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Giant SX test

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Machine Review

**Toshiba's 486
notebook**



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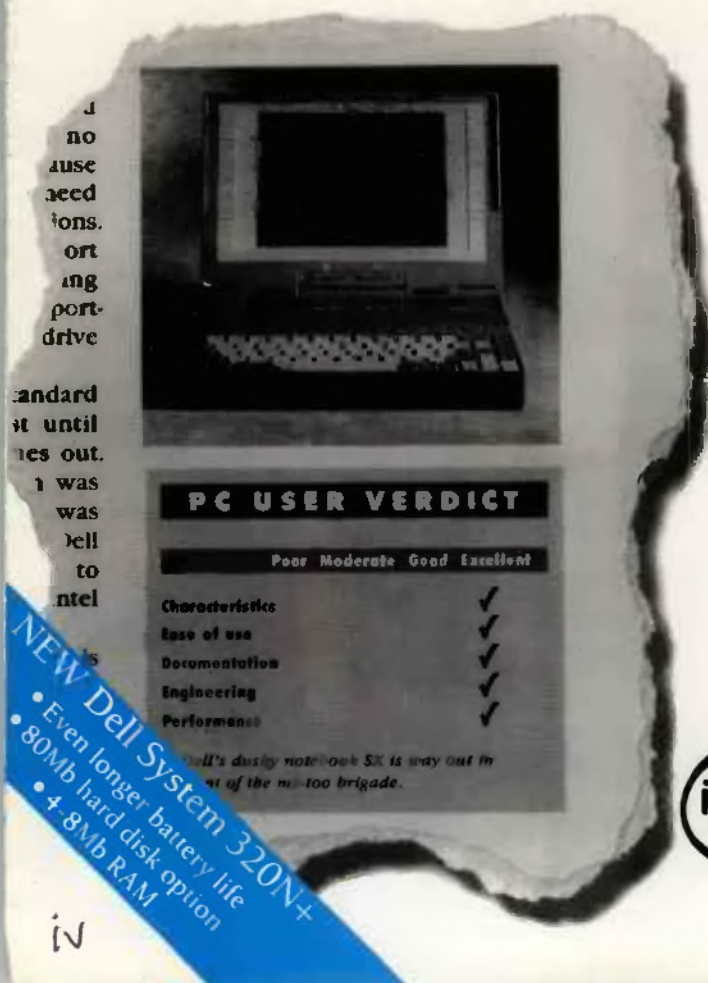
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COVER FEATURE



162

20MHz 386SX's

Most new software these days runs under Windows 3.0. We take a look at 45 20MHz 386SX's, configured specifically to run Windows well. Can you guess which one came out on top?

Cover Illustration by AdHoc Graphics using Hercules Art Dept and Finalia.

FEATURES

Raise you half a billion!

Exactly what did happen behind the scenes in Bull's takeover of Zenith? How did Zenith manage to lose so much of its lead in the portable market? And how did they manage to persuade Intel to let them gain it back with the 386SL? Helen Johnstone extracted some answers from Zenith boss, Ray Sangster.

334

CAD of the track

Tyrrell and AutoDesk are proud of their joint venture, using PCs and AutoCAD to design Formula One racing cars. Simon Rockman found out how the process fits into the overall design and manufacturing operation.

358

Practical neurocomputing

Does the future of computing really lie in the brain? By modelling the way we think the brain works, some incredible strides have already been made towards thinking machines. Nick Beard looks at the principles and at some practical applications.

366

Cache transactions

The word 'cache' has become as prevalent in the computer industry as 'turbo' was in the motor industry. Unlike its automotive equivalent though, cache has many meanings. Peter Jackson draws back the veil of mystery.

314

HARDWARE BENCHTEST

298

Backpack vs HP DAT

Backup may not be the most exciting area of computing but it is important, and at last there are some sensible solutions to the problem. Frank Leonhardt looks at two, from Hewlett-Packard and Backpack.

346

Toshiba 4400SX vs AST Premium Exec 386SX/25



A 25MHz version of the 386SX, and a 486SX at the same speed should make for two very different machines. But as Guy Swarbrick discovered, the Toshiba and the AST have a lot in common.

SOFTWARE BENCHTEST

306

ClarisWorks

After a couple of years in the fashion wilderness, integrated packages, like flared jeans, are making a comeback. Unlike flares, integrated packages can be taken seriously, and as Jack Weber discovered, ClarisWorks is a fine example of the breed.

322

ObjectVision 2.0

When Simon Rockman reviewed the original version of Borland's entry-level development tool, he felt there was a lot missing. He wasn't alone, and Borland took the criticism to heart. Simon has now seen version 2...

326

CK Modeller 4.0

Ever since PCW featured Brainstorm on its front cover in January 1984, the concept of a program to organise your ideas has been a strong background noise in the software industry. Rupert Goodwins looks at a product designed to move the genre beyond outlining.

338

Ventura 4 for Windows

A success in the corporate marketplace, Ventura has nonetheless lagged behind Quark XPress and PageMaker in the professional arena, thanks largely to poor colour support. Xerox has changed all that, as Karl Dallas found out.

354

NetWare Lite

NetWare Lite is undeniably a low-cost networking product. Has Novell sacrificed functionality in order to distance the product from its more expensive stablemates? Stuart Berman investigates.

REGULARS

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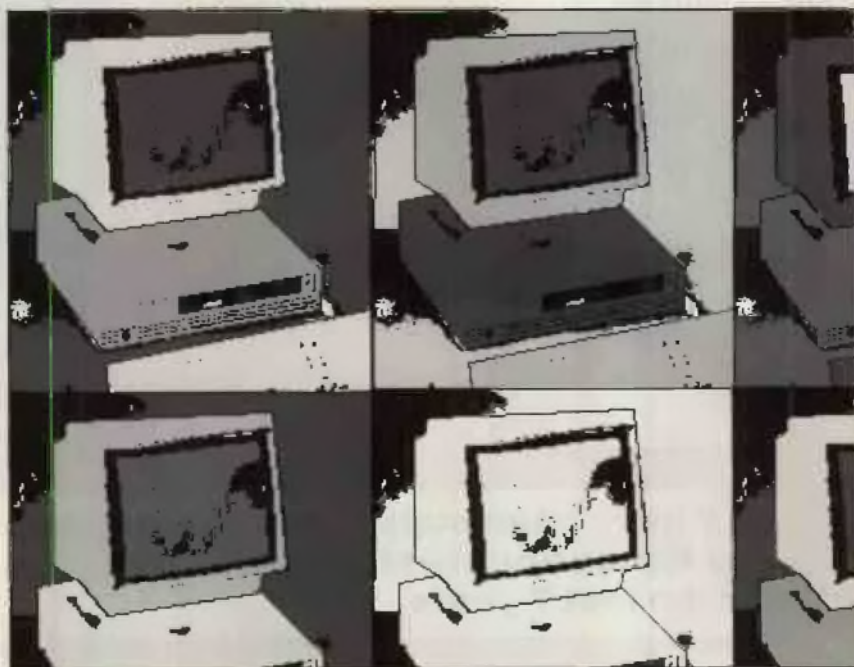
HARDWARE GROUP TEST

162 20MHz 386SX Desktops

Nick Edmunds & Mat Beard

We had originally planned to include 16, 20 and 25MHz 386SX's in this Group Test, but when we discovered there were over 200 on the market in the UK, we had to narrow the choice a little. There were only half a dozen AMD-based 25MHz machines so that was a fairly simple decision, as was deciding that, as most of the 16MHz boxes were no cheaper than 20MHz boxes, we'd stick to the top-of-the-range Intel SX.

ALR Powerflex 20CSX	163	IBM PS/2 Model 57	207
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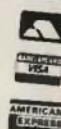
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FLOPPY DISK	N/A	N/A	3.5" 1.44MB	3.5" 1.44MB
HD OPTIONS	N/A	N/A	0 OR 52MB	0 OR 52MB
HDI ACCESS TIME	N/A	N/A	17MSEC	17MSEC
GAME PORT	NIL	NIL	OPTIONAL	OPTIONAL
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CACHE MEMORY	N/A	N/A	64K	64K

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

STANDARD FEATURES ON ALL PST MACHINES

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- FLOPPY DISK 3.5" 1.44MB
- HARD DISK OPTIONS 105 210 338
- HDI ACCESS TIME 17MSEC 15MSEC 16MSEC
- SERIAL PORTS 1 X 9 WAY 1 X 25 WAY
- PARALLEL PORT 1 X 25 WAY
- GAME PORT OPTIONAL
- GRAPHICS CARD TRIDENT 9000 512K
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STANDARD FEATURES

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- PROCESSOR SPEED 33MHZ
- LANDMARK V2.0 SPEED 111.5MHZ
- CACHE MEMORY 64K
- USER MEMORY 4MB
- FLOPPY DISK 3.5" 1.44MB
- HARD DISK OPTIONS 210 338 670 SCSI
- HDI ACCESS TIME 15ms 16ms 16ms
- SERIAL PORTS 1 X 9 WAY 1 X 25 WAY
- PARALLEL PORT 1 X 25 WAY
- GAME PORT OPTIONAL
- GRAPHICS CARD TRIDENT 9000 512K
- MONITOR SUPER VGA 0.28mm DOT PITCH
- MS DOS V5.0
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14" Mono VGA (640 x 480)	649	749	829	899	959	1349
14" Colour VGA (640 x 480)	749	849	929	999	1059	1449
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Caching Disk Controller	Add £350
1MB Super VGA Video Card for 1024 x 768, 256 colours	Add £50
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All prices include 1MB RAM expandable to 16MB; 1 floppy drive (1.2MB 5.25" or 1.44MB 3.5" format); 2 serial, 1 parallel and 1 game port;
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17" Super VGA (1024 x 768, non-interlaced)	1149	1179	1279	1359	1429	1489

For 16MHz or 20MHz versions please add £30 or £50 respectively to the above prices
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Standard Options

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

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12" Monochrome (Hercules)	749	849	929	999	1059	1449
14" Mono VGA (640 x 480)	799	899	979	1049	1109	1499
14" Colour VGA (640 x 480)	899	999	1079	1149	1209	1599
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Lytleton Court
Birmingham Street
Halesowen
West Midlands
B63 3HN
Tel: 021 585 5888
Fax: 021 585 6255

TAND

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LASER PRINTERS

Brother HL-4 - 4 Pages per minute 512K RAM. One year on-site maintenance	£596.00
Brother HL-8-V - 8 Pages per minute 1MB RAM	£1049.00
Canon LP8-4+ - 4 Pages per minute 512K RAM. One year on-site maintenance	£599.00
Canon LBP8 III+ - 8 Pages per minute 1.5MB RAM. One year on-site maintenance	£979.00
Epson EPL-4100 - 6 Pages per minute 512K RAM.	£589.00
Epson EPL-7500 - 6 Pages per minute 2MB RAM.	£1178.00
HP LaserJet IIIP - 4 page per minute 1MB RAM	£699.00
HP LaserJet III - 8 Pages per minute 1MB RAM. One year on-site maintenance	£1023.00
HP LaserJet IIID - 8 Pages per minute 1MB RAM, Dual bin, Double sided printing. One year on-site maintenance	£1739.00
HP LaserJet IIIsi	£2535.00
Postscript upgrade for LaserJet IIIsi including installation	£POA
Mannesman Tally MT 905 - 6 Pages per minute 512K RAM	£675.00
Olivetti PG306 - 6 Pages per minute 512K RAM. One year on-site maintenance	£785.00
PostScript upgrade board for PG306 2MB Memory, 13 hard and 22 soft fonts	£419.00
Qume CrystalPrint WP Plus - 6 Pages per minute 256K RAM. One year on-site maintenance	£699.00
Qume CrystalPrint II - 6 Pages per minute 1.5MB RAM. One year on-site maintenance	£1049.00
Star LP-4 - 4 Pages per minute 1MB RAM. One year on-site maintenance	£575.00
Star LP-8 III - 8 Pages per minute 1MB RAM One year on-site maintenance	£929.00

POSTSCRIPT LASERS

NEC Silentwriter2 S60P - 6 Pages per minute 2MB RAM. One year on-site maintenance.	£1075.00
NEC Silentwriter2 290 - 8 Pages per minute 1.5MB RAM. One year on-site maintenance	£1525.00
NEC LC890XL - 8 Pages per minute 4MB RAM. One year on-site maintenance	£2339.00
Olivetti PG312D - 12 Pages per minute 640K RAM. One year on-site maintenance	£1825.00
Qume CrystalPrint Publisher II - 6 Pages per minute 2MB RAM. One year on-site maintenance	£1525.00
Qume CrystalPrint Express - 12 Pages per minute 3MB RAM. Dual bin. Two year on-site maintenance	£2455.00
Star LP-4 StarScript - 4 Pages per minute 2MB RAM. One year on-site maintenance	£795.00
Star LP-8 II StarScript - 8 Pages per minute 2MB RAM. One year on-site maintenance	£1168.00

NEC

PRINTERS

P20 24 Pin, 216/72 cps	£195
P30 24 Pin, 216/72 cps	£255
P60 24 Pin, 300/100 cps	£335
P70 24 Pin, 300/100 cps	£419
P90 24 Pin, 400/133 cps	£655
COLOURMATE PS/40	£3,599
COLOURMATE PS/80	£4,199

Head Office

Terminus Road
Chichester
West Sussex
PO 19 2TX

Tel: (0243) 771786

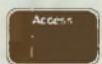
Fax: (0243) 785878

Northern Division

Waters Edge Business Park
Modwen Road
Salford
Greater Manchester
M5 3EZ

Tel: 061 876 8833

Fax: 061 876 8803

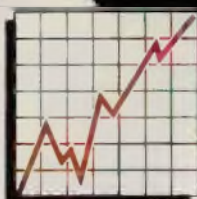


Tandon



Model	Mono	VGA Mono	Colour
PORTABLES			
NB386sx-40		£1,349	
NB386sx-60		£1,529	
ENTRY LEVEL			
286N/12-NF (diskless)		£769	£899
386Nsx/16-NF (diskless)		£815	£949
286N/12-1		£675	£815
286N/12-40		£769	£899
386Nsx/16-1		£719	£855
386Nsx/16-40		£815	£949
THE MCS MODULAR SYSTEMS			
MCS 286/16-40		£889	£1,029
MCS 386sx/20-40		£1,029	£1,169
MCS 386sx/20c-110		£1,249	£1,389
MCS 486sx/20-110		£1,479	£1,619
MCS 486/33-110		£1,759	£1,899
THE NEW MCS PRO RANGE			
MCS pro 386/33c-110 (32-bit, with cache)		£1,699	£1,839
MCS pro 486/33-110 (32-bit)		£2,159	£2,299
REMOVEABLE DISK TECHNOLOGY			
PACII 386sx/20c-40		£1,299	£1,439
PACII 486sx/20-40		£1,535	£1,675
PACII 486/33-40		£1,799	£1,939
40MB DataPacII			£226
100MB DataPacII			£359
200MB DataPacII			£539
400MB DataPacII			£1,129
Floppy drive for PAC machines			£89
EXPANDABLE DESKTOPS			
386/33-110	£1,757		£1,897
386/33-200	£2,049		£2,189
386/33-300	£2,299		£2,439
486/33-110	£3,099		£3,239
486/33-200	£3,299		£3,439
486/33-300	£3,659		£3,799
TOWER SYSTEMS			
Tower 386/33-110	£1,999		£2,139
Tower 386/33-200	£2,299		£2,439
Tower 386/33-300	£2,539		£2,679
Tower 386/33-600	£2,859		£2,999
Tower 486/33-110	£3,399		£3,539
Tower 486/33-200	£3,599		£3,739
Tower 486/33-300	£3,959		£4,099
Tower 486/33-600	£4,259		£4,399
Tower 486/33-1000	£4,659	£4,799	

* Prices are exclusive of
delivery and VAT. E&OE.
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OPTIMUM TECHNOLOGY

MORE THAN JUST LOWER PRICES!

OPTIMUM

OPT-III TELETEXT CARD

*** STOP PRESS! ***

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

The OPT-III - a unique, advanced full-featured Teletext receiver that fits inside your IBM-PC or compatible - simply plug in a tv antenna

- Would you like free data?
- Without costly phone bills?
- Use the data within other applications e.g. Lotus 1-2-3?
- Control of the OPT-III from your Basic, C or Pascal programs?

Now you can receive free city news and data including stock and share prices, company results, Wall St. unit trusts, City Newsfile, takeover news etc. Also up-to-date world news, sports, what's on, TV/Radio, magazines, holidays, reviews and much more.

Easily print out pages, or save received pages to disk as an ASCII file for use within other programs.

New advanced features include:

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

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

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

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

• **The OPT-III is available now for £195** (ex 4.5 card + VAT).

Please ask for a detailed leaflet.

DR SOLOMONS ANTI-VIRUS TOOLKIT

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

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

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

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

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

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

CORPORATE NEWS!

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

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

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

BYTE - NOVEMBER '91

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

INTEL FAX CONNECTION CO-PROCESSOR

• NEW LOW PRICE - £495

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

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

PC MAG. 'EDITORS CHOICE'

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

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

FAX-IT FOR WINDOWS! £45

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

WINFAX PRO £99

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

"The fax card comes of age with the Intel Connection CoProcessor" PC USER

Please phone for a 'fax' datapak.

CBT SOFTWARE TRAINING

A selection of superb training software offering you product from the best training software producers, including American Training International, Individual Training, Intelligence etc. In addition to the individual user, these packages have been extremely popular with training organisations, support departments, colleges, universities etc. Optimum CBT (Computer Based Training) offers you an attractive alternative to 'normal' training. (Most standard training companies offer tutor-based training, with 5-10 students per class, and typically charge £100-£200 per day per person). Optimum CBT is the fast way to learn, teaching you to use your package to its full potential. With Optimum's CBT training, your own PC becomes a highly qualified personal teacher - it teaches you individually at your own pace. You can also go back for a 'refresher' whenever you like. It can be used again and again, and train many people. Ideal for training, R&D and support departments.

