, continuing this process until all files have been copied. This algorithm is seen to fail to generate the optimal number of floppies in the artificial case above. However, Michael Meieruth claims a success rate (defined as those cases resulting in the use

of the optimal number of floppies) of about 78% using randomly generated samples, compared with a 30% success rate using the same samples with simple sequential copying. Michael also has a slightly altered version of the above algorithm which yields a 98.5% success rate!

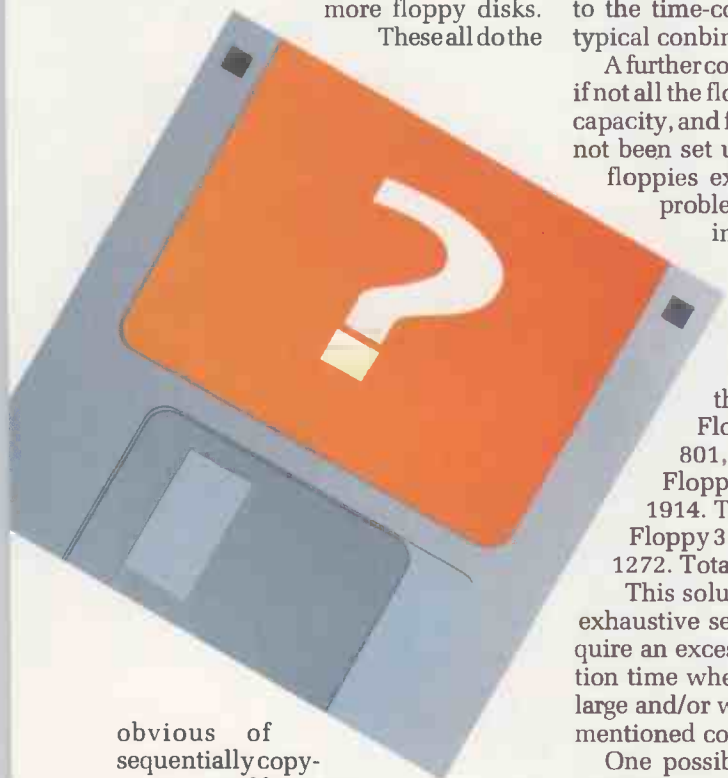
Readers are challenged to reproduce, and if possible improve upon, the above success rates. Particular attention should be given to the simulation (random generation process) of the file samples both with regard to their number and spread of magnitudes. A unit of 1 floppy accompanied by decimal file sizes may be relevant here?

Attempts at this challenge may be sent to Mike Mudge, 2 Gorsfach, Pwll-Trap, St Clears, Carmarthen, Dyfed SA33 4AQ, to arrive by 31 March 1993. Any communications received will be judged, using suitable subjective criteria, and a prize will be awarded, by PCW, to the 'best' contribution arriving by the closing date.

It would be appreciated if such submissions contained a brief description of the hardware used, together with sufficient details of programs to enable the results (and in particular the random samples of files) to be reproduced. Run times, a summary of results obtained and suggestions for further work in this area should also be enclosed. Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

(This article first appeared in the October 1990 issue of PCW.)

Mike Mudge welcomes correspondence on any subject within the areas of number theory and computational mathematics. Particularly welcome are suggestions for future Numbers Count articles.



obvious of sequentially copying as many files as possible and requesting a change of floppy disk when the next file will not fit in the available space. The investigation is concerned with working out, and implementing, an algorithm for optimising the copying process: that is, using the minimum number of floppy disks while not requiring an excessive amount of

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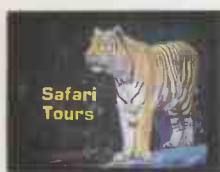
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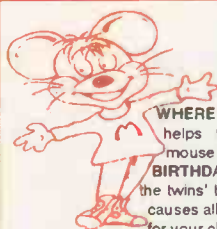
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Programming productivity

The failure of computers to significantly improve human productivity can be laid at the door of software: programming is inaccessible and difficult, and programs unreliable. Some business management techniques should be applied at the outset, says Nick Beard,

Programs are the engines of computational creation. The real work, the production of value, is done by the program (after the programmer has finished, of course). Computer hardware is merely the driving force behind the program, the real machine. *Computers are to programming languages as petrol is to cars.* Not that hardware counts for nothing, as anyone running Windows on a 286 soon realises. More complex or sophisticated programs require more power, just as a Porsche drinks petrol faster than a 2CV.

This is not the first time an automotive analogy has been constructed for computers. The best known is probably this: 'If cars had improved and cheapened at the rate computers have, we could all be driving in Lotus-beating supercars which cost a mere hundred pounds and deliver two hundred miles to the gallon.' To which a wag might add... 'and blow up every year or so killing everyone on board...' and not without some justification. If we were to trust our lives to computer software, we would need to be far more sure of its quality than we can usually be with most of the stuff on the market.

The noise surrounding the astonishing pace of computing development is predominantly about *hardware*. There has been far less progress in *software*, although the usual line about software not keeping up with hardware is a trivial oversimplification. Consider 'Windows', which Xerox had running years ago, long before Microsoft's early efforts, efforts which were waiting for hardware to catch up and provide enough affordable power.

Irrespective of how fast and cheap computers are, they will still need programming. Programming has not become much easier or accessible, and programs frequently remain unreliable.

Although *self-organising systems* exist, based on approaches to computing such as neural networks, they have limited scope, and computers will always require programs. Even if very powerful hierarchies of neural networks, Boltzmann machines, and genetic algorithms can be put together to solve problems without a clear step-by-step algorithmic basis, conventional programming will still be required to form the 'glue' between the sub-systems. So there will still be a need for careful debugging.

Furthermore, although research on formal methods and CASE tools continues, it is unlikely in the extreme that programs other than the most trivial will ever be *provably* correct — bug free. The problem is that, apart from small and simple applications, *computer programs are extremely hard to write* — and the problem does not stop there. Programs need maintenance. Once written, they nearly always need *changing*, and this brings trouble: *software rust*. Each time a program is altered or adjusted, even tiny amendments can have unforeseen *side effects*. These effects surface some *time* in the life of the program and need to be tracked down and fixed, which means further changes. This adds up to a big chunk of expense. The whole edifice becomes unstable and not worth maintaining.

As hardware continues on its inexorable growth path towards ever greater potency, the software bottleneck remains, a major stumbling block in getting useful work out of computers. We all know how expensive products are released onto the market, bought by hapless PC users with hard earned cash, even though the programs are stuffed with bugs and other failings. Why is this? Why is it so difficult, time consuming and, ultimately, so expensive

to produce good software? There is no simple answer; and if I had one, I would certainly not give it away for nothing, even in the pages of an august journal such as this! So here we will look at the background to the problems of software development, some of the approaches to alleviating them which have been tried — and which have generally failed — and address some of the approaches to getting the most 'bang per buck' from your IT spend.

Part of the difficulty is that there is no usable, widely agreed definition of software quality. As we will see later, this entire realm concerns more than dry technical matters. Even 'provably correct' software could turn out to be correct according to a specification which is in itself inappropriate. What is high quality software? Not every person will agree that a particular program is high quality. I believe WordPerfect 5.1 to be one of the highest quality products around; some people disagree, apparently concerned about its lack of a Windows button bar. Is code elegance important? Some programmers think so; but what if it reduces time-to-market by so much that the company goes bankrupt and so is no longer able to provide support?

As in many areas of human endeavour, people seek magic bullet solutions to the software development problem. Such solutions simply don't exist.

Many moons ago, a leading computer scientist, John Backus, developed a new programming language. *Fortran*, first developed in 1954, had a major goal: to *eliminate programming*. Backus and colleagues wrote 'if [the machine could] code problems for itself and produce as good programs as human coders (but without the errors)... large benefits could be achieved.' True indeed. But doomed to failure. The project

was a success in one sense: it eliminated the need for *assembly language programming*. Programming remains necessary, of course, and so errors continue to arise.

Fortran was no magic bullet, neither was *structured programming*. In an effort to improve the overall quality and maintainability of programs, Edsger Dijkstra issued the dictum 'GOTO statement — considered harmful' in the *Communications of the ACM* (Association for Computing Machinery). The point was well made: the tangled spaghetti loops which soon develop through excessive and crude use of the GOTO statement can render programs unreadable — except by a computer. Which is fine if the program works, but not if it has to be fixed or altered. Structured programming took Dijkstra's diktat to heart, and propounded the formulation of code in carefully planned modules which performed discrete tasks, control being passed between modules in an orderly, and therefore easily followed, fashion. There is little doubt that structured code is far easier to maintain. However, it does not much help the problem of rapid applications development. Perhaps logic programming, with its different perspective on coding, could help?

Niklaus Wirth summed up the essence of a program in the phrase program = algorithm + data. Robert Kowalski, Professor of Computational Logic at Imperial College, offered an alternative view, with the dictum algorithm = logic + control. The *logic* of the algorithm is then a declaration of the programmers' assumptions about the problem.

Control is the method of directing the computer to interpret the program in a particular fashion, including implementation-technique specific statements, the strategic considerations of efficiency, memory handling and so on. The latter elements are things that are dependent on the details of the chosen hardware or programming language and have no necessary connection with the specific problem being addressed.

This logical core is the *declarative* aspect of the program, a *declaration* of the essence of the problem. It represents that which the programmer sought to embody in the program. It declares the problem principles that would also have to be embodied in a different program, written by a different person, in a different language. In logic programming these principles can be explicit, unlike conventional languages like Pascal or Fortran where they are often obscured by program control state-

ments. Indeed, it is this mix of problem definition and solution-procedure control which makes software so complex. Although logic programming enables rapid project prototyping, it is doubtful whether it has revolutionised software development.

Software is the most complex of human artefacts. What makes it so baroque? First, there are fewer repeated structures within software (contrast this with the regularity of a memory chip). Second, scaling-up software does not only produce a linear rise in complexity: things get out of hand far faster than that! Third, constant modifications cause additional trouble.

These factors help to explain why such a large proportion of software projects fail and never deliver the intended goods. It is possible that object orientation will help (see Mat Beard's article 'Speaking the Lingo' in the December issue of *PCW*). There is some (scant) evidence that a properly trained bunch of OOPS programmers, once tooled up with class libraries to enable code re-use, can cut development times.

So, even if novel approaches to coding can improve software development productivity, there remains a big maintenance problem. Cobol, frequently the subject of obituaries in the computer press, remains a central component of business computing. Eighty *billion* lines of Cobol code are reputedly out there, software which is at the very heart of many enterprises. This is why some of the big old mainframes are sometimes called *code museums*. Even if new languages come on stream which help programmers to generate code faster and more reliably than ever before, these existing applications will still be required, for many years. No such language is in sight, either. There is little reason for confidence that software development will become any cheaper; but old applications are 'rusting' fast, as each little change in the code pushes the program closer towards software meltdown. Each little change has unforeseen effects, consequences following from rather 'clever' chunks of code which were kludged together to get around a problem.

Chasing these effects can push software maintenance budgets sky high. But companies will continue to need to change their applications as regulatory demands are altered and companies discover new reporting requirements. With greater scepticism around these days about the profit benefits of information technology, it is doubtful that many companies will be prepared to spend the amounts of money required to re-write collapsing software com-

pletely anew, on fresh, blank sheets of magnetic tape. 'We see computers everywhere except in the profit margins' say the sceptics, with a strong case. (They only have to look at the time people spend messing around with fonts. 'Type managers' and such font packages are among the most worthless of software utilities.) This places companies on the horns of a difficult dilemma: *they can no longer afford to maintain their programs, but they cannot afford to re-write them*. How can companies get out of this bind?

The only choice open to companies in this situation is to change the way they work. Most computer systems were devised to automate badly thought out paper processes. In how many offices do people word-process six drafts of an internal memo, print it (over a network), maybe revise it after seeing the paper copy, then make many photocopies which are distributed by hand via pigeonholes or the internal mail. Crass.

Re-engineering the processes through which things are done is the latest approach to solving the PC productivity problem. This means radically shaving lumps off tasks *before* embedding tasks in computing systems. It is fundamentally a business *management* issue and not a technical *computing* issue. But since computer people are being challenged to account for the failure of computers to improve productivity, they had better get to grips with it.

Resource Guide

Automating Software Design

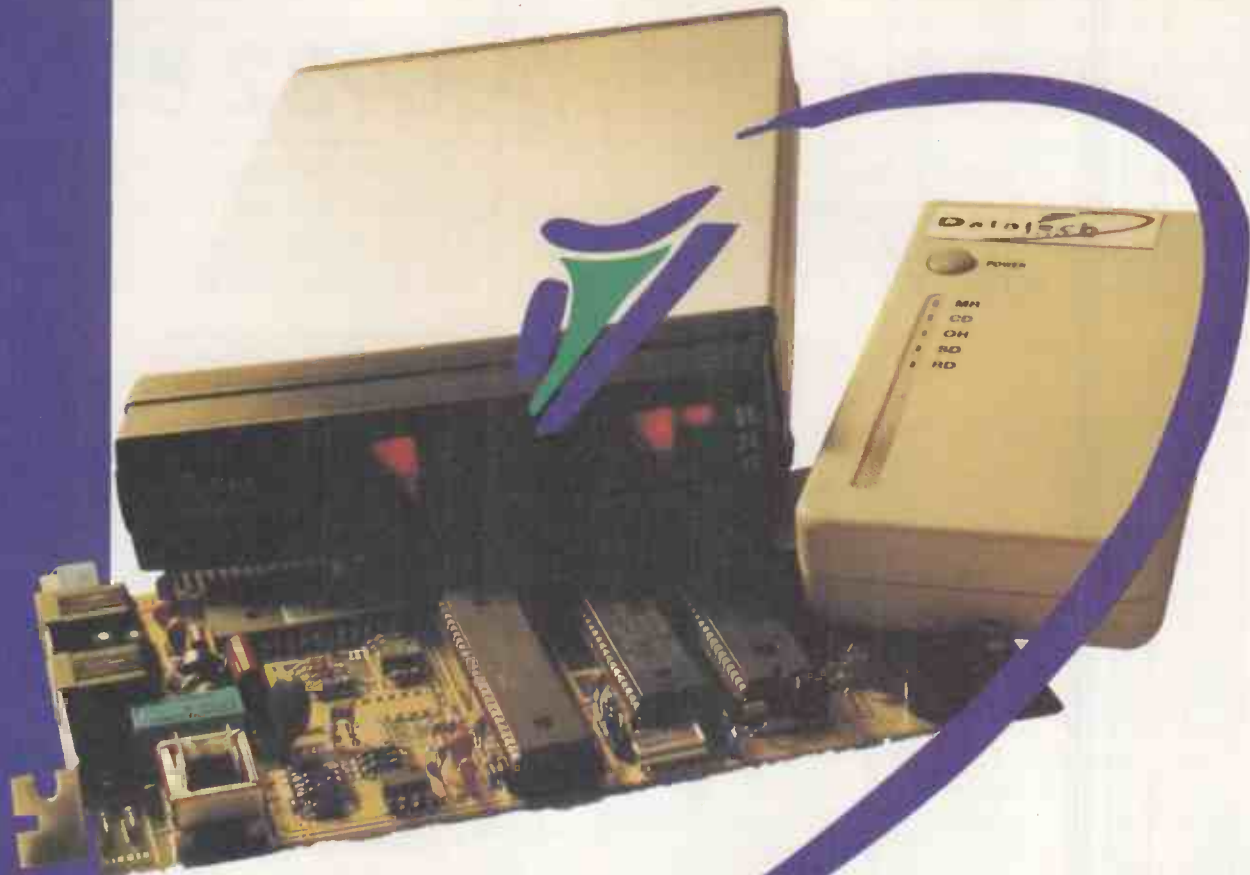
Michael Lowry and Robert McCartney (Eds), MIT Press

A series of papers, with a mixture of industrial and academic perspectives, discussing the role of AI techniques in software design and CASE tools. The book discusses knowledge-based tools for large software systems, formal derivation systems, and cognitive and planning-based approaches to software design. Valuable for anyone with a serious interest in CASE or knowledge-based systems.

Quality Software Management: Volume 1 — Systems Thinking

Gerald Weinberg, Dorset House Publishing

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MX2400	£69	X			X			S					X		5	4800
MX2448	£79	X			X			S			4800		X		5	4800
MX2400-5	£99	X			X		X						X		5	4800
MXE2400	£94	X			X			S					X		5	4800
MXE2400-5	£104	X			X		X						X		5	4800
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PM2400-5	£105		X		X		X						X		5	4800
ZX2496	£139	X			X			S			9600	9600	X		5	4800
ZX2496-E	£159	X			X		X	X			9600	9600	X		5	4800
ZX2496-P	£179	X	X		X			X	X	X	9600	9600	X		5	9600
9600S	£229	X		X	X	X		X	X	X			X		5	38,400
1496i	£259	X		X	X	X	X	X	X	X	14,400	14,400	X		5	57,600
1496E	£279	X		X	X	X	X	X	X	X	14,400	14,400	X		5	57,600
WS3000 Miracom	£145		X		X	X								X	5	2400
2400S + Omnitel	£199	X		X	X			X	X	X				X	2	9600
Miracom V32	£385	X		X	X	X		X	X	X				X	5	38,400
Miracom D/2	£595	X		X	X	X	X	X	X	X				X	5	38,400

V23 = 1200/75bps, V21 = 300bps, V22 = 1200bps, V22bis = 2400bps, V32 = 9600bps, V32bis = 14,400bps, MNP 4 = error correction MNP5 = 2/1 data compression, V42 = CCITT error correction, V42bis = 4/1 CCITT data compression. All modems V21/V22/Bell 212/Bell 103, Hayes compatible, auto answer, auto dial (pulse & tone) and have monitor speaker, S = Software error correction. Our non BABT approved units are designed for international use, including the UK. All modems supplied with RJ11/BT lead.

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Hitting the decks

Having persuaded everyone to chuck away their records and replace them with CDs, Sony and Philips are at it again, but this time they've got their eyes on your tape deck. Tim Frost sounds out the rival formats aiming to make the compact cassette obsolete.

Sony is currently trying to breach the bounds of audio technology on two fronts. Not satisfied with launching a completely new format that both supports pre-recorded material and is able to record, the company has also come up with a nifty way of improving the quality of CD.

First to Mini-Disc. Few people with any interest at all in audio will have escaped noticing that there is a battle between Philips and Sony to sell us new audio formats. Both companies have their eye on the substantial cassette deck and pre-recorded cassette business, and believe we are ready to spend a lot of money on an all-digital system that can have mass-produced pre-recorded material (just like the cassette) combined with the ability of home recording (just like the cassette). Where Philips has turned the cassette digital with its DCC system, Sony has moved to a more CD-like approach.

Shell suit

The Mini-Disc is an optical format, similar to CD. But where you are able to handle the CD itself, with the possible risk of scratching or damaging it, Mini-Disc comes with its own integral outer shell. Sony has looked to the floppy disk for its basic design ideas. Mini-Disc is completely self-contained and doesn't need an outer box to protect it; if you didn't know any better you would think the Mini-Disc, with its sliding cover, was a shrunken 3.5in floppy (and they're a real bugger to get back out of a computer drive).

The optical disc used by Sony is just 2.5in in diameter as opposed to 4.25in for a CD. So although Sony is using CD

technology for pre-recorded Mini-Discs, if it used standard PCM digital encoding, the playing time would be under 15 minutes. To get over this they use a data reduction system to squeeze over an hour's music onto the disc.

Sony's data reduction system, ATRAC (Adaptive Transform Acoustic Coding) works very much along the same lines as the system used for DCC, already covered in depth in previous Innovations columns.

Briefly, ATRAC duplicates the ear's threshold of hearing and masking functions; it discards all the elements of sound the ear would not normally register. The developers of the system calculate that if we don't hear these low level sounds in the first place, then there is no point using up data space to record them; this enables them to cram a lot of audio onto the disc. So much so, that there is plenty of spare capacity for non-audio data for which the main use is going to be as a text carrier. This will show on a small LCD built into the better Mini-Disc players with track and performer information, and other texts such as the words of the songs. Since this space can be reallocated as additional 'user space', in future developments it could be used for graphics, or other data or control information.

The system has the same frequency response as CD — flat up to 20kHz: and theoretically at least, has a 6 to 7dB dynamic range advantage over CD. On the other hand, the ATRAC processing may introduce its own little quirks and the general term used by Sony to describe Mini-Disc's audio quality is 'CD-like' rather than 'equal to CD'.

However, these are the first genera-

tion of ATRAC chips. Digital/analog technology used on CDs has marched forward to the point where digital to analog conversion is now executed almost totally differently to a decade ago when CD was launched. The use of over-sampling and new generations of bit-stream converters has radically improved CD sound quality. It is not unreasonable to expect the same thing to happen with the data reduction schemes used on Mini-Disc and DCC, so that they soon overtake the sonic performance of CD.

Apart from using ATRAC to encode the data, the pre-recorded side of Mini-Disc is similar to CD. Discs are stamped out with the digital information as pits in the disc's reflective surface, which are picked up by a solid state laser head in the player.

Sony reckons that by far the biggest initial market for Mini-Disc will be 'Walkman' and in-car units and it knows nobody wants a player that jumptracks with the slightest jog or bump in the road. Rather than spend vast sums trying to stabilise the disc transport, Sony has taken advantage of the reducing cost of solid-state memory and inserted a buffer memory just ahead of the decoding electronics.

The transport can read data at the rate of 1.4Mbit/sec, but ATRAC needs a bitstream of only 0.3Mbit/sec to play properly. If the unit is jogged, the buffer memory has enough data stored in it to allow it to carry on playing until the laser once again locates its position.

To help find the right place quickly, Mini-Disc has address data recorded after every 13ms of audio, so the decode electronics can quickly recognise

that the laser head is not where it ought to be and can quickly find the right position again.

Electronic shock protection, or ESP as Sony engagingly calls it, will also be added to CD Walkmans, with Sony already announcing memory-loaded units in the US. If you see a Walkman advertised as having ESP, you'll know that it hasn't been fitted with a chip to start playing the right track just before you thought about what you wanted to hear!

With the pre-recorded Mini-Discs functioning very much like a CD, this should lead on to using CD-R technology for recording. Sony however has rejected standard CD-R technology for the record side of Mini-Disc for two reasons. Firstly, the cost is still in thousands rather than hundreds of pounds, and secondly, CD-R, which burns the data into the blank disc's dye layer, is a write-once system. Once you have recorded on a blank CD-R disc, that's it; you cannot erase or put any other tracks over previously recorded music. Instead Sony has gone for magneto optical technology and Mini-Disc uses different technologies for its pre-recorded and its record/play functions.

The MO Mini-Disc looks exactly the same as a pre-recorded disc, but inside the cartridge is a disc with a magnetic layer that will polarise reflected light in different directions depending on the layer's magnetic polarity. The Mini-Disc recorder has a 0.5MW laser which is focused onto the disc from underneath, heating it up to 400°F. At this temperature the magnetic layer loses its coercivity over the tiny area the laser is focused on; the area can then be oriented 'North' or 'South' by using a tiny magnetic recording head.

In a spin

As the disc is spinning, the spot instantly cools down as it goes past the laser spot. Back to normal temperatures and the layer holds on to its new magnetic orientation, with North representing a '1' data bit and South representing '0'. The disc will permanently store this data until you want to record over it, at which point the whole process is repeated: writing new, magnetically-held data over the original.

On playback, a laser is beamed onto the surface of the MO disc and the reflected light is passed through a polarising filter onto two separate photo-detectors. Depending on which way the light has been polarised by the surface of the disc, one photo-detector will be receiving more light than the other and a simple comparator will decipher these as either 1s or 0s.

By separating the playback-only and the record/play functions, Sony can launch two varieties of Mini-Disc unit. The cheap (relatively speaking as prices will start from £300) ones will duplicate the function of CD players and CD or cassette Walkmans and in-car players, as a playback-only system which can play both Mini-Disc 'albums' and MO discs recorded on other units. If you want to record as well, then you have to spend the extra £100 or so for a unit that has the combined CD/MO transport and electronics.

The pre-recorded discs will match the price of CDs exactly, so there won't be any advantage there. The cost of the MO blanks will be around a fiver, the same as a good quality metal cassette.

Altered audio

One long-term drawback with systems like Mini-Disc and DCC is the way they permanently alter the audio. A piece of music recorded and replayed on Mini-Disc will end up with substantial bits of the sound removed by the data reduction system from then on. Even in the analog domain it will always carry the 'fingerprint' of the conversion system. If that track is re-recorded on the same system, the data reduction system then has little or nothing to do because it did all the filtering the first time round, so repeated copying on the same system works perfectly, with no degradation.

But re-record that music track on DCC where the data reduction system works along the same lines but with slightly different parameters, and the encoded signal carries a mixed fingerprint of both data reduction systems.

A single pass through both systems is unlikely to generate any noticeable problems, but repeated transferring between formats will produce rapidly deteriorating sound quality.

Whether or not Mini-Disc takes off as a domestic format, one bit of good news is the knock-on effect it will undoubtedly have on the cost of computer MOs. Second or third generation Mini-Discs will be substantially cheaper than the £400 launch price, already half the price of a low-cost MO disc drive. As the price drops further this would make Mini-Disc an attractive proposition as a 180Mb archive, even if by hard disk standards access time may be a bit on the slow side.

Super Bit Mapping

Now back to boring old CD and Sony's other little development: Super Bit Mapping. One problem with CD is that it 'only' has 16-bit resolution. When CD was introduced 16-bit was thought to be more than adequate for any hi-fi

system, offering as it does in excess of 96dB dynamic range. But developments over the last decade have highlighted limitations caused by this 'limited' resolution, that cannot be totally alleviated by better digital to analog processing; most noticeably the problem of quantization errors. With 16-bit resolution the sound wave can be broken down into any of 65,536 possible values. These are steps of finite size, so if the waveform is between two of these steps when it is being sampled, the closest step value is recorded and what is eventually played back is not totally accurate. These 'quantization' errors show up as noise which is fairly uniform over the audio spectrum, like tape hiss. And like tape hiss this background quantization noise continues at about the same level, no matter how loud or quiet the music is.

Although most studios continue to record using 16-bit digital, an increasing number, especially in the classical world, are moving up to recorders that work at 20-bit resolution, giving substantial improvements. However, even if the engineers have gone to the lengths of recording in 20-bit, the quantization problem returns when the 20-bit tapes are converted down to 16 bits. Either the four least significant bits of the 20-bit data are just dropped or the tapes go through a process of dithering, similar to image dithering, which introduces its own level of inaccuracy and, consequently, noise.

Scientific approach

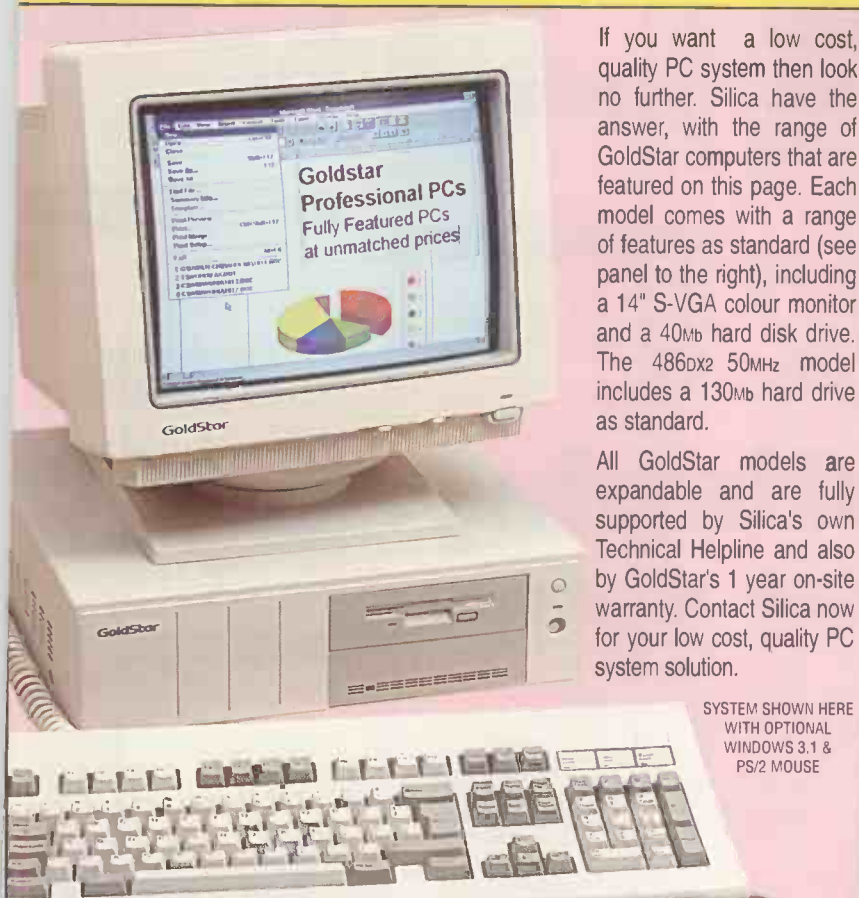
Super Bit Mapping takes a more scientific approach to the problem. The ear's sensitivity to noise is not uniform. Noise between 3kHz and 5kHz is a lot more noticeable than noise outside this 'mid-band' area, so during the conversion process from 20-bit to 16-bit the SBM converter cannot stop additional quantization noise occurring but can redistribute that noise so that it is moved away from the areas of the audio spectrum to which the ear is most sensitive. Although the total noise energy remains much the same, it is far less audible. In this respect at least, the 16-bit CD will have performance characteristics closer to that of a 20-bit system.

The good news is that most of Sony's recent new classical releases have been Super Bit Mapped, many from original 20-bit recordings. The bad news (proving the dictum that the more useful the technology, the more likely the marketing man will miss the point entirely) is that the rock titles released in SBM are re-masters of old analog albums, with limited dynamics and higher noise, such as Dylan's *Blonde on Blonde*.

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Looking good on paper

Hewlett Packard's LaserJet 4 has raised the laser printing standard from 300 to 600dpi. But as Nick Edmunds says, there is more to high resolution than appears at first sight.