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

- Advanced 1-2-3 Rel-2 £139
- Advanced 1-2-3 Rel-3 £139
- Advanced dBase-III Plus £139
- Advanced dBase-IV £139
- Advanced WordPerfect v.5.1 £139
- How to Use your PC/AT £59
- How to Use your IBM PS/2 £59
- Individual Training - LANs £99
- Individual Training - Excel £89
- Intro to Business Software £59
- Intro to Database Mngmnt £59
- Intro to Word Processing £59
- LAN Administrators Kit £195
- Manage Business with 1-2-3 £89
- Professor DOS £69
- Professor Windows £69
- Teach Yourself 1-2-3 V2.2 £89
- Teach Yourself 1-2-3 V2.3 £89
- Teach Yourself 1-2-3 V3.1 £89
- Teach Yourself 1-2-3 Macros £89
- Teach Yourself Database V4 £89
- Teach Yourself dBase-III Plus £89
- Teach Yourself dBase-IV £89
- Teach Yourself Display/Write 4 £89
- Teach Yourself DOS 3.3 £59
- Teach Yourself DOS 4 £59
- Teach Yourself DOS-5 £59
- Teach Yourself Framework £89
- Teach Yourself Freelance+ £99
- Teach Yourself MS Word V5 £89
- Teach Yourself M'Mate Advta £89
- Teach Yourself Multiplan V2 £89
- Teach Yourself Open Access-II £89
- Teach Yourself Paradox3 £89
- Teach Yourself Pagemaker3 £99
- Teach Yourself QGA £89
- Teach Yourself Quattro V3 £89
- Teach Yourself PC Tools V7 £89
- Teach Yourself RBase for Dos £89
- Teach Yourself Supercalc 5 £89
- Teach Yourself Symphony £89
- Teach Yourself Ventura (gsm) £99
- Teach Yourself Windows-3 £69
- Teach Yourself W/Perfect 5.1 £89
- T Yself W/Perf for Windows £89
- Teach Yourself Wordstar 3.3 £89
- Teach Yself Wordstar Prof-4 £89
- Teach Yself Wordstar 2000+£89
- Unix/C Course Demo available £995

OPTIMUM TECHNOLOGY LTD

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

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

WORD PROCESSORS

*AMI V1.2 (Lotus)	£95
*AMI Prof V2 - New! (Lotus)	£295
*DisplayWrite V5	£295
*Grammatik for Windows	£89
*Grammatik-IV-UK (grammar chkr)	£89
*JustWrite - New Symantec	£189
*Manuscript (UK) V2.1	£275
*Multimate 4.0 (UK)	£289
*PeriFORM V2.1	£99
*PeriFORM PRO for Windows	£369
*Prof Write Plus - New!	£195
*Word V5.5 UK - MS (UK)	£259
*Word V5.5 Network	£895
*Word for Windows V2 UK	£289
*Word for Windows Net	£1295
*Word for Word Professional	£95
*Word for Word Pro Windows	£95
*WordPerfect for Windows	£229
*WordPerfect V5.1 (UK)	£229
*WordPerfect Executive	£149
*WordPerfect LetterPerfect	£149
*WordPerfect Office 3-PC	£95
*WordPerfect Office 3 Net	EPOA
*Wordstar for Windows	£235
*Wordstar V6 UK	£235
*Wordstar Net Server/Users	CALL
*Wordstar 2000+ Rel3.5 (UK)	£255

DATABASES

*ACT 2.0 Contact Management - NEW!	£369
*Agenda V2	£289
*Cardbox Plus	£295
*DataEase V4.5 (UK)	£489
*DataEase Network (3 User)	£579
*DataPerfect V2.2 (Microsoft)	£289
*dBase III Plus V1.1 (UK)	EPOA
*dBASE-4 V1.1 (UK)	EPOA
*dBASE-4 V1.1 Dev Ed. (UK)	EPOA
*dBASE-4 V1.1 Lan Pak	EPOA
*Clipper V5.01 (UK)	£349
*Delta-V Rel2 - Compsort	£439
*FormBase (Xerox)	£369
*Foxbase Plus V2.1	£245
*Foxbase Plus V2.1 MultiUser	£389
*Foxbase Plus V2.1 Developer	£449
*Foxbase Plus/386 V2.1	£349
*Foxbase+/386 V2.1 Devel.	£549
*FoxPro V2 UK	£449
*FoxPro V2 UK Multi-User	£649
*FoxPro Distribution Kit	£295
*Object-Vision (special offer) - NEW!	£89
*Omnis-5 for Windows	£529
*Paradox V3.5 (UK)	£289
*Paradox Network Users	£495
*Professional File V2	£169
*Q & A V4 - NEW!	£269
*Q & A V4 Network - 3 User Pack	£249
*Rapidfile V1.2	£239
*rBase V3.1	£439
*rBase Personal - New!	£139
*Reflex V2.0	£195
*Superbase-2 (Windows)	£239
*Superbase-4 V1.3 (Windows)	£395
*Superbase-4 V1.3 Developer Ed.	£795
*Superbase-4.5 User Runtime	£179
*Superbase-4 V1.3 LAN (5 User)	£745
*TAS Professional - Single User	£445

* - signifies a Windows or a Windows associated product

SPREADSHEETS

*Excel V3 Microsoft	£249
*Excel Lan (5 User Pack)	£1145
*Impress V2L	£125
*Logistix V1.3	£135
*Lotus 1-2-3 for Windows	£319
*Lotus 1-2-3 2.3	£249
*Lotus 1-2-3 2.3 Net Server	£439
*Lotus 1-2-3 2.3 Net User	£239
*Lotus 1-2-3 3.1+ 286/386/1MB	£295
*Lotus 1-2-3 3.1+ Net Server	£489
*Lotus 1-2-3 3.1+ Net User	£289
*Multiplan V4.2 - Microsoft	£129
*PlanPerfect V5.1 (WordPerfect)	£269
*Quattro Pro V3	£195
*Quattro Pro V3 Competitive Upgrade	£65
*Supercalc-5.1 (UK)	£79
*Supercalc-5.1 LAN (5 User Pack)	£195
*Wingz V1.1 (UK) - Informix	£329

INTEGRATED PACKAGES

*CA SuperOffice - New!	£149
*Framework V4	EPOA
*MS Office for Windows	£489
*PFS:Windows Works	£139
*Smartware-1 V1.5 (UK)	£449
*Symphony V2.2	£389
*Works for Windows - MS	£129
*Works V2.0 - MS	£129
*Xchange - Psion (UK)	£439

PROJECT

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

DATA MANAGEMENT

*ABC Flowchart V1.1	£249
*ACT 2 Contact Management - New!	£375
*Access Dragnet (Data Retrieval)	£95
*Access Prompt (Data Manager)	£95
*Agenda V2 (UK) - Lotus	£289
*Grandview V2 UK - NEW! Symantec	£269
*IBM Current V1.11	£289
*Lotus Magellan V2.0	£99
*Lotus SmartText Builder Dev. Sys	£445
*Lotus SmartText Reader	£95
*PC Guide V3 - Hypertext	£449
*PC Guide Reader	£95
*Portex Professional	£129
*Portex Prof Net 8 User	£795
*Statgraphics V5 - New!	£529
*VP Expert V2.0	£185

JANUARY'S OPTIMUM CHOICE

FREE 'FLOPPY CALC' IS BACK!

Back by popular demand is the 'Floppy Calc', a great free gift, a 'thank you' for your custom, from Optimum. It is not really hardware - it is not really software! The unique 'limited edition' Optimum Floppy Calculator - a superb seven function solar powered calculator with a unique attractive hi-tech design.

Free with your order over
£60 (+ cart & VAT - one per customer - while stocks last.)

THE OPT-III TELETEXT CARD

***STOP PRESS!!!
- Do you have a PS/2, portable or non-IBM/PC computer and also wish to receive Teletext data? - Coming soon - the exciting new OPT-III/S Teletext Receiver, an external unit that communicates through a standard RS232C serial port. Although supplied with PC software, it will also supply Teletext data in either 'raw' or ASCII data, thus allowing its use with any computer with an RS232C serial port. Please call for pricing and availability.

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

Features now include:
• **Twin Page Viewing** - you can now optionally watch two pages from a TV channel simultaneously (EGA/VGA) - and Yes! - they both continually update. So you can watch the news headlines on the left with share prices on the right.

• **Share Scanning** - you can scan the teletext share pages for share names previously specified - and automatically save the share names and prices to disk as an ASCII file.

• **Page Review** - Instant 16-page review.

• **Mouse Support**

• **SetClock** - set internal PC (net?) Clock from the Teletext accurate clock

Signal (perhaps from AutoExec?).

• **Page Click**

• **Reduced Size** - now a half-sized card.

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

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

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

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

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

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

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

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

Typical applications include:

• 'Prices-on-the-Move' - one user is automatically

'bleeped', via modem, on his RadioPager every hour with his shares portfolio pricing.

• 'Network News' - one network manager has

delighted users by offering a free 'real-time' news service down the network.

The OPT-III package includes

a precision half sized PC card, manual, easy-to-use

application software, as well as sample programs for the

programmers amongst you in Basic and C.

The OPT-III is available now

for only £195 (+£5 cart + VAT). A comprehensive DataPak is available on request. cont...

OPTIMUM SALES DESK

Telephone: 081-203 0220

Fax: 081-203 7004

See next page.



OPTIMUM TECHNOLOGY

MORE THAN JUST LOWER PRICES!

OPTIMUM

UTILITIES/MISC

386Max V5 - 1+ New!	£79
Adobe Type Manager (PC)	£79
Adobe Type Mgr Plus Pak	£139
AutoRoute Express - New!	£49
AutoRoute Plus V4	£279
AutoRoute Products-call for prices	
Battery Watch Pro	£35
Bridge-Batch (Win3)- New!	£119
Central-Point Anti-Virus	£95
CHECKIT V3 PC Diagnostics	£95
Dan Bricklins Demo-II V3	£195
DESQview V2.4 - New!	£85
DESQview 386 V2.4 inc OEMM	£145
DESQview Manifest	£39
DESQview QRAM 286 V2	£65
DESQview OEMM 386 V6	£65
DESQview OEMM 50/60	£65
Direct Access V5 (5th Gen.)	£65
DOS V5 Upgrade (Microsoft)	£59
DR Dos V6 - New!	£75
Dr Solomons Anti Virus V5	£95
Dr Solomons "Corporate"	£269
FASTI - Power Windows/DOS disk cache	£79
Fastback Plus V3 - New!	£99
Flight Simulator V4.0B	£35
HDC Windows exam. as below	£89
1st Appl. Windows Experts. Fee Appl. 20th Designer	
Lap-Link Pro V4 - New!	£99
NewWave V3 (HP) - New!	£95
Norton Anti-Virus V1.5 (UK)	£135
Norton Backup V1.2	£95
Norton Commander V3	£89
Norton Desktop for Windows	£95
Norton Editor V2 - New!	£59
Norton Utilities V6 - New!	£115
PC Tools Deluxe V7 - New!	£99
Pegasus Easifacts Accounts	£195
Pegasus Business Manager	£289
Sage Sterling for Windows	£289
Sage Sterling Acc/Acc+ £239/339	
Sage Sterling Fin Controller	£449
Sage Sterling PayrollII	£169
Sideways V3.3	£55
Sidekick V2 - New!	£75
SPINRITE-II V2 - New!	£79
Stacker V2 Software	£95
Storyboard Level (IBM)	£345
Software Bridge V5	£99
Superprint V2 for HP (win3)	£119
TOOLBOOK V1.5 - NEW!	£269
TURBOCASH PLUS - NEW!	£179
WinConnect - New!	£79
WINDOWS-3 (Win)	£79
WINDOWS-3 Dev Toolkit	£295
Windows Entertainment Pk	£29
Windows Productivity Pack	£45
WordPerfect Office V3/PC	£95
Xtree Pro Gold V2.5 - NEW!	£95
Xtree Network (Novell only)	£295

SOUND/VIDEO BOARDS

Hercules Graphics Plus	£185
Hercules Graphics Station	£749
Hercules G/Station 2MB LRG	£365
Hercules G/Station+2MB DRAM	£1095
Hercules Graph.Station PS/2 £979	
SoundBlaster Pro - New!	£195
Video-7 VGA 1024i 512K	£145
Video-7 VRAM-II 512K	£245
Video-7 VRAM-II 1MB	£295

CAD / DTP & GRAPHICS

ABC Flowcharter V1.1	£249
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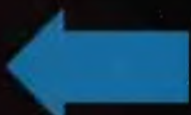
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W - signifies a Windows or a Windows associated product

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b = V23 - 1200/75 (CCITT)
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d = V22bis - 2400bps (CCITT)
e = V-Series Hayes Express 9600 'Special'
f = VST - 9600bps US Robotics 'Special'
g = V32 - 9600bps (CCITT)
h = V32bis - 14400bps (CCITT)
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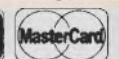
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- 12MHz Zero wait state main board with 80286-12 Microprocessor, AMI BIOS & Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 4MB) • 200W Power supply • Small footprint case • 102 UK

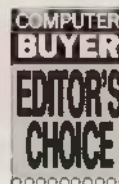
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Dan-486c/33 64K CACHE SYSTEM

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• 33MHz Main board with i80486-33 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 32MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

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40Mb (28ms) IDE	£1028	1069	1222
88Mb (19ms) IDE	£1111	1152	1306
125Mb (19ms) IDE	£1193	1234	1388
200Mb (15ms) IDE	£1354	1395	1549
300Mb (16ms) IDE	£1705	1746	1899

Add £42.00 for every additional 1MB of RAM.

Dan-386c/33 64K CACHE SYSTEM

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• 33MHz Main board with 80386-33 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 32MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO VGA	14" COLOUR SUPER VGA
NO HDD	£ 601	641	795
40Mb (28ms) IDE	£ 779	820	973
88Mb (19ms) IDE	£ 862	903	1057
125Mb (19ms) IDE	£ 944	985	1139
200Mb (15ms) IDE	£1105	1146	1300
300Mb (16ms) IDE	£1456	1497	1650

Add £42.00 for every additional 1MB of RAM.

Dan-286/20 SYSTEM

PC TODAY
EDITORS
CHOICE

£309

• 20MHz Zero wait state main board with 80286-20 Microprocessor, AMI BIOS, EMS LIM 4.0 & Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 4MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO VGA	14" COLOUR SUPER VGA
NO HDD	£ 378	416	559
40Mb (28ms) IDE	£ 543	582	725
88Mb (19ms) IDE	£ 621	659	802
125Mb (19ms) IDE	£ 697	735	878
200Mb (15ms) IDE	£ 846	885	1028
300Mb (16ms) IDE	£1172	1210	1353

Add £42.00 for every additional 1MB of RAM.

Dan-286/12 SYSTEM

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

MONITOR	12" MONO	14" MONO VGA	14" COLOUR SUPER VGA
NO HDD	£ 321	362	541
40Mb (28ms) IDE	£ 499	541	720
88Mb (19ms) IDE	£ 583	624	803
125Mb (19ms) IDE	£ 665	706	885

Add £42.00 for every additional 1MB of RAM.

Dan-486SX/20 64K CACHE SYSTEM

£642

• 20MHz Main board with i80486SX-20 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 32MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO VGA	14" COLOUR SUPER VGA
NO HDD	£ 716	756	910
40Mb (28ms) IDE	£ 894	935	1088
88Mb (19ms) IDE	£ 977	1018	1172
125Mb (19ms) IDE	£1059	1100	1254
200Mb (15ms) IDE	£1220	1261	1415
300Mb (16ms) IDE	£1571	1612	1765

Add £42.00 for every additional 1MB of RAM.

Dan-386/25 SYSTEM

£441

• 25MHz Zero wait state main board with i80386-25 Microprocessor, AMI BIOS, Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 8MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO VGA	14" COLOUR SUPER VGA
NO HDD	£ 515	555	709
40Mb (28ms) IDE	£ 693	734	887
88Mb (19ms) IDE	£ 776	817	971
125Mb (19ms) IDE	£ 858	899	1053
200Mb (15ms) IDE	£1019	1060	1214
300Mb (16ms) IDE	£1370	1411	1564

Add £42.00 for every additional 1MB of RAM.

Dan-386c/40 64K CACHE SYSTEM

£556

• 40MHz Main board with 80386-40 Microprocessor, AMI BIOS, 64KB (upgradable to 512KB) cache memory & Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 32MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO VGA	14" COLOUR SUPER VGA
NO HDD	£ 630	670	824
40Mb (28ms) IDE	£ 808	849	1002
88Mb (19ms) IDE	£ 891	932	1086
125Mb (19ms) IDE	£ 973	1014	1168
200Mb (15ms) IDE	£1134	1175	1329
300Mb (16ms) IDE	£1485	1526	1679

Add £42.00 for every additional 1MB of RAM.

Dan-386sx/20 SYSTEM

£353

• 20MHz Zero wait state main board with i80386SX-20 Microprocessor, AMI BIOS, Shadow RAM for System & Video BIOS • 1MB RAM on board (expandable to 20MB) • 200W Power supply • Small footprint case • 102 UK Keyboard • 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO VGA	14" COLOUR SUPER VGA
NO HDD	£ 427	468	622
40Mb (28ms) IDE	£ 605	647	801
88Mb (19ms) IDE	£ 689	730	884
125Mb (19ms) IDE	£ 771	812	966
200Mb (15ms) IDE	£ 932	973	1127
300Mb (16ms) IDE	£1282	1324	1478

Add £42.00 for every additional 1MB of RAM.

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MONITOR	14"	VGA	Colour
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44Mb (28ms)	£1345	£1395	£1545
90Mb (19ms)	£1445	£1495	£1645
135Mb (17ms)	£1545	£1595	£1745
180Mb (16ms)	£1645	£1695	£1845
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Add £50 for Tower case

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MONITOR	14"	VGA	Colour
	MONO	MONO	SVGA
44Mb (28ms)	£1095	£1145	£1295
90Mb (19ms)	£1195	£1245	£1395
135Mb (17ms)	£1295	£1345	£1495
180Mb (16ms)	£1395	£1445	£1595
380Mb (15ms)	£1645	£1695	£1845

Add £35 for additional 1Mb RAM (per 1Mb)

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MONITOR	14"	MONO	Colour
	MONO	VGA	SVGA
44Mb (28ms)	£995	£1040	£1195
90Mb (19ms)	£1095	£1140	£1295
135Mb (17ms)	£1195	£1240	£1395
180Mb (16ms)	£1295	£1340	£1495
380Mb (15ms)	£1545	£1525	£1745

Add £35 for every additional 1Mb of RAM

MBC 386-33MHz-4Mb RAM **64K Cache (expandable to 256K)**

Intel 80386-33MHz CPU, 0 Wait-state, Socket for Weitek 80387 3167 Maths Co-processor, 4Mb RAM on board (expandable to 64Mb), 64K cache, AMI BIOS, 1.2Mb & 1.44Mb Floppy drives, IDE Hard & Floppy controller, 2 Serial, 1 Parallel & 1 Game port, Desk-top case, 200W PSU.

MONITOR	14"	VGA	Colour
	MONO	MONO	SVGA
44Mb (28ms)	£895	£945	£1095
90Mb (19ms)	£995	£1045	£1195
135Mb (17ms)	£1095	£1145	£1295
180Mb (16ms)	£1195	£1245	£1395
380Mb (15ms)	£1445	£1395	£1645

Add £35 for every additional 1Mb RAM

MBC 386sx-20MHz-2Mb RAM

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MONITOR	14"	MONO	Colour
	MONO	VGA	SVGA
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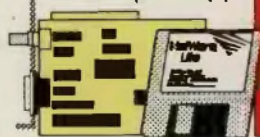
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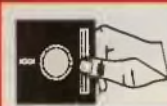
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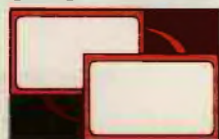
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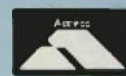
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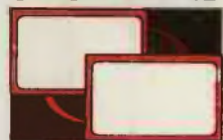
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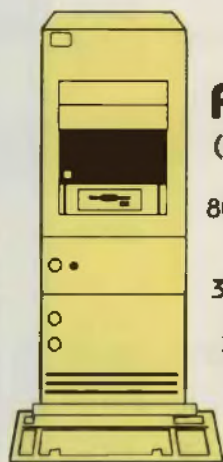
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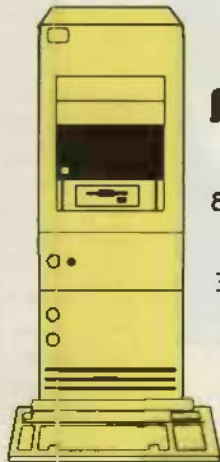


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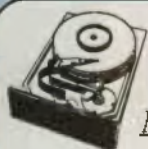
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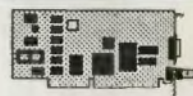
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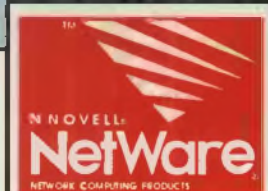
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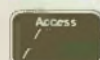
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386	386sx	16	40Mb	3.5"	1Mb	£810	£940	£960
386	386sx	16	110Mb	3.5"	1Mb	£850	£970	£990
N/Workstation Range								
286	286	12	Ethernet 3.5"	1Mb	£600	£700	—	—
386	386sx	16	Ethernet 3.5"	1Mb	£700	£800	—	—
N/Workstation computers complete with an Ethernet network card								
MCS Range								
286/16	286	16	—	3.5"	2Mb	£746	£890	£920
386sx/20	386sx	20	—	3.5"	2Mb	£896	£1025	£1055
386sx/20C	386sx	20	—	3.5"	2Mb	£971	£1112	£1143
486/20	486sx	20	—	3.5"	2Mb	£1193	£1329	£1359
486/33	486	33	—	3.5"	2Mb	£1496	£1636	£1666
MCS Pro Range								
386/33C	386	33	—	3.5"	4Mb	£1420	£1550	£1580
486/33	486	33	—	3.5"	4Mb	£1860	£1990	£2020
Hard Disks for MCS Range:-								
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			3.5"	£89	5.25"	£69		
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PacII Range								
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486/20	486sx	20	—	—	2Mb	£1279	£1416	£1446
486/33	486	33	—	—	2Mb	£1546	£1677	£1700
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486/33	486	33	300Mb	3.5"	4Mb	£3650	£3830	£3850
486/33 Tower Range								
486/33T	486	33	110Mb	Dual	8Mb	£3470	£3600	£3660
486/33T	486	33	200Mb	Dual	8Mb	£3740	£3880	£3940
486/33T	486	33	300Mb	Dual	8Mb	£4000	£4140	£4200
486/33T	486	33	600Mb	Dual	8Mb	£4440	£4580	£4640
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T2000-40	12MHz	40Mb	1 x 3.5"	1.44Mb	£1140
T2000SX-20	16MHz	20Mb	1 x 3.5"	1.44Mb	£1313
T2000SX-40	16MHz	40Mb	1 x 3.5"	1.44Mb	£1427
T2000SX-60	20MHz	60Mb	1 x 3.5"	1.44Mb	£1846
T2200SX-60	20MHz	60Mb	1 x 3.5"	1.44Mb	£2226
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T3100SX-80	16MHz	80Mb	1 x 3.5"	1.44Mb	£1466
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T3200CSX-120 Col.	16MHz	120Mb	1 x 3.5"	1.44Mb	£4096
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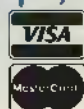
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124MB	£838	£909	£929	£1059
211MB	£1028	£1099	£1119	£1249
337MB	£1369	£1439	£1459	£1589

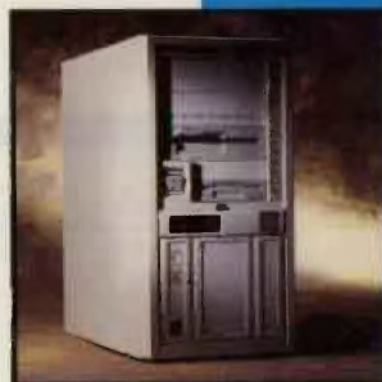


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FALCON 486/C64-25Mhz

- * 25Mhz 80486 Main Board
- * 64K On Board Cache
- * VGA 512K Plus Card Expandable to 1Mb
- * 4Mb Ram Expandable to 32Mb
- * 3.5inch 720K/1.4Mb Disc Drive
- * 2 Serial, 1 Parallel & 1 Game ports
- * Full 102 UK Keyboard
- * 220 Watt power supply
- * IDE Hard Disc Controller
- * Baby Tower Metal Case
- * Landmark 114.1Mhz

MONITOR:-	NONE	14" MONO	MONO VGA	COLOUR SUPER VGA
NO HDD	£799	£874	£894	£1024
44MB	£924	£999	£1019	£1149
89MB	£1025	£1099	£1119	£1249
124MB	£1088	£1159	£1179	£1309
211MB	£1278	£1349	£1369	£1499
337MB	£1619	£1689	£1709	£1839



£1099.00

EAGLE 486/C256-33Mhz

- * 33Mhz 80486 Main Board
- * 256K On Board Cache
- * VGA 1Mb Plus Card Fully Expanded
- * 4Mb Ram Expandable to 32Mb
- * 3.5inch 720K/1.4Mb Disc Drive
- * 2 Serial, 1 Parallel & 1 Game ports
- * Full 102 UK Keyboard
- * 230 Watt power supply
- * IDE Hard Disc Controller
- * Large Tower Metal Case
- * Landmark 151.9Mhz

MONITOR:-	NONE	14" MONO	MONO VGA	COLOUR SUPER VGA
NO HDD	£1099	£1174	£1194	£1324
44MB	£1224	£1299	£1319	£1449
89MB	£1325	£1399	£1419	£1549
124MB	£1388	£1459	£1479	£1609
211MB	£1578	£1649	£1669	£1799
337MB	£1919	£1989	£2009	£2139

OPTIONAL EXTRAS FOR OUR SYSTEMS

DRIVES

Alternative 5.25" Drive	£8.00
3.5" 720/1.4Mb Disc Drive	£42.00
5.25" 360K/1.2Mb Disc Drive	£50.00

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(Includes Cable and Frame)

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ST1102A 89Mb	£226.00
ST1144A 124Mb	£289.00
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MS-DOS Version 5.0	£49.95
MS-DOS V5 and Windows 3	£65.00

MEMORY

1Mb (Please State Model)	£34.95
VGA to 1 Meg Upgrade	£19.95

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Wren MT904 Laser Printer	£649.00
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MISC

Serial MS-Compatible Mouse	£19.95
----------------------------	--------

Free serial mouse when you buy a VGA colour system!

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- Software does not take up space in DOS.
- Allows you printer & hard disc sharing.



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- 2 serial 1 Parallel Port.
- Full 102 key keyboard.
- 70 Watt power unit.
- Discless boot up.
- Low profile case.

	No monitor	14" mono	*VGA mono	*SVGA colour
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With LAN card	£264.00	£339.00	£394.00	£519.00



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STORK - 386SX - WORKSTATION

- 386 - 16 Mhz CPU - (see Hawk 386) Main mother board.
- 1Mb - Main RAM expandable to 8Mb.
- 2 Serial 1 parallel port.
- Full 102 key keyboard.
- 70 Watt power unit.
- Discless boot up.
- Low profile case.

	No monitor	14" mono	*VGA mono	*SVGA colour
Without LAN card	£225.00	£299.00	£355.00	£480.00
With LAN card	£329.00	£404.00	£459.00	£509.00



£375.00

HERON - 386 DX WORKSTATION

- 386 DX - 33Mhz 64K cache (see Harrier 386) Main board.
- 1Mb - Main RAM expandable to 32Mb.
- 2 Serial 1 Parallel port.
- Full 102 key keyboard.
- 70 Watt power unit.
- Discless boot up.
- Low profile case.

	No monitor	14" mono	*VGA mono	*SVGA colour
Without LAN card	£375.00	£449.00	£505.00	£629.00
With LAN card	£479.00	£554.00	£609.00	£734.00



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- 486 DX - 33 Mhz 64K cache Main mother board.
- 4Mb Main RAM expandable to 32 Mb.
- 2 Serial 1 Parallel port.
- Full 102 Key keyboard.
- 70 Watt power unit.
- Discless boot up.
- Low profile case.

	No monitor	14" mono	*VGA mono	*SVGA colour
Without LAN card	£729.00	£804.00	£859.00	£984.00
With LAN card	£834.00	£909.00	£964.00	£1089.00

* VGA monitors use 512K/1Mb SVGA card supplied with monitor.

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No.1

THE DOVE - 286 - STARTER PACK



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- 14" Mono/graphics monitor.
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Just switch on and your ready to type a letter or write a book.
This package has got to be the best value for money in the UK.
(phone or write for more details)

Micro Solutions
No.2

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- 1 x Harrier 386 - 33 Mhz with SVGA + 124 Mb hard disc.
- 1 x Lan card kit.
- 1 x SVGA monitor
- 2 x Robin work stations with Lan cards.
- Cables etc.
- 2 x Mono monitors

This three user system makes the best sense for the small business user ie DTP production on the 386 - Harrier, invoicing on a workstation and word processing on an other! The data is on one common hard disc.
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OPTIONAL EXTRAS:-

HARD DISC TAPE STREAMERS:-

120 MB	£199
250 MB	£275

NETWORK CARDS:-

LAN CARD KIT	£125.00
ETHERNET CARD	PHONE
NOVEL CARD™	PHONE

GRAPHIC CARDS:-

MONO GRAPHICS	£15.95
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- ▼ 8 single-ended A/D inputs
- ▼ 1 D/A output
- ▼ 16 digital inputs
- ▼ 16 digital outputs
- ▼ Wiring Terminal Board

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The complete and cost-effective solution for your PC based automation needs.

- ▼ 12 bit 30KHz
- ▼ 16 single-ended A/D inputs
- ▼ 2 D/A outputs
- ▼ 16 digital inputs
- ▼ 16 digital outputs
- ▼ Timer/counter
- ▼ Pacer Clock
- ▼ DMA and Interrupt

£275

Also with Programmable Gain £325

High Performance Data Acquisition Card

The high-end specifications of this card make it ideal for a broad range of industrial and laboratory applications.

- ▼ 16 S/E or 8 differential 12 bit A/D inputs
- ▼ Instrument Amplifier
- ▼ Very high speed A/D 60KHz (also 100KHz option)
- ▼ 2 D/A outputs
- ▼ 16 digital inputs
- ▼ 16 digital outputs
- ▼ Timer/Counter
- ▼ Pacer Clock
- ▼ DMA & Interrupt

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Also 100KHz Option £550 with Programmable Gain £575

6 Channel D/A Output Card

Ideal for industrial applications requiring multiple analog outputs or current loops

- ▼ 6 independent, 12 bit D/A output channels
- ▼ Multiple output ranges
 - 0 to 5V (unipolar)
 - 0 to 10V (unipolar)
 - 5V to +5V (bipolar)
 - 10V to +10V (bipolar)
 - 4 - 20mA (current loop)
- ▼ 16 digital inputs
- ▼ 16 digital outputs

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Provides complete IEEE-488 functionality on a half size board

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- ▼ DMA & Interrupt
- ▼ On-board firmware driver
- ▼ 16 digital outputs
- ▼ Basic, Pascal and C drivers included

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- ▼ 8 opto-isolated digital input channels
- ▼ Easy to use and program

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Program PROMs, EE/EPROMs, PALs, GALs, FPLDs, PEELs, EPLDs and MicroControllers.

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C O N T R O L



M E A S U R E M E N T

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- Prototype Development Card £69
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- Active Bus Expansion System £240
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- EPROM for above, each 360Kb £49

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- Screw Terminal Assembly £89
- Opto-Isolated D/I Board 16ch £129
- Electro-Mechanical Relay Bd 16ch £149
- Solid State Relay Board 4ch £99
- Solid State Relay Board 8ch £139
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- ▼ EMS 4.0 and/or Extended Memory
- ▼ Start address from 512K up to 16Mb in 128K steps
- ▼ 2Mb Memory on-board

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T3200SXC 2Mb Card £139
4Mb Card £299
T3100SX, T3200SX 2Mb Card £119
4Mb Card £229
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SIMMS 256K x9 80ns 1pc £20
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Intel 80387 16MHz £199, 20MHz £199
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A short size card providing standard input/output functions.

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Also V21/V22/V22bis Ext. Modem £199

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3.5"/5.25" DD	£329.00	£409.00	£489.00
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5.25"/3.5" HD30	£519.00	£595.00	£675.00

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3.5" HD40	£655.00	£735.00	£819.00
5.25"/3.5" HD40	£699.00	£775.00	£859.00

PC3386SX, 20MHz 80386SX processor, 1Mb RAM, 3.5" 1.44Mb floppy disk drive and 40Mb hard disk. With **Free windows 3, Excel 3.0 & mouse**

40Mb HD	£845.00	£919.00	£995.00
80Mb HD	£1145.00	£1219.00	£1299.00
Upgrade to 4Mb Memory	£132.00		

Generation 4

PC4386SX 80386SX 20MHz, 4Mb RAM, 3.5" 1.44Mb FDD, 80Mb HD with look ahead cache. Socket for optional 80387SX 20 maths co-processor & VGA Graphics Interface, Amstrad mouse, MS DOS V3.3 & Windows 3.

10" VGA Mono	£1139.00
10" High Res VGA Col	£1299.00

Series 5 Games Pack

PC5286 Games Pack 16MHz 286-based PC compatible with 1Mb on-board memory, 1.44Mb 3.5" floppy and 40Mb Hard Drive and 2 16BIT expansion slots. Other features include enhanced VGA graphics, 14" colour monitor, PS/2-type mouse, DOS 3.3, easy-to-use graphical interface, analogue joystick, 100% Ad-Lib compatible soundcard with joystick port and two external speakers and three games: Links, F-15 Strike Eagle II and Prince of Persia. **£759.00**



Amstrad Series 5

PC5086 8086 processor, 8MHz, 640k RAM, 3.5" floppy drive, 2 free 8BIT expansion slots. **Free LotusWorks and DMP3160 Printer**

	14" FMD	14" CDR	14" HRCD
SD	£335.00	£415.00	£495.00
DD	£375.00	£455.00	£535.00
40Mb HD	£535.00	£615.00	£689.00
PC5286 16MHz, 640k RAM, 3.5" floppy drive, 2 16BIT expansion slots. Free Lotus 1-2-3 V2.2			
	14" FMD	14" CDR	14" HRCD
SD	£455.00	£535.00	£615.00
40Mb HD	£655.00	£739.00	£819.00

External Floppy Drive

FD16 Amstrad 2000 Series **£45.00**

All Amstrads with **FREE** 1 Year On-site Maintenance

PORTABLES AND NOTEBOOKS

AMSTRAD	CPU	MHZ	RAM	HD	3.5" FDD	WARRANTY	PRICE	with BJ10e
ALT 286	286	16	1Mb	20Mb	1.44Mb	1 Year	£984.00	£984.00
ALT 286	286	16	1Mb	40Mb	1.44Mb	1 Year	£1212.00	£1212.00
ALT 386SX	SX	16	1Mb	40Mb	1.44Mb	1 Year	£1288.00	£1288.00
ALT 386SX	SX	16	2Mb	80Mb	1.44Mb	1 Year	£1515.00	£1515.00
ACL-386SX	SX	20	4Mb	120Mb	1.44Mb	1 Year	£3029.00	£3229.00
ANB-386SX	SX	16	1Mb	20Mb	1.44Mb	1 Year	£899.00	£1099.00
ANB-386	SX	20	2Mb	40Mb	1.44Mb	1 Year	£1129.00	£1329.00
CORPORATE Notebook	CPU	MHZ	RAM	HD	3.5" FDD	WARRANTY	PRICE	+VGA Monitor
	SX	20	2Mb	40Mb	1.44Mb	1 Year	£1299.00	£1499.00

PORTABLE & DESKTOP ACCESSORIES

Megastor Portable Hard Disk

An external Hard Disk Drive that requires no internal controller. This device plugs straight into the parallel port of your portable computer, co-existing with any existing drives.