When Hewlett Packard's brand new LaserJet 4 arrived in the PCW office, we all gathered round to watch. After years of highly satisfactory 300dpi laser printing, everybody wanted a good look at the quality of 600dpi output. After much close scrutiny of both text and graphics, a disagreement ensued. Was 600 dots per inch resolution really necessary? Personally I liked what I saw. The printed page was sharp and clear and evidently of better quality than from any 300dpi laser.

600dpi laser printers have been around for some time, but HP's LaserJet 4 changes everything. All of a sudden 600dpi is the standard for desktop printing. HP dominates the market so HP dictates the standards. The LaserJet 4 replaces the popular 300dpi LaserJet 3 with this latest 600dpi machine which has a superior specification and a lower cost. Prospective customers, then, will buy this new technology without even considering whether it's necessary. If it's better and cheaper what more could they want?

The arrival of a mass market, high-resolution laser printer prompts this month's 1000 Hours. Suddenly, greater-than-300dpi printing is of interest and high resolution print products are appearing more frequently. Reviewed in last month's PCW alongside the new HP printer was another high-res device, Compaq's 400 x 800dpi Pagemarq 15. This uses an identical 15 page per minute (ppm) Fuji-Xerox laser engine to that in the Dataproducts LZR1560, which manages only 400 x 400. Same engine, different resolution. Why? More mysteriously, LaserMaster (a US company) has for years succeeded in coaxing a standard HP LaserJet 3 into producing much better than 300dpi. How?

All laser printers are based on a similar technology from the same roots.



In the mid-seventies Xerox produced the first laser printers using a technology straight from its photocopying systems. These printers were floor standing, connected to mainframes, and huge compared with today's desktops. In 1984 Canon developed the solid-state laser engine around which Apple and HP based their respective laser printers, the LaserWriter and LaserJet.

The heart of the printing mechanism,

the engine, is a drum coated in photo-conductive material. This material has the interesting property of being non-conductive to electricity when kept dark and conductive when exposed to light; you may have glimpsed this magic coating under the protective flap of a replacement laser print cartridge. This drum is the width of a page and is rotated past a corona wire, building up a static charge on the surface.

The drum continues to rotate and the area of the surface which has just been charged moves into the imaging position. Here a picture is drawn onto the drum by a rapidly scanning light: a laser beam. Light has the effect (bearing in mind the drum's photo-conductive quality) of making only the illuminated parts conductive, thus discharging the static in those areas.

The drum surface is then passed through the toner unit. The black powdery toner is charged with the same polarity as the drum and is thus repelled by the entire drum surface other than where it has been illuminated. This results in an 'image' of toner sticking to the drum surface. The drum then rotates onto the paper which is held in front of a highly-charged transfer wire. The toner, attracted by the transfer wire, leaves the drum but is stopped by the paper. The paper, with loosely adhering toner, passes through a fuser unit which combines heat and pressure to 'fuse' the toner into the paper. The printed end result — as you may have noticed — comes out of the printer warm. The toner powder itself is a mixture of iron (to take the charge) and coloured plastic (to produce the image). Canon uses half iron oxide, half styrene acrylate co-polymer, and a dash (1%) of amorphous silica to keep down the lumps. It has a melting point of around 150°C.

The bitmapped image is drawn on to the drum by the laser in a series of dots. Oki uses exactly the same system minus the laser; instead it uses a line of 2560 tiny red LEDs close to the drum to produce the same result. Its current models only go up to 300dpi, but higher resolutions are promised. The printer controller feeds a digitised signal to the laser, which scans the width of the page, pulsing on when it needs to place a dot. The laser beam is directed across the page by a spinning, poly-faceted mirror, while the laser on a 300dpi printer pulses 300 times an inch. The increasing-in-pitch whining you hear when you switch on a laser printer is this mirror spinning up to speed.

After each sweep of the laser, a stepper motor moves the drum, and with it the paper, forward by one increment (say 1/300in) ready for the next sweep. These two aspects, the pulse rate of the laser and the movement of the drum, give us the resolution of the printer in both directions. This is 300 x 300 in the LaserJet 3 using the Canon SX engine or 600 x 600 in the LaserJet 4 using the new Canon EX engine. It is worth pointing out that despite the wide use of Canon print engines by many manufacturers it certainly doesn't have a mo-

nopoly. As well as Xerox and Oki, laser engines are produced by IBM, Minolta, Sharp, Brother, Fujitsu, Ricoh, Samsung, Panasonic and Kyocera. Most of these have high resolution printers either in production or planned.

Determining the resolution of a laser printer appears relatively straightforward then: so many laser-pulsed dots across, by so many drum increments down. In fact the situation is far from clear. For starters, Canon itself says its 300dpi SX and LX engines are actually capable of 1200dpi. Further, there are many 'edge enhancement' technologies on the market which make the printer appear to produce a much higher resolution by improving the look of printed output. We have HP's RET (Resolution Enhancement Technology), IBM's PQET (Print Quality Enhancement Technology), Canon's own AIR (Automatic Image Refinement) and many others. In fact the HP LaserJet 3 with RET, launched in 1990, used an identical engine to the LaserJet 2. Some printer manufacturers appear to quote dpi resolutions in their specifications which should really read: 'print quality has the appearance of Xdpi resolution'.

In addition to the different engines and enhancement technologies, companies like LaserMaster can actually improve the resolution on existing printers. They can do this because, unknown to most owners, many laser printers have a back door, with direct access to the laser engine's electronics. The port, often labelled 'Optional I/O' or 'Video Interface', bypasses the normal printer controller. LaserMaster produces a card which installs in your PC ISA slot and drives an HP 2 or HP 3 at a claimed 800 x 800dpi when using PostScript.

Print enhancement and/or resolution improvement (defining either is a minefield) is achieved in a number of different ways. A laser beam in an engine is optimised for a given resolution. The size of the dot is obviously crucial: too small and you can't achieve strong blacks, too large and you start losing definition. The dot size is not fixed though, and can be varied depending on the laser pulse strength. HP's RET uses 20%, 40%, 60% and 80% dot sizes as well as off and full 100%. This gives much greater control when you get to the edge of a character, whether a straight line or something more complicated like trying to fill out a serif.

RET examines 50 pixels around the dot in question before deciding on its size. The object of the exercise is to improve the look of the print quality and avoid the jagged edges which occur when producing diagonal, curved or thin shapes. Any shape which can-

not be made up easily from the vertical/horizontal matrix of dots presents a problem, so algorithms which consider what size the dot should be, given its surrounding dots, run on an ASIC (Application Specific Integrated Circuit) inside the printer.

Not only can the laser dot size be varied, but so can the frequency of pulses and the time at which the dot is pulsed. So, control over the laser 'firing mechanism' can again increase the resolution by getting more dot positions per inch. Thus by 'modulating' the laser, improved print quality can be achieved along the horizontal axis. Interestingly, a combination of dot positioning and dot sizing can also be used to improve apparent print resolution in the vertical axis. The result of a laser beam hitting the photo-sensitive drum is not, when examined in detail, black and white. There is actually spillover onto adjoining pixel areas. Because the dot size can be varied, a line of large dots can be followed, in the next pass, by a line of much smaller dots which effectively adds height to the line below. In this way, variations in vertical resolution can be achieved without changing the stepping motor increment.

Even this method has different approaches producing different results. The algorithms used to guess the correct character shape can only be so clever if working on a bitmapped model of lower resolution, so if the printer receives a 300dpi bitmap, resolution enhancement has a difficult job to convert this into a 600dpi printed page. Scaleable fonts such as PostScript and TrueType can be converted into any resolution, hence LaserMaster's claim to produce 800dpi images. By working from an 800dpi bitmap, LaserMaster's resolution enhancement is certainly going to be better than a system that starts with 300dpi.

In the light of the various enhancement technologies then, the prospect of a LaserJet 3 running at 1200dpi looks less surprising. Precisely what is meant by 1200dpi in this context though is certainly open to argument.

With real increased resolution come increases in printer memory size. A 600 x 600 bitmap contains four times as much data as 300 x 300. Higher resolutions and more data also mean more work for the printer, so processor power must also increase. The latest printers now have powerful RISC processors alongside their ASICs, data compression, bulging memory, and hard disks full of resident fonts.

So is 600dpi really necessary? No, of course it isn't. But it looks good and, more importantly, it's here to stay.

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Keeping an eye on optical computing

PC or mainframe, computers are variations on the same chip. As electronic computing approaches its limit Mat Beard sees how optical systems could stretch the boundaries.

Computers are used for just about everything; you would be hard pushed to enter a home in the UK and not find something controlled by a computer of one type or another. All these computers, from the simple chips in your washing machine to the largest supercomputer, are basically the same: their hardware is based on VLSI (Very Large Scale Integration) circuits, etched in silicon; their architectures are based on processing units that operate on data kept in the memory; they run sequential programs that specify what to do at each step. Broadly, they are Von Neumann electronic computers.

Computers have come a long way in the last few years and are unlikely to be replaced by new technology in the near future; but there are several things electronic computers are not yet capable of doing adequately. Typical examples are massive computational tasks, such as image processing, and simulations, especially those of fluid dynamics.

Fifth generation

Various research efforts are in progress to address this problem and concentrate on designing machines of new types. One idea revolves around 'fifth generation' computers which incorporate ideas from artificial intelligence and logic programming. Another is concerned with parallel computing. However, this month's Bluesky takes a look at optical computing.

The field of optical computing is very broad; it encompasses virtually any computational or information processing operation that uses an optical device, and the advantages are just as widespread.

Optical computers are particularly well suited to direct image processing. Images are naturally thought of in terms of optical systems and light beams. Certain image processing functions can

be carried out by specific optical systems directly on the image, with no need for sampling: quantization is an example of this. Such an optical system can operate faster and at a higher resolution than its electronic counterpart.

Optical systems allow for massive parallelism and connectivity, which leads to increased speed. The problems preventing the speeding up of conventional systems do not arise from the inadequate speed of the basic elements: rather their interconnection. Optical communication allows for millions of data channels, each with a bandwidth much greater than that of any electronic link. These highly parallel systems give rise to very high speed data processing, vital in some of today's applications where the amount of data to be sorted is massive. Work by NASA over ten years ago led to estimates that a space station would produce over 55,000 images every day, for weather forecasting, pollution control and earth resource mapping. This amount of data would overwhelm any conventional computer.

Optical systems remove some of the limitations associated with electronic computers. Electrons circulating in a conventional computer are susceptible to electromagnetic interference (EMI). In particularly electronically noisy locations and high radiation areas, they fail. Optical computers do not suffer the same problems; they carry on regardless.

Surely an optical system with all the aforementioned benefits would be large and expensive? Quite the contrary. Optical systems tend to be smaller, lighter and less complicated than equivalent electronic computers, hence their lower costs.

The development of optical computing is linked to that of radar systems. The need to quickly process the

large amount of data supplied by radars used in mapping was the motivation behind early optical signal processing research. Many ideas developed by the radar community were later found their way to optical computation.

Optical computing became much more feasible in 1960 with the invention of the laser. Laser light allowed numerous operations to be carried out by optical means. These operations were analog in nature, and are best described by the term 'signal processing'. Electronic signal processing systems have one (temporal) degree of freedom, whereas typical optical systems have two (spatial) degrees of freedom; the data is a 2D image. One of the basic operations that can be performed on images in laser light is the Fourier transformation, from which numerous applications have grown.

The development of optical computers has suffered a desperate lack of funds. Sporadic attempts have been made to realise digital logic by optical means but the results haven't amounted to much, mainly because of the success of conventional electronic Von Neumann computers. They gave results that were accurate to any desired degree, and were flexible and easy to program, giving them the edge over analog optical systems which were based on immature technologies and were potentially loaded with pitfalls.

Indecisive

Another reason for the seeming lack of interest in optical systems has been the indecisiveness of the optical computing community. When electronic computers received a push from the invention of transistors and integrated circuits, those working on developing optical computers were still on the quest for materials and technologies. As long as there was no chosen technology,

there was no single channel in which to invest, so no idea became concrete and reached completion.

There are now two distinct trends in optical computing: special purpose analog systems, and general purpose digital optical computers. The analog systems can be further divided into another two classes: those dealing with signal and image processing, and those dealing with numerical processing. Image processing systems have been around for some time and here, the word 'computer' may be misleading. These systems are designed to accept one beam of light as an input, manipulate it, and produce a different output light. The manipulations are based on various physical phenomena in the field of optics, such as 2D Fourier transformations. Such systems are specific and inflexible, but well suited to their tasks.

Numerical optical processors are more like conventional computers in that they deal with arrays of numbers. Rather than electrical switches, the numbers are represented by multiple points of light. These systems lend themselves well to operations related to linear algebra and matrices. They cover a wide array of areas so they're fairly general purpose, but not as flexible as an electronic programmable computer. Both analog and digital optical systems are usually coupled to a front-end electronic computer.

Alternatives to electronics

You may ask why bother with optical systems if they are so underdeveloped. Well, it is hoped that as electronic computers approach their limits of size and speed, optical systems will provide a viable alternative. This is why analog systems are still being pursued with the support of major institutions such as NASA, DARPA and SDIO.

General purpose digital optical computers have only recently become a major research topic. They are based on non-linear optical effects and try to mimic existing electronic computers. Using optical devices, the aim is to create a general purpose computer, comparable to electronic machines but better in some way: it may be faster or smaller. Currently, only prototypes of the basic elements exist, such as logic gates and memory elements. No complete system exists, but in recent years a major research effort has been directed towards this goal. This includes not only sporadic individual projects, but also co-ordinated efforts such as the European Joint Optical Bistability (EJOB) project.

Optical components are currently used in the communications and data

storage areas of computing. Where they have been implemented they have demonstrated certain aspects electronics can't match. Fibre optic links support much higher data transfer rates, and optical storage devices hold a much higher density of data than equivalent magnetic devices. These systems are undergoing development that should improve and perhaps revolutionise them.

Probably the most common use of optical data manipulation components is in digital communications networks, including long distance, large capacity telecommunication links and local area networks.

Today, only data transmission is carried out by optical fibre. The rest of the work — coding, addressing, routing, parity check — is carried out electrically. As data rates increase, delay caused by the electrical parts of the process might become unacceptable. If this is done entirely optically, the need for time consuming optical/electronic conversions is eliminated.

Optical communication started with long-distance fibre optics, now used widely for LANs. With the trend for using optics at ever lower levels, the next step must be interconnection of VLSI components optically. The main motivation is the high bandwidth available; other benefits are high interconnection density, negligible crosstalk and increased speed. These hopefully justify optical/electronic conversion.

The success of computers built exclusively from optical components depends not only on the ability to implement all functional units optically, but how well these units work together and the resulting performance. Any invention must improve on existing technologies: technical achievement isn't enough. Optical computers will have to outperform today's electronic computers. They may be faster, or make parallel processing architecture easier; their immunity to EMI may be enough. They will need technical specifications on a par with today's electrical computers; they can't be bigger or harder to maintain and their power consumption should be equivalent.

Optics open many possibilities. One is 3D graphic computer output. For years we have been able to record the wavefront of light from a 3D object in holograph form. That wavefront may be reconstructed, displaying a 3D image of the original object. You will be able to produce computer-generated holograms (CGHs) to create arbitrary wavefronts which simulate wavefronts of objects not physically available. CGHs may be used to create 3D images as part

of a computer's output.

The applications are varied. Medical imaging would allow doctors a 3D view of bones or internal organs constructed from tomographic data. Entertainment would be revolutionised with 3D television and 3D movies (and you wouldn't need to wear strange, coloured glasses). Such an output system is under development at IBM and a prototype should be around by 1995.

Optical memory

A computer's conventional memory could be replaced by optical means. Current memory is generally location-addressable, which means the program must specify the location of the data element it wants to manipulate. Keeping track of the data's whereabouts is one of the program's more time-consuming tasks.

An alternative is content-addressable memory (or associative memory) where each data element has two fields: a key, and the actual data. For a program to manipulate a data element it only specifies the key. In electronic computers, only small associative memories are provided for operating systems. Large, fast, associative memories aren't feasible as it is hard to search for the wanted key among all the memory cells.

Two optical schemes have been proposed to overcome this. One is volume holography; the other uses the more interesting Hopfield model of neural networks which deals with a fully interconnected network of simple threshold elements. These are considered a formalisation of neurons. Each neuron is in one of two stable states, active or inactive. The neurons influence each other through their synapses (the connections between them). The system of neurons may exist in a number of stable states which repeat themselves under certain circumstances. These are interpreted as states that the system *remembers*. It's possible to design a neural matrix so that specific chosen states are stable. This is *learning*. If the system starts at an arbitrary state the dynamics move it to the nearest stable state. This can be viewed as readout from an associative memory: given a partially correct state, the system finds the nearest memory and converges on it.

Electronic systems are revised and improved all the time. But as conventional computers get smaller and faster, they are getting ominously close to physical limits. Eventually, alternatives will be needed. Hopefully these will reach a reasonable stage of development before they are required in anger, so that the current rate of advance can be maintained.

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What's in Hands On

Beginners 426



PostScript, Inkjet, NLQ, 9-pin or 25-pin? If you find all the jargon associated with printers confusing, then this month's Beginners column is for you. Chris Cain takes a look at a variety of machine types, and explains the difference between them and how they work.

Utilities 428



The Macintosh has been able to talk for a long time and now, as Karl Dallas tells you, the PC is catching up. He also looks at a utility that will proof-read your spreadsheets and letters, and scrutinises another front-end for Windows, Dashboard.

Spreadsheets 432



Steve Cassidy shares the stage with one of PCW's many North American fans, the irrepressible Shane Devenshire, whose collection of thoughts from the summer of '92 include a variety of neat utilities for 1-2-3 and Quattro users.

Databases 437



Fox Software has recently been bought by Microsoft. Kathy Lang looks into Microsoft's motives, and has a glance at FoxPro 2.5 for Windows, its features and shortfalls.

Word Processing 441



Continuing the multimedia theme in this month's Hands On, Michael Hewitt considers adding sound and colour to word processors and talks to some of the world's leading software producers to elicit their thoughts. Chinese type can be a problem on a conventional keyboard: we offer a solution.

Low Level 445



Good programming practice is boring. Dan O'Brien looks at the fun in being obtuse and asks if you can tell what his listings do. Polyglots need not apply.

Macintosh 454



Mick O'Neil deplores the narrowmindedness of PC-centric purchasers, and waxes eloquent on the new features of FileMaker Pro 2.0 and IntelliDraw.

Windows & OS/2 458



Operating systems are the soul of a machine. Ken Morse is surprised at how easy it is to have a machine with a foot on the other boot.

Unix 463



Our new Unix columnist, Paul Lavin, explains how the old operating system fits in to complement the PC platform and explains that all that glitters is not Intel.

Networks 466



As anyone who uses a network knows, reliability is crucial. Ralph Bancroft gives a few tips on how to increase the stability of your network and how to lessen the blow should disaster strike and your network crash.

Readers' Tips 471



To call an Amstrad 2000 series an IBM compatible is stretching the definition to the limit. Here's an explanation of how to upgrade a flagging Amstrad.

Computer Answers 473



How do you password-protect your system bootup, and what are the problems when installing a second IDE drive of a different type to your existing one? Frank Leonhardt explains.

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 Readers' Tips and Computer Answers we'll pay £25 per tip, with a bonus of a subscription for the Tip of the Month. Contributors should supply an invoice for the relevant amount.

What are we looking for? For the application section — Databases, Word Processing 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.

Finally, Readers' Tips and Computer Answers. The first is fairly obvious: if you have found a better way of doing something, share your knowledge with the rest of us. With Computer Answers we'll try to help with your queries, but if we can't help someone, feel free to chip in.

All submissions, addressed to the editor of the right department, should be sent to 'Hands On' at *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG.



Getting it down on paper

If you don't know a dot-matrix from a daisywheel, if you can't tell laser from inkjet, don't worry. Chris Cain is here to lead you through the printer maze. All you need to decide is what job you want your printer to perform... and how much you are prepared to pay.

When you're starting out with computers, learning about PCs is easy; it's peripherals that tend to cause problems. There seem to be a thousand and one books on the micro and how it works, but only a handful of publications give an insight into the bits that bolt on the side. Printers in particular are not well documented, and it's easy

paper.

The two things you really need to understand when it comes to printers are the main differences between the many types available, and to which applications each is best suited. After all, it's no good buying a machine that outputs in black and white at two pages a minute if you plan to produce a full-colour newsletter with it. The personal printer world can be split into seven main types of hardware: dot-matrix, inkjet, laser, thermal, daisywheel, golf ball and dye sublimation.

Join the dots

By far the most simple and popular type of printer is the dot-matrix, and this is often the choice of those buying on a tight budget. Many of the major printer manufacturers produce matrix-based systems, and good ones can be picked up for less than £200. All these printers connect to the standard RS232 port located on the back of the PC via a dedicated printer cable that is available from computer stockists.

There are two types of dot-matrix printer, 9-pin and 24-pin, and both work by striking an inky ribbon with a series of vertically aligned pins to form characters on the paper made up of tiny dots. The 24-pin machines give the best definition, and in some cases are faster; as a consequence though, they tend to be more expen-

sive. The overall quality of the output produced by either type isn't brilliant, although this does depend on exactly what you want to do.

There are several key features to look for on dot-matrix printers, one of the most vital being a Near Letter Quality (NLQ) facility. In operation this makes the unit print each character twice, to produce darker, sharper and generally better-looking text. The downside is that a standard page of text takes at least twice as long to print, but if you plan to produce business documents you really must use NLQ. The standard printing mode of a dot-matrix is called *draft*, and a decent unit can manage an average of 240 characters per second (cps), and around 100cps in NLQ. Normally, the more a printer costs, the faster it can go.

Other terms that pop up regularly when discussing dot-matrix printers are tractor feed and friction feed, which refer to the paper-handling mechanism used to draw pages into the printer's jaws. The former incorporates two sprocket rings that pull (or in some cases push) specially designed paper in line with the head. The paper features a row of small holes at both the left and right-hand sides enabling the sprocket pins to get a grip on it. This kind of paper is referred to as fanfold, and is widely available. A good dot-matrix printer will have adjustable sprockets to suit different paper sizes.

Friction feed works in much the same way as a typewriter, with the paper wrapping around a large rubber roller known as the platen. It is kept in place by smaller rollers, or bails, and the whole lot goes round as the paper is fed through the printer. Friction feed mechanisms work best with single sheets, such as the A4 size commonly used in office work.

△ Hewlett Packard's popular DeskJet 500 is a fine example of inkjet technology

to get confused by the many technical terms used when describing them. This month Beginners wades through the personal printer world to bring you a simple guide to putting things down on



One last phrase often heard around dot-matrix hardware is Epson compatibility, which means that a unit is compatible with the printer code standard laid down by Epson many moons ago. If a printer is compatible it should work with all software packages that support an Epson standard printer driver, regardless of the make of hardware. Most dot-matrix systems follow the Epson rules, but some companies like to design their own control codes and so a potential purchaser should always check to see if the unit they want is compatible. If it isn't, they must check that drivers for the software they plan to use it with are available.

Inkjet printers are also popular. They form characters and graphics by throwing a matrix of fine ink blobs onto the paper. The rest of the hardware around them tends to work in the same way as dot-matrix, but a good inkjet like the Hewlett Packard DeskJet 500 gives text quality far superior to most 24-pin dot-matrix printers. Some inkjets can even accept different colour ink cartridges: a prime example is the DeskJet 500C.

Laser lines

The best quality text comes from **laser printers**, and this is probably the most rapidly expanding group. Once only available to those on a high salary, good laser printers can now be picked up for about £600 if you shop around. The internal workings are more complex than with other types, but the printing process is not hard to understand.

Laser printers are electrophotographic devices: they use a light beam to write images onto a photoconductive drum or band which has a uniform electric charge over its surface. The light beam causes local conductivity and the charge pattern on the photoconductor is developed by applying particles of pigment, called toner, that carry an electrostatic charge. The toner is attracted to the image but repelled by the background. Paper is pressed against the drum and an electric field transfers the text or graphics on to it.

Terms often heard in the laser printer arena include dpi (dots per inch) and PostScript, a very important specification that greatly enhances a printer's performance. The former is used when talking about output resolution; the more dots you have per inch, the finer the images and text can be. A typical amount these days is 300dpi, but 600dpi is slowly emerging.

PostScript power

PostScript is a programming language devised by Adobe Systems Inc, de-

signed to convey the description of virtually any desired page to a printer. It does this by using mathematical calculations to draw images rather than just dumping them as straight bitmaps; as a result the output is of a very high quality. PostScript truly shines when you're printing line art such as diagrams, and using large, complicated fonts.

The first printer to use this system was the Apple LaserWriter, launched in 1985, and just about every manufacturer has licensed the technology from Adobe. PostScript printers are expensive as they have built-in processors and lots of RAM to cope with detailed images. Software support is good because PostScript is fairly device independent, and Microsoft Windows comes complete with a standard driver.

Adobe has developed PostScript for displaying images on screen. This is known as Display PostScript, which gives you true WYSIWYG (What You See Is What You Get) quality. At present Sun, IBM and NeXT are about the only companies to have made it standard on their hardware, but in the future we may see the system implemented on PC compatibles.

Another interesting development is PostScript Level 2, which was announced in June 1990 but only saw the light of day at the end of last year. It defines colour support and provides data compression to speed up communications. The latter is certainly welcome as calculations can take an age if you're dealing with complex graphics — there has to be a downside to everything I suppose. Unfortunately, at present, no software fully supports Level 2.

Other terms often used with laser printers include ppm (pages per minute) and PCL, a printer control language developed by Hewlett Packard.

The fourth hardware category is a hot little number: **thermal printers** work by literally burning images into the paper. You have to use specially designed paper and the cost can mount up with use. The quality of thermal printers varies a great deal, and they're not as popular as they once were. Possibly the best known was Sinclair's little unit for the ZX Spectrum.

▲ Post is bitmapped, Script is PostScript. The difference is clear

Daisywheel printers are far more likely to be seen in the average office, and they work in much the same way as a typewriter. The text produced by them is of a high quality because the system has large pins with whole letters and numbers printed on them. Golf ball systems work in a similar way.

The last common category is **dye sublimation printers**, which can produce full-colour images of almost photographic quality. When printing, the units fire gas jets at special paper; these form a solid hard mass as soon as they hit. The dye never reaches the liquid stage, like water going straight from vapour to ice. As you can imagine these don't come cheap, and can set you back as much as £10,000. The quality offered is excellent, and a typical resolution is around 300dpi — up to laser standards.

Some of you may have seen or heard of **wax-based printers**. Like dye sublimation units, they are expensive but good. They heat wax then shoot it at the page, and are used mainly for detailed colour work.

The final printout

Now you can see and understand the differences between the most common types of printer hardware, the mystery surrounding them should be a mystery no more. There is more to look at in the printer field, but not enough space to go into great detail here. However, I would say that the more fonts on a printer, the more versatile it will be.

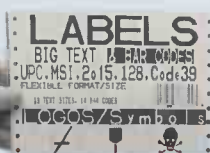
Happy printing.

Following October's column on databases, I would like to thank all those readers who answered my call for a lucid description of exactly what a relational database is. In particular, thanks to Phil Medway of Wokingham, Berkshire for a particularly comprehensive piece on the ins and outs of Codd's Law. This piece is too long for publication in this column, but Mr Medway has kindly agreed to allow me to give a copy to anyone who sends me a blank disk.

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Sounds in mono

Karl Dallas looks at Monologue, a PC package that makes a game stab at the Mac's multimedia usability. But can a program with a voice like a Dalek truly be called friendly?

Multimedia on the IBM-compatible PC will never be able to compete with the Mac (not to mention other platforms like NeXT) until it gets as easy to use as QuickTime. The open architecture of DOS, which makes it almost infinitely extendable, in almost any direction you care to mention, makes it conform to that peculiarly IBM version of the quest for standards: 'We love standards. That's why we have so many of 'em!' No-one, not even Microsoft, has sufficient clout to set a standard and make it stick, though Bill Gates is trying hard.

But it's getting easier. Using a new package called Monologue, here's all you have to do to get it to speak (if not quite sing and dance). Select a block of text, copy it to the clipboard, then double click with the right button on the Monologue icon. The result is quite easy to understand if you have a proper sound card hooked up to a decent amplifier, even if it sounds a bit soulless.

It will also work with the Speaker.Drv which is on a lot of bulletin boards now, and is even being distributed with some software (like the fascinating new Windows front-end utility, Synergy), but it's not really that clear without a proper sound card. The program has three modes: Excel (which will read out any block of selected text), clipboard (the one I've just described), and DDE Server.

This last is the most applicable to this column, since it means vocal output of selected text is no further away

than a macro keypress. For instance, the macro in Fig 1 will work with Ami Pro. Note that the spaces in the seventh line are required. The same thing can be executed with the following Excel macro:

AB	
1	Excel calling Monologue via DDE link.
2	
3	SendChnl Speakdata
4	=INITIATE("MONOLOG", "TALK")
5	=POKE(SendChnl, "", B1)
6	=TERMINATE(SendChnl)
7	=RETURN()

Two available speech engine functions can be called with the following prototypes:

```
Int FAR PASCAL Say(LPSTR  
lpEnglishString);
```

and

```
Int FAR PASCAL SetSayGlobals(int Reserved1, int  
Reserved2, int Pitch, int Speech, int Volume);
```

The SetSayGlobals function requires the first two parameters to be passed as 0, and the pitch, speech and volume parameters can be passed by an integer from 0 to 9. This is the same as the dialog box which the program itself displays for the user.

The program uses a default dictionary to determine how words should be pronounced. This can be supplemented by the user, but must, in that case, be saved under a new name since the default dictionary is read-only. It would be nice if the voice could be modified in some way, perhaps to use your own special way of saying things.


```

FUNCTION DDESAY()
child=DDEInitiate("Monolog","Talk")
If (child=0)
    message("Can't initiate DDE Conversation")
EXIT FUNCTION
ENDIF
DDEPoke(child, "", "Ami Pro calling Monologue via DDE link")
DDETerminate(child)
END FUNCTION

```

Fig 1

In use, it makes remarkably good guesses at how to pronounce most words. When speaking Excel ranges that include £ signs, it ignores them and speaks the amounts out as decimals: £20.25 comes out as 'twenty point two zero'. Dashes are interpreted as minus signs.