45Mb	£299.00	177Mb	£884.00
89Mb	£499.00	210Mb	£944.00
130Mb	£648.00	426Mb	£1738.00

NEC

With FREE On-Site Maintenance
Silentwriter2 S60 6ppm, 1.5Mb RAM parallel & RS232 interfaces. £775.00
Colourmate PS/40 1 colour ppm, 4Mb RAM, 17 scaleable fonts & Parallel, Serial & AppleTalk I/F's £3599.00
Colourmate PS/80 1 full colour ppm, 8Mb RAM, 35 scaleable fonts & Parallel, Serial & AppleTalk I/F's £4199.00
Silentwriter2 S60P Adobe Postscript, 6ppm with parallel, serial & AppleTalk interfaces £1115.00
Silentwriter2 290 8 ppm, 2Mb RAM, 35 scaleable fonts. Parallel, Serial & AppleTalk I/F's £1429.00
Silentwriter2 266 8 ppm 8 resident fonts, 1.5-5.5Mb RAM, NEC V50 Processor, P/S I/F's £922.00
LC890XL 8 ppm, 4Mb RAM, 3 emulations & 35 resident fonts. Two 250 sheet trays. SCSI I/F. Parallel, Serial & AppleTalk I/F's £2379.00

Hewlett Packard

With Free On-Site Maintenance
HP LASERJET IIP 4 ppm, P/S I/F's, 1Mb RAM, RET (Resolution Enhanced Technology) £729.00
LASERJET III 8 ppm, 8 internal scaleable fonts, 14 built-in bitmapped fonts, P/S and extended I/F's £1079.00
LASERJET IIP 6 ppm, RET, Macintosh compatible with HP Postscript printer cartridge, £1799.00
HP Laserjet III Si 16 ppm, 2x500 paper trays, 2-17Mb RAM, Optional integrated Adobe Postscript £2659.00

NEW Konica LP3110

300dpi, 10ppm, A4, 512K RAM expandable to 3.5Mb £999.00

New 3 year on-site 8hr call out on all HP Printers. Call for prices on £50.00 Deskjet

Corporate Pocket Lan Adaptor

Plugs directly into standard parallel printer port enabling users to log onto a network, compatible with Novell. Full 10Mbps/sec operation. 8KB data buffer. No configuration jumpers or switches £179.00

Portable CD ROM

External CD-ROM Player interfacing through the parallel port of your portable. Requires no adaptor card and allows simultaneous use of printer & CD. Ideal for large data retrieval, with World Atlas II £449.00

LASER PRINTERS

Panasonic With FREE On-Site Maintenance

PANASONIC KX-P4450 11 ppm, Parallel and Serial interfaces with 512k of RAM. Two 250 sheet paper trays and 22 resident fonts. £985.00
PANASONIC KX-P4420 8 ppm, 512k-4.5Mb RAM, 250 sheet paper tray, 22 fonts & Parallel I/F £649.00
PANASONIC KX-P4455 ADOBE POSTSCRIPT Capable of 11ppm, 2Mb RAM, dual bin paper feed, 39 scaleable fonts, 26 internal fonts in HP Laserjet II emulation mode. £1475.00

Bitstream Facelift ONLY £25

when bought with any laser printer from RSC Corporate Computing. Facelift gives you high quality fonts in every size, including matching screen fonts for Windows applications. Complete with 13 typefaces. (RRP £89.00)



New Sharp JX-9500H, Desk top, 300dpi, 9ppm, 512k RAM expandable to 4.5Mb, an impressive printer at an impressive price. £599.00

PORTABLE PRINTERS

New Star SJ-48

Inkjet printer 360dpi resolution, 100 cps in LQ mode, 28kb buffer, weight 1.8kg £199.00

Olivetti JP150

Fantastic "Bubble Ink-Jet" printer, 300x300dpi, laser printer quality with a very small footprint. £225.00

Seikosha LT-20 Portable 24-pin dot matrix

£259.00

Canon BJ10e Inkjet

100cps (12 cpi) with a resolution of 360 x 360 dpi in high quality mode. 37Kb buffer. £199.00

CANON BJ10e Ink Cartridge

NEW BJ10e black refill £15.00

Citizen PN48 thermal printer

£229.00

Epson With Free On-Site Maintenance

EPL-7100 6ppm with 300dpi resolution & 24 fonts. 512k RAM, expandable to 6Mb £665.00

Epson EPL-7500 £1249.00

NEW EPL-4100 6ppm, 300dpi, HP Laser IIP compatible, 540k RAM expandable to 5.5Mb, parallel & serial I/F's £589

Laser Accessories

Labels Laser 2 Across 2000 £13.50
Labels Laser 3 Across 3000 £13.50
NEC S60/60P Toner £67.00
NEC 266/290 Toner £68.00
KXP4450/4455 Toner KX450 £30.00
KXP4420 KXP451 £22.00
Epson Imaging Cartridge £85.00
HP IIP/III Toner £45.00
HP IIP/III Toner £59.00
NEC 2Mb Memory Upgrade (S60P/290) £309.00
NEC 1Mb Memory Upgrade (266) £136.00
NEC 4Mb Memory Upgrade (LC890XL) £819.00
1Mb RAM Card KXP443 (KXP4420/4450/4455) £149.00
2Mb RAM Card KXP441 (KXP4420/4450/4455) £289.00
Jetware 1Mb Memory Upgrade £113.00
Jetware PostScript Cartridge III £289.00

DOT MATRIX PRINTERS

Epson
LX400 9 PIN 80 COL 180 CPS 30 NLQ £110.00
LX850 9 PIN 80 COL 200 CPS 30 NLQ £156.00
LQ200 24 PIN £174.00
LQ450 24 PIN £169.00
LQ570 24 PIN £227.00
FX850 9 PIN 80 COL 264 CPS 54 NLQ £291.00
LQ1010 24 PIN 132 COL 60 CPS 8k Buffer £328.00
LQ1070 24 PIN £317.00
FX1050 9 PIN 132 COL 264 CPS 54 LQ £365.00
LQ870 24 PIN £402.00
LQ860 (COL) 80 COL 290 CPS 88 LQ £485.00
LQ1170 24 PIN £489.00
LQ1060 (COL) 132 COL 290 CPS 88 LQ £633.00
LQ2550 (COL) 132 COL 400 CPS 132 NLQ £739.00
DFX5000 HEAVY DUTY 533 CPS £1169.00
TLQ4800 48 PIN 132 COL 250 CPS 83 NLQ £1492.00
DFX8000 192 CPS NLQ PRINT £1999.00

Panasonic

NEW KX-P 1170 9 PIN 80 COL 192 CPS £110.00
NEW Quiet KX-P 2624 24Pin 136 COL 300 CPS £399.00
KX-P1624 24 PIN 136 COL £279.00
KX-P1695 9 PIN 136 COL £279.00
KX-P1081 £109.00
KX-P1180 9 PIN 80 COL 192 CPS 38 NLQ £109.00
KX-P1123 24 PIN £144.00
KX-P1124 24 PIN, 80 COL, 240 CPS, 80 CPS LQ £199.00
KX-P1654 24 PIN, 136 COL, 300 CPS, 100 CPS LQ £399.00

Citizen

SWIFT 9 + 9 PIN, 80 COL, 192 CPS, 64 CPS NLQ £154.00
SWIFT 9X + Same spec. as Swift 9 with 136 column £210.00
SWIFT 24 + 24 PIN, 80 COL, 192 CPS, 64 LQ, 360dpi £236.00
SWIFT 24X + Same spec. as 24 but with 136 column £312.00

New Citizen 224 24pin, 80 col, 192 CPS, 64 CPS LQ, colour printing as an option and 2 year warranty £199.00

New Swift 24e 24 pin, 80 col, 216 CPS, 72 CPS LQ with optional colour kit and 2 year warranty £235.00

Olivetti

Olivetti DM124 24-pin, 200cps draft, 50cps NLQ, Parallel I/F, Tractor & Single sheet feeders, 1 year on-site warranty £185.00
Olivetti DM124C Professional quality 24-pin colour printing now available - at an affordable price, 200cps output in draft, 50cps LQ, 7 colour output, Graphics Resolution up to 360x180dpi. Parallel interface, tractor & Single sheet feed as standard. 1 year on-site warranty £210.00
Cut Sheet feeder for Olivetti 124C & 124 £49.00

Accessories & Connectivity

We carry a wide range of peripherals, please call for details
Switches from £12.00
Gender Changers from £2.50
Paper per box from £12.00
Cables from £5.50

Star

LC15 9 PIN 132 COL 150 CPS 37 NLQ £189.00
LC20 £107.00
LC24-10 24 PIN 80COL £147.00
LC24-15 24 PIN 132 COL 167 CPS 66 NLQ £259.00
XB24-200 24 PIN 80 COL £315.00
XB24-250 24 PIN 80 COL £383.00
LC24-200 24 PIN 222 CPS 67 NLQ £177.00
LC24-200 COLOUR £222.00
LC-200 9 PIN 80 COL 180 CPS 45 NLQ £155.00
ZA200 £249.00
ZA250 £315.00

CAD VILLAGE

AutoCAD II £2500.00
FastCAD £499.00
Generic CAD 5+ £215.00
Draft Window CAD £389.00
Draft CAD Quickstart £95.00
Turbo CAD V1.8 £85.00
Easy CAD II £125.00
Autosketch V3 £69.00

Sketchmate Colour plotter £335.00

Digitisers

GT 1812 Genlizer Tablet 18"x12", PC, XT/AT & PS/2 compatible. With Utility S/W & Driver, CasCad II, Colour Maestro S/W & Stylus pen £269.00
GT906 Tablet 9"x9", PC, XT/AT & PS/2 compatible. With CasCad II & Colour Maestro S/W £89.00
Summasketch 2 £345.00
Summasketch Professional 2 £521.00
Cherry Digitiser Mk 4 £339.00
HP SketchPro £329.00

Hewlett Packard Plotters

7440 £423.00 7475 £603.00
7550B £2217.00 7570 £1959.00
7575 £2599.00 7576 £3699.00

Roland Plotters

DXY 1100 £502 DXY 1200 A3 £639
DXY 1300 A3 £839 DPX 2500 A2-A4 £2365
DPX 3500 A1-A4 £3255 GRX 300 AG £2739
GRX 400 AG £3425

New DPX 4600 A0 flatbed with 1Mb Data compression buffer & HP GLII compatibility £5149
LTX 321 A1 thermal plotter with 4Mb buffer & FREE on-site maintenance £4149

LTX 420 A0 thermal plotter with 8Mb buffer & FREE on-site maintenance £5195
Autocad direct Raster interface for use with LTX 321 or 420 supplied with ADI driver £555

OFFICIAL ROLAND PLOTTER SUPER DEALER

Full range of plotter pens & stationery in stock, call for prices

Black ink cartridge for Deskjet 500

1+	5+	10+
£19.50	£12.50	£12.00

Black Ink Refill £7.99 Green Ink Refill £9.99
Violet Ink Refill £9.99 Red Ink Refill £9.99
Brown Ink Refill £9.99 Blue Ink Refill £9.99

All prices exclude VAT

Prices subject to change without notice. E & OE

INK JET PRINTERS

EPSON SQ 850 80 COL 600 CPS 198 NLQ £455.00
EPSON SQ2550 132 COL 600 CPS 198 NLQ £669.00
DICONIX 150 PLUS IMPROVED QUALITY £219.00
DICONIX 150 INK CARTRIDGE £12.00
CANON BJ300 £359.00
CANON BJ330 £419.00
CANON BJ300/330 Ink Cartridge £9.00
HP DESKJET 500 16k memory, 3 pages of text and two pages of graphics per minute, 300 DPI. £299.00
HP DESKJET 500c colour printer £479.00
Olivetti JP350 Hewlett Packard Deskjet+ workalike, large capacity 150 sheet tray, 2nd bin feed option, tractor feed option, times roman font on card, 1 year on-site maintenance, 360/120cps, 8k buffer Only £299.00
Black Ink Cartridge £11.00
2nd Bin Sheetfeed £115.00
Serial Interface £60.00

COLOUR INKJET

NEW KODAK 'DICONIX' 330C 64k RAM, prints on transparencies for overhead presentations, built-in 50 page sheet feeder. 150CPS draft, 75CPS NLQ and 34CPS LO. £739.00
HP PAINTJET XL £1159.00
HP PAINTJET 30 COLOURS 90 DPI 167 NLQ £615.00
COLOUR INK CARTRIDGE £30.00
BLACK INK CARTRIDGE £24.00

Motherboards - All zero Memory

CPU	SPEED	MAX RAM ON BOARD	SLOTS	SIZE	CACHE	PRICE
80286*	12MHz	4Mb	3x16BIT	22.5 x 33	-	£75.00
80286*	16MHz	4Mb	3x16BIT	22.5 x 33	-	£85.00
80286	20MHz	4Mb	6x16+1x8BIT	22 x 22.5	-	£99.00
80386sx	16MHz	8Mb	3x8+5x16BIT	22.5 x 33	-	£159.00
80386sx	20MHz	8Mb	3x8+5x16BIT	22.5 x 33	-	£175.00
80386sx	25MHz	16Mb	1x8+6x16BIT	22.5 x 33	-	£199.00
80386	25MHz	8Mb	2x8+5x16+1x32BIT	22.5 x 33	-	£289.00
80386	33MHz	16Mb	1x8+6x16BIT	22.5 x 33	128k	£399.00
80486sx	20MHz	32Mb	6x16+2x8BIT	22.5 x 33	64k	£575.00
80386	40MHz	32Mb	1x8+7x16BIT	22.5 x 33	128k	£425.00
80486	33MHz	32Mb	1x8+6x16BIT	22.5 x 33	128k	£759.00

*Includes IDE HD/FD Controller and 2 Serial & 1 parallel ports

3.6V High Energy Lithium Battery



Computer Cases with Power Supplies

Chosen for their practical design, construction material (metal cases), expandability and accessibility. All of our motherboards fit each of the cases.

Deskline desktop case + 200W power supply

Baby vertical case + 220W power supply

Full height vertical case + 220W power supply

£69.00

£79.00

£129.00

Power Supplies

Deskline 200 WATT Power supply, 14.8cm's high, 16.5cm's deep, 14.8cm's wide £45.00

Baby Hi-Line 200 WATT, 14.8cm's high, 16.5cm's deep, 14.8cm's wide

£45.00

Hi-Line - 220 WATT, 14.8cm's high, 21cm's deep, 15cm's wide

£65.00

Hard/Floppy Disk Controllers

ST02 SCSI Controller - 2 floppy drives, 2 Hard

Drives up to 84Mb

£25.00

ST11 - XT MFM or RLL HD

£29.00

ST22 - AT MFM/RLL 2HD/2FD 1:1

£35.00

Corporate 1006V - 16 bit MFM disk controller for AT bus PC's, supports 2 hard disk and 2 floppies.

Supports 1:1 Interleave, WD-1006V-MM2 compatible, disk activity LED connector & cable set

£29.00

The Corporate IDE/FDD is a 16 bit disk controller for AT bus PC's. Supports 2 hard disks & 2 floppy drives

£10.00

Corporate IDE/I/O As above with 2 serial, 1 parallel & 1 games port

£19.00

TMC885 Future Domain SCSI Card 16 bit, for Hard drives with floppy controller without software

£90.00

TMC885 With software Novell OS/2

£120.00

Maths Co-Processors

INTEL

80287XL £55.00

80387-SX (SX386)16 £77.00

80387-SX (SX386)20 £83.00

80387-20 (386DX) £129.00

80387-25 (386DX) £129.00

80387-33 (386DX) £129.00

80487-SX-23 £345.00

BIT

286-2C87/8MHz £39.00

286-2C87/10MHz £49.00

286-2C87/12MHz £52.00

286-2C87/20MHz £55.00

386-3C87/16MHz £116.00

386-3C87/20MHz £116.00

386-3C87/25MHz £116.00

386-3C87/33MHz £125.00

386sx-3C87/25MHz £99.00

386-3C87/40MHz £199.00

Mitsubishi Floppy Drives

FD19 360K 5.25"

£39.00

FD20 360K/1.2Mb 5.25"

£39.00

FD22 720K/1.44Mb 3.5"

£35.00

5.25" fitting kits for 3.5" bare drives

£9.00

HARD DRIVES

Size	Type	Model	Access	Media	Price
Seagate					
		No.	Time	Size	
20Mb	MFM	225	65ms	5.25"/H/H	£119.00
30Mb	RLL	238R	65ms	5.25"/H/H	£122.00
40Mb	MFM	251-1	28ms	5.25"/H/H	£152.00
65Mb	RLL	277R	28ms	5.25"/H/H	£169.00
80Mb	MFM	4096	28ms	5.25"/H/H	£345.00
60Mb	SCSI	177N	24ms	3.5"/H/H	£225.00
84Mb	SCSI	169N	24ms	3.5"/H/H	£233.00
94Mb	SCSI	2106N	18ms	5.25"/H/H	£379.00
183Mb	SCSI	2209N	18ms	5.25"/H/H	£545.00
337Mb	SCSI	2383N	15ms	5.25"/H/H	£729.00
44Mb	AT/IDE	ST157A	28ms	3.5"/H/H	£125.00
89Mb	AT/IDE	3096A	16ms	3.5" 1"	£198.00
107Mb	AT/IDE	3120A	16ms	3.5" 1"	£245.00
130Mb	AT/IDE	3144A	16ms	3.5" 1"	£259.00
242Mb	AT/IDE	ST227A	16ms	5.25"/H/H	£799.00
337Mb	AT/IDE	ST238A	16ms	5.25"/H/H	£775.00
40Mb	MFM	ST151	28ms	3.5"/H/H	£199.00
32Mb	RLL	ST138R	40ms	3.5"/H/H	£139.00
Fujitsu					
105Mb	IDE/SCSI	M2612ET	19ms	3.5"/H/H	£225.00
135Mb	AT/IDE	M2613ET	19ms	3.5"/H/H	£315.00
180Mb	AT/IDE	M2614ET	19ms	3.5"/H/H	£370.00
45Mb	SCSII/MAC	M261ESA/MU	19ms	3.5" 1"	£159.00
135Mb	SCSII/MAC	M2613ESA/MU	19ms	3.5"/H/H	£389.00
180Mb	SCSII/MAC	M2614ESA/MU	19ms	3.5"/H/H	£429.00
Quantum					
52Mb	AT		17ms	3.5"/H/H	£185.00
105Mb	AT		17ms	3.5"/H/H	£299.00
210Mb	AT		15ms	3.5"/H/H	£539.00
52Mb	SCSII/MAC		17ms	3.5"/H/H	£195.00
105Mb	SCSII/MAC		17ms	3.5"/H/H	£299.00
210Mb	SCSII/MAC		15ms	3.5"/H/H	£549.00

"TYPE" refers to MFM, RLL, SCSI or AT, H/H = Half Height, F/H = Full Height

FREE 86 allows you to back up, move, erase, copy, rename, print, view or execute any file. RRP £69 but only £10.00 if bought with one of the above drives

£10.00

120Mb Megasafe Tape Back-up System



Internal drive

(with software) £185.00

Internal PS/2 (with software)

£230.00

External XT/AT or PS/2 Drive (with s/w)

£280.00

Model 55 SX Cables

£25.00

Adaptor board XT/AT

£45.00

Adaptor board PS2

£40.00

XENIX Back-up

£32.00

Formatted 40Mb

£14.00

Formatted 60Mb

£16.00

All Media Floppy Drive

A revolutionary concept in floppy drives, an internal 3.5" AND 5.25" drive encased in the same 5.25" half height housing - using just one data cable. Ideal for those without free drive bays or expansion capabilities.



Corporate Pocket Lan Adaptor

Plugs directly into standard parallel printer port which enables user to log onto a network, compatible with Novell. Full 10Mbps/sec operation. On board 8KB data buffer. No configuration jumpers or switches

£179.00

All prices exclude VAT

Prices subject to change without notice. E & OE

UPSONIC UPS Uninterrupted Power Supply

Protects against power failures, spikes, surges, rages & short circuits.

UPS MIGHT 25 - (250va 50Hz)

£98.00

UPS MIGHT 35 - (350va 50Hz)

£147.00

UPS MIGHT 55 - (550va 50Hz)

£219.00

Tower UPS - for File Servers & small PC Networks / LANS, inc. Novell. 60 mins back-up for single 386 fileserver on

UPS600. 140 mins on UPS1250

Tower UPS600 (600va 50Hz)

£385.00

Tower UPS 1250 (1250va 50Hz)

£559.00

Slim Wonder 1000

£305.00

RSC Corporate Computing Awarded Upsonic "Best Dealer of the year 1991"

Ethernet Cards

8 bit with remote boot ROM, NE1000 compatible

£69.00

16 bit with remote boot ROM, NE1000/2000 &

WD8003E compatible

£89.00

Radius Pivot

The monitor features a 15" flat square tube, up to 1024x768 resolution, 256 colours and a .28mm dot pitch and a refresh rate of 60-107Hz minimizes screen flicker. SVGA Multiview is a high performance VGA and VESA compatible graphics interface with a horizontal refresh rate of between 31.5 and 57KHz. Any orientation change made by the Pivot display automatically triggers the SVGA Multiview to rotate the screen pixels in real time.

Radius Pivot plus Multiview Card £999.00



Graphic Cards

Corporate 8/16 bit VGA 256k on board expandable to 512k £45.00
Colour Image 16 bit VGA 512k card £99.00
CORPORATE 1Mb ultra VGA card - 16 bit - VGA adaptor for AT bus, 1Mb on board £89.00
NEW CORPORATE HiColour Super VGA Graphic Card. Display 32.768 colours instead of just 256. In-chip video cache memory, supports both interlaced and non-interlaced monitors. A true breakthrough in PC Graphic capabilities £149.00
Orchid Pro-Designer IIX 1Mb 16bit VGA Card £175.00
Orchid Pro-Designer IIS £199.00

Monitors

NEC 3FG High Res 15" FS, VGA 1024 x 768(ii) £399
 NEC 4FG 15" FS, Super VGA 1024 x 768(ii) £515
 NEC 5FG 17" FS High Res, VGA 1280 x 1024(ii) £965
 NEC 5D 20" High Res, VGA 1280 x 1024(ii) £1374
 NEC 6FG 21" FS High Res, VGA 1280 x 1024(ii) £POA
 PHILIPS 7749 MONO VGA 14" FST paper white mono, 920x480, PC, PS/2, Dark Glass screen £79.00
 Panasonic C1381 14" Super VGA multi-scanning monitor, compatible with most VGA video standards. 1024 x 768 max res interlaced on 800x600 max res non interlaced 0.28mm dot pitch, scans horizontal frequencies from 30 to 37KHz. Tilt/swivel base, 6th D-type connector & 2yr on-site, loan unit policy £249.00
 Mitsubishi 20" Diamond Scan (19" V) 1280x1024, 1024x768 VGA and SVGA resolutions with 0.31 Dot pitch. With integral tilt and swivel base £1195.00

Corporate Special

Tystar 14" Super VGA+. A new generation VGA monitor for the IBM PS/2, 8514A, Mac II and all IBM compatibles. Res: 1024 x 768, 800 x 600, 640 x 480, 640 x 400 and 640 x 350. Low dot-pitch gives a vivid and delicate picture. Tilt and swivel base and 2 year 48hour replacement warranty £175.00

BITSTREAM FACELIFT £25

when you purchase any monitor (VAT @ 8%)

CD CITY Corporate CD PC's



386SX CD PC

20MHz 80386sx AT compatible, 2Mb RAM, 325ms CD-ROM Drive, 44Mb 28ms AT IDE Hard Drive, 3.5" and 5.25" Floppy Drives, Super VGA 1024x768 Graphics Adaptor, 14" VGA Colour Display, Microsoft compatible Mouse, World Atlas II on CD-ROM, MS

DOS 4.01 System Setup & Diagnostics 1 Year On-Site Maintenance £1299.00

Ricoh 9200E II

Rewritable Optical Disk at the forefront of optical technology; Ricoh offer, an external, high capacity, removable magneto-optical disk subsystem. Driven via a SCSI interface, this device may be connected to any PC XT/AT, PS/2 or Apple Mac (with additional interface). Each removable cartridge can contain 600Mb of easily retrievable information, providing a potentially infinite library of data. With its effective dust protection system reliability 600Mb capacity, 256k buffer, 66.7ms average access speed, SCSI controller, Dust free chassis design, Conforms to the latest ISO standards £1999.00



AT interface kit including software £229.00
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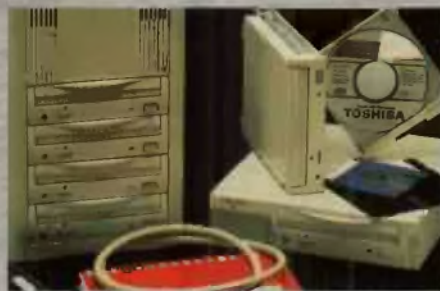
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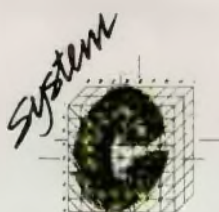
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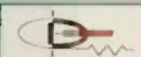
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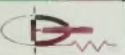
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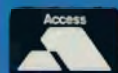
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120Mb HD	320 210Mb HD 420
SX16 card	189 SX20 card 369
486/25 card	1299 RAM per Mb 50

BUSINESSVEISA RANGE
Desktop case, 4 EISA slots, 2 ISA 16-bit slots, 1Mb RAM expandable to 17Mb (49Mb with expansion board). Processor upgradeable to 25 or 33Mhz 486. Slot for 64k cache. 1 floppy drive, VGA.

386/33	1295	1395	1445
386/33 cache	1645	1745	1795
486SX/20	1745	1845	1895
486/25	2095	2195	2245
486/33	2595	2695	2745

Hard Disk prices as per Powerflex

HANDHELDS

Poqet PC	£699
Z88 and peripherals	£CALL
Casio Digital Diary	£CALL

SHARP IQ

IQ8000	159	IQ8200	189
IQ7200	119	ZQ5200	99
ZQ2250	59	32k Card	32
IQ PC Link	55	IQ7000 Wallet	20
IQ8000 Wallet	25	IQ Printer	99

Phone for more details on accessories

AGENDA

Agenda 32k	129	Agenda 64k	159
32k Storage Cd	25	Printer Lead	19
Spreadsheet	25	Finance Card	25

DABS PRESS QUALITY IBM COMPATIBLE PERSONAL COMPUTERS

PRICES (VGA systems, including DOS)



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BOARDS

286/16	99	286/20	109
386SX/16	199	386SX/20	259
386SX/25C	279	386DX/25	279
386DX/33	379	386DX/40	479
486DX/25	699	486DX/33	799

All boards have OK RAM and expand to bracketed figure. All take copro

NOVELL

CARDS			
NE1000	£109	NE2000	£129
NE1 Compat.	£85	NE2 Comp.	£99
NE2 C.MCA	£199	WD Elite16	£129
NETWARE 2.2			
5 User	£396	10 User	£936
50 User	£1656	100 User	£2648
NETWARE 3.11			
20 User	£1678	100 User	£3398
250 User	£6198	Upgrades	£CALL

STREAMERS

JUMBO			
120Mb Ext	293	120Mb Int	213
250Mb Ext	354	250Mb Int	284
Controller	68	Option	£CALL
WANGTEK			
60Mb Ext	574	60Mb Int	470
150Mb Ext	673	150Mb Int	549
525Mb Ext	1185	525Mb Int	1050

Please call for advice on fitting kits and interfaces.

CO-PROS

AMAZING INTEL REDUCTIONS	
Compatible	Intel
8087 5 Mhz	59
8087 8 Mhz	79
8087 10 Mhz	109
80287 10/12 Mhz	51
80287 16/20 Mhz	65
80387SX 16 Mhz	75
80387SX 20 Mhz	82
80387SX 25 Mhz	CALL
80387 DX (all speeds)	112
80487SX	312

Compatibles are AMD or iIT for 287, ULSI for 387, all 80387DX supplied work at speeds from 16-33Mhz

VIDEO

Herc only	15	Herc/CGA	25
256k VGA	45	1Mb VGA	69
1Mb CEG	199	Orchid Pro IIx149	

Call for advice on video cards, or see panel above.

CASES

Desktop (3F,1T)	£79
Mini Tower (3F,1T)	£99
Midi Tower (takes full size 386/486 boards, 3F, 2T)	£109
Full Tower (4F, 2T, 230W)	£169
Basestation (like Opus B/s)	£CALL

F.No. of 5.25in bays. T.No. of 3.5in bays. Cases include screws, motherboard standoffs, blanking plates, power cable etc. All have turbo/reset/keylocks.

SEAGATE HARD DRIVES

ID			
ST125A	144	ST138A	174
ST351A	164	ST157A	133
ST1102A	228	ST3120A	294
ST1144A	288	ST1186A	448
ST1201A	468	ST1239A	425
ST2274A	788	ST2383A	628
ST1480A	1128		
SCSI			
ST125N	157	ST138A	174
ST351N	170	ST157N	237
ST1102N	244	ST296N	221
ST2106N	448	ST2125N	488
ST4128N	548	ST1186N	478
ST1201N	498	ST2209N	618
ST1239N	528	ST4350N	808
ST3476N	848	ST2383N	818
ST4385	929	ST1480N	998
ST2502N	1088	ST4702N	1148
ST4766N	1198	ST4767N	1348
ST41200N	1668	ST41650N	1988
MFM			
ST225	128	ST125	154
ST138	157	ST151	238
ST251	178	ST4096	358

User knowledge is assumed when bare drives purchased. Many other models available - please call.

COMPONENTS

IDE Hard/Floppy Controller	£25
2 serial/1 parallel/1 game cd	£25
2 x game port card	£15
Single Serial Port	£12
Single Parallel Port	£12
4 serial port card	£35
AdLib synthesiser card	£75
Soundblaster card	£99
102-key tactile click keyboard	£32

Processor	No Monitor	Mono	Colour	Super
80286 16Mhz	£379	£459	£569	£599
80286 20Mhz	£399	£479	£589	£619
386SX 16Mhz	£429	£509	£619	£649
386SX/20 cache	£469	£549	£659	£689
386SX/25 cache	£549	£629	£739	£769
386DX/25	£569	£649	£759	£789
386DX/33 cache	£699	£749	£859	£889
386DX/40 cache	£729	£809	£919	£949
486DX/33 cache	£999	£1079	£1189	£1219

These prices include Desktop Case with Turbo/Reset switches and LEDs, (MiniTower for 386/33 and 486), 200w PSU, 1Mb of RAM, expandable to 4Mb (286), 32Mb (386) or 64Mb (486), VGA card (see panel), VGA monitor as listed, IDE controller for 1 or 2 hard discs, 102-key keyboard, 1x3.5" or 5.25" high density floppy disc drive, 2 serial ports, 1 parallel port, game port if required, bus mouse port if required, maths co-processor socket, MS-DOS 5 with Q-BASIC, (DOS 3.3 available) BIOS manuals, 12 months return-to-base parts and labour warranty.

SPECIAL OFFER

£50 OFF OUR TOP-SELLING MODEL IDEAL FOR WINDOWS 3
 80286 16Mhz Colour VGA £599
 MiniTower Case add £20
 1 of each floppy, so add £50
 44Mb Hard Disc add £120
 Mouse add £15
 Total 2Mb RAM, so add £40
TOTAL £845

SPECIAL PRICE £795

MONITORS

Elzo 9060SZ	£449
NEC 3D, 4D, 5D	£CALL
Panasonic TX14H10 SVGA	£215
Panasonic C1381 Multiscan	£229
Philips 8833/II Amiga/ST	£199
Samsung ML2611 Mon VGA	£69
Samsung Colour VGA	£199
Taxan Multivision 795	£424
SVGA 14in Col. (1024x768)	£199
SVGA 14in FST Mono	£89

MEMORY

SIMM (Amstrad, Olivetti, ALR etc.)			
256kx9	10	1Mbx9	35
4Mbx9	130	256kx8 (Mac)	10
1Mbx8 (Mac)	35	4Mbx8	130
SIPP (Most dealer-built PCs)			
256kx9	10	1Mbx9	39
DIL			
64k x 1	£2.00	64k x 4	£2.00
256kx1	£1.25	256kx4	£5.00
1Mbx1	£5.00	Others	£CALL

UPGRADING AN XT (8086)?

XTs have no main board expansion, so an expanded (not extended) or LIM card is required with an EMS driver. Our 'Everex RAM' card can be fitted with 1Mb (£149) or 2Mb (£199). Any program supporting expanded or LIM memory will 'see' the extra memory.

UPGRADING A 286 OR ABOVE?

Main board expandable? If so you need either proprietary RAM (Compaq, IBM, most laptops etc.) or standard SIMM, SIP or DIM RAM (prices above). Sometimes the first 1Mb must be removed. If not main board expandable, you need the AT RAM card (same price as XT, goes to 8Mb at £50/meg).

DABS PRESS PC OPTIONS

The prices quoted above are for complete systems with one floppy drive. To add a hard drive, second floppy etc. to your chosen system, decide the capacity, and add to the price above. These prices only apply when the hard disc is purchased as part of a PC system. Prices for these components bought separately are shown elsewhere on the page.

20 Mb add £50	40 Mb add £120
90 Mb add £220	124 Mb add £280
211 Mb add £420	422Mb add £900
613Mb add £995	Larger £CALL
20 Mb for 8086	add £150
32 Mb h/card for 8086	add £125
Larger sizes for 8086	£CALL

MODULES

APPLE			
Portable 1Mb	219	Portable 2Mb	569
Portable 3Mb	859	Portable 4Mb	999
Mac II 2Mb	109	Mac Ili 1Mb	79
Mac Ili 2Mb	169	Mac Ili 8Mb	669
LW IINTX 1M	79	LW IINTX 4M	229
CANON LASER PRINTERS			
LBP-4 1Mb	169	LBP-4 2Mb	299
1Mb Add-on	169	LBP-8II 1M	119
LBP-8 II 2Mb	199	LBP-8II 4M	299

COMPAQ
 Call with Compaq expansion part no. and/or confirm that your Compaq does accept proprietary RAM upgrades.

OKI LASER PRINTERS			
400 1Mb	149	400 2Mb	319
PANASONIC LASER PRINTERS			
4420 1Mb	199	4420 2Mb	349

TOSHIBA			
1000/E/XE 1M	209	1000... 2Mb	289
T1200XE 2Mb	159	T1600 2Mb	159
T3100SX 2Mb	159	T3100SX 4M	379
T3100 512k	109	T3100 2Mb	159
T3200SX 2Mb	159	T3200SX 4M	379
T3200 3Mb	219	T5100 2Mb	159
T5200 4Mb	319	T5200 8Mb	999

SPECIALS

HARD DISC MOBILE RACK
 Transport your hard disc from one machine to another. 1 unit £40, 2 units £75.

SOUNDBLASTER DELUXE
 Soundblaster Board, (AdLib compatible) plus CMS chips for Gamelabster compatibility, speech, joystick port, demo disc and joystick, twin stereo speakers and Walkman-style headphones. Only £139.

CONTINUOUS EDGE GRAPHICS
 1Mb VGA with Eddson Labs CEG chipset providing smooth system font/line drawing, works with Windows 3, over 700,000 colours, demo pix. Amazing at only £199.

DR-DOS 6.0 instead	add £25
MS Windows 3.0	add £60
Mouse	add £15
Second floppy (any size)	add £40
LPT2 and COM3/4 ports	add £20
Twin joystick ports	add £15
Memory per addl. 1Mb	add £35
Mobile Hard Disc Rack	add £35
Mini Tower Case	add £10
Midi Tower Case	add £40
Full sized Tower Case	add £90
12 months OSM	add £50
2 or 3 years OSM	£CALL

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Drive to Junction 17, M62 and leave the motorway heading south (follow sign for Prestwich/Salford). Go south on the A56 through the pelican crossing at the hospital, then through the main lights in the village and on to the next pelican crossing. Turn right immediately after this crossing into Warwick Street. We are about 100 yds down the street on the right. Trading hours 10.00 to 5.00 Monday-Saturday.

CARRIAGE

Hardware: £7 per box. Software £7 per order. Consumables and small items: £2 per order. Next day service, Offshore UK and foreign also available. Call for details.

TERMS

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Add to this a list of options that include HI-performance video cards and 17" or 20" HIRE monitors, up to 1.7Gb SCSI hard discs with up to 16Mb cache RAM, CD ROMS, Tape streamers, sound cards for leisure applications and you see that we make more than just standard run of the mill PC's. Now compare our prices.