The program was used with the MediaVision ProAudio Spectrum, but it is also said to work with the Covox Sound Master II card which can be configured to be identical to the Covox Speech Thing. Among the programs said to work with it are Ami Pro, Cross-talk for Windows, dbFast, Excel, PackRat, PageMaker, PerFORM Pro, SuperBase, Ventura Publisher for Windows, Windows Write, Cardfile, Notepad, WinEdit and Word for Windows. Indeed, it worked with all the applications I tried it with.

On occasions it increased its pitch to near-Dalek 'exterminate' mode for no apparent reason, then dropped down to more conversational tones.

While the simplicity of Monologue is commendable, its somewhat inhuman tones limit its more general application. For real multimedia, we need something like MediaBlitz! from the Asymetrix people whose Toolbook application is one of the nicest development environments for Windows, even if its performance leaves something to be desired. MediaBlitz! doesn't need a full version of Toolbook, though it can easily be integrated with Toolbook applications. Installation places a runtime version of Toolbook on your path. In addition to sounds it can play Animator Pro FLI files, and do it simultaneously: similar programs I have come across can play animations, or Wave, or MIDI files, but not simultaneously.

Monologue has no recording capability, though this is inherent with Windows 3.1 Sound Recorder. What it allows you to do is edit files together in what are called clips, and to control how they are played. If you're shy of doing your own recordings, there are over 10Mb of sounds and images available when you register. Unfortunately, these are supplied in compressed form on disk so they have to be expanded on

to your hard disk before you can check them out. Fine, but I was impressed by the fact that the new PhotoMagic image editor actually comes with over 200 24-bit colour images which can be loaded up from floppy as required; that makes a lot of sense. My hard disk is already cluttered with a zillion megabytes of fonts, clip-art, sound and vision files which I hardly ever use.

Monologue consists of three modules: ClipMaker, ScoreMaker and ScorePlayer. The latter is a runtime player which can be distributed with scores, scripts of assembled clips. These are put together with ScoreMaker, when you can drag and drop the elements in a show onto a graphical timeline which is calibrated in seconds. CD audio clips, Wave and MIDI files, animations and bitmaps can be assembled into a complete score.

Another useful application from the same source is Multimedia Make Your Point, an inexpensive presentation graphics package with 30 templates and 80 or so Wave, MIDI and animation clips. The program also uses graphics files in CGM, TIFF, WMF, or Micrografx DRW formats. It allows hot-links to be defined between files, providing a sort of hypertext capability.

These are decidedly entry-level products, with adequate but not expansive documentation. But this is exactly what we need if multimedia is to stop being a specialist niche. *Monologue for Windows costs £89 from Iansyst on 071-607 5844. MediaBlitz! costs £85 and Multimedia Make Your Point £95, both from Interactive Developments on 071-700 4808.*

Co-ordinating multiple Windows

If, as seems likely, Windows for Workgroups is going to have the same impact upon the networking world as Windows had on the standalone environment, LAN administrators are pretty soon going to have to grapple with the way various INI files can quickly get out of step with each other.

This problem of co-ordinating Windows configurations on multiple workstations has been addressed by

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WinLogin, an inexpensive utility from Microsoft which works with NetWare, Microsoft LAN Manager, Banyan VINES, DEC Pathworks, 3Com 3+Share, 3Com 3+Open, IBM DOS LAN Server, and Artisoft LANtastic. The absence of any support for Windows for Workgroups is as surprising as the lack of WFWG support for LANtastic. WinLogin will not work with some MSDOS-based networks, including IBM PC LAN Program, as they don't fully support byte-range file locking.

Basically, WinLogin allows you to edit three file types, .INI, .PIF and .BAT, but these can be added to by changing the values for the default file types.

The program stores the default source for each entry value in an .INI file, along with the type of entry and a user preference rule for the entry, in what are known as Merge Rules. Entries can be 'simple', 'multivalued' or 'multi-instanced'. For instance, BorderWidth= or KeyboardSpeed= in Win.Ini would be a simple value, a multivalued entry might be the load= or run= lines, while a multi-instance entry might be the device= lines in System.Ini.

The User Preference rule can be used to disallow user preferences and override them with the default value, can merge them with the default (unless the entry is a simple one), or it can completely override the default value(s). The program includes a Merge Rule Editor for changing the defaults and either permit, disallow or merge the user preferences with the default values. Based on these merge rules, the WinLogin client will process an .INI file, and construct the data Windows needed to boot the system.

For this to work, there must be some shared file space in which WinLogin can store the administrative default settings, either globally or on a user-group basis, the user preferences (each in a separate sub-directory), the workstation specific settings (which can be edited remotely by the administrator), the merge rules, the file-type information, all other configuration files of types (other than .INI), the location of the default configuration files, all users, workstations and groups known to the system, and the location of their configuration files. The merge rules, file-type information, and all the optional data are stored in a shared database.

The program maintains a set of fallback configuration files known to successfully boot Windows, made up of the critical .INI files that were on the machine at the time the WinLogin client software was installed, or a set of files for the last user for whom WinLogin successfully built a configuration on

the machine. These files are stored in the Windows directory itself, with the suffix .LGN replacing the usual .INI.

When the program is installed, Win.Com is renamed W31.Com and WinLogin's Wlcom.Com is renamed Win.Com. This serves a double purpose: the user can invoke WinLogin with the ordinary 'win' command (possibly without even knowing that WinLogin has been installed) and if necessary regular Windows can be run, either by just running the W31 program or by renaming it Win.Com. A new switch is added to the command line options of Windows so that typing

WIN /U:<username>

will cause Windows to boot with that user's last successful configuration. Otherwise the files in the fallback directory are used as the initial boot configuration.

WinLogin.Exe performs most of the work associated with the client side of WinLogin, and can be run as the shell or as a regular application. After the program has loaded up the configuration, it 'wakes up' every few seconds to check for log-on status changes and if it detects a change of user, can exit to DOS, restart with a new configuration for the current user, or use the current configuration for the new user.

When the user Exits Windows, he is prompted to save his current configuration. (A useful precaution which sets the save option back to the way it was in Windows 3.0, not a special option to be chosen as with 3.1.)

It is possible to set up the system so that a certain file, for instance a Cardfile data file, can be placed on each user's workstation by adding it to the files the workstation setup installs, as listed in the [ClientFiles] section in Stfsetup.In_ on the workstation setup disk.

The format of this section is critical and must include an exact size reference. The documentation suggests copying an existing line in the section and making changes to it. For instance, the file on the installation disk might have the section in Fig 2, as edited.

The purpose of all this is to control what changes ordinary users can make to their configurations, and to prevent unauthorised changes. A lot of changes — desktop colours, for instance — may be quite innocent, but others could be more catastrophic. It is to prevent these that WinLogin is so useful, but it is not a program for those who are frightened by its rather forbidding parameter sets and merge rules. But then, anyone frightened of such things shouldn't be a network administrator.

WinLogin costs £25 from Microsoft on (0734) 270000.

[ClientFiles]

```

1, winlogin.exe, DATE=$(DATESTR), SIZE=32000
1, wlcom.com, RENAME=win.com, BACKUP=w31.com, DATE=$(DATESTR),
    SIZE=5000
1, wlmerge.dll, DATE=$(DATESTR), SIZE=22000
1, msinimrg.dll, DATE=$(DATESTR), SIZE=22000
1, copymrg.dll, DATE=$(DATESTR), SIZE=8000
1, errmsg.dll, DATE=$(DATESTR), SIZE=6000
1, wldapi.dll, DATE=$(DATESTR), SIZE=56000
1, wldnet.dll, DATE=$(DATESTR), SIZE=9000
1, wluserfn.dll, DATE=$(DATESTR), SIZE=6000
1, wlplatfn.dll, DATE=$(DATESTR), SIZE=6000
1, jet.dll, DATE=$(DATESTR), SIZE=190000
1, winlogin.ini, DATE=$(DATESTR), SIZE=300
1, winlogin.hlp, DATE=$(DATESTR), SIZE=11000
1, MYRECORD.CRD, DATE=$(DATESTR), SIZE=1024

```

Fig 2

Dashboard

For a program that's meant to make life easy, Windows spawns an enormous number of alternative interfaces. Some of them, like Hewlett Packard's New Wave, have object-oriented functionality which ought to have been included in Windows long ago (and would have been, if HP's offer to license the technology had been taken up). But since Windows isn't inherently object-oriented itself the new interface tends to confuse rather than elucidate, though the latest version is better at configuring itself for beginners.

Now, however, HP has come up with something very different — and a damn sight simpler — than New Wave, a task switcher, program launcher, clock, virtual screen, system resource monitor and print manager called Dashboard. It's a little reminiscent of the WinDock shareware utility except that instead of running down the side of the screen, it lies along the bottom rather like a sports car dashboard, or so it says here. It translates program groups into a series of card index tabs along the top, which I've never seen on the dashboard of any car I've driven, but don't let's overstrain the metaphor.

The first good thing about Dashboard is that it uses few system resources, and if you install it as the Windows shell it gives you nearly all of your system for apps. Another thing I like is that it allows for the nesting of program groups, so that you could have a group called Comms for instance and nest groups for Winfax and Procomm, say, in their own areas. Any GUI file system needs hierarchical folders.

You can install the most frequently used apps into the Dashboard, and since they scroll you can install more icons than width of screen allows. WinDock is basically a Windows 3.0 app and it doesn't allow for the inclusion of working directories, but Dashboard installs

launchable apps in much the same way as you can add items to a Program Manager group, complete with browsing for the exact name and location of files. Icons can be stacked two at a time, unlabelled, or singly if labelled.

The clock has quite sophisticated alarm capabilities as well as about a dozen face designs. Up to five virtual screen areas can be defined. For some reason, the miniature screens on the dashboard have a mountain vista against which are displayed tiny (and I mean *tiny*) representations of the programs in that area of the screen.

You can drag applications from one segment to another, to provide each with an uncluttered screen. Screen layouts can be saved under various names, so that you load up a number of related apps in a single command.

The only problem with the Dashboard virtual screen is that it renders Windows' task manager almost redundant, since if you click on an application on another screen in it, you don't move to that screen. You have to do this with Dashboard.

Since I have a tendency to cram my memory with lots of applications, I am always running low on system resources with the inevitable Protection Faults that result. I'm going to try to train myself to keep an eye on them with the resource monitor. You can set this up with an alarm to warn you before things get catastrophically low.

Since I am always having to switch between a fax printer driver and my regular printer, I was pleased to find that the program allows multiple printers to be displayed, and files can be dragged and dropped onto the appropriate printer icon for output.

I am usually sceptical about utilities like Dashboard, but I think I might well use this one. Until something better comes along, that is.

Dashboard costs £49.95 from Hewlett Packard on (0344) 369222.

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Objectively speaking

Steve Cassidy kicks off his column with a look at object orientation in Quattro Pro for Windows, and regular contributor Shane Devenshire fills in with formulae.

Along with all the other registered users doing an upgrade, I've finally got my hands on Quattro Pro for Windows. This has made a big play of the use of object orientation in both the programming of the application and the presentation of the program to the user. It took me only the briefest moment to look at the program and ask myself what the object orientation really meant.

An object is a thing that does stuff. That's as much as you need to know about it in order to use someone else's objects in your program. (Thanks to John Hawkes-Reed for letting me borrow his definition to use in this article.) The underlying point is that an object hides what's inside it and controls what you get from it without you having to expend any effort on the matter.

An object can be built up from other objects and can 'inherit' some of the embedded object's 'stuff', more properly known as properties. These characteristics of the object-oriented methodology enforce the delights of properly structured programming without making it seem such an onerous load. It's feasible to come up with a grossly unstructured program in an OO environment, but only to prove the point.

The success of OO in programming is uncontested: what is less successful is the way in which newly converted nerd programmers (I'm sorry, chaps, but you're nerds: it's not necessarily a dishonourable term) try to carry the Good News through to their users. Quattro Pro has a few elements of OO operation in its terminology. There's a Properties menu, and a sticker in the distribution kit which you're encouraged to slap on your rodent, to remind you to whack the right mouse button in order to bring up a small pop-up menu.

This menu is worthy of a bit of con-

sideration in its own right; it takes the concept of context-sensitive help to its final and, thankfully, logical conclusion. If the context of what one is doing is sufficiently clear to be able to deliver help about it, why not deliver restrictions in what one can do, according to context? Why not, in fact, deliver only what can be done to the thing you're handling — the object — and thereby cut down for good on the dreaded error message?

The first of these 'why not's' came in with the Mac and GUIs in general, with 'greying things out' in menus. But then functionality spiralled, to the point where most products have more commands than can safely fit on a screenful of menus. So Borland was the first to demonstrate the right mouse button as a property inspector, months before the launch of Quattro Pro for Windows, only to have its thunder stolen by the introduction of Excel 4.0 with its identical mechanism. Regulars who are familiar with my membership of the Excel fan club will be surprised to hear that I saw Quattro inspecting object properties first, sometime in 1991.

So, we have things which do stuff inside the Quattro environment, and the stuff they do is visible through the right mouse button. Is that really all there is to say for object orientation within Quattro? Unfortunately, yes. Here, the object to which you are oriented is the cell, range or chart over which your mouse cursor rests: they are quite possibly the most 'real' objects that any soi-disant OO system has had to cope with. The crucial barrier here is that while the programmers have benefited, and have seen fit to help you slightly, the motivation for that help has come more from marketing surveys than a deep understanding of the problems facing spreadsheet users. Borland

spotted the same problem as Microsoft had seen with Excel 2.2: that the vast majority of their users were only just dipping into the feature set of their product, and that getting more punters into the shallows was going to sell more copies than getting the top brains into the deep dark depths. OO terminology came along to lend a bit of bar-room gossip level credibility.

This view might seem a trifle harsh, given the richness of the rest of the environment Quattro Pro provides, but a quick look through the facilities for macro recording, execution and management will show that Borland believes OO is for developers and not the humble spreadsheet modeller. Yes, you can have a library of macro objects which can be re-used between different workbooks (collections of sheets, 3D and otherwise), but no, you can't have a macro which takes some parameters and returns a result, turning away to hide its workings inside itself. In this respect, both Excel and Wingz/Resolve have the edge. Wingz/Resolve has a much nicer scripting language, which misses the full object-oriented appellation only because it doesn't compile minor called objects into the caller.

It would be ever so pleasant to take object orientation forward into the operation of the worksheet, to restrict a named range so that all it presented was its sum, no matter how many rows it contained, or to define small regions of the sheet as discrete objects so that sections destined to print next to one another could have widely varying column widths and row heights. But nobody thinks this is important to us yet.

Except that it is *hugely* important: the number of items or properties inside an object could represent anything, in the loosest possible sense. If one had a stack of 2D worksheets whose contents are only ever delivered through an object with, say, five properties, one could construct a genuinely five-dimensional spreadsheet, leaving the object to handle the remapping of dimensions to addresses. So far, nobody has thought to give us anything like this much functionality.

Quattro Pro remains impressive, however, in the 'leap-frog' sense which seems to be driving the competitors in this market. The 3D operation is neatly conceived by way of the 'page' metaphor, though the transposition functions still only work between rows and columns. There's no taking a column and setting it up so it spears through all the same cells in a given range of pages.

The 'page' system shows some ideas inherited from Lotus 1-2-3 3.0's so-called 3D capabilities, although

there's a neat mechanism for grouping pages together and for choosing the page notation in formulae which best suits your mental picture of the precedence of ranges:

'FirstPage:..LastPage:ThisCell...
ThatCell'

or

'Firstpage:ThisCell...LastPage:
ThatPage'

This isn't quite as neat as CA-Compete's mind-bendingly complex facilities for handling beyond two dimensions, but Quattro Pro doesn't go quite that far. The import formats show signs of the Borland hookup with IBM, too, including Legato worksheets and graphs. (It's just as well, since Legato won't write things out into any format save its own.)

There are signs of the 'me too' syndrome in the automatic style assignment dialog box: just like Excel, you can choose a range with a rectangular sum in it and Quattro lets you grab a custom format with bold titles, plain body data and bold totals and apply it to the range as you see fit. The 'me too' fades rather with the assignment of various schemes to classical composers' names: how they decided that bright and garish colours were Beethoven utterly escapes me.

If you're an existing Quattro user you'll be keen to upgrade already, for font support and the 'pages' structure; but take my word for it and do your best to ignore the 'object-oriented' flim-flam.

Shane's World

Shane Devenshire, a regular Hands On contributor of Walnut Creek in California, has written with the following spreadsheet suggestions:

• Printing multiple print areas on the same page in Excel

'Often when I am printing in Excel I wish to print two separate print ranges on the same page. If you select non-contiguous ranges to print they will be printed on separate pages. If these ranges are in the same columns or in the same rows the macro in Fig 1 will solve the problem. To run the macro make the following setup:

Suppose the two areas are in the same columns; for example, the first range is cells A1:C5 and the second range is in cells A21:C30. Also, assume you do not have anything below row 300 in your spreadsheet. Select these two ranges by selecting the first one, holding down the Ctrl key and selecting the second. Although it is not necessary, name this selection by choosing Formula and Define Name, and typing PAreas in the dialog box. Enter the macro as shown below. Name the first

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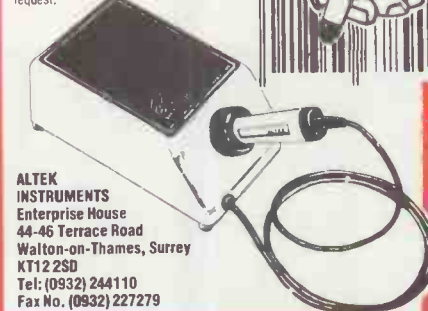
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Print (ctrl p)	=ECHO() =COPY("Pareas", "R300C") =SET.PRINT.AREA() =PAGE.SETUP(" ", 0, 0, 0, 0, FALSE, FALSE, TRUE, FALSE, 2, 1, 100) =PRINT(1,, 1, FALSE, FALSE, 1, FALSE, 1) =CLEAR(1) =SELECT(!A1) =RETURN()	Speeds up macros by suppressing screen updates
		Clears the copied print area

Δ Fig 1

cell Print and assign the shortcut key Ctrl-P. You can duplicate the macro's actions manually if you don't wish to program it. It works as follows:

=ECHO0: this command suppresses the updating of the screen and therefore speeds up the macro.

=COPY("PAreas",R300C): copies the print areas to an empty range in the same column. Any non-selected rows are not copied. The *to* range is treated as a single range and will be printed on one page. This command works in Excel 4.0; earlier versions will require:

```
=FORMULA.GOTO("PAreas"),
```

=COPY()

=FORMULA.GOTO("R3000") and

=PASTE ()

=SET.PRINT.AREA() : sets print area.

=PAGE.SETUP() : sets page features (the example is for an HPIP), records those that are appropriate for your printer.

=PRINT() : prints — set this as appropriate for your print job.

=CLEAR() : clears the print area.

=SELECT(!a1): returns you to cell A1.

=RETURN() : ends the macro.

If you need to print blank cells between the two ranges on the same page, the following somewhat different approach will accomplish this task:

Print (ctrl p)

=ECHO ()

Speeds up macro by
suppressing screen updates

```
=COPY ("PAreas", "R300C")
```

```
=SET.PRINT.AREA()
```

```
=PAGE.SETUP(""," ",0,0,0,0,
            FALSE,FALSE,TRUE,
```

```
FALSE,2,1,100)
```

```
=PRINT(1,,1,FALSE,FALSE,1,FALSE,1)
```

=CLEAR

Clears the copied print area

```
=SELECT(!A1)
```

```
=RETURN()
```

- **Utility Save Macro**

If you use a macro library you may have run into the following problem. If you use a /FS~R macro in an unnamed spreadsheet, the file will overwrite the first file in the current directory. This problem can be solved using the macro in *Fig 2*. To set up the macro, enter it into cells B2...B11. B10 is a formula and should read +"/fs"&L&".wk1~r".

Enter the range names shown in cells A2..A16 and E15. Use the /Range Name Labels Right command to name the cells to the right of the labels in column A. Name the cell E16 BYTES. Since the /File Admin Table commands will fill four columns and as many rows as

▽ Fig 2

VS	/fs~r {goto}T~ /fatw ~~ {if BYTES<=1400}{quit}			
BACK	{beep} [getlabel'File saved as 0.WK1, Enter correct file name: ",L}~ {if@cell("contents",L)<>""}{branch CONT} {branch BACK}			
CONT	/fsTEST.wk1~r{esc} {system copy 1.WK1 0.WK1}			
L	TEST			
	BYTES			
T	0.WK1	33844	0.671527	2604
	1.WK1	33844	0.659189	1399
	CONTEST.W	33837	0.594664	1971
	CONTEST1	33843	0.013321	45817
	SAMPMACS	33364	0.057766	4708
	TESTING.W	33844	0.671076	2602
	W.WK1	33843	0.602152	1504
	WYSIWYG\	33687	0.924606	<DIR>

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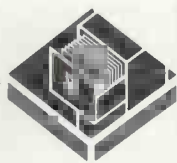
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Outsmarted by the Fox

Fears over Microsoft's takeover of Fox Software and its effects on FoxPro2 were allayed at a recent Developers' Conference, as version 2.5 shows. Kathy Lang reports.

Over the last few months, the confidence of the many users of Fox products, notably FoxPro2, has been just a trifle dented by two important happenings. A major feature of FoxPro2 is its speed, both in conventional indexed access and in response to queries that can use Fox's patent Rushmore technology. It therefore came as a considerable shock to many to hear that, according to National Software Testing Laboratories (NSTL) tests, Paradox 4.0 is significantly faster than FoxPro2 in some important areas.

The other shock to Fox users was the announcement that Fox Software had been taken over by Microsoft. To some, notably the largest corporate users and potential users, this was welcome news. But many feared losing the advantages of dealing with a relatively small, dedicated, specialist company. Fox's willingness to pay proper attention to users' requests for enhancements, and to respond quickly and competently to bug reports, contrasted badly in some minds with the almost inevitable isolation from user pressures that stem from Microsoft's position as the world's largest supplier of PC software. Nor did Microsoft's almost legendary ability to keep support customers waiting before answering phone calls bode well to those used to Fox's enviable technical support.

But perhaps most alarming of all was the fact that Microsoft's motives in buying Fox were unclear. It has long been public knowledge that Microsoft is developing a powerful database package of its own. To the suspicious, the takeover smacked of buying out and killing the most effective competition: not so uncommon a tactic in the hard world of commerce.

These fears were largely laid to rest at the Fox Developers' Conference in Phoe-

nix in September, initially by Dr David Fulton, formerly CEO of Fox Software and now Chief Database Architect at Microsoft, and at the end of the conference by Bill Gates himself. Dr Fulton laid the first ghost by announcing that NSTL had, after clarification of the best ways to carry out the benchmarks using Fox techniques, rerun its tests and found FoxPro2 to be significantly faster than Paradox 4.0 in the majority of them. The initial error was put down to a 'failure in communication' between Fox and NSTL.

Dr Fulton also explained the logic behind the takeover. His decision to sell out to Microsoft had surprised many, since his was a private company and he has always driven it technically from the top. Those of us who feared for the future of FoxPro had to do some rethinking when we heard Dr Fulton describe the merger as 'a model of gentlemanly behaviour and goodwill'. By contrast with the Borland takeover of Ashton Tate, only those staff who could not relocate have left the company. Apart from one member who had to stay put in Ohio for family reasons, the entire technical team has moved to Seattle. The message was clearly that continuity is assured.

The future of FoxPro under Windows was demonstrated with an equal lack of equivocation. Fulton (without assistance) showed FoxPro 2.5 for Windows, with some great new features including full support for OLE and DDE, new linked library features, improved screen and report generators, a new data type for multimedia applications, a new 'spinner' control type, and improved text and program editing.

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Hints on running FoxPro

• Rushmore operation requires a construct of the form

<expression> <logical operator> <constant>

e.g. age < 30

If there is a complex index expression, for example on

l_name + f_name

then for Rushmore to be operative the whole expression must be included in the test, even if only the first part of the expression needs to be matched,

e.g. l_name + f_name = 'SMITH'

- No index should be set on if Rushmore is to be operative.
- Rushmore will not operate if SET DELETED is set to ON: that is, if deleted records are being ignored. To use Rushmore either SET DELETED OFF, or have SET DELETED ON but also INDEX ON DELETED().
- Program macros are reputed to be slower than name indirections; in practice they exact little time penalty and are usually more readable.
- The fastest place to put called procedures is in the program file that calls them. But only DO <procedure> IN <file> is appreciably slower.
- When declaring lots of local variables, rather than declaring them individually, use

PRIVATE ALL LIKE <skeleton>

which is faster and avoids accidentally missing one variable name from a long explicit list.

- Using the SQL SELECT command to obtain a subset of matching data can be very much faster than explicit programming (for example, with SCAN...ENDSCAN) if the selection criteria are simple. For complex queries SQL is generally slower, although some people say it is 'much more readable'.
- Currently the 'small' version of FoxPro outperforms the larger 'extended' version. At least 4Mb is required to run the extended version sensibly.
- Under DOS a disk cache program will improve performance, but only if not more than 512K is devoted to the cache. Super PC Quik was recommended at the conference; use the \L switch with it.
- No DOS buffers should ever be loaded high (this can cause a 'transgressed file handle' error).
- To speed up the initial loading of FoxPro, a CONFIG.FP file with the _FOXDOC and other subsystem locations can be explicitly set to empty. (I am not sure if this affects compiled user programs too; to experiment, start programs with a -C switch, or set the appropriate DOS environment variable to start automatically with a specific

product. That's three reasons to expect poor performance! Fulton commented: 'Our engine does not behave materially differently under Windows and DOS, nor is computational speed fundamentally different.'

Microsoft has not yet announced a release date for version 2.5; the impression I get is that it will spend as long enhancing and testing as it dares while still pre-empting the announcement and release of dBase for Windows, whose features are subject to non-disclosure agreements. Beta testing of FoxPro 2.5 is well under way, getting on for 300 sites. It will be released first for DOS and Windows; Unix and Macintosh versions will be available subsequently. Most speakers at the conference based their demonstrations on 2.5 for Windows, without apparent errors. Version 3.0 is already in the planning stages, with enhancements to include object-oriented extensions, debugging extensions (including hooks for version control of source programs) and even faster LAN performance.

The relationship of FoxPro to Microsoft's Access database package, demonstrated at this conference only under non-disclosure agreements, was to some extent clarified during Bill

Gates' closing address. Access will be marketed primarily as an end user product, while FoxPro's role as a developer's tool will be stressed. Both products may share some elements in the future, such as common database engine, and form and report design tools.

Before this conference, it was speculated that Microsoft's takeover of Fox Software was a short term effort to give it a stop-gap product while Access was developed. On the evidence there — not just the statements of Gates and Fulton but some personnel changes too — the reverse may be true. It is possible that six years' development had shown that Access could never be developed far and fast enough to become the best in the world in its class, an aim which Bill Gates clearly has for all the members of his software family. It remains to be seen whether he will now aim for the 'best end user database' crown for Access, while promoting FoxPro as 'best developer database', or whether the days of Access are numbered before it has even been released.

The acquisition of FoxPro has clearly brought Microsoft into the XBASE fold, and some firm statements were made about Microsoft's enthusiasm for XBASE standards. I was not wholly

CONFIG.FP file.

- Program version control is not provided in the current version, though there may be some facilities in version 3.0. If you are responsible for a large Fox system, you may frequently operate with several versions of the same program such as the live version, a stable test version and the next test version with the newest facilities. Several external packages provide control of these program source versions, allowing you to step back to earlier versions, compare versions and branch alternatives. The version control package recommended at the conference was 'SourceSafe'. Alternatives are TLib and PCVS. Unfortunately, I have not yet located a UK source for any of these products.
- Networking with Novell. The current version of FoxPro is provided with a procedure library which allows a Fox program to employ the Novell transaction processing facilities to ensure the integrity of a complete related transaction. If the user switches off half way through an operation, the whole transaction is discarded and the database files are left consistent. In some quarters this facility is regarded with suspicion, since it is only mentioned in the on-line documentation and has the air of being only 'semi-official'. But at the conference I met a consultant who had

used this facility with great success on a network with ten servers and 1600 users. He had found it reliable and felt there were no significant performance penalties.

- Reporting facilities. The trouble with most report generators is that in staying simple to use, they never seem general enough to produce a real report from a complex multi-file database. One query/report package that did seem popular at the conference is FoxFire. This helps by allowing the programmer to build a data dictionary in advance and provide a set of program procedures, so that the path of the end user to the data is much smoother. I hope to comment further on this product in a later issue; readers' reactions would be most welcome.

- On a more grand scale, the new version of DataBase Publisher for Windows interfaces to Fox as well as exchanging data via DDE with other Windows-aware programs. It can now handle calculated fields and related files, at present with one to one relationships between records, although a Developer's Version permitting one to many relationships will be available soon. Output is in a variety of forms including tagged Ventura format, permitting very high output quality in an easily automatable fashion.

convinced, and not only because during Gates's speech, the slide that said 'XBASE is important' kept disappearing from the screen each time he tried to show it. In the past it has been the case that, like IBM before it, Microsoft has thought of standards as goals the company sets for itself and others fol-

low, rather than conditions developed in collaboration with others.

Policy statements are often as interesting for what is not said as for what is. Among the notable absentees from the speeches of both Dr Fulton and Bill Gates was any mention of client-server architecture, so presumably no major

Converting existing programs to FoxPro 2.5

Programs written under DOS FoxPro version 2.0 should run directly under DOS FoxPro 2.5. Programs written under version 2.0 should also run under Windows FoxPro 2.5. However, the system then has to map the 24-line DOS character screen onto the Windows graphics screen, using a default character font size based on 35 text lines per screen. Under Windows, therefore, the DOS program screen looks distorted (to two thirds the full screen height, at least in some demonstrations).