MODEL	SHILTEC PC386-25SX	SHILTEC PC386-40	SHILTEC PC486-20SX	SHILTEC PC486-33	SHILTEC PC486-33E
PROCESSOR	80386SX	80386	80486SX	80486	80486 EISA bus
CLOCK SPEED	25MHz	40MHz	20MHz	33MHz	33MHz
CACHE RAM	32k	64k	8k + 64k	8k + 128k	8k + 128k
MAIN RAM	2Mb	4Mb	4Mb	4Mb	8Mb
HARD DISKS	IDE 40Mb, 80Mb 120Mb, 210Mb, 340Mb	IDE 40Mb, 80Mb 120Mb, 210Mb, 340Mb	IDE 40Mb, 80Mb 120Mb, 210Mb, 340Mb	IDE 40Mb, 80Mb 120Mb, 210Mb, 340Mb	SCSI 40Mb, 80Mb 120Mb, 210Mb, 340Mb
HD ACCESS TIME	<18ms 32k or 64k cache RAM	<18ms 32k or 64k cache RAM	<18ms 32k or 64k cache RAM	<18ms 32k or 64k cache RAM	<18ms 32k or 64k cache RAM
SVGA CARD - OPTIONS	1Mb TRIDENT or 1Mb ORCHID PRODESIGNER	1Mb TRIDENT or 1Mb ORCHID PRODESIGNER	1Mb TRIDENT or 1Mb ORCHID PRODESIGNER	1Mb TRIDENT or 1Mb ORCHID PRODESIGNER	1Mb TRIDENT or 1Mb ORCHID PRODESIGNER
MONITOR	0.28mm SVGA Colour	0.28mm SVGA Colour	0.28mm SVGA Colour	0.28mm SVGA Colour	0.28mm SVGA Colour
MAX RES	1024x768x256 Col	1024x768x256 Col	1024x768x256 Col	1024x768x256 Col	1024x768x256 Col
MAX COLOURS	32768 with Orchid IIS	32768 with Orchid IIS	32768 with Orchid IIS	32768 with Orchid IIS	32768 with Orchid IIS
FLOPPY DISKS	1.2Mb & 1.44Mb	1.2Mb & 1.44Mb	1.2Mb & 1.44Mb	1.2Mb & 1.44Mb	1.2Mb & 1.44Mb
IO PORTS	2 Serial, 1 Parallel	2 Serial, 1 Parallel	2 Serial, 1 Parallel	2 Serial, 1 Parallel	2 Serial, 1 Parallel
KEYBOARD	102 key Cherry	102 key Cherry	102 key Cherry	102 key Cherry	102 key Cherry
EXPANSION	4 free slots	5 free slots	5 free slots	5 free slots	5 free slots
SOFTWARE	MSDOS 5, Windows 3	MSDOS 5, Windows 3	MSDOS 5, Windows 3	MSDOS 5, Windows 3	MSDOS 5, Windows 3
MOUSE	Genuine MS Mouse	Genuine MS Mouse	Genuine MS Mouse	Genuine MS Mouse	Genuine MS Mouse
WARRANTY	1 YEAR on site	1 YEAR on site	1 YEAR on site	1 YEAR on site	1 YEAR on site
SVGA OPTIONS	TRIDENT ORCHID IIS	TRIDENT ORCHID IIS	TRIDENT ORCHID IIS	TRIDENT ORCHID IIS	TRIDENT ORCHID IIS
HARD DISKS	SVGA SVGA	SVGA SVGA	SVGA SVGA	SVGA SVGA	SVGA SVGA
40Mb (17ms)	£1099 £1199	£1399 £1499	£1499 £1599	£1775 £1875	£2575 £2675
80Mb (17ms)	£1149 £1249	£1449 £1549	£1599 £1699	£1825 £1925	£2525 £2625
130Mb (17ms)	£1199 £1299	£1499 £1599	£1649 £1749	£1899 £1999	£2699 £2799
210Mb (15ms)	£1399 £1499	£1699 £1799	£1799 £1899	£2099 £2199	£3099 £3199
340Mb (13ms)	£1699 £1799	£2099 £2199	£2099 £2199	£2379 £2479	£3199 £3299

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DSi 486-33 64K cache £849

486-33MHz mainboard, 64Kb cache (upgradable), 1 Meg RAM expandable to 32 Meg, small footprint case, appropriate video card, 102 Uk keyboard, 1.44 Mb disk drive, IDE controller, 2 serial 1 parallel port.

Monitor type	Mono monitor	VGA mono	VGA multisync
No H/D	£849	£895	£1039
44 Meg	£999	£1065	£1249
110 Meg	£1113	£1149	£1349

DSi 386-33 64K cache £529

386-33MHz mainboard, 64Kb cache (upgradable), 1 Meg RAM expandable to 32 Meg, small footprint case, appropriate video card, 102 Uk keyboard, 1.44 Mb disk drive, IDE controller, 2 serial 1 parallel port.

Monitor type	Mono monitor	VGA mono	VGA multisync
No H/D	£529	£589	£755
44 Meg	£675	£729	£889
110 Meg	£799	£859	£1025

DSi 386-SX-25MHz £399

386-SX-25MHz mainboard, 1 Meg RAM expandable, small footprint case, appropriate video card, 102 Uk keyboard, 1.44 Mb disk drive, IDE controller, 2 serial 1 parallel port.

Monitor type	Mono monitor	VGA mono	VGA multisync
No H/D	£399	£455	£615
44 Meg	£539	£605	£749
110 Meg	£669	£730	£899

DSi 386-SX-16MHz £359

386-SX-16MHz mainboard, 1 Meg RAM expandable, small footprint case, appropriate video card, 102 Uk keyboard, 1.44 Mb disk drive, IDE controller, 2 serial 1 parallel port.

Monitor type	Mono monitor	VGA mono	VGA multisync
No H/D	£359	£415	£575
44 Meg	£499	£565	£699
110 Meg	£619	£689	£849

DSi 386-40 64K cache £569

386-40MHz mainboard, 64Kb cache (upgradable), 1 Meg RAM expandable to 32 Meg, small footprint case, appropriate video card, 102 Uk keyboard, 1.44 Mb disk drive, IDE controller, 2 serial 1 parallel port.

Monitor type	Mono monitor	VGA mono	VGA multisync
No H/D	£569	£649	£799
44 Meg	£725	£785	£969
110 Meg	£849	£925	£1099

DSi 386-25 non cache £469

386-25MHz mainboard, non cache, 1 Meg RAM expandable to 8 Meg, small footprint case, appropriate video card, 102 Uk keyboard, 1.44 Mb disk drive, IDE controller, 2 serial 1 parallel port.

Monitor type	Mono monitor	VGA mono	VGA multisync
No H/D	£469	£529	£699
44 Meg	£599	£675	£825
110 Meg	£745	£799	£965

DSi SPECIALS

• 386-SX-20 notebook	£999
• 286-12 + 1 Meg RAM	£85
• 286-16 + 1 Meg RAM	£95
• Windows 286 v. 2.1 disk only	£5
• VGA Multisync + 1 Meg card	£299
• ST157A + IDE controller 2S 1P	£145
• Toshiba 110 + IDE controller 2S 1P	£239

DSi 286-12MHz £269

DSi 286-16MHz Add £20

DSi 286-20MHz Add £40

286-12MHz mainboard, 1 Meg RAM expandable, small footprint case, appropriate video card, 102 Uk keyboard, 1.44 Mb disk drive, IDE controller, 2 serial 1 parallel port.

Monitor type	Mono monitor	VGA mono	VGA multisync
No H/D	£269	£310	£475
44 Meg	£399	£475	£575
110 Meg	£529	£599	£749

DSi - Main Boards

<input type="checkbox"/> 486-33 64K cache	£685
<input type="checkbox"/> 486-20-SX 64K cache	£499
<input type="checkbox"/> 386-40 64K cache	£369
<input type="checkbox"/> 386-33 64K cache	£349
<input type="checkbox"/> 386-25 non cache	£239
<input type="checkbox"/> 386-SX-25	£169
<input type="checkbox"/> 386-SX-20	£159
<input type="checkbox"/> 386-SX-16	£139
<input type="checkbox"/> 286-20	£79
<input type="checkbox"/> 286-16	£65
<input type="checkbox"/> 286-12	£55

DSi - Add On Cards

• IDE controller with 2S 1P	£19
• XT multi I/O with all format floppy controller	£19
• XT/AT all format floppy controller to 1.44Mb	£15
• 2 Serial 1 Parallel card	£13
• Anti Virus card	£29
• Mono card with LPT1	£13
• VGA card 256K 8 bit	£30
• VGA card 256K 16 bit	£33
• VGA card 512K 16 bit	£44
• VGA card 1 Meg 16 bit	£69
• VGA card 1 Meg 16 bit Tseng Lab chipset	£89
• VGA card 1 Meg 16 bit Tseng Lab 32K colours	£149
• VGA card 1 Meg Tseng 32K clrs 1280x1024 res	£169
• Super VGA monitor	£219
• Super VGA multisync	£239
• 102 UK keyboard	£29
• 5.25" 1.2 Mb floppy disk	£42
• 3.5" floppy disk	£37
• 3.5" fixing kit	£7
• 40 Mb Seagate ST 157A	£129
• 110 Mb Toshiba H/D	£239
• Axelan mouse	£15
• IDE controller 1 Meg cache	£245

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> Medium Tower	£69
> Full Tower	from £85

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64K cache memory
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HiG-386X-40 £1480
AMD 80386DX processor
40MHz clock speed
4Mb RAM expandable to 32Mb
64K cache memory
52Mb hard disk, 3.5" and 5.25" floppies
VGA mono monitor*



HiG-486-33 £1820
Intel 80386DX processor
33MHz clock speed
4Mb RAM expandable to 64Mb
64K cache memory expandable to 256K
52Mb hard disk, 3.5" and 5.25" floppies
VGA mono monitor*



HiG-486E-33 £2280
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Extended Industry Standard Architecture
4Mb RAM expandable to 64Mb
64K cache memory expandable to 256K
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VGA mono monitor*



HiG-286W workstation £540
Intel 80286 processor
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VGA mono monitor*



Hi-Note £1250
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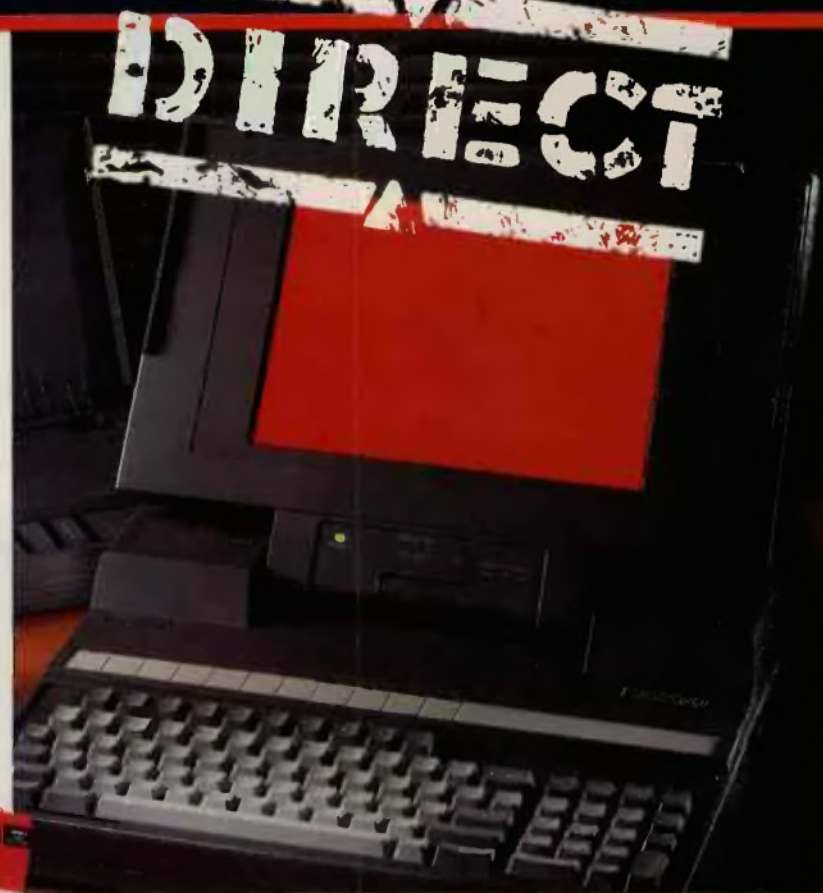
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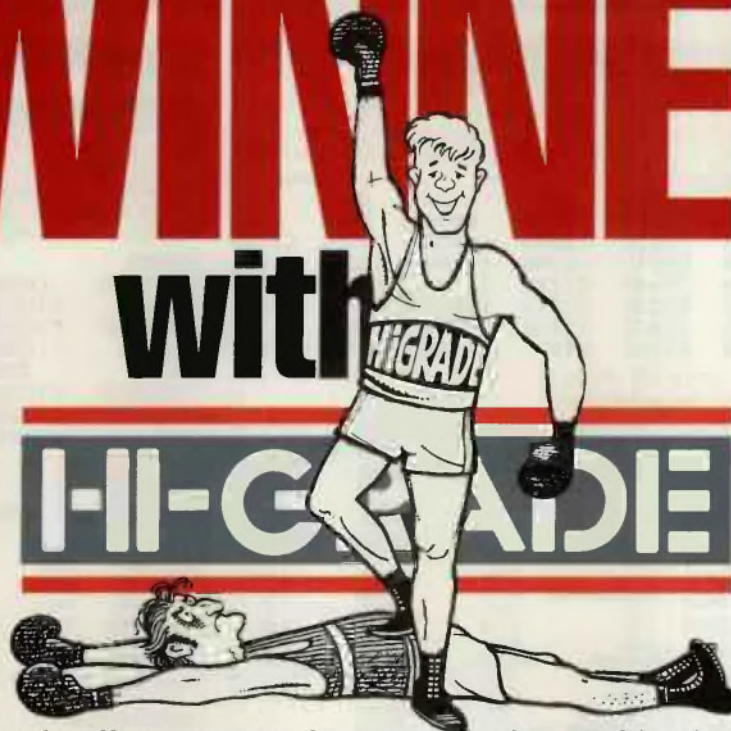
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4Mb	£155	£155	£239
CANON	LBP4	LBP8 II	LBP8III/TR
1Mb	£129	-	£129
2Mb	£249	£125	£249
PANASONIC	4420	4450i	4455
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2Mb	£119	£119	£229
4Mb	£199	£199	-
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OKI	1Mb	2Mb	-
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ALT286	80286	12.5	1Mb	1.44Mb	40Mb	£1179
ALT386SX	386SX	16	1Mb	1.44Mb	40Mb	£1169
ALT386SX	386SX	16	1Mb	1.44Mb	80Mb	£1349
ANB386SX	386SX	16	1Mb	1.44Mb	20Mb	£899
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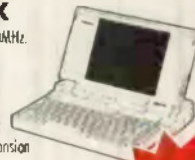
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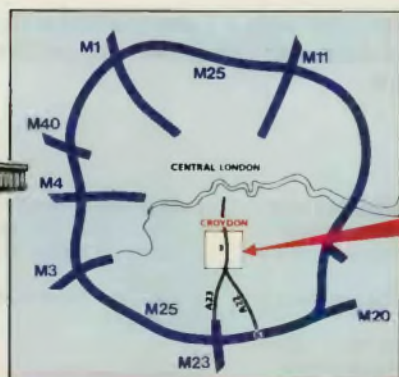
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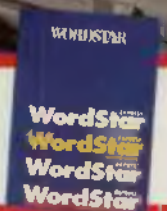
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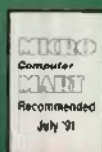
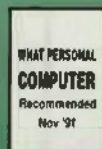
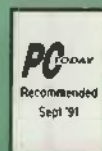
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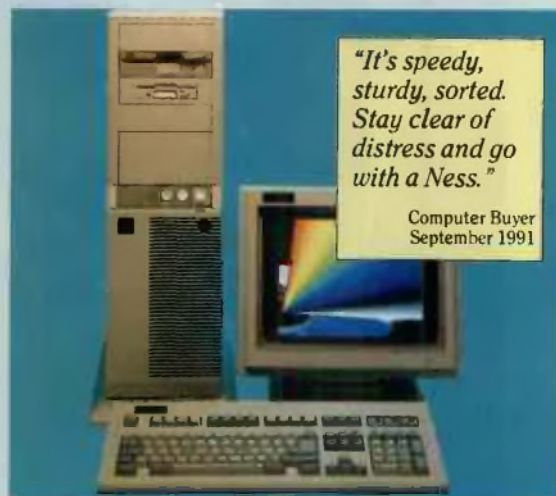
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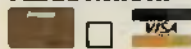
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PS/1	286	10	40Mb	3.5"	1Mb	£499
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FamPack system includes Audio Card and Joystick, Sierra sliphead, Cakewalk Apprentice, PC Globe, Fomtrap, World Class Chess, Collins On-Line, Bushbuck

Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA
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386x	386x	16	40Mb	3.5"	2Mb	£499
386x	386x	16	80Mb	3.5"	2Mb	£599
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Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA
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PCS286	286	16	80Mb	3.5"	1Mb	£499
PCS286	286	16	120Mb	3.5"	1Mb	£599
PCS386x	386	16	40Mb	3.5"	1Mb	£1016
PCS386x	386	16	100Mb	3.5"	1Mb	£988
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Model	CPU	MHz	Hard Disk	Floppy	RAM	VGA
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286	286	16	40Mb	3.5"	1Mb	£745
386	386x	16	40Mb	3.5"	1Mb	£809
386	386x	16	110Mb	3.5"	1Mb	£849

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386	386x	16	Ethernet	3.5"	1Mb	£699

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486/20	486x	20	—	3.5"	2Mb	£1192
486/33	486	33	—	3.5"	2Mb	£1495

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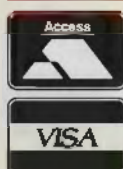
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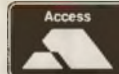
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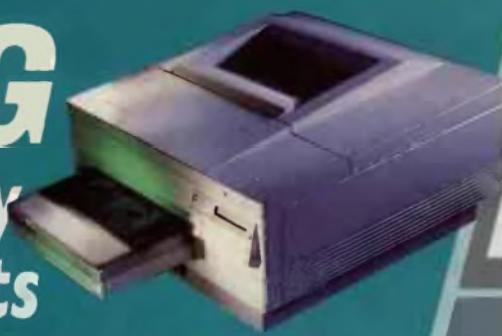
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NB17 286-60 With FREE Dicon 150 Printer	8.72	9.88	11.82
NB18 386sx-20	9.62	10.90	13.04
NB18 386sx-60	11.07	12.55	15.01