Where separating ruler lines and boxes are drawn explicitly under DOS with the line drawing characters from the ASCII character set, they look quite different when mapped directly onto the Windows character set. Some level of positive conversion will therefore be required. Unfortunately this is one of the areas of version 2.5 still changing, most in the beta releases, so I cannot be sure of all the nuances, not even the two thirds screen effect. Certainly there was some disagreement between the various speakers.

It will also be possible to use a conversion facility to convert 2.0 programs more directly to Windows version 2.5 (and even vice versa). This conversion then does its best to use full Windows screen facilities, for instance with sculpted screen buttons. However, this automatic conversion depends upon screen layouts having been built with the Screen Builder tool. If your screens have been explicitly programmed, for really impressive visual images your screen layouts will need rejigging via the Screen Builder. (This could be the case anyway if your designs have been around for a while.)

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FoxPro 2.5 for Windows

- A faster database engine.
- An extended report generator, including a WYSIWYG graphics preview mode.
- A new screen generator: more flexible, including better handling of colours, and the full range of Windows fonts in any point size.
- A new general data field type that can hold sounds, speech, and static and real-time video pictures, which looked very impressive on the system demonstrated at the conference. Combined with the OLE capability, this feature could be a real boon in multimedia applications and bring their implementation much closer to the capabilities of ordinary users.
- Yet further improvements to the SQL query optimiser.
- Access to Windows Dynamic Link Libraries. These are libraries of procedures and functions that can be called from any Windows program (and from several Windows programs 'at the same time'). The library part of the Fox system (to access databases, search indexes and drive screens) will itself be implemented as a DLL. If several FoxPro programs are running together under Windows, they may share the same FoxPro DLL: this may save memory and boost performance.
- Use of Direct Data Exchange, a technique that allows two Windows programs that have been written to obey the appropriate protocols to exchange data 'on the fly'. At the conference we saw text stored in a FoxPro memo field being passed to the Word For Windows spell checker and back to Fox. Data can be exchanged with the Excel spreadsheet

and with any other program written to the same rules. In the new version of FoxPro there are extra commands to allow access to this facility directly, with no need for extra interface programming in C.

- Ability to 'fire up' other applications directly via Object Level Embedding, so that a change in some FoxPro data can be reflected immediately in any document or spreadsheet that has been linked to it and the application made available for the user to work on the changed data.
- User capability to 'shrink' the window in which a Fox program is being run before moving to another program, and to choose the design of the icon for the shrunk window.
- Availability. Under Windows, only the 'extended' version of Fox will be available since this uses a full 32-bit address space. The small and large alternatives will remain for the DOS 2.5 version.
- Changes to the the Applications Programming Interface. This is the mechanism for interfacing procedure libraries written in C, for example, for handling communications. The 2.5 version of FoxPro will be changed to use the API for the Microsoft C compiler rather than the C compiler of Watcom. This is a fairly major development, and at least one speaker implied that the new API may not be supported by the first release of version 2.5 (though I personally think this is somewhat unlikely). Libraries will have full access to DLL, DDE and OLE facilities. In the longer term, the API will offer programming not only in Microsoft's C but in the Borland and maybe Zortech C++ compilers too. This will help make the system even more 'open'.

developments are under way in this area.

The conference was an excellent opportunity to glean useful hints about better ways to use the current version of FoxPro. Apart from the opening and closing sessions, nine parallel sessions ran throughout the remaining two and a half days. The value of these sessions may be judged by the popularity of the best speakers, who were already well known to attendees from previous years, and to regular users of CompuServe. Big queues formed outside the lecture rooms of these speakers long before the previous session in the same room had finished. Since no session was given more than twice, even with co-operation from other delegates I must have missed many pearls of wisdom. Those I did glean are summarised in the panel. If FoxPro developers find their appetites whetted by

what they have read here, then I have done the conference some justice.

With so much happening on the XBASE front, I thought it best to concentrate this issue on Fox; other XBASE offerings will get their turn next month.

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capability, even if it's just using Microsoft's basic PC speaker driver, you can insert into a Word document .WAV files which are activated by clicking on them with the mouse. The usual repertoire includes beeps and drum rolls, while Clint Eastwood and Arnold Schwarzenegger can be downloaded from several bulletin boards. As well as playing back commercially produced sounds, you can create your own sound effects if you install an audio card into your machine.

A number of companies produce them, including NEC and Creative Labs. Microsoft's own was announced in last month's PCW. Once the thing is installed and running, something which I'm told by a Microsoft representative is 'an utter breeze', you select the section of the text you want vocalised, click on the Insert Sound option in Word's menu and say your piece into a microphone. This is recorded as a .WAV file that will be played back when clicked.

One of the more obvious drawbacks is that .WAV files do tend to be rather large. If your document is particularly loquacious, it's going to need a fair sized hard disk to accommodate your mouthings. In order to offset this slightly, Microsoft includes an option whereby you can select the sound quality of the annotations. Obviously, lower quality sound is going to take up less disk space than the high quality pieces.

Voice annotation of this kind is exactly what it suggests: not by any stretch of the imagination a full blown multimedia function, but rather the audio equivalent of short footnotes and remarks. Even used in this limited way it's going to enhance standard word processed text considerably. Take the example of a language teacher putting together classroom material. Normally the only way of giving the pupils guidance as to the pronunciation of foreign words is to speak them aloud or play back a tape. With voice annotation the pupil can work without supervision, simply clicking with his or her mouse next to the word in order to hear what it should sound like.

Microsoft also claims that voice annotation is starting to take off in a big way in the business sector. It seems that Chairmen of the Board are now personalising their email messages with recorded comments before sending them off around the network. Office minions are apparently much more receptive to memos which, as well as telling them they're fired in 24-point boldface, can wish them a nice day and do so aloud.

As the computer becomes less of a text processing tool and more of a general information processing manager,

programs combining sound, images and colours are going to be the norm. By then a word processor won't be just a standalone program but a single element in a chain, like a spell checker or an outliner.

Fear of mice

My piece on the keyboard vs mouse debate in October prompted a bit of correspondence. Here are Alan Montgomerie's thoughts on the subject:

'My present day input is mostly words and figures and for this I regard the keyboard as supreme. There is, however, a lot of further development possible for the keyboard, though some of it might be regarded simply as a case of reinventing the wheel.

'For solid input of text accurately and quickly, I am sure that touch-typing is the best and it seems natural that keystrokes should then be used for special instructions. And though it may not be the done thing for a touch-typist to look down at the function keys, I'm not so proud that I never do it myself. There are, however, alternatives.

'In days gone by there were two versions of the QWERTY keyboard. The first is the one we're all familiar with today with its four rows of keys. The second had just the three rows of letter keys. The traditional top row figures and symbols were on the letter keys and accessed by a second Shift key, while the first Shift key performed the standard capitals function. If this layout were to be adopted again for today's computers, the function keys could go in the top row where the figures now are, giving a total of only four rows which would be easy to reach in touch-typing.

'If lots of text is being input, there is a good case for increasing the speed still further, perhaps up to 'real time' dictation rates of 120 to 150 wpm. This could be achieved by adopting a keyboard such as you see in the Stenotype and Palantype machines used in court reporting and the like. Such keyboards allow 'chords' to be played, whereby words are input not a letter at a time but a syllable at a time, increasing the speed by a factor of several times. The disadvantage is that they are phonetic and their output has to be translated into proper spelling. Computer programs to do this were being worked on as early as the fifties, so I believe they should be generally available by now.

'It is also possible, however, to arrange similar keyboards (playable in chords, a syllable at a time) to give correct spelling straight away (like the one for which I got the IEE Design Prize a few years ago!) but there is no getting over the fact that they do take quite a bit

of time to learn and so are really only for professionals. In passing, there are also the special keyboards and other devices for use by the disabled, which generally need support from a computer program to turn their input into conventional text output.

'So perhaps some of the efforts of present day designers should be diverted away from the more exotic concepts, such as voice input, towards improving the good old-fashioned keyboard. Then, concentration on text-type input might produce better (old-fashioned) ways of thinking and writing.'

Mark Pettigrew, on the other hand, is a proponent of the conventional keyboard. And though once a function key aficionado, he's now become very much a mouse man:

'When I moved into my current job, I was used to WordStar and Microsoft Word and I used to get very frustrated at the Mac Plus without cursor keys. The DTP people there were thoroughly used to them, though, and didn't know any better. When they got new Mac IIs with cursor keys and Microsoft Word 4.0 which could use them, I was happier.'

'I then read about some results from a variety of sources, including Apple, which showed that although some experienced users believed cursor keys for deletions and suchlike were quicker, research showed they actually performed the operations more slowly than when they used a mouse. Now, I believe that if people are happy with something like that, then fair enough: let them think it is quicker and keep to their keyboard shortcuts. I decided to try using the mouse more for things like deletions. In fact, now that I work with Word for Windows I only use the keyboard shortcuts for a small number of frequently performed operations such as saving files and printing.

'However, I use some keyboard shortcuts in conjunction with the mouse. I use the mouse to select an area of text, and the keyboard shortcut to embolden it or increase the point size. I hardly ever select text using the keyboard, except sometimes for fun. The most frequent keyboard shortcut I use, and I suspect a lot of other people do too, is a 'modeless delete' with the Backspace key. That is to say if I notice a mistake a few characters back I simply backspace all the text up to it and retype from there on. It feels quicker to me than any other way, even though I might have deleted a sentence or two in the process.

'I suppose the question is which method, mouse or keyboard, gets least in the way of you using the computer to

do your job. If you are a copy typist, using the keyboard probably makes sense because you are focusing on the text directly. I don't know for sure, although I do believe that looking away from the original copy to watch the cursor on screen requires you to pause in mid-flow. That is what takes the time, not moving your hand to the mouse and back. However, having to think in terms of keystroke combinations to perform screen functions stops me from thinking creatively as I'm typing. I can touch-type at about 60wpm, and using the mouse doesn't seem to interfere with either my throughput or my attention to the job in hand.

'I never really got on with WordStar. I still use editors occasionally which use WordStar keyboard commands, and I remember some of them. A few, like ^KB are still almost automatic. But now I can use a mouse and a WYSIWYG word processor, I'm not interested in going through all that learning again. With WordStar it was necessary to use the keyboard commands to get things done. You had to learn them, or else have huge key charts on the wall. But you don't need to learn any except the most productive keyboard shortcuts any more, and I'm glad.

'So there you are. I don't agree that the mouse is a distraction. For me, it's a productivity tool and I wouldn't willingly go back to using a word processor without it. When I do use a DOS text editor like QEDIT to edit a batch file, for example, I feel lost without mouse support. I ask you: ALT-A to mark start of block, then move to the end of the block, then.... Yecch!'

Typing Chinese

If you though you had problems using WordStar's keyboard combinations, spare a thought for anyone who has to word process in Chinese. The average number of individual characters in a daily newspaper amounts to over 1000, while advanced literary works can have 7500 or more. Now imagine the sort of keyboard you'd need to accommodate that lot.

While word processing in Chinese probably isn't something many PCW readers have to do on a regular basis, a quarter of the world's population might find it very useful indeed. And for a nation that developed printing in the first place, it's curious that computer technology has only come to their aid in the last few years. However, according to Hugh Longford, MD of a company called Dunamis Computer Systems, all current solutions to the problem are at best compromises.

'All existing Chinese word proces-

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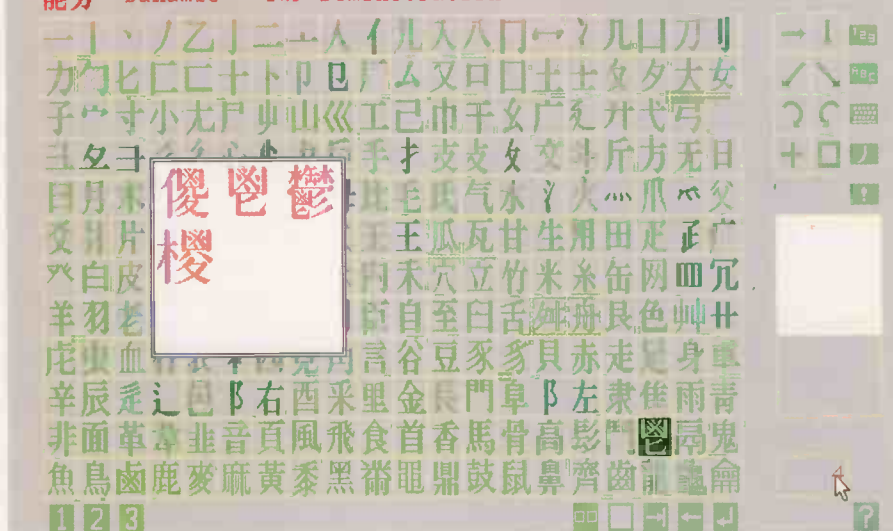


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能力 Dunamis - CWP Demonstration



sors have the drawback of forcing the user to think in terms of the QWERTY keyboard,' he said. 'But English people don't have to learn Chinese characters before they can use a computer, so why should Chinese people have to learn the Latin alphabet?'

The problem obviously lies in the sheer number of individual characters. Current Chinese word processors usually try to code them all in order to make them accessible from a conventional keyboard. The 7500 characters can all be broken down into a maximum number of 213 different 'radicals'. A radical can usually be thought of as an individual concept or ideogram. The Chinese words for book, writer and library all contain one common radical that conveys the concept of writing. This radical is modified by the addition of another to create the different words. The radical for 'writing' in combination with that for 'building' means 'library'. 'Writing' plus 'man' means writer. And so on.

The radicals can in turn be subdivided into individual character strokes. If you give each different stroke a specific code number, a unique numeric code can be generated for each of the 7500 characters in the Chinese language. And while this does allow the user to enter Chinese characters at a fair rate of knots, it also obliges you to learn a separate code for each one. Mastering conventional Chinese word processors usually requires a long period of training and practice; so long, in fact, that most Chinese people don't bother.

Dunamis' solution, a PC-based package called CWP, bypasses the keyboard and allows words to be created via screen-based icons and windows. The startup screen displays the 213 radicals which make up all the characters in the

△ Dunamis' CWP: radical word processing in Chinese

Chinese language. Using the mouse, the operator selects all the radicals contained in the word he wishes to construct. Once they are entered, CWP's database displays all the Chinese characters which contain those radicals. Finally, the user clicks on the appropriate word and then starts the process again.

If this sounds like a convoluted way of working, obviously it is. However, bear in mind that ideograms are meant to be written with pens and brushes rather than constructed electronically. This being the case, Dunamis Computer Systems' solution is probably one of the most intuitive ways of word processing in Chinese. According to Hugh, CWP can be used effectively by beginners and advanced users. And while it isn't as fast in operation as the code-driven Chinese word processors mentioned previously, it is far easier to learn, with the average user getting up to speed in little more than an hour. So long as he speaks Chinese in the first place, of course.

CWP requires only 640K of RAM and a VGA or EGA display. The current version will drive Hewlett Packard LaserJet, Canon BubbleJet and Epson dot-matrix type printers. If you'd like more information, Dunamis Computer Systems is at 164 Mossley Hill Road, Liverpool L19 9BD, tel 051-427 7726.

And that's me for this month. Please keep the letters and macros coming in. I'm still looking for that elusive one which will allow me to edit seamlessly across multiple documents. By post, it's the address at the front of PCW, while email reaches me as hewitt@CIX or on CompuServe as 100031,250.



Language barrier

Dan O'Brien reminisces on the days your new computer came with a decent language for you to muck about with. Plus, scant response to his Multilingual Competition.

Quickie puzzle in the spirit of JJ Clessa first. What do Listings 1 and 2 do? Easy peasy. Answers at the end of the article if you're stuck.

Actually, both are almost impenetrable, even to hardened programmers. I've asked the question here because this Low Level includes the annual How To Start Programming Wrongly column, and I felt I needed to remind the old hands quite how confusing the world of complex programming languages and low level coding can appear when first touched. It doesn't have to be that convoluted, of course. Indeed, if this column was devoted (as most technical journals are) to helping professional programmers write code that is clear, approachable and cuddly, then these two contributions would never see the light of day.

Fortunately, Low Level is devoted to Programming As Chess-like Hobby; the sort of coding which real programmers indulge in on their days off. Unlike sex, if programming is boring, you're doing it right. If on the other hand you want to have a bit of fun with your clothes on, in the privacy of your listing-scattered den, this is where to start.

Last year, we mildly bemoaned the death of the free, pre-packaged compiler or interpreter. Time was, no self-respecting home computer would be sold without some sort of decent language so you could start messing around with internals. Nowadays, most per-

sonal computers come with, at best, a crippled version of an otherwise respectable language. Last month's discussion of the pros and cons of the QBASIC 1.0 interpreter packaged with MSDOS 5.0 demonstrated the problems: Microsoft makes a lot of money from selling decent languages to serious, corporate customers. The only way it can afford to drop any language at all into freebie packages is by deliberately weakening it in some way.

Fortunately, the world of software development is a fiercely competitive place, with the two giants of the market, Microsoft and Borland, constantly battling to maintain technical supremacy at a reasonably low selling price. If you're interested in sado-masochistic programming as a hobby, then you can purchase basic versions of their highly professional development systems (BASIC, Pascal or C) for under £100.

In this sub-ton price range, the traditional battle is between the Quick compilers, Microsoft's baby range of easy-to-use development systems, and Borland's Turbo systems. Received opinion states that Borland products have a slight edge when bought in these standard varieties, since the main thrust of the company's development work has always been in these simple systems. The more expensive Professional series has, since Borland's early days, simply been extended versions of the basic setup.

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Listing 1

```

(*O/*_/
Cu %* )pop mark/CuG 4 def/# 2 def%%@GP[TX---
P\P_SXPY!Ex(mx2ex("SX!Ex4P)Ex=
CuG %* *+Ex=
CuG %* *+Ex=
CuG %* POLYGLOT - a program in seven languages *+Ex=
CuG %* *+Ex=
CuG %* Written by Kevin Bungard, Peter Lisle,
and Chris Tham *+Ex=
CuG %* (peril@extro.ucc.su.oz.au) *+Ex=
CuG %* *+Ex=
CuG %* *QuZ=
CuG %* *+Ex=
CuG %*!Mx)ExQX4ZPZ4SP5n#5X!)Ex+ExpQXH,B+Exp[-9Z-
9Z)GA(WG'UTTER_XYZZY'CPK*+
CuG #(* *(
C # */); /*(
C # *) program polyglot (output); /*+
C # identification division.
C # program-id. polyglot.
C #
C # data division.
C # procedure division.
C #
C # *)cleartomark /Bookman-Demi findfont 36
scalefont setfont (
C # *
C #
C # * hello polyglots$
C # main.
C # perform
C * ) 2>_$$; echo "hello polyglots"; rm _$$; exit
print
C stop run.
-*, 'hello polyglots'
C
C print.
C display "hello polyglots". (
C */ int i; /*
C */ main () { /*
C */ i=printf ("hello polyglots\n"); O= &i; return
*O; /*
C *) (*)
C *) begin (*)
C *) writeln ('hello polyglots'); (*)
C *) (*)
C * ) pop 60 360 (
C * ) pop moveto (hello polyglots) show (
C * ) pop showpage ((
C * )
end .(*)
C)pop% program polyglot. *) {*/}

```

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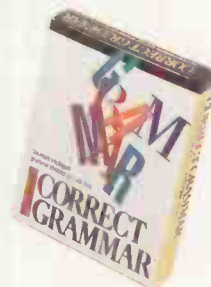
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While the philosophy behind this may be no longer true (Borland C++ Professional is now, in many ways, a completely different product from Turbo C) Borland has not ignored the more impoverished end of the market. The Borland split was caused by the need for something more than a few extra utilities to cope with the complexities of Windows programming.

For both Microsoft and Borland (at least in the C/C++ languages) the great dividing line for the haves and the have-nots is the application framework. These collections of objects provide an extra wrapping to the operating system for programmers who wish to explore *That New Paradigm In Full*, object-oriented programming. Unfortunately, the two company frameworks, Microsoft's AFX and Borland's ObjectWindows, have introduced a spot of means-tested apartheid to programming. Frameworks allow programmers with a bit of company lucre to treat their machine as a fundamentally different piece of hardware to the poor plebs still struggling down the pits. Professional development systems have 'em; the tinny ones, generally, do not. A shame, as if there is any area of computing which is still amusingly chaotic it's object-oriented programming.

There is a solution, if you're interested in moving on from the vagaries of batch programming and QBASIC's limits to the wonderful world of OOP. Choking though it is to admit it, the best bet for aspiring PC muckers around are actually Pascal and BASIC. Turbo Pascal from Borland (in truth always a safe hiding place for explorative coding) now includes, for Windows users, the excellent Pascal implementation of ObjectWindows for around a hundred quid. And Microsoft's pride and joy at the moment is Visual Basic, both in its Windows and DOS versions. While not heavy OOP, the proportion of listings sent to me both in this, and Turbo Pascal, indicate just how great an enclave of hacking is going on in these languages.

One more tip for beginners: splash out on Ray Duncan's *Undocumented DOS*. Probably a book to save for cold winter evenings, but required reading nonetheless. Plus, it includes every hacker's favourite on-disk reference, Ralph Brown's Interrupt Listing. I've recommended both before, but it bears repeating. At disreputable book stores near you.

ERRORLEVEL in DOS

Er... well, that's enough unsolicited advice for one year. Michael Hubbard of Manchester has some slightly more

Listing 2

```
DIM A%(64): co% = VARPTR(A%(0)): se% = VARSEG(A%(0))
REM Data for m/code parts
DATA &HB8,0,0 : REM MOV AX,xxxx
DATA &HB3,0 : REM MOV BL,xx
DATA &HCD,&H010 : REM INT 010h
DATA 203 : REM RETF
DATA 0
DATA &HFA,203 : REM CLI, RETF
DATA &HFB,203 : REM STI, RETF
DATA -1
M% = co% + 1
DEF SEG = se%
PRINT
DO
READ D%
IF (D% <> -1) THEN POKE M%, D%
PRINT HEX$(D%); ", ";
M% = M% + 1
LOOP UNTIL (D% = -1)
doAnInt% = 1: doACLI% = 10: doASTI% = 12
FOR I% = 0 TO 5: PRINT I%, HEX$(A%(I%)): NEXT
PRINT HEX$(A%(0))
A%(1) = &H212: PRINT HEX$(A%(1))
A%(2) = (A%(2) AND 255) + &H3000: PRINT HEX$(A%(2))
CALL ABSOLUTE(doAnInt%)
A%(1) = &H300
CALL ABSOLUTE(doAnInt%)
A%(1) = &H211
A%(2) = (A%(2) AND 255)
CALL ABSOLUTE(doAnInt%)
CALL ABSOLUTE(doACLI%)
OUT &H3C4, 0
OUT &H3C5, 1
OUT &H3D4, 23
OUT &H3D5, INP(&H3D5) AND 127
OUT &H3D4, 17
OUT &H3D5, INP(&H3D5) AND 127
OUT &H3C2, (INP(&H3CC) AND &HF3) OR 4
OUT &H3C4, 1
OUT &H3C5, (INP(&H3C5) OR 1)
OUT &H3C2, INP(&H3CC) OR 192
x% = INP(&H3DA)
OUT &H3C0, 19: OUT &H3C0, 0: OUT &H3C0, 32: OUT &H3C0, 32:
OUT &H3C0, 32
DATA 0,108,1,93,2,94,3,143,4,98,5,142,19,47
DATA 6,11, 7,62, 9,79, 16, 234, 17, 140, 18, 223, 21, 231,
22, 4

DATA -1,-1
DO
READ x%, y%
IF (x% <> -1) THEN OUT &H3D4, x%: OUT &H3D5, y%
LOOP UNTIL (x% <> -1)
OUT &H3D4, 17
OUT &H3D5, INP(&H3D5) OR 128
OUT &H3D4, 23
OUT &H3D5, INP(&H3D5) OR 128
OUT &H3C4, 0
OUT &H3C5, 3
CALL ABSOLUTE(doASTI%)
DEF SEG = 0
REM Now tell BIOS
POKE &H44A, 94
POKE &H484, 59
POKE &H485, 8
```


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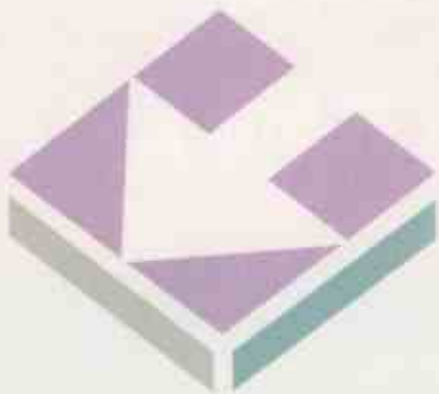
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concrete information. He's been looking at the behaviour of the elusive ERRORLEVEL facility in DOS, and has come up with some very useful utilities. Over to you, Mr Hubbard:

'It has been my ambition for some time to discover a way to find out the current ERRORLEVEL in DOS and put it in an environment variable, so that it can be used by a batch file. GETERL.BAT is a program I've written to do just this.

'Whenever a .COM or .EXE program stops running, a "return code" is given back to the operating system. This code is a number between 0 and 255 inclusive. MSDOS intended it to be used to show errors, with the general idea that 0 = "finished with no problems", and the higher the number the worse the error. The programs XCOPY and BACKUP do this, but the others generally just return 0.

'To test the return code in a batch file (or from the command line) you can use the command "IF ERRORLEVEL nn instruction", where "nn" is a decimal number and "instruction" is any DOS command. This command is only obeyed if the return code is nn OR GREATER. This makes writing batch files which use return codes unnecessarily complicated.

'Another problem with ERRORLEVEL is that you have to test it as soon as your program finishes. DOS internal commands (like DIR or COPY) leave it unchanged, but every external one runs like FORMAT, and BACKUP will reset it, usually back to a useless 0.

'The first batchfile in Listing 3 will set an environment variable called ERL to the current value of ERRORLEVEL. If you have just run an .EXE or .COM program and want to know the error level it returned, just run this batch file. It will tell you the level on screen, and also put this value, as a string of decimal digits, in an environment variable called ERL.

'GETERL is a lot more useful when called by another batch file. Suppose you want to GOTO one of several labels according to the value by a menu program. The usual way is to write the

Listing 3

```
@echo off
rem GETERL.BAT by Michael H. Hubbard
set ERL =
for %%N in (1 2) do if errorlevel %%N0 set ERL=%%N
set DX=
if not %ERL%00==200 set DX=6 7 8 9
for %%N in (0 1 2 3 4 5 %DX%) do if errorlevel
                                %ERL%%N0 set DG=%%N
if not %ERL%%DG%==0 set ERL=%ERL%%DG%
if not %ERL%0==250 set DX=6 7 8 9
for %%N in (0 1 2 3 4 5 %DX%) do if errorlevel
                                %ERL%%N set DG=%%N

set ERL=%ERL%%DG%
set DG=
set DX=
if not %1$==$ gotoendif
echo:
echo The ERRORLEVEL is now %ERL%
:endif
```

rem Listing 3b

```
IF ERRORLEVEL 6 GOTO MISTAKE
IF ERRORLEVEL 5 GOTO J5
IF ERRORLEVEL 4 GOTO J4
```

batch file as in Listing 3b. With GETERL.BAT you can shorten this to Listing 3c.

'Although the batch file should work with any version of DOS, you really need version 3.3 or above to use it in batch files because you'll need to use the CALL command. The prior method to get a batch file to execute another, "COMMAND/C filename.bat" will, unfortunately, not work because COMMAND, like any other .COM program, will change the current value of ERRORLEVEL as soon as it starts running. As if that were not enough, it only changes its own copy of the environment variable ERL, leaving the parent value unchanged.

'Yet another problem with using other copies of COMMAND.COM is that when it stops running, either from the EXIT command or from finishing a batch, COMMAND.COM will not return the current ERRORLEVEL to the parent program at all. Yes, it sets it back to zero again.

'To test GETERL and to demonstrate how to write programs that use ERRORLEVEL, you could try using SETERL, a Turbo Pascal program listed in Listing 3d. You can write something similar in most languages, though not, unfortunately, QBASIC.

'As should be apparent, the code given by the halt procedure is write-

only in the program, and read-only in a batch file.

'You can set the error level to any value between 0 and 255 inclusive by running SETERL. The number can either be on the command line, or typed later. If you type Ctrl-C in response to the question, the error level returned will be 255. Any invalid input returns 106 (the Turbo Pascal runtime error number). Numbers greater than 255 or less than 0 are acceptable (see below).

'There are other uses of GETERL. I once saw a batch file in a book which put the current date into an environment variable. It used three very small machine code programs that returned the day, month and year respectively in ERRORLEVEL. These programs were only a few bytes long — just a couple of DOS INT calls and some minor register shuffling — but the rest of the program was a huge chain of IF ERRORLEVEL checks, each one checking a different value. Thirty one in all, just to enter the date. With GETERL, the whole thing could be compacted into just three lines.

'While writing GETERL, I made some interesting discoveries about MSDOS. For example, although ERRORLEVEL is always between 0 and 255, you can test for any positive or negative integer value. Those of you who know about binary arithmetic should recognise the


```

IF ERRORLEVEL 3 GOTO J3
IF ERRORLEVEL 2 GOTO J2
IF ERRORLEVEL 1 GOTO J1
GOTO J0

```

```

rem Listing 3c
IF ERRORLEVEL 6 GOTO MISTAKE
CALL GETERL!
GOTO J%ERL%

```

```

{$I+,R+}
{Listing 3d}
program seterl;
var okflag,n:integer;
begin
  okflag:=1;
  if paramcount = 1
  then val(paramstr(1),n,okflag);
  if okflag <> 0
  then begin
    write('What Errorlevel did you want?');
    readln(n);
    end;
  if n shr 8 <> 0
  then writeln('This number mod 256 is ', n and 255);
  halt(n)
end.

```

logic behind this; if ERRORLEVEL is 2, then it is also 258 and 514, and any other multiple of 256 + 2. The same is true for negative numbers, although they are off by one, as experimentation will demonstrate. It is because of this "feature" that I needed the temporary environment variable DX in GETERL, so that I could avoid testing ERRORLEVEL for values above 256.

'Why does this happen? My guess is that when Microsoft wrote MSDOS they took the ASCII-to-integer routine out of the standard library, instead of writing their own, so it works with signed integers, not just unsigned byte values.

'When I started to investigate ERRORLEVEL I tried various approaches. DOS and BIOS calls nearly work but not quite. A call (INT 021h with AH=04Dh) returns the result of a "child" process, but nothing gives you the result of the last program; the way ERRORLEVEL operates.

'I tried looking for the location used by DOS to store ERRORLEVEL, but was unsuccessful. I suspect that the previous value of ERRORLEVEL is overwritten as soon as another program starts to run, which is why I chose to use a low-tech, high-level method — a batch file. It does not use any undocumented or unreliable parts of DOS and should therefore behave the same way on all systems.'

Mode Mods and Englishmen

What defines an Englishman? Overpowering reticence and a distaste for learning foreign languages if you judge matters by Low Level's recent Multilingual Competition. A few months ago, this column posed this teaser (inspired by a scribbled-on envelope in a train carriage near Luton). Readers had to write a source listing that could be interpreted in more than three languages. The response? Well, 'negligible' would be to indulge in typical English understatement. Not even the Celtic fringes came up with an answer. Instead, I had to scout around in the colonies for a solution that came up to scratch.

Listing 1 is the canonical resolution, written by Australian programmers Kevin Bungard, Peter Lisle and Chris Tham, and quoted to me by many old hands on the Internet. Now the deadline is past, it wins by default, and that despite the fact its authors were so modest as to refrain from sending it in themselves. Their modesty is misplaced: the code not only runs under Fortran and Pascal (the requirement: the competition) but, via Aussie ingenuity, also ANSI COBOL, Adobe PostScript and Unix shell script.

In its original form it would even execute as an IBM PC .COM file, al-

though I've stripped out that part of the code as a little too typo-sensitive for a listing that is fated to be keyed in. The competition's mystery prize will join other fine works of art being sent overseas. No wonder we lost the empire.

On a slightly happier note, Ed Smith of Leicester writes in with a piece of code that shows a John Bullish disregard for established theories of PC text modes, as well as a healthy wish to keep up with the Continentals.

On a recent trip to Germany, Mr Smith noticed a standard PC displaying text in an unusual text format. Looking closely, he counted no less than 94 columns and 60 rows of simultaneously displayed VGA text. Back in Blighty, a midnight oil re-reading of the VGA manuals revealed a sequence of the video processor register values that managed to perform the same trick on homegrown PCs.

A warning, though: Mr Smith bluffly states that the code in Listing 2 may not work for all displays. It stretches older monitors beyond the official IBM parameters. If you are brave enough to run the code and your monitor refuses to give back the C> prompt, TURN IT OFF IMMEDIATELY. PCW accepts no responsibility for hardware damaged through entering this code without adopting a Captain Cook-like sense of empire-building adventure.

And if this smacks of irresponsible journalism, I'd like to point out that Low Level's predecessors in the early eighties indulged in this sort of derring-do all the time. Back in 1982, PCW was the first to print the fabled Commodore PET command which either speeded up your display refresh time, or blew up the video circuitry entirely: no namby pamby, un-British in-between. Moreover, in one celebrated article, we published a circuit diagram for testing pain response that, if attempted by the weak-hearted reader, could induce a fatal coronary. You don't get the reputation for being Britain's Leading Computer Magazine by sitting around on chaises longues reading BSI standards and eating Turkish Delight you know.





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Fear of the unknown

'No-one ever got fired for buying IBM' may be history, but as IBM compatibility is still the criterion for many purchasing departments, Mick O'Neil dispels some myths. He also looks at packages that give virtually 100% compatibility between the Mac and the PC.

*Beware the Jabberwock, my son!
The jaws that bite, the claws that catch!
Beware the Jubjub bird, and shun
The frumious Bandersnatch!*
[Lewis Carroll]

Computer managers are a notoriously conservative lot. They work in an environment where technological change is the status quo and, in order to maintain some semblance of sanity, they often try to channel types of change for their own particular organisation. One method used by MIS departments is to publish regulations that insist on compatibility between existing systems and future procurements. The compatibility argument has immediate logical appeal even to the non-computer types. Surely it would be foolish to buy a piece of equipment that was incompatible.

Why, that would be a tacit admission that the present equipment was (oh dread!) out of date. The new rule drafted in the early nineties is 'no-one, who already has IBM compatible equipment, has ever been fired for buying more IBM compatible equipment.'

One large organisation with which I'm intimately familiar recently purchased several million dollars' worth of 80486-based PC compatibles; never mind the fact they're still running SuperCalc 3 under MSDOS. I think they'd like to work in a friendlier environment, but they fear the complexities of switching to the Macintosh or installing Windows and retraining all their clerical help. Abandoning DOS and PC compatibles is simply out of the question. The non-DOS woods are full of jubjub birds and bandersnatches.

In this column we've reviewed compatibility issues at some length, and demonstrated Macintosh emulation software that provides virtually 100%

compatibility with MSDOS software (see Insignia Solution's SoftAT, PCW, March 92). We've also looked at myriad options for moving and translating files between the PC and the Mac (see PCW, January and November 91, April 92, and later in this column for insights into programs like AccessPC, LapLink Mac, and MacLink Plus.) Despite increasing compatibility between these two platforms, many companies continue down a single narrow path in procurement policies.

• To be fair, compatibility is not the



simplest issue and there have been confusing signals elsewhere in the press. I noted in the March Beginners column that *Which?*, the voice of the Consumers' Association, picked the Apple Macintosh Classic as the Overall Best Buy based on its tests of 'widely available computers' in December 1991. Yet, after a year of advances in compatibility solutions, the October issue of *Which?* states '[Apple Macintosh] will suit certain users perfectly, but may be a less good choice if you want a general purpose PC.' *Which?* goes on 'If you want a computer for a broad range of tasks, or one that's probably compatible with your work machine, then an IBM compatible PC is almost certainly your best bet.'

Myth One, that the Mac is not a good general purpose PC, is patently absurd. I am a general purpose user of both PCs and Macs and I know of no general purpose software available for the PC that isn't also available for the Mac.

Myth Two, that an IBM compatible is your best bet because it's compatible with your work machine, ignores the facts. *Which?* has done a disservice to its readers.

FileMaker Pro 2.0

I've done a series of feature reviews of FileMaker as it has evolved through FileMaker Plus, FileMaker II, and FileMaker Pro. The reason I've been willing to devote that kind of time to one program is that, outside of my word processor, FileMaker is the single most utilitarian program I own. I use it to organise conferences, inventory equipment, maintain contacts, generate student reports, create labels, create mailmerge files, and manage this column. Though I might be better off using a relational system like Double Helix or 4th Dimension for some of these tasks,

FileMaker is preferred for its ease of use, flexibility, and amazingly versatile report generation capabilities.

Scripts in FileMaker were equivalent to macros in Excel except that they were a lot more intuitive to use. Of course intuition only goes so far, so scripting in earlier versions of the software was somewhat limited. FileMaker Pro 2.0 includes a new script writer module called ScriptMaker. ScriptMaker includes a preset script template and an accessible list of most of the menu commands and options in FileMaker Pro. The ScriptMaker can pause scripts so you can take unscripted actions, perform scripts and update values in other databases, send Apple events, duplicate scripts, and print script definitions. Though ScriptMaker has added complexity, it has also provided much more power.

Other changes to FileMaker Pro include an expanded Find command with symbols for wildcard searches; an ex-

tended columnar layout that displays all fields on one line across the page; a revamped label layout that includes more than 50 preset Avery label sizes to choose from; a new text align option for full justification; text editing enhancements that let you move through text with the arrow keys; new picture formatting options that let you fit the picture in a frame, maintain original proportions, and align the picture in the frame horizontally and vertically; the addition of scroll bars to fields; a host of new data entry options including sound support; the ability to duplicate field definitions; exportation of summary data; full System 7 support including QuickTime Movies in picture/sound fields, Apple Events, Data Access Manager, Edition Manager, and Balloon Help; and cross-platform file compatibility with FileMaker Pro for Windows. (For a full review of FileMaker Pro see *PCW*, February 91.)

I've always been intrigued by the idea of storing my monthly columns in a FileMaker database. One of the nifty features of FileMaker is its ability to search and find records based on any text string and so the program could provide an important reference source for future columns and reviews. Unfortunately, earlier versions of the software froze when I tried to paste my monthly 3000 words into a text field. FileMaker Pro's new scrolling fields, however, appear to have resolved that problem. I now have a FileMaker database that covers my *PCW* columns for 1991 and 1992 with text fields that must total over 72,000 words. Despite the massive fields, the database still seems quick and responsive.

MacFlow 3.7

One of the first computer courses I took back at the dawn of the microcomputer revolution (1981) was Programming Logic. It was taught by an instructor from British Telecom's Research Centre at Martlesham Heath and was strictly hands off. That is, hands off the computer. We were required to create elaborate flowcharts. The argument, that I rejected out of hand at the time, was that forcing us to design a flowchart provided insights into programming logic that we might have missed had we attacked a terminal and splashed out lines of BASIC. In retrospect, it was a valuable course. The thing that bothered me most was the sheer tedium in drawing those odd flowchart shapes and fitting text neatly inside.

Mainstay's MacFlow 3.7 completely eliminates this tedium. The program includes a customisable scrolling palette of the 13 standard flowchart sym-

bols. Symbols can be added or deleted and are simply dragged from the palette to the chart area. Text insertion points for each symbol are automatically centred and symbols 'AutoGrow' to contain overflow text. Lines serve as dynamic links between symbols remaining attached even when one of the symbols is repositioned. In addition, lines can be centred on the face of a symbol, adjusted to right angle vertices, and transformed into Bézier curves. Text can be entered inside a symbol, in the middle of a linked line, or free-standing anywhere on the chart.

Though MacFlow is the ultimate flowchart tool, it's also much more. Actually it's more than MORE's tree charts are cumbersome in comparison. MacFlow can be used to build that ultimate organisational chart that MORE could never quite handle. For charts that are just too large for the page, MacFlow offers the option to nest charts within a chart. Double clicking a node or symbol summons a subsidiary chart associated with it. And if you'd like to summon a word processing document or graphic associated with a specific node, MacFlow lets you launch another application. When you quit the application, you're returned to MacFlow.

MacFlow's documentation is superb. It includes two-way translators for MORE and ACTA files and incorporates MicroMacFlow, a program that turns MacFlow documents into standalones so anyone can use them even without the original software. These SmartCharts are created by opening an existing chart with MicroMacFlow and selecting SmartSave from the File Menu. SmartSave attaches a copy of MicroMacFlow to the document for distribution over a network or on a disk. MacFlow is System 7 savvy supporting Publish and Subscribe, Apple Events, and Balloon Help.

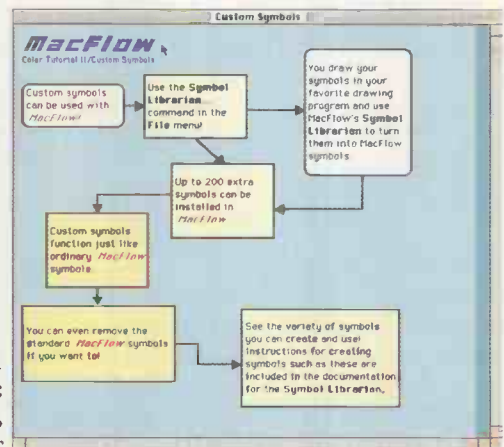
MacLinkPlusPC

MacLinkPlus has always been the premier PC/Mac file translation software. It comes complete with all the requisite cables for attaching the PC or PC compatible to the Mac, along with DOS Mounter software that helps Apple's FDHD floppy recognise and mount PC disks. Version 7.0 adds over 100 new translation combinations bringing the DataViz library of translators to over 700 translation paths. The new software has added support for graphic formats including Windows Metafile and bidirectional translation between PICT and TIFF. New translators sup-

port Word for Windows 2.0, WordPerfect 2.1 (Mac), Microsoft Works 3.0, WordStar 6.0 and 7.0, and Ami Pro 2.0. Embedded graphics in several word processor formats are now supported.

IntelliDraw 1.0

Over the past few years the evolution of drawing programs like Canvas 3.0 and MacDraw Pro appears to have slowed. We can do Bézier curves now, select from a broad range of gradient fills, and check the spelling in some software or makeslide shows, but there's been noth-



Δ MacFlow 3.7 lets you design your own flowchart shapes

ing earth shattering. Drawn objects are still placed on documents like their physical equivalents. The major abstraction benefits are in the ability to resize them, change their stacking order, modify their attributes, realign them, or change their grouping. With IntelliDraw, Aldus' Silicon Beach Subsidiary has introduced the next step in the evolution of drawing software: smart artwork.

Smart Art is created by establishing interactive relationships between drawn objects. These relationships can be based on spatial, alignment, or dimensional requirements between objects, and once in place, relationships remain intact even when one or more components is changed. Thus, it's possible to place Object A on the border of Object B. Dragging Object A will follow around the outside of Object B but will not let go of the border. Similarly, resizing Object B simply adjusts Object A to maintain border contact.

Another breakthrough feature in IntelliDraw is the Auto-Align command. Auto-Align displays guidelines to show when the corners, centres, or edges of two objects have been aligned. This is a deceptively powerful tool that would be a welcome standard in all software that supports draw objects.

Working in conjunction with that tool are the horizontal, vertical, and general dimension lines that automatically show the distance between two points.

Blend Shapes automatically generates transitions and fills between multiple selected objects while real world shape operations include the ability to cut a hole in an object using another shape. Another interesting new feature is grouping objects into a flip book so that only one is visible at a time. You flip to the next object in the stack by double-clicking.

The Connectigon Tool produces arbitrarily-shaped objects like the PolyShape tool but the vertices of these shapes will bond to the reshape points of existing objects. That is, the two objects become bound at the vertices and dragging one object distorts the other; if one is reshaped, the other is also, wherever their vertices are attached. The Symmetricon tool creates symmetrical objects with a variety of reflection options and can be simply employed to create very sophisticated shapes. An Align/Distribution tool creates a rectangle or frame within which objects are automatically aligned or distributed horizontally or vertically. If the frame is resized, objects are rearranged, inserted or deleted; the alignment is still maintained.

IntelliDraw's Action Buttons Palette includes options to add all selected shape objects to form a single new shape, subtract the frontmost shape from the furthest back to form a new shape, produce an object from the intersection of two or more selected shapes, or slice the frontmost selected shape through all of the selected objects beneath it. Other Action Tools are the Match Angle button which equalises the angle of rotation of all selected objects and maintains that relationship, Match Width, Match Height and Match Size buttons that do just as you might expect, a Link button to create links between selected objects, an Unlink button, a Lock button that locks all selected objects so they cannot be moved or edited, and an Unlock button.

IntelliDraw's Animator Tool is used to create animation buttons and animation links. Although the program's animation is not meant for full-motion, rapid-action sequences, it can be used to help illustrate a topic where motion is a critical part of the explanation.

Silicon Beach's ingenious equivalent to Apple's Balloon Help is a small Info window. Instead of pop-up balloons that distract you while you work, the Info window includes the same information but can be placed unobtrusively on the side of the screen.

The IntelliDraw documentation is just adequate, but is accompanied by an excellent training video that steps you through the basic features of the software. With IntelliDraw, Silicon Beach has once again asserted itself as the leader in the production of innovative graphics software for the Mac.

Typetry 1.0

Three dimensional rendering programs are all similar in one respect. When they go about rendering a three dimensional image they also render your computer useless. Generally speaking, they're processor-intensive memory hogs and their unresponsiveness coupled with complex interfaces makes program mastery tricky. Pixar's Typetry is a 3D, type program that offers an interface designed to break through these barriers.

Typetry supports Type 1 and most standard TrueType fonts. After choosing the text tool, you click anywhere on the Typetry document and a text dialogue box is summoned. You then choose a font, enter your text, select Build Object, and a 3D mock-up of your text is generated. You can then use any of five tools from a tool palette to enter more text, select and reposition the text object, rotate the object in three dimensions, rescale the object, or change the level of extrusion. There is also an important cropping tool available from a pull-down menu that lets you limit your rendering job. Once you've defined, sized, and oriented your text object, you use a Light palette to control the position, brightness, colour, and shadow of up to nine separate spot-lights.

You can also apply any of five Gels for each light source. A Gel acts as a pseudo filter that sits between a light source and the text object and casts a unique shadow. Control over the surface appearance of the text object is provided by the Looks Palette. A Look consists of a texture, colour, and/or pattern that can be applied to the object, the wall behind it, the sides of the object, and the floor. There are also a number of special effects that can be applied including motion blurs and perforations. The former blurs the text between two points implying motion while the latter lets you cut out perforations in your object.

When you've selected all the desired options, you render the object. That is, the bare bones of the text object is draped with a three dimensional solid surface. You can choose any of four rendering options including Quick and Dirty, Reasonable, Excellent, and Custom. Quick and Dirty gives you a quick

screen preview of what you're likely to end up with and this option should be used to fine-tune your results. Reasonable gives you a more accurate screen representation but takes considerably longer. Excellent seems to take forever but provides the highest quality image. Custom depends upon entries in Custom Setup as the basis for rendering.

Images can be saved as PICT files and you can render an object directly to a file as a TIFF or EPS file. I did note that Typetry EPS files seem incompatible with most of the graphics and desktop publishing software I applied.

The Typetry documentation is magazine-style and seems adequate at best. I would prefer a real manual with an extensive table of contents and numerous examples. Performance of the software is predictable. On a Quadra 900 with 20Mb of RAM, rendering in high quality took an inordinate amount of time. If you have less power, I strongly recommend you use the Quick and Dirty Option to fine-tune your image prior to full rendering.

Details

FileMaker Pro

Price: £275 + VAT (£50 upgrade from FileMaker II or FileMaker IV)
FrontLine Distribution
Intec 1
Wade Road
Basingstoke RG24 0NE
Tel: (0256) 20534

MacFlow 3.7

Price: £239.95 + VAT
Computers Unlimited
2 The Business Centre
Colindeep Lane
London NW9 6DU
Tel: 081-200 8282

MacLinkPlusPC 7.0

Price: \$199
DataViz
55 Corporate Drive
Trumbull, CT 06611, USA
Tel: 0101-203 268 0030

IntelliDraw

Price: £149 + VAT
Aldus UK
39 Palmerston Place
Edinburgh EH12 5AU
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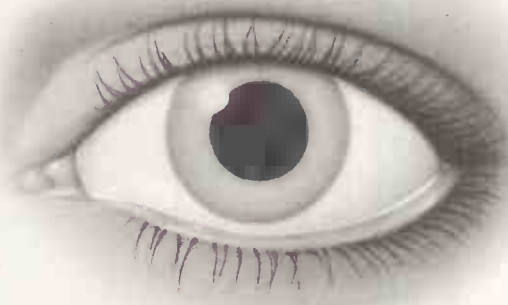
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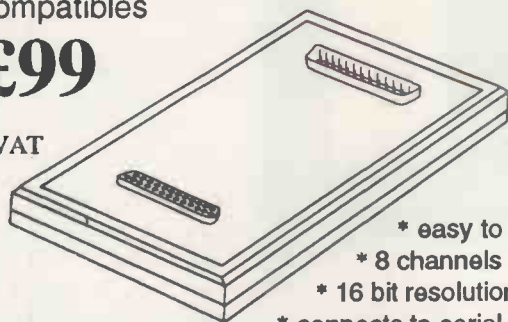
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A well developed system

When faced with a choice of four operating systems, how do you get them to coexist? Ken Morse's answer was to set up his own development system, using a Windows Development Kit and an OS/2 toolkit. But that's not to say he's forgotten Comdex...

This month I thought I'd tell you about a particular developer's Windows and OS/2 development system — mine! With the availability of four operating environments, I have had a developer's headache: how do I configure my systems to allow DOS, Windows, OS/2 and NT development? Then last week I decided to throw caution to the wind and configure a single system that would allow all to coexist. This is my story, mainly ups but with the occasional down to remind me of my fallibility.

Let me start with my main development computer, a 33MHz 486 no-name clone with a 500Mb SCSI hard drive and a SCSI CD-ROM. The hard disk space is a major requirement for a development machine and the CD-ROM was necessary to install the pre-release version of Windows NT. I started by backing up all my old work on tape drive since I knew I was going to completely wipe the machine. I then used FDISK to set up a primary C: drive of 200Mb. The remaining 300Mb would be used for adding OS/2 and the Boot Manager later. I have found out the hard way on previous systems that the Windows NT install process does not like having Boot Manager lying around: the trick is to install Windows NT first and add Boot Manager later.

Now it was time to start. The first step was to format the C: drive with DOS 5.0 and install DOS. This went

fine and I had my first operating system installed. Now it was time to install the pre-release of Windows NT. Microsoft has followed IBM's lead in providing operating systems on CD-ROM. IBM started doing this with its Multimedia

The Windows NT installation process is similar to that of Windows 3.1 and took about 15 minutes from CD-ROM. One thing to note is that the documentation tells you to install NT on drive C: only and it is not joking: try

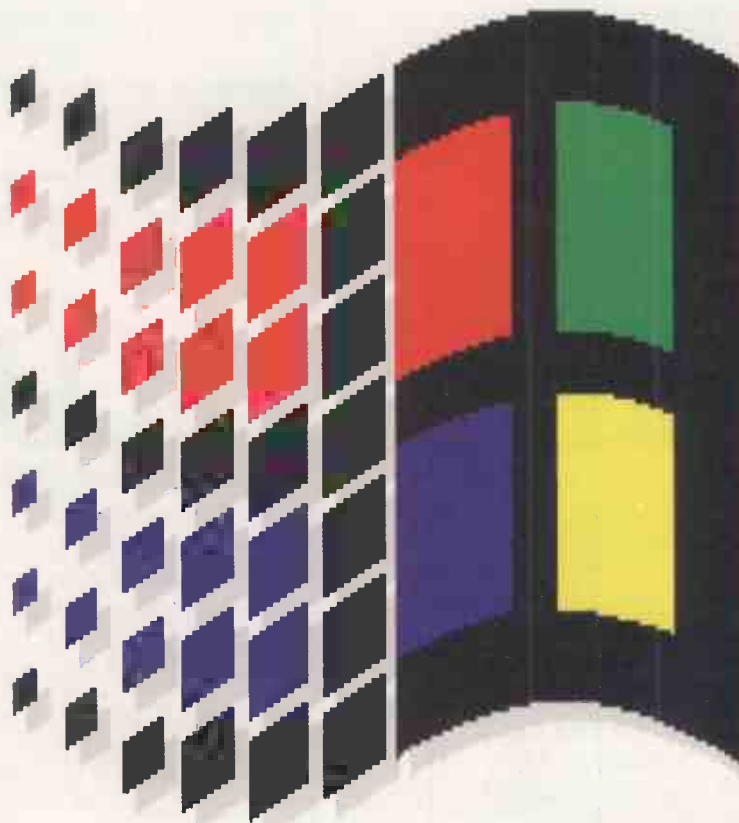
putting it on another partition if you want to see a machine hang! I've now got DOS 5.0 and Windows NT on my C: drive. The next step is to partition the rest of the drive and add O/S 2.0.

The version I'm adding is the latest beta which adds 32-bit graphics engine and Windows 3.1 support. By the time you read this it will probably be available as OS/2 2.01. Pop the OS/2 boot disk into the drive and quit when the prompt screen appears. This allows you to run FDISK to partition the remainder of the drive. I added an extended logical drive D: of 150Mb and an extended logical drive E: of 149Mb. This left 1Mb to assign for the OS/2 Boot Manager. After setting the D: partition to installable, I could run through the

M57 computers a year ago and is following the same strategy with its recently announced Multimedia machines. All you need is a floppy boot disk and a CD-ROM. I popped the Windows NT pre-release CD-ROM into my drive, inserted the boot disk and did the three-key salute.

OS/2 2.0 installation.

The beta version of the new OS/2 2.0 comes on 29 diskettes, another good reason to move to CD-ROM based installations. The basic disk layout remains the same: 15 base OS/2 diskettes and five printer driver diskettes. However, the display drivers have been



moved onto two separate diskettes which allows for easier future expansion. The installation went flawlessly, but it did take about an hour.

When OS/2 2.0 is installed you take the remaining seven disks which add Windows 3.1 support. Again, this process was straightforward and was soon completed. When I booted the system I was greeted with Boot Manager giving me the option to boot OS/2 2.0 or Windows NT. If I chose Windows NT I was greeted by the Windows NT Portable Bootloader which gave the option of booting Windows NT or DOS 5.0. From start to finish this had taken about three hours and I was ready for a break. After all, I now had the operating systems installed but I still needed to install a mass of development tools before I could start generating applications.

After a walk along the beach in the Florida sunshine (and you wondered why I left England?) it was time to get serious and finish what I had started. I now had three operating systems installed (four if you count Windows 3.1) and no development tools. First I installed Microsoft C/C++ 7.0 on the DOS drive, followed by the Windows 3.1 SDK. This gave me the ability to develop DOS and Windows 3.1 applications. Next it was the turn of the Win32 SDK for Windows NT. Again, this was provided on the pre-release Windows NT CD-ROM.

The Win32 SDK

If you are a Windows programmer *au fait* with the Windows 3.1 SDK (Software Development Kit), you'll find the Windows NT Preliminary SDK (PDK) largely familiar. You'll also find a number of areas where significant enhancements have been made in the 32-bit Windows (Win32) API instead of 16-bit Windows, and in the tools available for building and testing Win32 applications.

Installation couldn't have been easier. I changed to the \mstools directory on the CD-ROM and typed SETUP, and it pretty much took care of itself from there. When it was done, I had everything I needed to build an application for NT on either an Intel 80x86 or a MIPS R4000. The compiler, linker, headers and libraries, all the on-line WinHelp files, a good assortment of small code samples and even a programmer's editor are included. You don't have to buy anything else, it's all here.

The centrepiece of the PDK for Intel programming is the Microsoft C/C++ 7.0 compiler that has been retargeted for the 32-bit flat model. It's robust and generates good solid code although

curiously, some of the C++ headers seem to be missing.

For MIPS R4000 programming, you have a choice: the stable, efficient but fussy MIPS C compiler that takes into account all the RISC idiosyncrasies, or a pre-release mixed hybrid of a Microsoft front end and a MIPS code generator. The hybrid compiler is Microsoft's long-term direction for NT development on the MIPS platform, and may indicate where it will go on other CPUs. By mating Microsoft's own C 7.0 front end to the MIPS back end, identical language definitions are provided on both Intel and MIPS platforms (right down to the level of error messages) while taking full advantage of MIPS strength in RISC optimisation. But this first release of the hybrid may not be as stable as the MIPS compiler, so you have a choice.

What's missing is a cross-compiler to let you develop MIPS code on an Intel CPU. The OS/2-hosted versions of the tools that were included in the PDK2 build last December are also gone; there's no longer any support for building an NT application except on NT.

While the compiler options are mostly unchanged from version 7.0, the linker is more like a Unix linker than Microsoft Link. Unfortunately the compiler doesn't know how to run the linker yet, so you will end up having to explicitly run the compile and link phases as separate steps using, if you're like most of us, the `nmake` utility.

The programming editor is a big disappointment. It's the old text mode M editor that dates back to the days of OS/2 1.0. If you have an old `TOOLS.INI` file from 1987 you might be able to live with M, but it just isn't worth using otherwise.

As for a command line, you'll find the Single Command Shell (SCS) basically familiar. Nearly all DOS or OS/2 commands and batch files will work, and some of the command keystrokes from both systems are present. For instance, you can get the last line by hitting F3 or the up arrow.

There are two debuggers in the PDK: NT Symbolic Debugger, a crude command line oriented debugger that is useful only if you're willing to follow your program flow through the individual machine instructions generated by the compiler, and WinDebug, a 32-bit variant of the Quick C for Windows debugger that will give you true source level debugging. Neither of these tools is up to the standard of Microsoft CodeView, but then it is a pre-release version of the development kit.

The graphical tools — the dialog editor, image editor, Spy, DDESpy,

Zoom and font editor — are identical to their 16-bit brethren, as are the help compiler, resource compiler and `nmake` facility. Windows NT also offers some new tools. The CPU Thermometer, Process Viewer and Performance Monitor help you understand what the system is doing, which can get a bit involved when you're doing multi-threaded programming.

C source code samples

There are a lot of C source code samples in the PDK that are right out of the Windows SDK, identical except for minor source code changes (mostly ANSI style function prototypes and strict `WINDOWS.H` definitions, along with the necessary changes to support 32-bit flat models). For C++ programmers, all but one of the Microsoft Foundation Class (MFC) examples from MSC/C++ 8.0 have been brought over to Windows NT. Apart from a couple of `#ifdef` lines added in `.H` files, they are identical to those in the regular Windows SDK. This may make it worthwhile for many of us to learn C++ at last, because it looks as though you can expect to port MFC-based C++ applications over to NT in about a day. Unfortunately, there are no new MFC samples to demonstrate using the new features of NT and Win32; hopefully this will change once a C++ compiler is available on the MIPS platform.

The PDK does have plenty of new sample programs written in C. These include samples that demonstrate the character mode console APIs, the Remote Procedure Call (RPC) subsystem, a debugging event viewer, a file management utility, two font viewers, a system parameters viewer, a demonstration of named shared memory, a security API example, a named pipe example, multi-threaded applications, Bézier curve, masking and other new graphics functions, and a utility for playing waveform sounds.

Probably the weakest area in the PDK is documentation. If you attended the Windows NT Pre-release Developers' Conference, or if you buy the \$399 development kit, you'll get a shelf full of paper documentation. If you purchased the \$69 CD-ROM, you still have the documentation; most of what you need is in Windows Help form, and the rest is buried somewhere in the 8000 pages of PostScript files on the CD-ROM. Why Microsoft limited the electronic documentation to PostScript format is something of a mystery. There is plenty of room on the CD-ROM and Microsoft could easily have delivered the documentation in Write and Word format.