SHARP			
6220 286-20 *	8.30	9.41	11.25
6240 286-40 *	9.41	10.66	12.75
6521 286-20 *	8.92	10.11	12.10
6541 286-40 *	9.89	11.21	13.41
6621 386sx-20 *	12.73	14.43	17.26
6641 386sx-40 *	14.12	16.00	19.14
6661 386sx-60 *	15.09	17.10	20.45
8041 386 VGA Colour *	25.61	29.02	34.71
8501 386 VGA Colour *	27.69	31.38	37.53

TANDON			
LT386sx-40 *	7.12	8.07	9.66
NB386sx-40 *	11.76	13.33	15.94
NB386sx-60 *	12.66	14.35	17.16

TOSHIBA			
T-1000SE	3.25	3.68	4.40
T-1000XE-20	4.31	4.89	5.85
T-1000LE-20	6.42	7.28	8.71
T1200XE 286-20	7.80	8.84	10.58
T1200XE 286-40	8.69	9.85	11.78
T2000 286-20	8.90	10.09	12.07
T2000 286-40	9.78	11.08	13.25
T2000SX 386sx-20	11.49	13.02	15.57
T2000SX 386sx-40	12.45	14.12	16.88
T2000SX 386sx-60	14.44	16.37	19.58
T3100e 286-20	8.58	9.73	11.64
T3100e 286-40	10.34	11.71	14.01
T3100SX 386sx-40	12.45	14.12	16.88
T3100SX 386sx-80	13.42	15.21	18.20
T3200SX 386sx-40	12.15	13.77	16.47
T3200SX 386sx-120	14.39	16.31	19.51
T3200SX 386sx-120 Colour	28.49	32.29	38.62
T5200 386-100	17.06	19.33	23.12
T5200 386-200	19.17	21.73	25.99
T5200C 386-200 Colour	28.97	32.83	39.27

ZENITH			
MastersPORT 286-20	8.72	9.88	11.82
MastersPORT 386sx-60	13.81	15.65	18.72
MastersPORT 386SL-60	20.73	23.50	28.11

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7475A A3/A4 *	4.15	4.71	5.63
7570A A1/A2 *	13.67	15.50	18.53

ROLAND			
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DPX2500 A2 *	16.37	18.56	22.19
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BROTHER HL-8V 8ppm *	7.40	8.39	10.03
BROTHER HL-8PS 8ppm *	10.27	11.64	13.93
CANON LBP-4 4ppm *	4.06	4.61	5.51
CANON LBP-8 III 8ppm *	6.85	7.76	9.28
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EPSON EPL7500 6ppm *	8.20	9.30	11.12
HP LASERJET IIP 6ppm *	4.98	5.64	6.75
HP LASERJET III 8ppm *	7.12	8.07	9.65
HP LASERJET IIID 8ppm *	12.04	13.64	16.32
HP LASERJET IIIsi 16ppm *	17.65	20.01	23.93
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Extra 4mb Ram for HP's	1.09	1.24	1.48
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KYOCERA F820T 8ppm	9.30	10.55	12.61
KYOCERA P2002 PS 10ppm	17.92	20.31	24.30
KYOCERA F5000 A3 9ppm	26.79	30.36	36.31
NEC S/writer2 S60P P/S 6ppm *	7.61	8.62	10.31
NEC S/writer2 266 8ppm *	4.81	5.45	6.52
NEC S/writer2 290 P/S 8ppm *	10.04	11.38	13.61
PANASONIC KXP-4420 8ppm *	4.51	5.12	6.12
PANASONIC KXP-4450i 11ppm *	7.08	8.02	9.59
PANASONIC KXP-4455ps 11ppm *	10.83	12.27	14.68
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QMS 810+ PS 8ppm	13.91	15.76	18.85
QMS Colourscript Model 10	31.42	35.61	42.60
QMS Colourscript Model 30i	59.88	67.86	81.17
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STAR LP-4PS 4ppm *	5.77	6.54	7.83
STAR LP-8II 8ppm *	6.76	7.67	9.17
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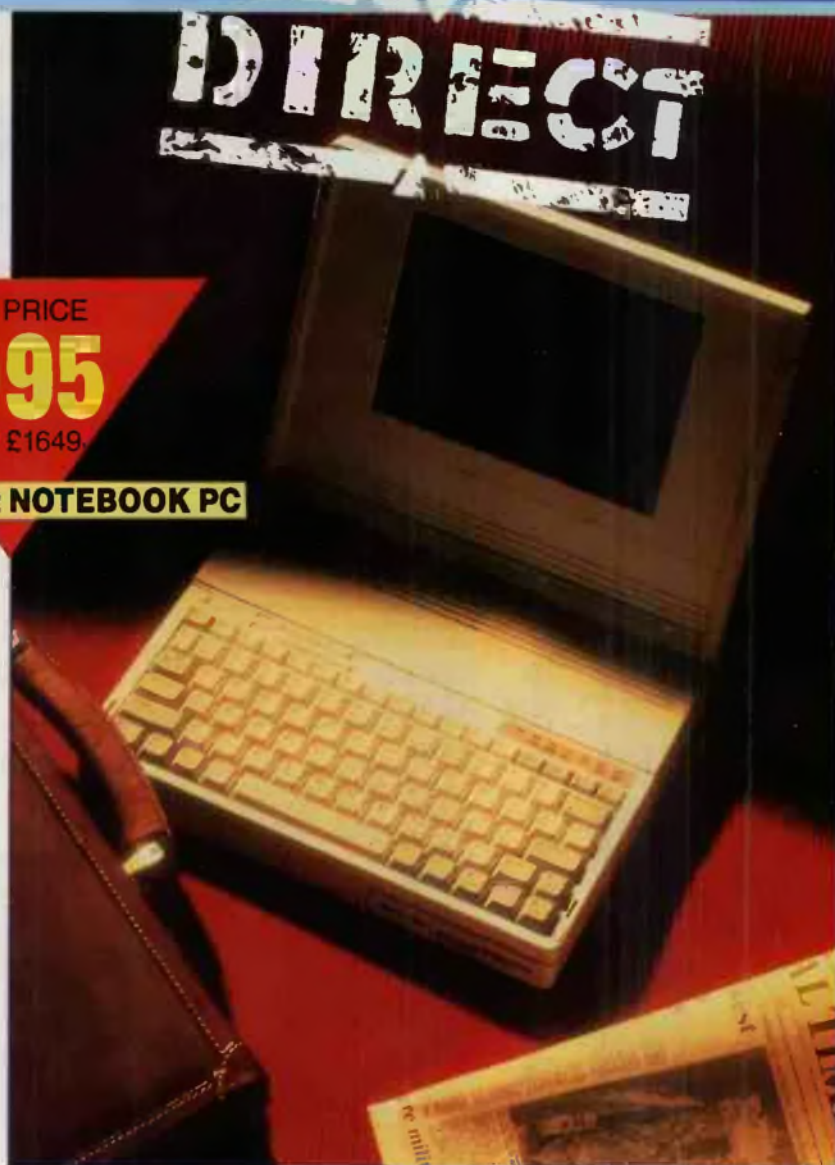
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80386 20MHz Processor. 2Mb. 40Mb hard disk. 3.5" 1.44Mb floppy drive. 14" Multicolour LCD screen. 640 x 480 Resolution. VGA Emulation with simultaneous 16 out of 512 colours (640 x 480) mode or 256 out of 512 colours (320 x 200) mode. 1 Year on-site maintenance. MS-DOS 4.01. 22lbs. **£3699**
- PC-8501 Colour**
80386 20MHz Processor. 2Mb Memory. 100Mb Hard disk. 3.5" 1.44Mb floppy drive. 10.4" TFT Colour LCD display. VGA Emulation with simultaneous 16 out of 4,096 colours (640 x 480 pixels) or 256 out of 262,144 colours (320 x 200 or 360 x 480 pixels) 1 Year on-site maintenance. MS-DOS 4.01 6.9Kg. **£3989**
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Ink Cartridge **£15**
Carry Case **£35**
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- SEIKOSHA LT-20**



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- ALT-386SX-80**
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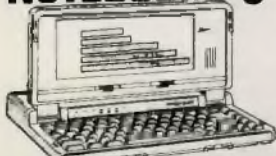
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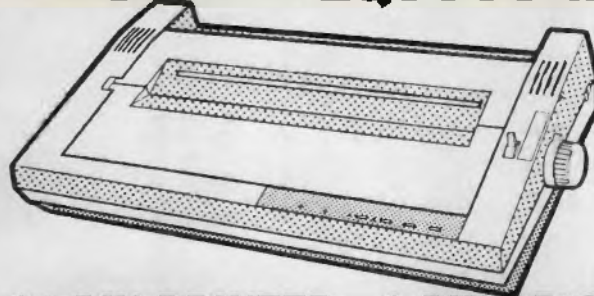
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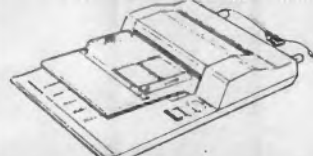
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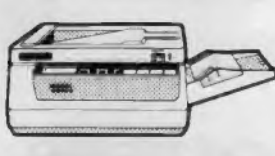
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386 386sx 40Mb	£810	£940	£959
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N/Workstation Range

286 286	£600	£700	—
386 386sx	£700	£800	—

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486/20 486sx	£1193	£1329	£1359
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40Mb	£131	110Mb	£261
200Mb	£435	400Mb	£869
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Extra Floppy Disks:-

MCS computers complete with Windows 3, Mouse & DOS

Pacil Range

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386/33 200Mb	5.25"	1Mb	£2020	£2160	£2210
386/33 300Mb	5.25"	1Mb	£2299	£2500	£2520

386/33 Tower Range

386/33T 110Mb	Dual	4Mb	£2020	£2160	£2200
386/33T 200Mb	Dual	4Mb	£2339	£2479	£2539
386/33T 300Mb	Dual	4Mb	£2630	£2770	£2830
386/33T 600Mb	Dual	4Mb	£3149	£3289	£3349

486/33 Range

486/33 110Mb	3.5"	4Mb	£3070	£3210	£3270
486/33 200Mb	3.5"	4Mb	£3425	£3559	£3619
486/33 300Mb	3.5"	4Mb	£3650	£3830	£3850

486/33 Tower Range

486/33T 110Mb	Dual	8Mb	£3469	£3599	£3659
486/33T 200Mb	Dual	8Mb	£3739	£3879	£3939
486/33T 300Mb	Dual	8Mb	£4000	£4140	£4200
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* models include O.S.M.

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ALT 286-40	TM3000sx-20	£1499	T4400sx-80 £2890
ALT 386sx-40	TM3000sx-40	£1649	T3100sx-40 £1370
ALT 386sx-80	TM3000sx-60	£1769	T3100sx-80 £1466
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NB18 386sx-20	£1290	T1000se	£399
NB18 386sx-60	£1480	T1000le-20	£760
		T2000-20	£1028
TANDON		T2000-40	£1140
NB/386sx-40	£1310	T2000sx-20	£1313
NB/386sx-60	£1490	T2000sx-40	£1427
			MastersPORT 286-30 * £1295
			MastersPORT 386sx-60 * £1959
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4214 LR 14" Multiscan	•	£372
6116 LR 16" Quadscan	•	£785
6120 LR 20" Quadscan	•	£1109
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4FG 15" Multisync		£465
5FG 17" Multisync		£850
6FG 21" Multisync		£1550
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TX1703 17" Multiscan		£796
TX2013 20" Multiscan		£1190
TX2103 21" Multiscan		£1460
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BM7490 14" VGA LR WH	•	£115
CM8833/II 14" CGA	•	£167
CM9809 14" VGA	•	£229
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KX245 12" VGA White		£97
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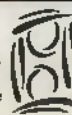


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Electronic Office starts new chapter for Inactive Book

The Active Book is dead. Long live the Electronic Office — which is what we must now call the new company that has been set up as a joint venture between the old Active Book Company and AT&T.

'Is this the vapour product of the year?' asked a colleague acidly, when told the news. It must be the longest fuse I've watched since the failure of an American manufacturer, Gavilan, to produce a single machine after four years of struggle. I just hope this doesn't mean that a similar fate awaits the EO computer.

The delay has been caused by founder Hermann Hauser, who was a co-founder of Acorn many years ago. He learned a hard lesson from the eventual fate of Acorn — that it isn't possible to succeed in world markets if your base is purely the UK. You need, he told me, an American partner. I suspect he's right; but one might be anxious about the size of the partner he's picked.

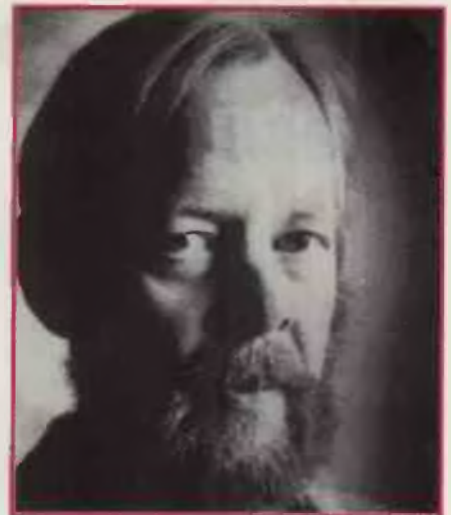
The deal is a share-for-share swap, not with AT&T directly but with its new EO subsidiary based in California. Since Hauser had half the shares in

Active Book, it's not hard to guess he must have a quarter of the shares in Electronic Office, which probably gives him the biggest individual shareholding and leaves him in control of the company's direction.

But there's no pretending the machine, long gestating at Active Book, isn't overdue. It was promised for the end of 1990; it was then ready for launch in May this year when the plan was frozen because of the chance of American money and muscle in the market. 'Well, we could have launched then. You saw the prototype, you know it was working; but we wanted something our partner would be happy with,' said Hauser.

All one can do is hope that he makes it. His hope is that almost no serious pen-driven machines will be available by next Summer, and certainly nothing to match his design for power, battery life, and ease of use, he says. Also, he thinks he's ahead of the field in communications. If he is, the delay won't matter at all.

The other thing worth mentioning, I think, is that Hauser is not going to be unknown in the US. The people he has



GUY KEWNEY

been working with are people who are well connected. His consultant for example, Mike Markkula, first became famous when he helped the two Steves — Wozniak and Jobs — to finance Apple. One of the partners in the venture-capital company backing EO is the 'Byers' in Kleiner Perkins Caufield and Byers. Not the famous Tom Byers, president of the Slate software company which Tom Byers set up with VisiCalc authors Frankston and Bricklin. He is Tom's brother.

You could say that the people who matter will know what is going on.

Expandable notebook is great but costly



In among the unbelievable pile of over-priced junk I've had to wade through this month, I found one machine I've been looking for ever since the German Cebit show in Hannover in March. This is the expandable notebook, exhibited by Keytronics; it expands by using the SCSI bus.

That's the good news. The bad news is that the maker, all too aware of the novelty, is asking £3000 for a machine with 60Mb hard disk and 4Mb of RAM.

It's being sold under the Vortec label by a Samsung subsidiary (called Vortec)

but has no connection at all with Samsung computers. The machine is easy to recognise, because although the SCSI port looks pretty well exactly like a parallel printer port there is a much more obvious feature: a 'mouse-key' next to the space bar.

For myself, the mouse-key is a gimmick: it's a joystick, really, the size of a standard typewriter key. It works exactly as well as you would expect — hardly at all. That said, I have to admit I've met people who have tried it and said it was wonderful, so it's probably worth a try. The drawback, I'm afraid, is that the maker decided users wouldn't need a real mouse and provided no socket for one. There was only one serial port on the prototype I saw, so if you want Windows comms, you will have to manage with the mouse-key.

But the idea of having a SCSI expansion port is brilliant, if it works. Lots of things — not just disks, but printers, system expansion boxes, even modems and network cards — will run off the

port because it is a complete bus, not just a parallel socket. When I get one to play with, I'll be plugging it into various 'standard' SCSI devices. I suggest you do the same, and that you start out with a cynical conviction that it won't work. You may get lucky.

The notebook is remarkable for another detail: it runs off damn near any battery. It will take the standard NiCad, but also alkaline cells (Duracell type) or even the new nickel hydride cells, which have more power and don't suffer from NiCad amnesia. And you can get a car adaptor, which plugs into what has always been called the 'cigar lighter' up till now, and which I suspect will soon come to be relabelled as a 'computer power point'.

Details from Vortec, on 081-862 9311; in the UK, a list of dealers will be supplied by P&P Distribution. I wish I had better news on price, but with a full 60Mb disk and the extra feature of SCSI, I suspect the company will test the water at the higher price for a while.

Superstore teaches smug dealers a lesson

When the Croydon computer superstore 'PC World' was announced, there was a lot of scepticism from normal computer resellers. 'It'll never catch on, this self-service business,' they said smugly. 'Our customers will continue to come to us because of the service we offer them. We don't just shift boxes.'

They will learn. What they didn't know, I think, was that the people who would patronise PC World were already patronising the company that launched it — Hi-Voltage. The Hi-Voltage operation was based on the Argos catalogue model: you don't get to handle the goods before purchase, but you don't have to rely on finding someone who knows what you're looking for. You just say what the part number is, and they pull it off the shelf.

Most dealers don't sell like this. They keep you waiting in line. No matter how trivial your requirement, you will have to deal with a counter salesperson who may, if you're lucky, know exactly what it is you're after. More likely they are underqualified, over-worked, have never heard of what you need, and take 20 minutes to find that they don't even stock it.

The new store takes the Hi-Voltage operation and eliminates the human bottleneck even further. Instead of standing in a queue that goes twice around the Toys R Us block in Croydon, you march straight in, grab a trolley, and start looking for what you want. And my goodness, the range is good! Toshiba, IBM, Tandon... the list is long.

Two months later, it seems to me that the store is already a success. Mind you, I was biased in favour of the idea: even before it was open, I had written an angry piece for the trade paper *PC Dealer*, asking just why it had taken Britain's resellers so long to adopt the very, very simple concept of self-service. Never mind whether this is a superstore concept: what I want is a chance to select what I want, think about it, and ponder in private. And then, if I do need help, I can find someone who knows the answer.

A week after that piece appeared, the store owner rang me up to ask if he could reprint that article in his company catalogue. Of course, I agreed; I even re-wrote it a bit — I really do think that the management there is doing it right. I suppose it's true that the self-



Big-name manufacturers have responded well to Jan Murray's PC World superstore

service system works best as a superstore, but it's important to realise that you don't have to have a big 100-acre site in order to let your customers do what they want to do — wander around and see what they want to buy.