All in all, the July PDK is sufficiently complete for you to write Windows NT applications. Microsoft has announced that the October release will include the Win32 libraries so that you can sell your Win32 applications outside the small circle of Windows NT users, along with a better editor and debugger.

OS/2 2.0 development tools

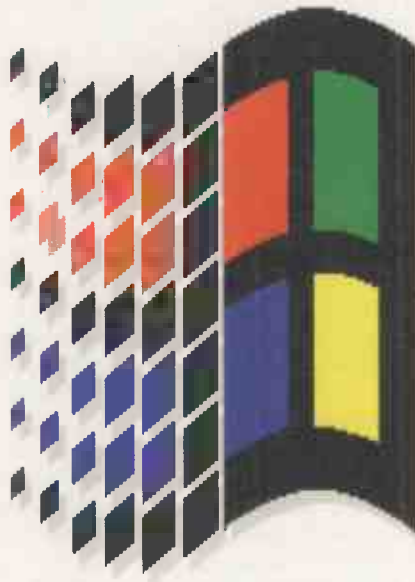
This leaves my OS/2 2.0 development tools to add. The first package to install is the C Set/2 compiler, a true 32-bit compiler for OS/2 2.0 which comes with a windowed source level debugger. The OS/2 toolkit is analogous to Microsoft's Software Development Kits. It adds the multi-threaded libraries for accessing OS/2 2.0 subsystems such as the Presentation Manager. Also included is a set of useful tools such as Dialog Editor, Bitmap Editor and Help Compiler.

For multimedia development I needed to add the Multimedia Presentation Manager extensions (MMPM/2) and their toolkit. I described MMPM/2 last month and the toolkit provides developers with a suite of sample applications and source code as well as a wealth of printed reference material. Hopefully, IBM will start incorporating MMPM/2 with the base OS/2. Version 2.0 with MMPM/2 today runs rings around Windows 3.1 with its built-in multimedia extensions. If IBM is to keep this lead it must start distributing it with OS/2 so that everyone can see the clear advantage. Of course, the multi-threaded nature of Windows NT will remove some of that advantage but today OS/2 has a big performance gain for multimedia applications.

Once I had added my favourite editor, a folding editor written by one of my colleagues, the system was complete. It seemed like overkill to have the DOS and Windows 3.1 development running under DOS 5.0 with the new OS/2 2.0 sitting on my system, so I started configuring Microsoft C 7.0 and the Windows 3.1 SDK to run under OS/2 2.0. It took about ten minutes and now I can develop and run DOS, Windows 3.1 and OS/2 32-bit applications in 2.0. This version certainly lives up to its title, 'the integrating platform'. The only thing missing from 2.0's support of Windows 3.1 applications is 386 Enhanced mode, but this is a fixed limitation since OS/2 2.0 is preserving the system integrity.

I talked about Windows NT a few months back and the preliminary release should be regarded as very preliminary. Being a big fan of 2.0 I wanted to see how the multi-threaded support under Windows NT performed. This

one feature will probably improve Windows NT performance over Windows 3.1, but I must admit to being disappointed by what I saw. The Windows NT PDK includes a sample multi-threaded application which allows multiple windows to be created, each with a bouncing coloured worm leaving a trail inside. The time-slice between each window appeared to be around two seconds: that is, one worm in one window would move for two seconds, then the next window and so on. This was hardly the multi-threaded performance I was expecting. On checking the source code, the thread param-



eters were set correctly for best performance. A strange effect was that if I moved the mouse around frantically, the time-slice decreased and the worms appeared to move together. Still, this is preliminary and I'm sure Microsoft will improve the performance with the next release.

It's that time of year...

Yes, it's here again: Comdex. Everyone and their mother will be heading to the bright lights of Las Vegas to show their latest wares and, more importantly, see what wares their competitors are showing. What can we expect this year? Microsoft will be pushing Windows NT and there are sure to be many third party big names showing updated versions of their software running on Windows NT. New Microsoft applications and updates to old ones are always a sure bet.

Perhaps the most interesting debutant at the show from Microsoft will be AVI (Audio Video Interleave), an architecture to provide software motion video on a Windows desktop with-

out the requirement for extra hardware. Microsoft has been pretty tight-lipped about it but the demos it has given have had people wanting more.

A couple of months ago in this column I described the ActionMedia II adapter from IBM which allowed full digital motion video to be shown on an OS/2 or Windows desktop. AVI will remove the need for the hardware but at a price. The quality and frame rate will not be as high and, perhaps more importantly, the software motion video will take up almost 85% of available CPU cycles. In contrast, ActionMedia II performing the same task will only take around 10 to 15% of the CPU. Last year at Comdex, ActionMedia II won 'Best Multimedia Product of Show' and went on to collect 'Best of Show' as well. It will be interesting to see if digital video grabs the attention again this year. Look out for a future column when I'll explain Microsoft's AVI architecture and implementation.

What about Big Blue? IBM should be announcing OS/2 2.01 with 32-bit graphics engine and true support for Windows 3.1 applications. Many performance tweaks have been incorporated as well as some bug fixes to make this release more usable on lower end machines. The response time of version 2.01 on my system is almost immediate compared with the slightly sluggish 2.0 release in March. IBM will hopefully be showing improved third party support for version 2.0 to bolster its market standing.

OS/2 2.0 has sold over one million copies and is expected to hit three million by the end of the year. However, for it to become truly accepted and make the most of the jump it has on Microsoft, the third party developers must embrace it. On the multimedia front IBM will be showing its new additions to the Ultimedia range of machines, the M57 and M77. The M77 has an impressive specification with a 33/66MHz 486DX2, 8Mb of memory, a 200Mb SCSI hard disk, CD-XA compatible CD-ROM, XGA-2 graphics and an optional read/write optical.

On the software side IBM will be showing new additions to MMPM/2 including an MCI driver for ActionMedia II and M-Motion along with some software motion video demonstrations of its own.

Many of the more innovative products come from the smaller companies who come to Las Vegas to do battle with the giants. Wherever you go at Comdex you can be sure to see new and innovative products, and after five days you can be sure you'll need a two week holiday to recover.

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Crosstalk For Windows	58
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Superbase 4 For Windows	336
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Superbase 4 win. Upgrade	265
WindowBase 1.0	189

DESKTOP PUBLISHING

Desktoppress	165
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Typografica Newsletter Collect.	57
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GENERAL UTILITIES

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PC Kwik WinMaster	66
PC Kwik Power Disk	45
Qemix 386 3.0	46
Rooms For Windows	42
Spawrite II	45
Xtree Gold 2.5	57
Xtree Gold For Windows	30

GRAPHICS

ABC FlowCharter	168
Adobe Illustrator	335
Adobe Streamline	242
Aldus Freehand 3 For Windows	205
Aldus Persuasion 2	225
Animator	179
Animator Pro	306
Animator To Pro Upgrade	159
Animator Clips	67
Applause II	227
Arts & Letters Apprentice	100
Chansma	285
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Corel Draw 3 Upgrade	88
Designer	355
Design Works	88
DrawPerfect	203
EasyFlow	179
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Freeance Graphics For Windows	278
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Harvard Graphics 3	244
Harvard Graphics For Windows	257
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Forest & Trees	292
Grandview	195
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Portex Personal	35
Portex Professional	92
Top Priority	62

INTEGRATED

CA Office Framework IV	93
Lotus Works	312
Lotus SmartSuite	87
Lotus SmartSuite Comp. Trade In	389
MS Office For Windows	249
MS Office Competitive Trade In	289
MS Works	82
MS Works for Windows	64
PFS: First Choice	95
PFS:Window Works	79
Smartware II	365
Symphony 2.2	364

NETWORKING

Novell Netware Lite	41
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Excel For Windows 4	227
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Quattro Pro 4	163

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ATOMSTYLE



Open for business

Our new Unix columnist Paul Lavin has declared war on proprietary systems and dreams of a Unix world. But unless Univel gets its marketing act together, he feels it could be gifting the personal computing future to the Microsofts and Intels of the industry.

Despite my appreciation of the awesome wonderfulness of Unix as a development environment and a backbone to larger computer systems, I am not ignorant of the fact that it doesn't fit onto every desktop nor do I feel that it is appropriate for every conceivable application. Therefore, some considerable ink hereabouts will be spilled about making Unix fit in with PCs running DOS, Windows and OS/2, Macs, and whatever else is out there in sufficient numbers (or of sufficient neatness) to matter.

However, along with my affections for things Unix, I have an almost religious conviction about 'open' systems. Open systems doesn't necessarily equal Unix, but in my book it does equal adherence to public standards. As I am sure you are aware, open is the most abused word in the computer lexicon next to the word standards. I resolve not to be one of the abusers of these terms. Rather, I shall be abusing those who pervert their true meaning.

As a consequence, you will see in these pages impassioned diatribes against anybody who attempts to steal the whole pie for themselves, lock out the competition and lure users down a path that should have already been thoroughly discredited: namely proprietary systems.

For the moment, that means you, Microsoft. And your fat friend behind you, Intel. And sometimes, in an off moment, even Sun will drift into firing range. The best of all possible worlds is when a number of companies deliver a number of solutions, each tuned to a particular set of needs, and the competition drives the prices down where they overlap. Domination by any single company means users wind up paying too much, and hence, progress into a giga-everything future is delayed.

The only way the computer buying public will be able to figure out what to buy, is for there to be some sort of humbug filter in action. For high-end desktop computing and small departmental systems, I hope this column will serve that purpose.

The enemy of open systems is incompetence. And now that the forces of darkness are gathering to pounce on the virtuous (perhaps just a touch melodramatic), it is nigh on unforgivable what Univel, the bastard child of Novell and Unix Systems Laboratories (USL), has done and is doing with Unixware.

Unixware, heretofore known variously as Destiny, or Unix Lite, received its formal launch at NetWorld, a Novell love-in, in Dallas last week. What an inauspicious start to what, from time to time, has been billed as the future of desktop computing.

The timing was off. Off by as much as a year, by some estimates. When first mooted by USL, Destiny was supposed to fit on Everyman's PC and enable the sort of connectivity-dependent applications that client/server and workgroup strategists dream of.

Well, they had their clear chance. Now we have Microsoft's shot at world domination in the frame as well as a credible (which is to say mostly finished) version of OS/2 as well as NeXTstep and Solaris to compete for the punters' attention.

What this world needed (and needs) is a good desktop client. Good meaning robust, graphical, multi-tasking. Desktop meaning sized to fit and run well on the recently installed PC desktop, as well as priced to fit desktop budgets. Oh well, we aren't going to get that just yet: not from Univel at least.

Univel has made Unixware a modular operating system which is a good idea given the diversity of the PC in-

stalled base and the wide spectrum of uses to which a desktop client operating system can be put. When you start totting up what it will cost, you have to agree that few users will want to spend that sort of money on a ubiquitous desktop operating system. Mind you, we don't know what price tag NeXT or Microsoft will be putting on their 32-bit offerings but clearly Univel's idea of a mass market is markedly different from mine.

The December '92 vintage Personal Edition of Unixware will cost £290 which is a good starting point until you find out what is missing. Networking, aside from the built-in NetWare IPX/SPX, will cost you an additional £230 for TCP/IP and NFS, another £230 for the Personal Utilities bundle (whatever that is), £60 for Encryption Utilities and £230 more for DOS Windows Merge (next year).

If you want the Application server, prices start at £1500 and then you can start playing the add-in game. The Software Development Kit is £590. One has to ask if these guys are serious about starting a mass movement to open systems or not.

To put this in perspective, SCO is offering Open Desktop 2.0, a well seasoned release after three years of tuning; for £960 it has all the bits included that Univel makes options. If your mum ever told you to stay away from Version 1.0 of anything (like mine did) you will be running in the direction of SCO with a cheque.

If all you want is a 32-bit multi-tasking, graphical client for a Novell server then Unixware is a good buy. However, OS/2 is a better buy on the basis of its comparative giveaway price and its much better Microsoft Windows integration. Although Novell and IBM seem to have cooled their relation-

ship to a degree, there is still enough mutual respect to make sure that OS/2 will have no problems working with NetWare.

Univel glibly asserts that Unixware will be available from selected Novell distributors in the UK. Oh yeah? Has it gauged the enthusiasm of these select few for promoting Unixware vis-à-vis NetWare? With no marketing, sales or support, is it planning to sell any at all? USL blew the classic clear opportunity it had a year ago and is now giving NT, NeXTstep and OS/2 another chance.

A friend of mine no longer with USL told me in October 1990: 'We know who the enemy is. It's Microsoft.' He was wrong. The enemy is whoever is tying Univel's shoelaces together. And that is probably somebody at the top of Novell who can't make up his mind about how and when to move the NetWare-equipped masses over to Unix.

There are those who maintain that ACE is not dead. ACE supporters, down from several dozen to a mere handful, include Olivetti, which insists it will sell ARCs to commercial users this year; Microsoft, stuck with porting NT to the R4000 lest it be seen to abandon another project like it did with OS/2; DEC, which hopes to hijack the 'standard' to its Alpha ends; and Silicon Graphics, which bought MIPS.

ACE has a long way to go to drag itself out of the comical situation it has found itself in. Compaq and SCO deserted the cause as Intel applied pressure by leaking the wonderfulness of the P5; this chip will now be known as Pentium despite the risqué humour the next processor in the X86 series will inevitably generate. Well, the P5 is late and it may be later still before you can buy a PC built with one ex-stock.

ACE retains the apparent desire to put a lot of computing power in a desktop box cheap enough for volume sales. Couple that to an operating system with sufficient application support and you could have the start of a new generation of personal computing. In other words, an alternative to the PC.

But to keep from being laughed off the world stage there has to be a sense of solidity to the effort: something the diverse ACE consortium members never got right. There must also be a demonstrable benefit to get the big PC buyers to risk their collective jobs in switching from a 'standard' that is comfortable.

Reasonable minds can differ as to the amount of difference in performance that is required before the conservative (small c) computer buyers of this world tumble for the new kid on the block. A power premium of 100% could be required before the hypotheti-

cal volume buyer would desert the familiar for the foreign. Of course, it would help if the price was lower, too.

Stepping into the crease recently deserted by ACE is Sun. Despite Sun's devolution to a number of planets, they all speak with a single voice unlike the cacophony that came from the ACE troupe. And it looks like Sun is going to put a lot of muscle behind its bat to make a new desktop standard, by carrying the battle down below the normal market position for workstations.

The announcement of the necessary power was made when Texas Instruments unveiled microSPARC. Sun is expected to launch its Tsunami project system in mid-November using the microSPARC. For monoglots, tsunami is Japanese for tidal wave. Apt?

The microSPARC will run initially at 50MHz and deliver 22.6 SPECint(92) and 17.4 SPECfp(92) benchmarks. These are the new SPECmark benchmarks, integer and floating point respectively, that replaced the older ones successfully fiddled by HP and others. In comparison, the microSPARC will deliver about 14Mflops. This offers less integer performance than the 50MHz Intel 486 but lots more floating point performance, on a good day cranking out 28 SPECint(92) and 13 SPECfp(92).

On the other hand, Intel has just rolled out its 66MHz 486DX2. While a sample of this wonderprocessor has yet to reach my hands, making me sceptical whether there is any real volume shipping going on, Intel reports (and would they lie?) that it achieves a SPECint(92) of 32.44 and a SPECfp(92) of 16. That comfortably buries the microSPARC in its current form.

Without clearly superior power (like the R4000 was supposed to have over the 486) a lot of the important difference the new Sun platforms need to find a place in the sun just isn't there. But as I have often pointed out in the past (and had pointed out to me) there's more to computing than sheer processor power. A detailed analysis of the strengths of the new machine will have to await my hands on review.

There's always software to make up the difference. The Sunergy (one leaked name for Sun's yet to be announced and heaven knows when delivered new product) supports only Solaris 2.1. This is Sun's version of SVR4 and one cause of a major open systems schism. Sunergy doesn't support Solaris 1.0 (really SunOS 4.0) and running on virtually every other Sun workstation sold thus far. And that's a problem.

Sun is trying to bring along Solaris 2.1 and next year (sometime) will offer it on the Intel X86 platform. To put the

old version on new hardware would cause confusion, says Sun guru DJ Walker-Morgan. I agree. However, Solaris 2.0 isn't yet on Intel and the magnetism for applications it is intended to produce has yet to appear.

Price-wise, Sun may be closer than ever before to what it calls 'the PC space' but perhaps not close enough, according to Valley sources. A Sunergy with a 15in 1024 x 768 colour monitor, 16Mb of memory; diskless, serial and parallel ports, SCSI-2; 8-bit audio and built-in Ethernet will cost a princely \$5500 in the US, it is rumoured. With 200Mb of disk (barely enough for the operating system) and a 16in screen, the price is \$6000, rising to \$8000 for a 19in, proper workstation-grade display.

Sun was shooting for \$5000. While taking aim, the target moved. Intel 486 systems of almost equivalent performance are now selling there for much less. Who knows what UK prices will be, but chances are the disparity between a cheap, but not nasty, 486 box and a Sunergy won't be narrower.

Has Sun blown it by not getting Sunergy well and truly into the PC space, and thereby cannibalising its own, higher-priced desktop sales? Will it suffer from the Mac Classic effect where volume doesn't necessarily lead to higher profits? Does Sun care?

Management on a mission

Perhaps the answer to the last is no. Like Apple, Microsoft and some portions of IBM, Sun's management is on a mission to gain critical mass. Sun has that in workstations but is not without competition both at the high and low end. While high-end esoterica will always be ultimate power and damn the cost, at the low end it is performance at a given price.

Then there's software availability: a slow starter given Sun's problems with device drivers on the Intel side. Once Solaris 2.0 is truly out for Suns and Intels then the applications story will be known. Arguably, the best thing to happen to Sun's low-end strategy (and the Unix side altogether) is the continual rollback of NT's bright new dawn.

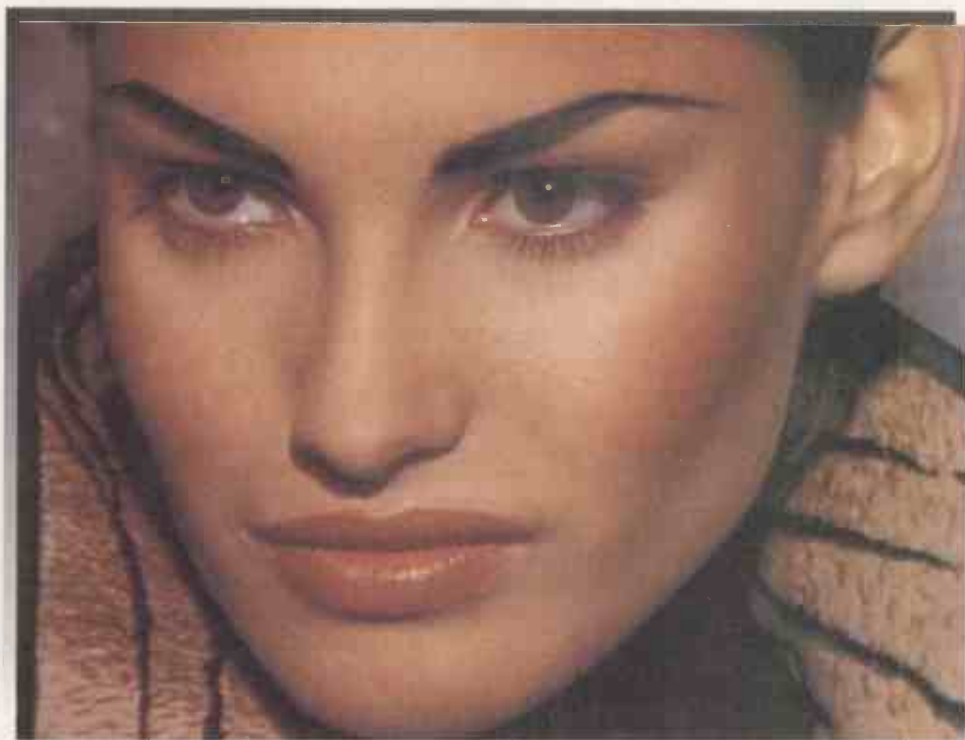
Soon Sunergy will be up against Apple and IBM's PowerPCs, what survives of the Advanced RISC Computer, HP's low-end PA and perhaps NeXT's RISC debut. It's likely future desktop computing will run Unix or a Unix-like operating system (NT?) but there is major divergence on what exactly.

Unix helps remove the fear of a non-Intel future. But can anyone come up with a suitable alternative to Pentium? When it comes, it probably won't be a tsunami.

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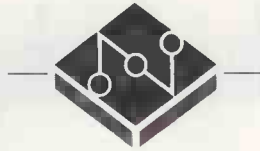
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Strengthening the weak link

Whether your network is five machines in one office or a local area network serving hundreds, one break in the chain can cause the same problem: lengthy and expensive downtime. Ralph Bancroft looks at ways of building in reliability from the start.

As companies become more reliant on applications running across corporate networks, so the need for system reliability increases. Reliability is important because any network failure could lead to loss or corruption of data. And any downtime while repairs take place can be costly because of lack of access to applications or, more likely, the data held in those applications.

Reliability is an issue on even the smallest network. Fortunately, there are simple steps you can take to build reliability into your network. For the large network, where the issue becomes more business-critical, a number of new developments should make it possible to build near bulletproof systems, rivaling the reliability of mainframe-based data centres.

Crossed wires

The most basic cause of network failure is in the wiring system. In a thin wire Ethernet network, a cable break disables the entire segment and the systems attached to it. Individual users are no longer able to see the server and can only continue working if the applications they use run off a local hard disk. Even then, they may not be able to print out the results of their work because the printers are attached to the server or another workstation.

Cable faults can be the most costly and irritating, as tracking down just where the break occurred can be fiddly and time consuming.

On a small network, say five users, this may not be too great a problem. It is a matter of checking every individual connection on the network and following the cable as it loops around the office to find if the cable is bent at an acute angle or pinched or trapped, causing a break in the wire. A simple insurance policy is to keep spare connectors

and cable handy to replace a faulty piece of the network.

On a larger network of ten or 20 users, the best insurance policy is to employ a professional contractor to install the cabling and test it before use. In selecting a contractor it is wise to find out what kind of maintenance service they provide. There are numerous tools available to track down cable faults; coupled with a fast call-out this can quickly get the network up and running again.

Above 20 users it is worthwhile considering spreading the risks by splitting the network into separate segments. A common strategy is to deploy a thick-wire Ethernet backbone running through a vertical riser in the building; repeaters on each floor provide an electronic barrier to the Ethernet segments running into each office. The exact arrangement should be decided on the advice of the cabling contractor, but the principal benefit is that failure of one segment of Ethernet only disables the users on that segment. There are still risks, though, if the segment that fails is the one that has the server or servers attached to it. In this case the whole building stops work until the fault is located and fixed.

An alternative arrangement is to consider a different kind of cabling scheme. One of the virtues of token-ring cabling is that if a break occurs the signal is automatically looped back; normally it would only be a single workstation or, at worst, a single server put out of action. Moreover, the location of the problem will be immediately obvious and can be fixed quickly.

Similar benefits can be had from unshielded twisted pair (UTP) Ethernet networks. This option is particularly attractive when moving into a new office. Using one of the several

structured cabling schemes now available, the under-floor space is 'flood wired' with UTP cabling and brought-up, floor-mounted sockets. Because the cabling is the same as that used for telephone systems, you have the built-in flexibility of using the cabling for phones or computers.

This kind of network can be visualised as a hub and spoke system. The UTP cabling all leads back to a central point and plugs into the network hub (or hubs). Now if a cable fault develops, only the workstation or server using that connection is put out of action. Corrective action entails little more than plugging the computer into an alternative floor socket: one principle behind flood wiring is that you have more outlets than you would ever need, but their distribution is such that there will always be a spare socket nearby, regardless of where you put a computer in the office.

In token-ring and UTP Ethernet networks there is still the concern that there is a single point of failure: namely, the access unit or hub. This need not be as serious as it sounds. They may be simple electromechanical devices employing 'make before break' connectors, so if a cable is accidentally pulled out, the internal circuit is automatically closed; this ensures the integrity of the network. Alternatively they can be intelligent devices managed from a workstation on the network. Any problems are then immediately notified to the management workstation which can also be used to reconfigure the device (for example, disabling a port if the computer on that connection is generating network errors or faulty packets).

With any professionally designed and installed cabling system the chances of failure are remote. With most of the cabling installed under-

floor or in ducting, it is just like the telephone system. The only really vulnerable part of the system is the cable from the PC to the floor or wall socket.

With the cabling sorted out, the reliability focus moves to the computers on the networks. At the workstation end, this may not be a serious problem (except in security terms, as discussed later). The most common problem is that the machine 'hangs', locking the user out of the network. In most cases, the solution is to get the user to reboot the PC or turn it off and on again. If the problem is caused by a hardware failure, the quickest response is to use someone else's PC while the problem is fixed. An alternative in some organisations (particularly where similarly-configured PCs are the norm) is to have one or more spare systems that can be swapped with the faulty unit.

Counting the cost

The main considerations here are what does that individual do and what is the cost to the business if they are without use of a computer? If the cost is high then the expense of the spare system strategy can be easily justified. If they are doing a job similar to others (like an accounts department), using an unused PC (or someone else's) might be preferred. Regardless of which approach is adopted, careful thought needs to be given to that person's network setup. If they are the only person using presentation graphics software it would not be sensible to have it only installed on one PC. Some companies get round this by making full use of log-in scripts and running all applications off the network server. That way, a user can use almost any workstation to log in to the network and be presented with access to all the applications they commonly use.

This approach, of course, increases concern about the reliability of the server. In single-server networks, or networks where servers hold business-critical data, you have a single point of failure on which the whole company may rely.

The failure can either be in the software or hardware. Software failure is largely avoidable providing it is running on the right hardware and this means making sure there is enough memory in the machine and enough hard disk space. That said, there has not been a network operating system or database server written without a bug in it. As with the workstations, taking the server down and bringing it back up again may be all that is required to cure the problem. If the problem persists it is time to give the software supplier a call.

Hardware failure is the thorniest issue. If the server hard disk fails, nothing less than a disk replacement and restore (you did have it backed up, didn't you?) will get the business up and running again. To avoid the downtime this could entail (a couple of hours if you are lucky, at least a day if you have to go out and buy a new hard disk) there are sensible precautions.

The most commonly used technique is disk mirroring. When data is written to disk it is mirrored on to a second disk drive. Should the primary disk fail, the server operating system automatically switches to the mirrored drive. You still need to replace the failed drive but you can now schedule this work to be carried out outside normal office hours. Once replaced, the server operating system will re-mirror the two drives. This may take some time and may slow down server response, so it is best to do it overnight.

You can go a stage further and use duplicate disk controllers as well as duplicate disks (known as duplexing). Now you are protected against controller failure as well as disk failure.

Power failure is the next danger to guard against. A sudden loss of power could corrupt data on the disk. If this data is any of the system files, you may have difficulty bringing the system back up again when power is restored. The solution here is to use an uninterruptible power supply (UPS) connected to the server. Firstly, the UPS can keep the server going for a limited time during which power may be restored. If not, the UPS can signal the server that it is running out of power and allow the server operating system to shut down in an orderly fashion without data loss or corruption.

Disk mirroring (or duplexing) and a UPS will guard against the more common threats to reliable operation but they are far from the only ones.

The network adapter card (and there may be more than one on a larger network) could fail. The only option here is to take the server down and replace the card. If you keep an identically configured card available for such an eventuality, a simple replacement may only take a matter of minutes. But you will need to carry out some checks once the server is up and running again. Normally, if a network adapter is going to fail it will do so under a heavy load. You need to check if there is a heavy load on the network and if so what is causing it. Failure to do so may result in the second adapter failing under the same conditions.

Many of the risks of server failure are inherent in the PC architecture. While

it is easy to duplicate disks, controllers and network adapters, the same cannot be said for the rest of the system. True, you can get dual processor systems (like the Compaq SystemPro) but currently the only server operating systems that support symmetrical multiprocessing are versions of Banyan Vines and SCO Xenix. A multiprocessing version of NetWare is still awaited while LAN Manager only supports asymmetrical multiprocessing (different tasks are allocated to different processors, so lose one processor and the server fails).

Similarly, there is only one set of memory chips (they might be spread over more than one board, but to the operating system it is a single memory space). Memory parity errors, while detected by the operating system still cause a server to fail; and there is only one expansion bus and motherboard.

The limitations of the PC architecture in business-critical environments have been known for some time, leading some US companies (like NetFrame) to develop innovative systems that get round some of the limitations. But these solutions are too expensive or proprietary for some tastes. What is needed are solutions from suppliers that companies already know and use.

In a sudden flurry of announcements back in October, Novell, Compaq and IBM in short order unveiled products that make the goal of reliable, fault-tolerant network servers possible.

Of the announcements, by far the most overdue but certainly the most comprehensive was from Novell. It must be four if not five years ago that the company first started talking about NetWare System Fault Tolerance (SFT) Level III. Where SFT Level I is disk mirroring and SFT Level II is disk duplexing, SFT Level III is mirroring of whole servers.

At your service

The concept is simple and elegant. You maintain two servers: the second server maintaining the same memory image and disk content of the first. If the first server fails due to hardware problems, the second server takes over without loss of data or any interruption of service to users.

Apart from fault tolerance, this arrangement makes it possible to carry out routine maintenance, such as hardware or software upgrades, during office hours. The network manager simply takes one server off-line to carry the work while the other server continues to service the network.

If the concept is so simple, why has it taken Novell so long to get its act

together? Well, it is not an easy feat to keep the two servers in perfect synchronisation. For the system to work it is not just the disks that have to be synchronised but the entire contents of system memory, and that means near instantaneous communications between the two servers. If the hardware failure occurs while the server is in the middle of a particular operation, the second server must step in immediately to ensure that the operation is completed.

Clearly, using the network for this inter-server communication is inadequate. Firstly, if the cause of the failure is in the network adapter all communication is lost. Secondly, even the speed of the network is too slow to ensure perfect synchronisation. Instead, SFT Level III uses a high-speed mirrored server link (MSL) via a fibre optic cable.

The use of a fibre optic link has other benefits as it allows the mirrored servers to be located at some distance from one another, like in different buildings. Useful for recovery after a disaster, like a fire. NetWare SFT III is by no means a cheap solution — a 250-user licence costs £12,000 — but for those businesses requiring maximum reliability

with disaster recovery it is a complete solution.

Compaq and IBM have chosen the alternative route of making the server hardware itself more reliable. Compaq's new SystemPro/XL builds on its existing fault-tolerant capabilities. The company was the first to bring drive array technology to PC servers. Its Intelligent Drive Array Controller (IDA) could manage an array of drives, reading and writing across all drives in the array simultaneously, so boosting disk performance.

The IDA could also be configured to provide RAID 4 fault tolerance. In this arrangement one drive in a four-drive array could be used to store parity information each time data was written to the array. If a disk in the array failed it could be replaced and the data regenerated by using the parity information and data on the other disks in the array.

Dramatic impact

While this was effective it had a dramatic impact on performance, as every disk write involved a write to the parity drive, thereby nullifying the performance advantage of using an array of drives. The IDA-2 in the SystemPro/XL supports RAID 5, an arrangement where parity is spread across all drives in the array, greatly boosting performance. The IDA-2 also comes with a battery backed 4Mb write cache that will ensure data held in the cache (but not written to disk) is preserved for eight to ten days. When the SystemPro is powered on again, the data is automatically written to disk.

Compaq has also incorporated error correcting code (ECC) memory in to the SystemPro/XL design. Normally if a parity error is detected it will cause a PC to crash. With ECC memory redundant bits are used, so when a parity error is detected it is automatically corrected. Normally ECC memory is used to correct single-bit errors. Compaq has gone further and its ECC memory can correct 2 and 4-bit errors which, says the company, will ensure that the server will continue operating even if an entire DRAM chip fails.

In addition to these hardware features, the SystemPro/XL also comes with a set of tools to manage the server. A feature called Automatic Server Recovery restarts the server after failure, and pages the server administrator in the event of a critical system error. Server Health Logs store information about the server and system errors.

These logs include information about server hardware and software configuration changes, as well as corrected ECC memory errors (so the administrator can be alerted when SIMM changes become necessary), and hardware and software errors that caused the system to fail. In addition, the IDA-2 keeps track of disk drive operational parameters allowing an administrator to be pre-warned about a degraded disk, allowing it to be replaced before it fails completely.

Most of the features in the SystemPro/XL are also available in the lower cost ProSignia line of servers (the main exception is the ECC memory). Further management of both types of server are possible over the network or telephone line using Compaq's Insight Manager and Server Manager/R.

IBM's new server offering is the PS/2 Server 295. Like the SystemPro/XL it comes with ECC memory, RAID 5 disk storage and monitoring and error recovery tools. The features are not, however, exactly the same.

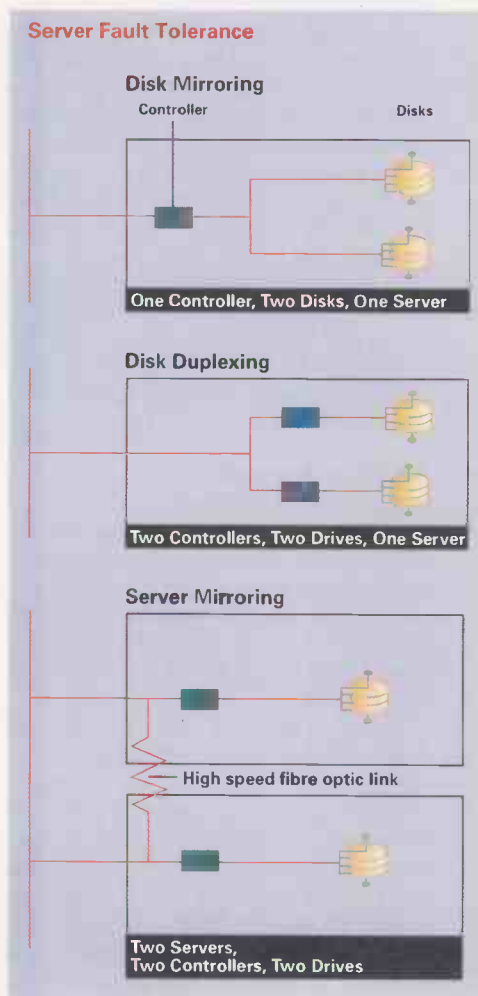
The ECC memory, for example, will only correct single-bit errors (although IBM says that this accounts for 95% of memory errors). IBM describes its disk technology as Orthogonal RAID 5 storage, by which it means it can recover from not only a drive failure but also after SCSI controller failure or SCSI bus failure. On the hardware side, it goes one better than Compaq by adding dual Micro Channel buses.

IBM's server management software is called Maximum Availability and Support System/2 (MASS/2). This includes the ability to restart after failure without human intervention, dial-out error notification, and dial-in monitoring and configuration management.

Both Compaq and IBM are so confident of the reliability of their new server systems that they are backing them with extended warranties. Both the SystemPro/XL and ProSignia systems come with three-year parts and labour warranty while IBM offers a three-year parts, one-year labour warranty on its latest PS/2 Model 95 servers, and a full three-year parts and labour warranty on the PS/2 Server 295.

With these announcements from Novell, Compaq and IBM it is clear that local area networks are now capable of offering a level of reliability and manageability to satisfy even the most sceptical of information system managers.

Ralph Bancroft is a freelance consultant and writer specialising in networking. He can be contacted on 081-861 5352, on CIX as ralphb, and on Telecom Gold as 92:jou002.



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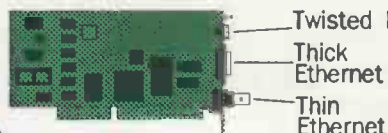
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Thanks for the memory

The old Amstrad 2000 series (PC2286 and PC2386) computers are capable of supporting a number of memory sizes other than their default configurations. However, you will find no mention in Amstrad's manuals of how to actually go about upgrading the memory. It should be within the capabilities of most users, is cheap and does not require any specialised skills.

Both machines have four sockets for SIMMs (Single In-line Memory Modules) on the motherboard. SIMMs are small circuit boards full of RAM chips which are designed to be easily plugged in by the end user. They come in four common sizes — 64K, 256K, 1Mb and 4Mb — and are advertised for sale at around £30 for a 1Mb part.

Both models use their four sockets differently, with separate rules about which combinations of SIMMs will work. The 2286 must have its sockets filled by one or two pairs of SIMMs, two SIMMs making up a pair being the same. Thus you can have two 256K SIMMs and two 1Mb SIMMs installed at the same time, giving you 2.5Mb, but you cannot get 3Mb using three 1Mb parts. The PC2386, however, requires that all four sockets contain SIMMs and that all of them are the same size.

After installing the SIMMs themselves you have to let the computer know what you have done. This is accomplished by adding or removing jumpers ('links' in Amstrad language) on the motherboard. Four links are used to specify the combination of different SIMMs and another two are set up to reflect their speed. SIMMs are available with RAM chips capable of running at a number of different speeds and it is important that the computer does not try to access them faster than they are capable of responding. You should set the links to choose a speed which is equal to or greater than the speed of the *slowest* SIMMs you are using. If you have a 140ns SIMM you should select the slower 150ns on the

links as the next fastest is 120ns and your SIMM would not work that fast reliably.

The legal SIMM combinations and link settings for both machines are shown in the tables below. If you have a PC2286 with twelve DRAM chips fitted into sockets on the motherboard you must remove them before using the SIMM sockets. You will know if this is the case because all four SIMM sockets will be empty.

The hard disks fitted to Amstrad 2000 series machines are mostly designated as either types one, 17 or 23. Any hard drive spotter can tell you that type one is 10Mb, and yet the 2386 always

had a 65Mb drive fitted and identified as type one. So what is going on?

The 2000 series was originally designed to use an Amstrad hard disk controller. Unfortunately this never worked, so a second Western Digital controller board was fitted to all the machines. This was a smart controller which, when told it had a type one drive, examined the drive itself to determine its dimensions. Attempting to use this BIOS/controller combination with anything other than the ST277R drive has proved problematic to say the least. Although the original BIOS does support different drive types, it does not support user defined drives.

Users, dealers and Amstrad can

spend a lot of time arguing about the exact nature of the incompatibility but fortunately there is a solution: upgrade to version 2.5 of the BIOS. It seems to work with all drive types, has user-defined types 49 and 50, and fixes a few other odd features in the original version. If Amstrad cannot supply them they can be bought as spare parts from CPCon (0772) 555034. You will have to ask for the part numbers 271634, 271635, 271636 and 271637 (to make up a set of four chips) and they cost £6.51 each. Once the BIOS is upgraded just plug in a different IDE disk drive, configure the BIOS and go!

Mark Bennett

PC2286 — Size Selection

Memory	Inner SIMMs	Outer SIMMs	LK20	LK19	LK18	LK17
512K	256K	Empty	In	In	In	Out
640K	256K	64K	In	In	Out	In
1Mb	256K	256K	In	In	Out	Out
2Mb	1Mb	Empty	In	Out	Out	In
2.5Mb	256K	1Mb	Out	In	In	In
4Mb	1Mb	1Mb	Out	In	In	Out
8Mb	4Mb	Empty	Out	In	Out	Out
16Mb	4Mb	4Mb	Out	Out	Out	Out

PC2286 — Speed Selection

Speed	LK21	LK22
80ns	Out	Out
100ns	In	Out
120ns	Out	In
150ns	In	In

PC2386 — Size Selection

Memory	Inner SIMMs	Outer SIMMs	LK22	LK21	LK20	LK19
1Mb	256K	256K	In	In	Out	Out
4Mb	1Mb	1Mb	Out	In	In	Out
16Mb	4Mb	4Mb	Out	Out	Out	Out

PC2386 — Speed Selection

Speed	LK23	LK24
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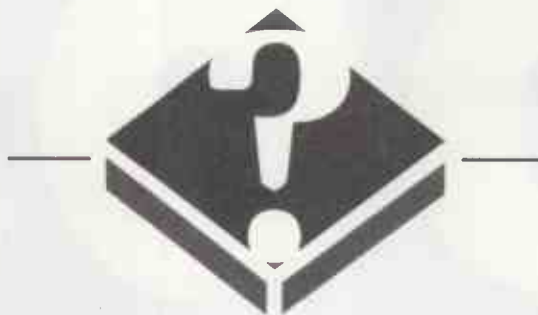
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PC security

I have tried to find a method of password-protecting the bootup sequence of my PC, but haven't found one that ensures security while maintaining compatibility with existing software.

I tried installing XTree's ALLSAFE (software for virus and PC security). This program managed to password protect the bootup sequence, including the disabling of the Control-Break combination, and initially seemed ideal for my security requirements. I found several errors with this software though: most significantly incompatibility with Windows 3.x and a tendency to produce 'Out of Memory' errors.

Out of Memory could be eliminated by removing most programs installed in the AUTOEXEC.BAT file, including 'C:\WINDOWS\SMARTDRV.EXE', needed to run Windows at efficient speed. But there was no way of rectifying the incompatibility of this software with the programs I am running under the Windows environment, such as XTree Gold, QBasic and Smartware II.

Secondly, I tried writing a small MS-QBasic program which I installed in the AUTOEXEC.BAT file, which asked for a password while booting up the computer. This program worked, but could be overridden by pressing Control+Break while it was booting.

I contacted Microsoft and Elonex (the PC manufacturer) to find out if it was possible to disable this key combination, but they couldn't suggest a method of fully protecting a PC and suggested I contact a magazine for ideas.

Glenn Thompson

Protecting the data on a PC interests a number of people. The Ministry of Defence is keen to ensure the contents of its hard disks are kept from prying eyes.

The most effective solution, from the MOD's point of view, is to use a computer with a removable hard disk cartridge, locked in a safe when not in use.

You should decide how far you wish to go to achieve 'full' protection. If you really do mean full, a removable hard disk cartridge is the best option. Tandon produces the best-known system for this, the Data Pac (see PCW October 1991 page 206 for review of a Pan-based machine). There are other removable cartridge drives: Syquest (as used by Atari PCs) and Bernoulli (see April 1992 page 162) which may be added to machines.

The next best idea is to encrypt your hard disk contents with an encrypting controller (at considerable cost) or using a suitable device driver. The latest version of SuperStor can password protect data as well as compressing it, and is compatible with everything I've tried it with. You enter a password (then used to decode data). But passwords can always be discovered by someone determined, especially if the computer is left unattended. When this is pointed out to the designers their reaction is 'that's cheating!' but however clever the mechanism, you still have to protect it from cheats.

The simplest way to stop others using your computer is use the keyboard lock standard on most machines. If yours is without, a computer engineer could easily fit one and disable any part of the machine you wish.

Some new machines incorporate a password in their BIOS chips which stops them booting if it is not entered. You may be able to obtain a BIOS upgrade with this feature. Although effective against colleagues, a keyswitch or BIOS password is no protection against a determined hacker. The hard disk could be removed and read on a

completely different machine.

The simplest protection is a password program in your autoexec.bat file, as you tried. It is possible to disable Control-Break checking by re-vectoring the keyboard handler, though this might be difficult using BASIC. This wouldn't stop a hacker as he could simply boot the computer from a floppy and bypass any startup checks you installed.

DRDOS 6.0 comes with built-in password protection, for the whole disk and for individual directories; this is worth considering as a replacement for MSDOS (see August 1992 page 398).

A simple file encryption program to scramble individual files may be the best answer. Just write a program which XORs each byte in the file with the next letter from a password and use it to encrypt and decrypt: XOR something twice and you get back to where you started. It may not be completely secure but it's the cheapest solution.

Frank Leonhardt

Added drive

Can I add a second IDE drive of a different type to my controller?

Brian Ford

In theory. In practice there are lots of incompatibilities associated with this and it doesn't always work. You are unlikely to do any damage by trying and it's by far the easiest way to tell. If the second drive doesn't work there is little you can do. Some IDE drives have different pin connections (though the same connector) so check this.

Frank Leonhardt

Computer Answers can be contacted on 081-429 3047, by Fax on 081-868 3754 or via e-mail as uab1018@dircon.UUCP or leo2@cix.compulink.co.uk

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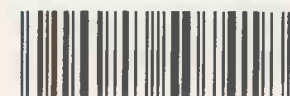
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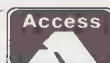
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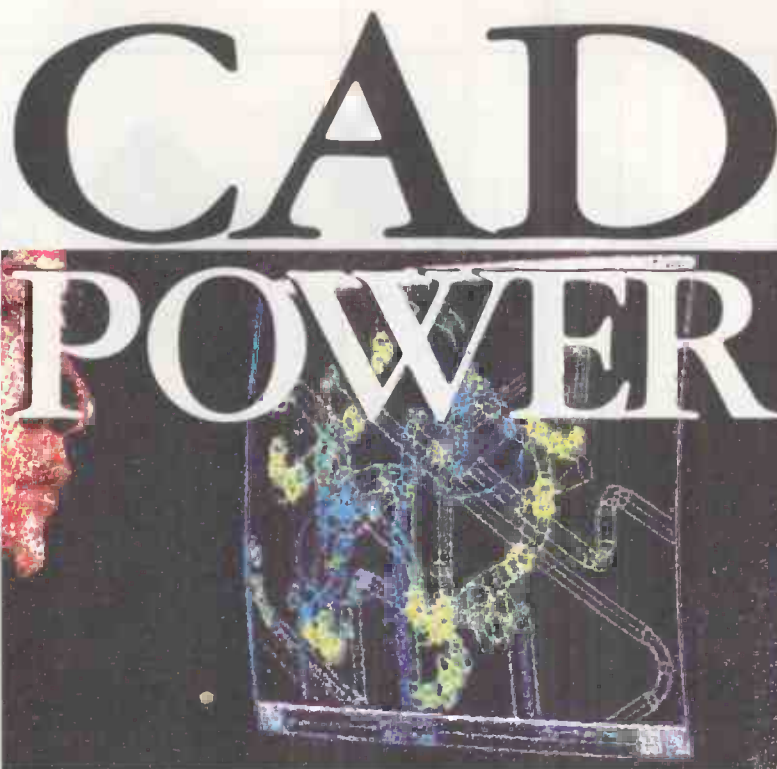
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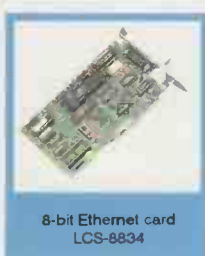
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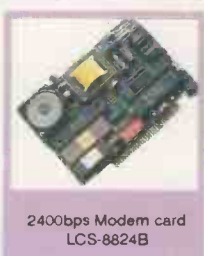
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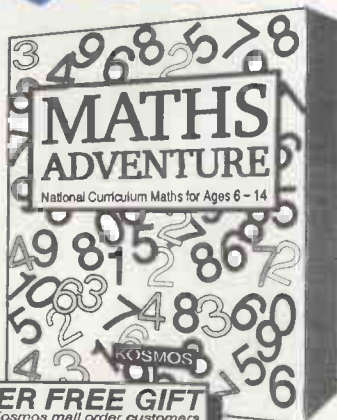
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BIOS:	AMI	AMI	AMI	AMI	AMI	AMI
Main Memory:	2 MB	2 MB	4 MB	4 MB	4 MB	4 MB
Cache Memory:	-	64K	256K	256K	256K	256K
VGA Card:	512K	1 MB	1 MB	1 MB	1 MB	1 MB
Colour Monitor:	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA
Serial/Parallel ports:	2/1	2/1	2/1	2/1	2/1	2/1
Keyboard:	UK 102 key	UK 102 key	UK 102 key	UK 102 key	UK 102 key	UK 102 key
Case:	Desktop	Desktop	Desktop	Desktop	Desktop	Desktop
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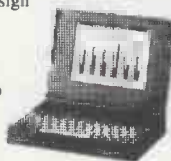
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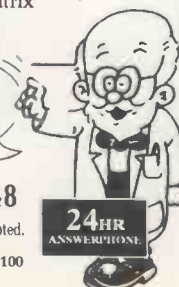
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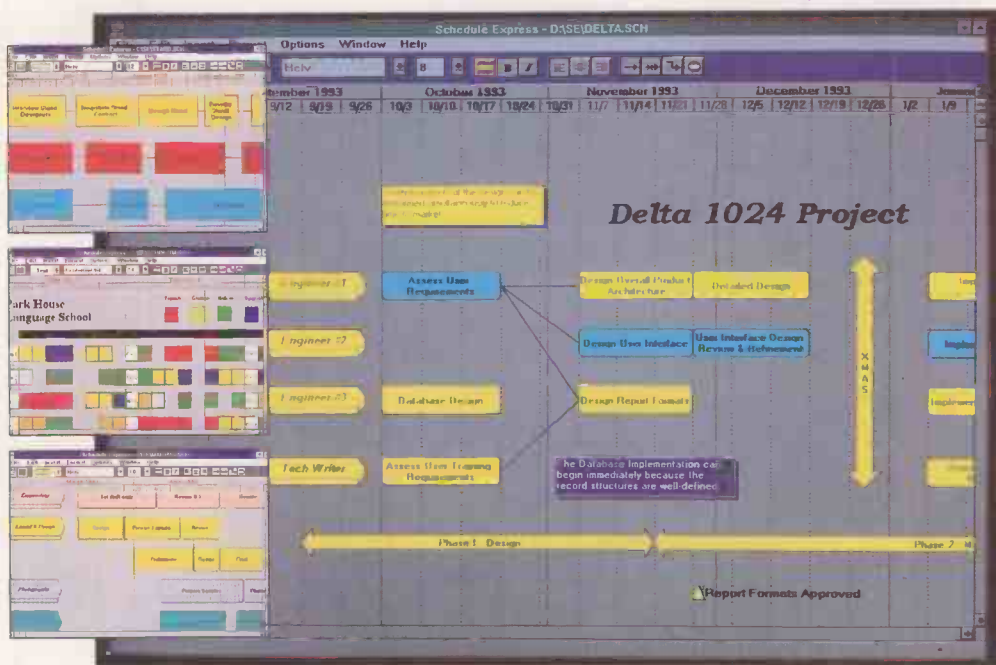


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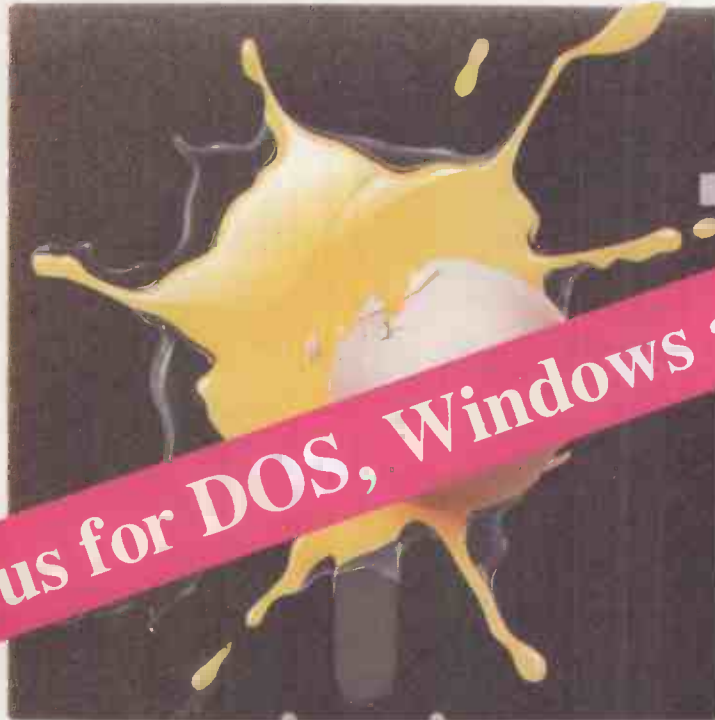
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- 5007 IMAGE-3D CGA/EGA/VGABeginners 3D design package (1)
- 5010 PC-KEY DRAWHighly flexible C.A.D. system (TD4)
- 5011 DANCAD-3DAdvanced 3D C.A.D. program (HD5)
- 5012 FINGER PAINTAlternative to GEM. V. Good (1)
- 5013 COGOCivil engineering 2D/3D modelling (2)
- 5014 EGA COLOURING BOOKDelightful kid's program (HD2)
- 5020 FLO DRAWChart design + tutorial (3)
- 5035 VGA CAD3D Design
- 5036 VGA PAINTPaint Prog (1)
- 5050 DRAFT CHOICEImpressive Graphics Tool (1)
- 5053 GRAPH TIME IIThe latest in graphing (2)
- 5057 PC-ROUTEPrinted circuit program (1)
- 5061 QUICK ROUTENew UK printed CCT prog. (1)

GAMES & MUSIC

WPS

ACCOUNTS

COMMS

BUSINESS

UTILS

- 5068 ENVISION PUBLISHERFirst shareware DTP prog. (HD2)
- 6002 BACKGAMMON, CRIBBAGE + DRAUGHTSBoardgames (1)
- 6004 SLEUTHDetective graphic adventure (1)
- 6005 PAGANITZU CGA/EGAGraphic Adventure Game (HD1)
- 6007 SAILING/CGASimulation Game (1)
- 6014 CARD GAMESBridge, Canasta, Hearts & Poker (1)
- 6015 ARCADE 1Collection of four games (1)
- 6016 ARCADE 2Collection of many games (1)
- 6018 ARCADE 4Collection of many games (1)
- 6020 CASINO 1Collection of four games (1)
- 6021 COMPOSER CGACompose and print your own music (1)
- 6030 JUMPMAN LIVESArcade Game. CGA/EGA/VGA (1)
- 6031 DARK AGESRequires 286 or better. (HD1)
- 6032 RETURN TO KROZGraphics Adventure game (1)
- 6033 CAVERNS OF KROZGraphic Adventure Game (1)
- 6034 ARTIC ADVENTURENevada Smith Adventure (1)
- 6038 CROSSWORD CREATORCustomised Entertainment (2)
- 6044 FORD SIMULATOR 2Driving simulator (2)
- 6046 CROSSWORD SOLVERCrosswords & Anagrams (1)
- 6048 MORAFF'S ENTRAP + S'BLASTArcade Game (1)
- 6049 CAPTAIN COMIC ECAAdventure game (1)
- 6060 SOLITAIRE CARD GAMESInc Canfield, Vegas etc (1)
- 6062 COMMANDER KEENTrilogy — 3 disks — avail. sep.
- 6064 MONUMENTS OF MARSRequires 286 or better (HD1)
- 6065 DUKE NUKEMRequires 286 or better (HD1)
- 6066 PHAROAH'S TOMBGraphics adventure (1)
- 6067 CAVES OF THORGraphics adventure
- 6068 MUSICIANS TOOLBOX EGAMusical Training Aid (1)
- 6069 SECRET AGENT EGA/VGAAdventure Game (HD1)
- 6070 WOLFENSTEIN 3DMin 286 720k or 1.2Mb drive
- 6071 COSMO'S COSMIC ADVENTURE8DI min 286 720k 1.2m
- 6073 SHOOTING GALLERY VGAClay Pigeon/Funfair (1)
- 6074 POWERCHECKSHerc. 2 VGA (1)
- 7002 GALAXYWord Star clone. Very fast (1)
- 7035 TUTORIAL WRITERAuthoring system (1)
- 7038 SHARPPELLStand Alone Checker (1)
- 7039 POWERMERGEManaging Mail Merge (1)
- 8002 HOME BUDGETHome finance (1)
- 8004 TIME & MONEYPersonal and small business accounts (1)
- 8006 LEDGER MASTERLatest accounts pkge (HD4)
- 8007 MR BILLProfessional billing system (2)
- 8012 PELTONSFinancial Utilities (HD2)
- 8014 TRINITYPersonal Finance (1)
- 8020 RETIREPlan for the future (1)
- 8026 PAYE MASTERNew UK prog. (HD3)
- 8028 PAGE FINANCIAL CTRLAccounts clone HD (2)
- 8033 CHEQUE IT OUTCheque Book Manager (1)
- 9003 ODYSSEYModern Comms Program (HD1)
- 9004 WILDCATBulletin Board system (HD2)
- 9005 KERMITClassic comms program (1)
- 9013 RBBSBulletin board HD (4)
- 9014 WEAK LINKFile Download Prog (1)
- 9015 EAZILINKFor View data/BBS (HD1)
- 9016 QVTDEC Terminal Emulator (1)
- 9017 SAPPHIREEasy 60 Use BBS (HD1)
- A002 MARKETEERContacts Manager (HD2)
- A005 ESTI-BIDProfessional estimating & job costing (6)
- A006 MAKE MY DAYTime scheduling, expenses etc (2)
- A008 PORTFOLIOReturn on investments and shares (1)
- A010 SUPERSTOCKU.K. Stock program (HD2)
- A014 IN CONTROLBusiness scheduling and reporting aid (2)
- A016 CONTRACT MANAGERGeneral Purpose Database (HD2)
- A017 EMPLOYEE MANAGEMENTControls this important area (1)
- A019 TIMETRAKTime management (1)
- A022 LEADMASTER(1)
- A024 SLOG 1Inventory/insurance tracker (HD1)
- A035 RESUME(1)
- A031 STOCKInventory control (1)
- A040 INVENTORY MASTERStock Control Prog (1)
- A051 PERSONAL PORTFOLIO MANAGERfor tracking graphing etc (HD2)
- A053 STARBURST MAINTENANCE (1)
- A054 UK COMPANY FORMATION (1)
- A057 STOCKTAKERFor pubs, hotels etc. (1)
- A058 TIME LORDTime Manager (HD2)
- A059 SHARE GENIUS EGA/VGAStock Investment Program (HD1)
- A061 HERSCHEL MFG SYSMFG Control sys. Min 286 (HD9)
- A064 FIXED ASSET REGISTER 3Asset Control (HD1)
- A065 BROKER MANAGEMENTFor agents/brokers (HD1)
- B007 MULTI TASKINGTwo multi-tasking programs (1)
- B026 POWER MENUModern Menuing Program (HD2)
- B029 PROFESSIONAL MASTERKEYMenu driven utils (1)
- B048 PK-ZIPStandard file archiver (1)
- B053 ON SIDEVersatile side print (1)
- B056 ANTI-VIRUS PROTECTIONVery Efficient Suite of Programs (HD2)
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- B073 FASTBATBatch compiler (1)
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START

LOOKING FOR
A NEW PC

END

UP WITH A
GREAT COMPUTER
FROM SILICON VALLEY

DAY 35

**LOSE YOUR
SHIRT**



DAY 34



**HIT THE
JACKPOT!**

DAY 33

**OUT OF SPACE
ON HARD DISK**

MISS A
TURN

DAY 32

**SILICON VALLEY
COMPUTER RACES
THROUGH TEST
GO FORWARD
2 DAYS**

DAY 31

STAB IN



THE DARK!

DAY 30

**MACHINE FROM
THE EAST
BREAKS DOWN ~
WAIT 2 WEEKS
FOR REPAIRS**

DAY 29

**ARRIVE AT
SILICON VALLEY
~
FREE
PARKING**

DAY 1

BUY 12
COMPUTER
MAGAZINES
£50

DAY 2

**TAKE A
CHANCE**



DAY 3

MAKE 24
PHONE CALLS
~
LOSE
2 DAYS

DAY 4

LEAVE QUOTES
ON TAXI ~ GO
BACK 2 DAYS

DAY 5

CONFUSED BY
CONFLICTING
INFORMATION -
GO BACK
2 DAYS



THE COMPUTER



THE FAVOURITE TO WIN

There's nothing like good old-fashioned craftsmanship – and there's nothing like straight-talking sales people, either. There's no mumbo-jumbo in our machines – just that good, hard-to-find element that's hard to find nowadays – quality. There's no mumbo-jumbo in the sales end either – just straight talk, and nothing like 'going for the close' or 'selling up'. If you don't know much about buying a PC, well, don't worry! We'll tell it like it is in language so simple an EEC financial minister could understand it. And if you're a technical boffin, well, we've got people who speak your language, too.

Whatever kind of buyer you are, buying a PC is a tough job - it's a minefield out there. Just look at all the ads in this magazine. It's difficult making a meaningful like-for-like comparison, isn't it? Go ahead, buy the magazines, make the phone calls and visit all the showrooms. You'll come back to us - we'll bet on it! Again and again and again.



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Silicon Valley Computer Systems PLC

Sparepenney House 5 Stroud Wood Centre Frogmore Park Street St Albans Hertfordshire AL2 2NF Fax: 0727 873701

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DAY 28

**SOME KEYS DON'T
WORK ON CHEAP
MACHINE ~
GO BACK 3 DAYS**

DAY 27

**TOUCH
WOOD**



DAY 26

**LAND BIG CONTRACT
BY RESPONDING
QUICKLY WITH
SILICON VALLEY
COMPUTER ~
GO ON TO FINISH**


DAY 25

**HOPE FOR
THE BEST**



DAY 24

**HAVE DIFFICULTY
NETWORKING
EASTERN MARVEL
~
GO BACK 4 DAYS**

DAY 6 RECEIVE 7 QUOTATIONS ~ LOSE 5 DAYS EVALUATING	DAY 7 VISIT 6 SHOWROOMS AND UNTOLD DEMOS ~ LOSE 4 DAYS	DAY 8 BUY COLOUR- BLIND MONITOR GO BACK 4 DAYS	DAY 9 RISK  EVERYTHING	DAY 10 SUPPLIER GOES BUST ~ GO BACK 3 DAYS	DAY 11 ARRANGE A DEMONSTRATION AT SILICON VALLEY ~ MOVE AHEAD 5 DAYS
---	--	---	--	--	--

BUYING GAME



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BEST BUY**

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the show' 'the perfect choice'



'a very high specification system'



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heavy-duty 102-key UK keyboard

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in Midi Tower or
Full Tower

DAY 12

**CHANCE
YOUR
ARM**



DAY 13

HAVE A



GAMBLE

DAY 14

**DON'T GET
ENOUGH RAM ~
LOSE A WEEK
WAITING FOR
UPGRADE**

DAY 15

**FINGERS
CROSSED!**



DAY 16

**SILICON VALLEY
DEMONSTRATION
BLOWS YOUR MINI
GO FORWARD
3 DAYS**

DAY 17

**MAKE A
DECISION
~
MOVE AHEAD
4 DAYS**

DAY 23

**LOSE A WEEK ~
MACHINE FROM
FAR EAST
SUFFERS FROM
JET LAG!**

DAY 22

FEEL LUCKY!



DAY 21

**MACHINE ARRIVES
FROM FAR EAST,
BUT IT WON'T
WORK ~
LOSE 8 DAYS**

DAY 20

**HEDGE
YOUR
BETS!**



DAY 19

**BUY A
SILICON VALLEY
COMPUTER ~
MOVE AHEAD
7 DAYS**

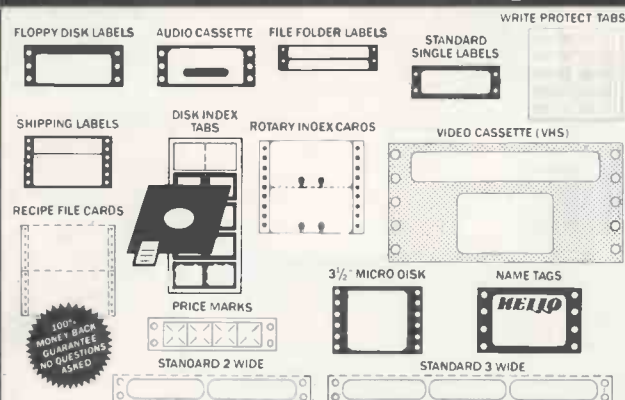
DAY 18

**EXCEED
BUDGET
GO TO
JAIL**

	386sx25	386sx33	386dx33	386dx40	486sx25	486sx33	486dx50	486dx2-50	486dx2-66	486dx33E	486dx50E	486dx33	486dx2-66E
PU	AMD	AMD	Intel	AMD	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel
5 FLOPPY DRIVE	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb	1.44mb
R 5.25 FLOPPY DRIVE	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb	1.2mb
EXPANSION SLOTS	6	6	8	8	8	8	8	8	8	8	8	8	8
PARALLEL PORTS	1	1	1	1	1	1	1	1	1	1	1	1	1
AME PORTS	1	1	1	1	1	1	1	1	1	1	1	1	1
ERIAL PORTS	2	2	2	2	2	2	2	2	2	2	2	2	2
MONITOR	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA
5", 17" & 20" OPTIONS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
CACHE MEMORY	ISA 0-32k	ISA 0-32k	ISA 64-256k	ISA 64-256k	ISA 64-256k	ISA 64-256k	ISA 64-256k	ISA 64-256k	ISA 64-256k	EISA 128k	EISA 128k	ISA 256k	EISA 128k
RAM MEMORY	1-16mb	1-16mb	4-32mb	4-32mb	4-32mb	4-32mb	4-32mb	4-32mb	4-32mb	4-64mb	4-64mb	4-64mb	4-64mb
IS DOS 5	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
IOS	AMI	AMI	AMI	AMI	AMI	AMI	AMI	AMI	AMI	AMI	AMI	AMI	AMI
with 42mb HARD DRIVE	651	682	762	763	789	959	1151	1111	1171	-	-	-	-
with 80mb HARD DRIVE	683	714	794	764	821	1011	1183	1143	1203	-	-	-	-
with 120mb HARD DRIVE	706	737	817	787	844	1034	1206	1168	1226	-	-	1144	-
with 127mb HARD DRIVE	748	779	859	829	886	1076	1248	1208	1268	-	-	-	-
with 130mb HARD DRIVE	762	796	873	843	900	1090	1262	1222	1282	-	-	-	-
with 212mb HARD DRIVE	-	-	950	920	977	1167	1339	1299	1259	2239	2843	1306	2716
with 340mb HARD DRIVE	-	-	1211	1181	1238	1428	1600	1560	1620	2415	3019	1554	2892
with 520mb HARD DRIVE	-	-	1330	1300	1357	1547	1719	1679	1739	2610	3214	1749	3087
with 900mb HARD DRIVE	-	-	-	-	-	1848	2020	1980	2040	2987	3591	-	3464

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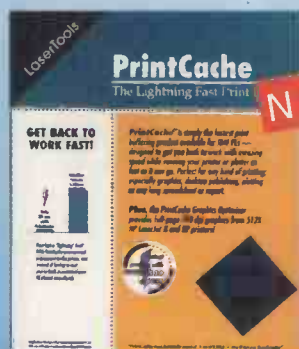
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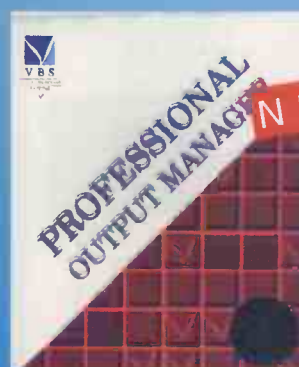
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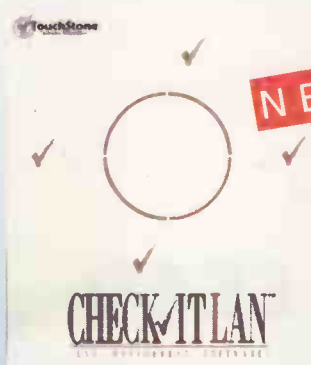
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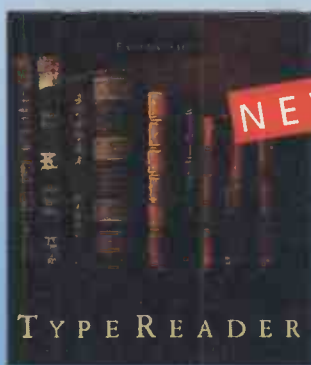
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Single Colours	F	4.09	3.87	3.66	3.44
8256/8512/9256/LQ3500	M	3.47	2.95	2.66	2.39
9512/9512+	F	3.36	2.86	2.57	2.31
9512/9512+	M	3.23	2.75	2.48	2.23
LQ5000	F	5.23	4.45	4.01	3.61

		2+	5+	10+	20+
BROTHER					
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M1109/1709	F	4.70	4.00	3.60	3.24
M1724	F	4.45	3.78	3.40	3.06
M1818/1824/1924/1324	F	4.61	3.92	3.53	3.18
M2518	F	11.22	9.54	8.59	7.73

		2+	5+	10+	20+
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		2+	5+	10+	20+
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		2+	5+	10+	20+
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		2+	5+	10+	20+
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MOP45/HOP45	F	4.28	3.64	3.28	2.95
PRODOT 24/HOP40	F	3.46	2.94	2.65	2.39
Single Colours	F	4.15	3.94	3.71	3.50
120D/124D/LSP10/100	F	3.27	2.78	2.50	2.25
Single Colours	F	3.92	3.72	3.50	3.30
Swift 24, Swift 9, 224	F	3.27	2.78	2.50	2.25
Single Colours	F	3.92	3.72	3.50	3.30
4 Colour	F	8.22	6.99	6.29	5.66
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		2+	5+	10+	20+
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MPS802/VC1512/1521/6	F	4.62	3.93	3.54	3.19
MPS802/VC1512/1521/6	M	3.83	3.26	2.93	2.64
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MPS1230	F	3.72	3.16	2.84	2.56
MPS1500/1550	F	5.08	4.32	3.89	3.50
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LX400/800, FX800/850	F	3.41	2.90	2.61	2.35
Single Colours	F	4.15	3.94	3.71	3.50
MX70/80/82, RX80	F	3.41	2.90	2.61	2.35
Single Colours	F	4.15	3.94	3.71	3.50
FX100/105/286/1000/1050	F	4.03	3.43	3.09	2.78
LX1000, MX/RX100/105	F	4.03	3.43	3.09	2.78
LX800/850, GX80	F	3.21	2.73	2.46	2.21
LP1500, LQ1500	F	3.75	3.19	2.87	2.58
LQ200/400/450/500/510	F	3.46	2.94	2.65	2.39
550/800/850	F	4.15	3.94	3.71	3.50
Single Colours	F	4.15	3.94	3.71	3.50
LQ1000/1050/1070	F	4.28	3.64	3.28	2.95
EX800/LQ2500/2550/860	F	3.66	3.11	2.80	2.52
4 Colour	F	7.23	6.15	5.54	4.99

		2+	5+	10+	20+
FACIT					
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		2+	5+	10+	20+
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DL2300/3300/3400	F	3.74	3.18	2.86	2.57
DX2000/2100/2200/2300	F	3.74	3.18	2.86	2.57

		2+	5+	10+	20+
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2300/5152	F	3.41	2.90	2.61	2.35
Single Colours	F	4.15	3.94	3.71	3.50
82	M	4.07	3.46	3.11	2.80
480, Prop 24XL	F	5.29	4.50	4.05	3.65

		2+	5+	10+	20+
JUKI					
6100/6100A/6100-1	M	4.07	3.46	3.11	2.80

		2+	5+	10+	20+
MANNESMANN TALLY					
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MT80/81, SP80	M	3.83	3.26	2.93	2.64
MT86/88	F	5.02	4.27	3.84	3.46
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		2+	5+	10+	20+
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MP201	F	4.03	3.43	3.09	2.78
MP135/480	F	4.62	3.93	3.54	3.19
MP135/480	M	3.83	3.26	2.93	2.64
NEC					
Pinwriter P1/P2/P6	F	4.28	3.64	3.28	2.95
Pinwriter P3/P7	F	4.85	4.12	3.71	3.34
P6+/P7+, P60/P70	F	3.83	3.26	2.93	2.64
P2200/P2+	F	3.58	3.04	2.74	2.47
P20/P30/P3300	F	4.39	3.73	3.36	3.02

		2+	5+	10+	20+
OKI					
120/ML182/192/193/195	F	3.57	3.03	2.73	2.46
ML320/321/380/390/391	F	3.57	3.03	2.73	2.46
ML393	F	9.03	7.68	6.91	6.22

		2+	5+	10+	20+
OLIVETTI					
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DM105	F	5.08	4.32	3.89	3.50
4 Colour	F	6.89	5.86	5.27	4.74
DM250	F	3.74	3.18	2.86	2.57
DM280/290	F	4.45	3.78	3.40	3.06

		2+	5+	10+	20+
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KXP1081/1082/1083/1090	F	3.68	3.13	2.82	2.54
Single Colours	F	5.80	5.51	5.23	4.97
KXP1091/1092/1160/1170	F	3.68	3.13	2.82	2.54
Single Colours	F	5.80	5.51	5.23	4.97
KXP1180/1190/1592/1595	F	3.68	3.13	2.82	2.54
Single Colours	F	5.80	5.51	5.23	4.97
KXP1123/1124	F	3.68	3.13	2.82	2.54
Single Colours	F	5.80	5.51	5.23	4.97
KXP1524/1540/1624/1654	F	4.29	3.65	3.29	2.96

		2+	5+	10+	20+
QUME					
MSIV/Sprint 7/9/10/11	F	4.09	3.48	3.13	2.82
MSIV/Aprint 7/9/10/11	M	3.69	3.14	2.83	2.55

		2+	5+	10+	20+
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15	F	3.44	2.92	2.63	2.37
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Infurunner	F	5.29	4.50	4.05	3.65

		2+	5+	10+	20+
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SL90/92	F	5.24	4.45	4.01	3.60
SL80/SP180/1000/1200	F	3.47	2.95	2.66	2.39
Single Colours	F	4.09	3.87	3.66	3.44
SP1600/1900/2000/2400	F	3.47	2.95	2.66	2.39
Single Colours	F	4.09	3.87	3.66	3.44
SL80/SP180/1000/1200	M	3.47	2.95	2.66	2.39
4 Colour	F	8.40	7.14	6.43	5.79
SP1600/1900/2000/2400	M	3.47	2.95	2.66	2.39

		2+	5+	10+	20+
SHINWA					
CP80	F	4.62	3.93	3.54	3.19
CP80	M	3.83	3.26	2.93	2.64

		2+	5+	10+	20+
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Single Colours	F	4.00	3.78	3.58	3.36
FR10/15, LC15, NX24-10	F	3.24	2.75	2.48	2.23
Single Colours	F	4.00	3.78	3.58	3.36
LC24-200, XB24-250	F	3.24	2.75	2.48	2.23
Single Colours	F	4.00	3.78	3.58	3.36
4 Colour	F	8.40	7.14	6.43	5.79
LC200/NX1020	F	2.94	2.21	1.99	1.79
4 Colour	F	6.56	5.58	5.02	4.52
NB15/24-15/NL15	F	5.10	4.34	3.91	3.52
NB24-10/ND/NG/NL10	F	4.33	3.68	3.31	2.98
ND15/NR15/NX15	F	5.42	4.61	4.15	3.74
Delta Gemini 10, DP510	F	2.33	2.21	2.08	1.96
SD10	F	4.57	3.88	3.49	3.14
SD15	F	5.96	5.07	4.56	4.10

		2+	5+	10+	20+
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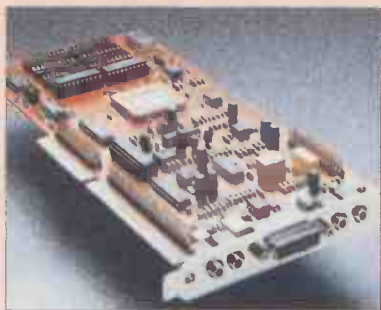
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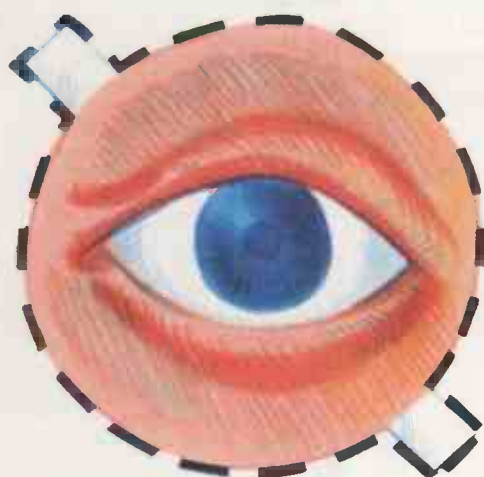
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Processor:	80486DX2	80486DX	80486DX2	80486DX	80486SX	80386DX	80386SX
Processor speed:	66MHz	50MHz	50MHz	33MHz	25MHz	40MHz	33MHz
BIOS:	AMI	AMI	AMI	AMI	AMI	AMI	AMI
Shadow RAM:	YES	YES	YES	YES	YES	YES	YES
Cache Memory (max):	256KB	256KB	256KB	256KB	64KB(256KB)	64KB(256KB)	0KB
Main Memory (max):	4MB/(256MB)	4MB/(256MB)	4MB/(64MB)	4MB/(64MB)	4MB/(64MB)	4MB/(64MB)	2MB/(16MB)
IMB Video card:	1MB RAM	1MB RAM	1MB RAM	1MB RAM	1MB RAM	1MB RAM	1MB RAM
Colour Monitor:	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA	14" SVGA
Serial/Parallel ports:	2/1	2/1	2/1	2/1	2/1	2/1	2/1
Keyboard:	UK 102 Key	UK 102 Key	UK 102 Key	UK 102 Key	UK 102 Key	UK 102 Key	UK 102 Key
Case:	MT/DT	MT/DT	MT/DT	MT/DT	MT/DT	MT/DT	MT/DT
Power Supply Unit:	200 Watts	200 Watts	200 Watts	200 Watts	200 Watts	200 Watts	200 Watts
Floppy Disk Drive:	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB
DR DOS 6/MS DOS 5.0:	Optional	Optional	Optional	Optional	Optional	Optional	Optional
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Microsoft DOS 5.0 & Windows 3.1
Desktop or Mini Tower case

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486/50 DX2	1859	2041	2162	2513
486/50 DX	1924	2106	2227	2578
486/66 DX2	1999	2181	2308	2653

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(VESA standard for 72Hz flicker-free display)
2 serial, 1 parallel & 1 game port
Enhanced 102 key Cherry keyboard
High resolution serial mouse with pad
Microsoft DOS 5.0 & Windows 3.1
Desktop or Mini Tower case

	NO HD	120MB	210MB	520MB
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486/50 DX2	1499	1680	1801	2151
486/50 DX	1565	1746	1867	2218
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VESA 72Hz flicker-free display
2 serial, 1 parallel & 1 game port
High resolution serial mouse with pad
Microsoft DOS 5.0 & Windows 3.1
Desktop or Mini Tower case

	NO HD	120MB	210MB	520MB
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486/50 DX2	1671	1852	1973	2324
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486/66 DX2	1828	2009	2131	2481

486 Local Bus Win-Station

286k Super fast Cache SRAM
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High throughput super IDE caching Controllers (W/2MB)
Reduces average disk seek to 0.3ms
120MB 15ms IDE drive w/64k cache
32 bit Local Bus S3 Graphics engine w/1MB VRAM
up to 1280 x 1024 resolution
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2 serial, 1 parallel & 1 game port
Enhanced 102 key Cherry keyboard
High resolution serial mouse with pad
Microsoft DOS 5.0 & Windows 3.1
Desktop or Mini Tower case

	NO HD	120MB	210MB	520MB
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486/66 DX2	1524	1706	1827	2178

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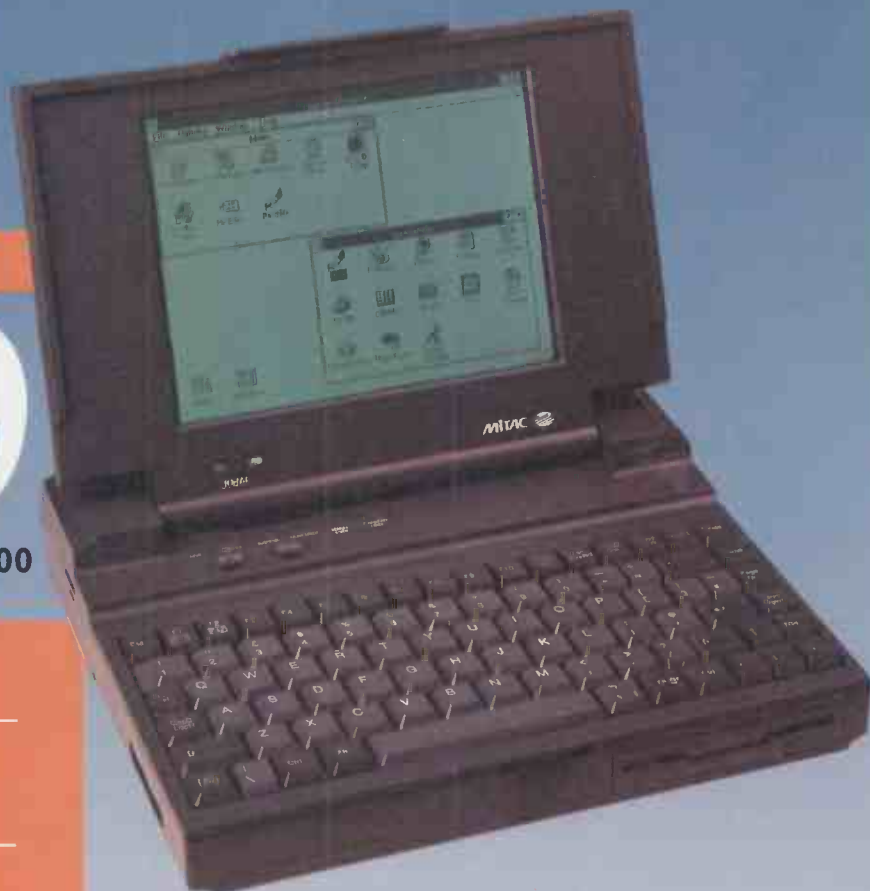
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Personal Computer World

MICROMART INDEX

519

PRODUCT INDEX

HARDWARE	Price	ECP Score	Feature	Page No.
Desktop PC				
80386SLC 25MHz				
IBM PS/2 56 486SLC2	£2,276.00	9.1	Benchtest	276
80486DX2 66MHz				
Dan for Windows Pro	£2,276.00	15.1	Benchtest	262
Dotlink 486 66MHz EISA	£2,750.00	20.0	Short Review	193
Notebook PC 80386 25MHz				
Compaq LTE Lite 4/25C	£3,499.00	7.0	Benchtest	244
Pocket PC				
Atari Portfolio	£149.00		Group Test	305
Casio SF-9300	£140.00		Group Test	306
Casio SF-R20	£222.00		Group Test	308
Fujitsu Poqet Pad	£1500.00		Group Test	321
Fujitsu Poqet PC	£799.00		Group Test	322
GRiD PalmPAD			Group Test	320
Hewlett Packard 95LX	£339.00		Group Test	310
Microwriter Agenda	£195.00		Group Test	312
Mitac 1600A	£399.00		Group Test	314
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Psion Organiser II LZ-64	£136.00		Group Test	324
Psion Series 3	£205.00		Group Test	326
Sharp PC 3100	£680.00		Group Test	330
Laser Printer				
Dataproducts LZR 960			Long Term Test	392
Miscellaneous				
Academy PowerPrint 2.0	£115.00		Short Review	188
SummaGraphics SummaScribe	£225.00		Short Review	194
Sound Card				
Delrina Sound Producer Pro	£19.00		Short Review	198
Video Card				
Videologic Rapier 24	£1,995.00		Short Review	184
Accelerator Card				
Atari Turbo 20/25	£299.99		Short Review	204
SOFTWARE				
Spreadsheet				
Windows for Pen				
PenMagic Numero			Short Review	186
Database				
Windows				
Microsoft Access	£495.00		Benchtest	284
Microsoft FoxPro 2.5/Windows			Benchtest	380
Utility				
Purple Software File Manager	£29.95		Short Review	195
DOS				
Central Point PC Tools 8.0	£139.00		Benchtest	354
Communications				
Windows				
Delrina Technology Winfax Pro 3.0	£99.00		Short Review	196
Image processing				
Windows				
CA Cricket Image	£279.00		Short Review	206
Development Tool				
Windows				
Asymetrix ToolBook	£310.00		Feature	218
Borland C++/App. Framework	£439.95		Feature	220
Borland Object Vision 2.0	£129.95		Feature	230
Borland Turbo Pascal for Windows	£119.95		Feature	232
Computer Associates dBFast	£339.00		Feature	222
Microsoft C/C++ 7.0/SDK	£335.00		Feature	228
Microsoft Visual Basic 2.0	£139.00		Benchtest	248
Art Package				
Windows				
CorelDraw! 3.0	£395.00		Long Term Test	393
Miscellaneous				
DOS				
Permax Power Letters	£25.00		Short Review	212
Education				
DOS				
Lander Count & Add/Spellbound	£34.99		Short Review	183
Music Software				
Atari ST				
Steinberg Cubase Lite	£99.00		Short Review	208

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We stock many items for which there is no space in these advertisements.

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Yes, kids, this is what zoos are all about in the 20th century — computers. Who wants all those smelly animals anyway? They're expensive to keep and only hang around making the place look untidy. Dr Jo Gipps, Chief Executive of London Zoo, is seen here explaining to eight year old Khashayar Alimzadeh the art of zoo-keeping. The 386/25 pictured is actually running Zoo Keeper, a DOS program.

As part of an imaginative, efficiency-driven Government initiative, the zoo is being cleared of noisy, hungry (and frankly unnecessary) fauna to make more effective use of its facilities. The zoo's inmates will be returned to the wild and replaced with banks of nice, clean, easy-to-manage computers. Instead of looking at cages, visitors will be able to operate PCs running animal simulation software such as Lemmings or Microslott's Panda Mating for Windows.

A zoo spokesperson said: 'There are a lot of old fuddy duddies who still think of a zoo as a place to see animals. Zoos in the nineties should be using the latest computer technology. They shouldn't be hampered in their provision of a zoo-style experience by the outmoded zoo-keeping concepts of having a lot of unhygienic and dangerous animals running around.'

'Of course we are sad to see them go but as you can see from the photograph, humans are so much more interested in



computers than animals.'

Larry the lemur (the one on the left), who is seen here enjoying a snack, said: 'I'm just letting these two use my machine while I warm myself on this

monitor. To be honest, we'll miss them when we've gone, so I'm writing a human-simulation program in Turbo Pascal which we can run back home in the jungle.'

Bits & Pieces

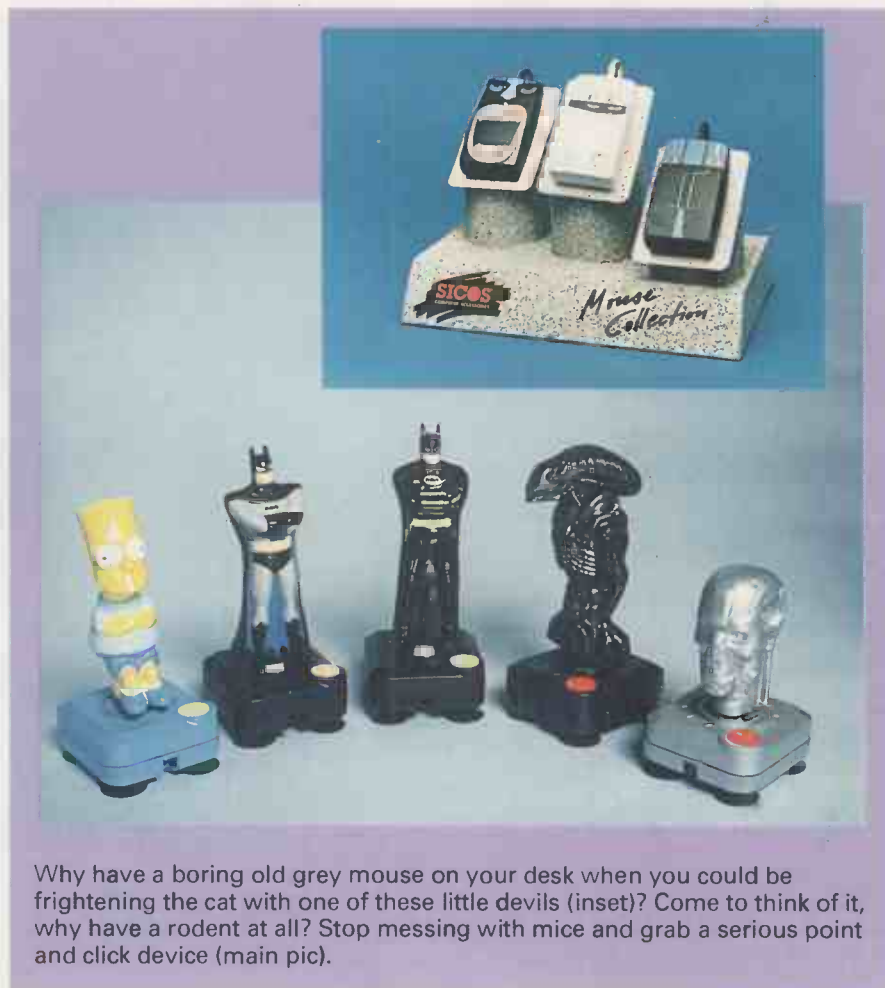
If anyone is still searching for the price/performance chart referred to in our 'New Macs' feature on page 222 of the December issue, they can stop looking. It isn't there. Instead you could look at the PC price/performance chart on page 135 of the same issue. Unfortunately, the Dell and Elonex lines on the graph have been transposed. The Dell 486DX2 is in fact cheaper. Oops.

TopLevel has been in touch to say that its TopCopy Pro does now have the Canon BJ-10e driver missing in our November word processor review.

Central Point also rang. Our November review of MacTools used an old phone number. The correct number is 081-848 1414.

Now is the time to say goodbye... to PCW's Editor. Bye-bye, Guy.

And congrats to Simon Rockman on his promotion to Deputy Editor.



Why have a boring old grey mouse on your desk when you could be frightening the cat with one of these little devils (inset)? Come to think of it, why have a rodent at all? Stop messing with mice and grab a serious point and click device (main pic).

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