In the weeks since PC World opened up, many people who were initially sceptical have decided to support it. Toshiba, for example, examined the store and gave it a dealership franchise. IBM decided to put its new 'home' machines — the PS/1 Famipack with games, for example — on sale there. Tandon has announced that the store will sell its 'full range of products' through the store.

Nobody who writes for magazines which carry mail-order adverts can seriously pretend to be unhappy about the failure of the computer shop in the UK. Many people will continue to buy mail order even when all computer stores are self-service palaces with PhD support staff and the best prices. When you know what you want, it's nice to be able to flip through the advert pages, pick the best deal, dial the number, and wait for the parcel with the new disk, extra cable, printer ribbon, or whatever.

But the industry does need as many outlets as it can economically support; and until the computer store manager stops getting between the goods and the customer, the computer store is not going to sell things. I wouldn't mind a pound for every time I've gone into a computer store for three items, and come home with only two because I forgot the third. Walking around with a

trolley, I'd probably have seen it on the shelves — and also seen things that I didn't realise were available, and things that are on half-price closing-down final offer, and things that suddenly took my fancy, and things that I've been looking for for weeks. The store that runs itself like that will get the money; and the customers will get the service that stores have always claimed they provided.

Mousepen is cat's whiskers

For Windows users who must have a mouse, I have started recommending the Mousepen, built by Appoint in the US. It's a pen-shaped pointing device that plugs into standard PS/2 mouse sockets, and comes with every adaptor you might need to plug into serial ports, other mouse ports like Microsoft or Logitek, or even VGA cards with mouse drivers.

And it has taken me a month to admit that I like the thing; at first, I found it not enough like a mouse, and not enough like a pen, either. But once you have tried the alternatives in tight working conditions, I think you have to say that it is a good solution. I particularly like the way I can hold the thing off the mousing surface (my leg, in an aeroplane, but the sofa will do) and click or double-click without having to press down. No wobble: it makes the double-click much more reliable.

How to double your disk space and learn to live in fear of the death of your utilities

'Your data is stored on a disk in a code, and decoded by the disk controller. Why get anxious about having it stored in a different code, which uses less space?'

The question was asked when I expressed anxieties about a new disk utility — a compactor. This is said to double (or better) the amount of space on your disks. People say such programs are reliable. Even so, it has taken me several weeks to work up the courage to test them.

There's a sudden glut of them. The one I was looking at, Stacker, uses the same software you find in modern modems to compress files. Version 2.0, now available through a few UK stores, adds a new dimension by giving you a 16-bit processor card which speeds the business up. Other software is available to do this — examples include Digital Research's DRDOS 6.0 and Speedstor.

The reason I was nervous is that I once lost 10Mb of data — in the days when 10Mb was all I had on the disk — by installing a Konan disk compressor card that arrived for evaluation. It appeared to work, giving me a lot more disk space.

But meanwhile an awful lot of disk utilities simply died when you ran

them. And one (the earliest Norton, it was) took the whole disk with it in its death agonies. The Konan supplier told me calmly that this was a 'known bug' and asked for the instant return of the hardware.

There is already a body of 'urban myth' about compressors. Early versions of Stacker are said to have had bugs, and as a result I've met people who swear that if you run this disk compressor, your hard disk will lose everything.

Not foolproof

My own tests, on a variety of machines, were mostly reassuring but it seems clear that Stacker only works if it works. Something like a disk compressor ought really to be foolproof, and this isn't.

My copy worked perfectly on the Samsung Notemaster notebook, the machine on which I'm beta-testing Windows 3.1. But it fell over badly when I asked it to run on a system having an extra disk, a Plus Hardcard II XL50 (see page 102), with its own controller card. The Hardcard drivers are loaded by a Config.sys statement. Stacker took one look at this, said that the disk was 'probably write-protected' and crashed, leaving me without my startup files.

I'm still waiting for an explanation

of this. Meanwhile, taking courage firmly by the throat, I've installed the software on several other 386-based machines. And the enthusiastic reports I've had from readers seem to be borne out: you do indeed get enormously more data on the same disk, and it doesn't slow down.

For a world suddenly afflicted by 14Mb and 23Mb programs that use Windows, this software is irresistible. I am constantly finding that people who make other disk accessories — sector editors, cache drivers, and so on — are holding on to their products for a little longer, in order to make sure they work with Stacker.

At this point, I have to admit that I haven't used Speedstor. I also haven't used DRDOS 6.0, which uses the same algorithm that Speedstor uses. I'm therefore unable to verify Stac's claim that its software/hardware combination is not only the fastest but the best at compressing data.

Back up your disk, and try it. I'm quite pleased with the extra 50Mb I got on a 60Mb notebook; a 20Mb DOS partition has turned into a 33Mb (maximum) drive, which is also quite good.

But if you feel in any way nervous, don't worry — you're in good company. So am I. Still.

Solbourne sees SPARC of hope in low-end workstation market

Solbourne has decided that Sun quit too soon. It is going to sell Volkstation machines based on the SPARC chip to the 'man on the Clapham Omnibus'.

It is only a year since Sun decided that it could sell its minicomputer SPARC machines cheaply enough to threaten the top-end PC market. The top-end PC was based at that time on ridiculously overpriced Intel 486 chips. Rivalry has since forced Intel to cut its prices, and the price of a 486-based AT is now under £2000 from any sensible supplier. So Sun has been left selling workstations rather than affordable desktop systems.

However, Solbourne reckons Volkstation prices let its machines in with a chance. It has quoted a £3500 price point for the entry-level S4000-M workstation, which includes 8Mb of RAM. 'We are throwing down the gaunt-

let to the 486 PC market,' the company announced.

Compared with Sun's own SPARC machines (Sun designs the scalable processor SPARC chipset, remember), the prices on Solbourne's new range are indeed aggressive. And Solbourne isn't as far out of touch with the top 486 market as it looks at first. True, many suppliers offer 486 machines with high-resolution VGA and big disks for under £2000, but there are also people with good reputations selling similar beasts with £3000 price tags.

More to the point, the highest performance 486 machines are built around the Micro Channel (IBM and friends) or the EISA (Compaq and associates) buses — both of which are much faster and more reliable than the old AT bus, but are also much more expensive. Against those, Solbourne certainly has a chance,



Solbourne's S4000-M workstation

if it can find people to sell the things.

Which leaves me concluding that you won't buy them. Solbourne has announced the new range without even considering the subject of who will sell them. I'm afraid, in my experience, this means that the company lacks energetic and inspired resellers prepared to flog the machines up and down the high street; that in turn means Solbourne might as well not bother to announce the price. Nice machines; shame about the marketing strategy, I'd say.

Cute tricks on cuts as computer price war heats up

Pricing of computers is undergoing a slow, reluctant reform, with most of the big suppliers trying the astonishing trick of advertising prices only 20% higher than the products cost.

This is cleverly described as 'an aggressive pricing policy' by people like Toshiba, Compaq, Mitac, Tulip, and the rest. Mitac has reduced prices on its portable machine, for example: 'Price cuts preempt price war' is the headline suggested by John Clarke, Portable Division manager at Mitac. No, John. Actually, price cuts are part of the price war. But no matter: they are welcome.

Mitac's cuts take the 386SX notebook below the £1000 price level. Admittedly, you only get a 20Mb hard disk for that price; definitely a case for buying something like Stacker or another disk compressor if you want it. But £945 for a complete 386 system with 1Mb RAM, VGA display, and high-density floppy is nice. The 40Mb version comes in at £1200 compared with £2000 before the cut. Rather reprehensibly, Mitac is quoting these prices excluding VAT — not the only company not to comprehend that the law has changed, and that people are required to quote the *inclusive* price, so add 17.5 per cent to those figures.

Common complaint

Rival Samsung has decided to put the value up, rather than cut the price; bundled with its Notemaster notebook will be a genuine 14in colour VGA screen, so that you don't have to use the built-in LCD when at your desk. Cost of the screen is £275. Together, the machine and screen cost £2400.

Incidentally, I've had the opportunity to use this machine for a couple of weeks, and have found nothing to complain about except the dreadful keyboard layout common to all notebooks except IBM's. The Notemaster keyboard is flakier than some: I've noticed missing keystrokes on this model.

From Elonex, a price cut of £100 takes its laptop down to £1400, also excluding VAT. The price isn't remarkable for a 20MHz 386SX with 40Mb of hard disk until you notice two features: a genuine AT bus with a single slot (two-thirds length, however) and the fact that the hard disk is removable.

Another notebook shift from Research Machines, with no change on price but double the disk space. Again, the bargain isn't remarkable: doubling 20Mb gives a miserable 40Mb hard disk. RM claims: 'This machine can be used as a fully functional AT desktop.' But this ignores the fact that most people want to run Windows these days, and a 40Mb system has just about room for Word and one other application before you start having to store the information on floppies.

Peculiar pricing policy

The highest profile notebook range at the moment is the Librex, from Nippon Steel. This company can't be said to have taken leave of its senses over prices, because it has yet to show any sign of sense in its pricing policy. Nippon Steel has absorbed the initials RRP and SSP, but appears to have not the vaguest idea of why everybody is using them. It's all very well to talk about a 'suggested selling price' as if this implies better value than the recommended retail price; the problem is that the SSP turns out to be double the 'sensible' selling price. All you can do is to shake your head sadly.

In a market where an established name like Mitac is offering something for under £1000, Nippon Steel is trying to get £1995 for a virtually identical 386SX machine with 40Mb of hard disk. Nippon Steel is even asking more for its 286-based notebook than Mitac is asking for the 386 version. Yes, the new Silly Selling Price is 31% down on the old Ridiculous Retail Price of £2900, but so what?

It isn't just notebooks that are subject to price cuts: Commodore has joined the reduction game with its multi-media CDTV, a consumer box based on the Amiga chips — cut by £100 to £500 including VAT 'on the eve of a massive pre-Christmas advertising campaign'.

Tulip is yet another price cutter. It has announced cuts of up to 29% in retail prices across its entire PC range — but adds that 'after consultation with its dealer base' it is retaining the concept of a Recommended Retail Price.

I'm pleased to report the opinions of the managing director, Steve McCall: 'Recent decisions by a number of manu-

facturers [he means, primarily, Compaq, Toshiba and Tandon] to introduce a typical buying price, as opposed to an RRP, has caused a great deal of confusion in the marketplace, and I genuinely believe these new schemes have done little to improve the purchasing power of the end user.' I have to add that I simply don't believe him; I think Tulip has succumbed to pressure which larger companies are able to resist.

It's easy enough to explain. When Compaq published RRP figures, everybody in the business knew that you didn't actually have to pay that much. Exactly how much less depended on how big an order you placed; people who bought ten or so machines at once could quite easily get 30% off, and I've heard of those who got nearly 40% off.

But not everybody in the business knew. Quite a few people went into shops and bought machines without asking for a discount; and the dealers liked the extra cash if they could get it.

From Compaq or Toshiba, the dealer receives with an ingratiating smile the unwelcome news that these occasional windfalls are over. Dealers have to have those two labels on the shop window to be taken seriously as a computer store. When Tulip says the same thing, I rather suspect dealers are just a touch firmer: 'Try that, Sunshine, and you're out.'

Vicious haggling

What this means to the customer, is that you should haggle viciously over the price of Tulip machines. The advice is hardly needed, to be frank. How anybody can look around the market and see 486 machines with more than 100Mb of disk, 33MHz clocks and upwards of 4Mb RAM, for under £2000, and then march back into the warehouse and put a £3500 price tag on an ordinary monochrome 25MHz 386 machine, I simply don't know.

Final price cut from this month's pile is from Texas Instruments, which has 'significantly reduced' the price of its 'highly specified' 386SX Travelmate: down by £500 to £1800. With only a 20Mb hard disk, this is still £600 too high. The only really interesting news from TI, on the notebook front, is the introduction of a £75 mouse — actually, a tracker ball called Travelpoint.



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DOS weds Unix under Windows

Getting a PC to look like it runs Unix has been the ambition of many people who have been busily writing things like DesqView X and Multiview. Sadly, all have taken a lot longer than they hoped to reach the point where they can ship.

So I'm not going to make any promises about the deal between Santa Cruz and JSB over Multiview Desktop, which has been announced in release 3.1 as a joint venture that 'reinforces SCO's DOS/Unix integration product set'.

The promise is that Desktop enables users 'to view multiple DOS Windows, Xenix and Unix system applications simultaneously, in multiple, configurable windows, on a PC'.

The application that takes all this input (mostly from a remote Unix system) and displays it, is actually a Windows 3.0 application in itself. Windows is used because of its dynamic data exchangeability: you can 'cut and paste' data from DOS to Unix, or vice versa.

Details in the UK can be obtained from SCO on (0923) 816344.

Christmas games from Microsoft

To my unspeakable rage, Microsoft has announced its Entertainment Pack for Windows, volume two and volume three, without letting me see the beta-test software first.

All I can tell you about it is that to follow up games like Minesweeper and Cruel, and Golf, we will be able to spend our Christmas money on a

plumbing game called Pipedream, a jig-saw puzzle, a Rodent's Revenge cat-and-mouse game, and on through a golf game, a skiing game — oh, nice stuff, and I haven't seen it. Irritated? I'll say I am. I'll have to get on with some work, instead of recreation — er, sorry, evaluation... Out before the end of November.



QEMM bug exposes truth about 'verify'

DOS Copy may just be one of the strangest commands in the book. All my PC life, I've been typing copy commands like this: COPY FILENAME NEWFILE /V, in the belief that the /V makes the system do a Verify.

And so it does; it took a QEMM bug to expose the fact that 'verify' is a technical term.

What 'verify' actually means is 'make sure that what you have written to the disk is readable'. I'm afraid I thought it might mean something obvious like 'make sure the copy is the same as the original'. After careful research, I find that it doesn't.

The problem arose when I was taking a 5in diskette to install a new piece of software, and making a 3.5in disk copy. The software refused to install. Yes, it was a slightly unusual machine — an ALR Powerflex, in fact, which is actually a 286 with a 486 chip bolted on the back like a V8 engine in a Mini — but it ran most other strange things, including the latest (beta) version of Windows 3.1.

Rule number one of computer usage is that it is somebody else's fault. As a result, it took me a very, very long time (weeks) before it occurred to me to check to see if the copy was faulty. I did a compare, using the DOS COMP program, and it showed that every second byte of the copy was a Hex FF value.

The problem is intermittent. Enough evidence has accumulated, however, to convince me that the culprit is an old version of the memory manager, QEMM. It appears to manage some parts of memory that it ought, perhaps, to leave alone. One of those is the buffer used for the COPY command.

What irritates me is the gratuitous stupidity of the way DOS handles this. To me, a 'verify' operation ought to check that the operation performed was successful. If that isn't what it does, fine. But the fact that it doesn't work as you might expect is important, and I find it hard to imagine that anyone would accept that 'verify' means no more than 'the CRC at the end of the file is valid'.

Wingpath works wonders in black & white

Windows gave us the bitmap graphics file and sparked off saucy 'wallpaper' based on .BMP files. And in the circumstances, I have to say that I find it quite astonishing that image file conversion packages are still appearing on the market which don't run under Windows.

The latest, Image Conversion Program from Wingpath, claims to be able to perform wonders in black-and-white scanned image files, converting from TIFF, PCX, GEM-IMG, WPG, GIF and PCT formats. And what about BMP? 'Not supported.'

The program supports all TIFF compression methods; the writers say that because of this, it is an excellent tool for compressing image files into limited disk space. They recommend the Group Four compression — or the LZW techniques.

Price is £75, and full details can be obtained from Wingpath at 5/45 Marine Parade, Brighton BN2 1PE, or you can telephone the company on (0273) 671167.

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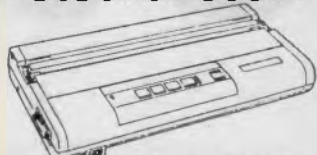
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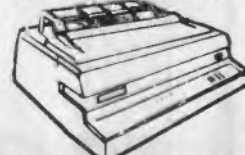
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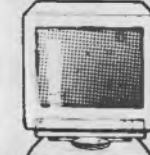
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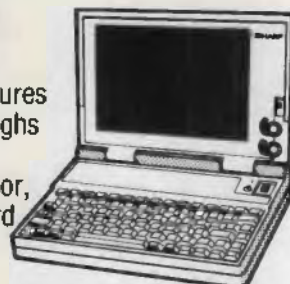
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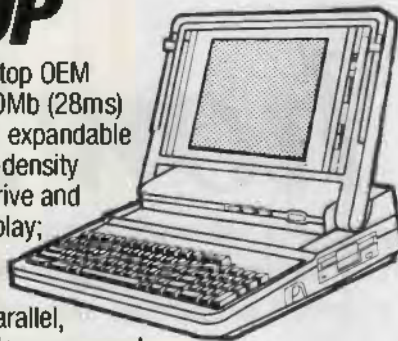
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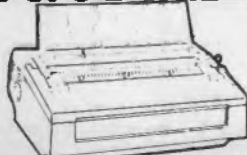
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Colourful Comdex shines in the Las Vegas limelight

 Colour and pens were the two big features of Comdex 1991. No-one announced a colour-based pen machine, but with rapid advances being



made in both areas one can't be far away. The show was big: it occupied the whole of the vast Las Vegas convention centre, with extra stands crammed into hallways. Most of the major hotels had space given over to stands, too. The show lasts for a week, which is not quite long enough for a diligent visitor to spend time at most of the stands. An estimated 125,000 people attended, to see 2.2 million square feet of booths set up by 1850 companies.

For four days the show takes over Las Vegas. A room which would cost \$85 (£50) a night any other week of the year magically costs \$300 for Comdex. Taxis, which usually carry advertising for casinos and shows, suddenly sprout billboards extolling the virtues of a new fault-tolerant computer system or yet another notebook. Comdex is the biggest show of any kind in the US, but you can upset the taxi drivers by pointing out that it is second in the world to the Hannover Messe.

The taxi drivers are pretty upset anyway, because Comdex-goers are not big gamblers or big tippers. Hannover may be bigger but it is staid by comparison. Comdex is the place for new products and razzamatazz.

Simon Rockman

Radius offers the two-in-one Mac

 There were few Mac-centric companies with stands at Comdex, though Apple gave journalists a 43-page list of third-party software and hardware launched at the same time as its new range. But of the Mac stuff that was on show, the most technically-exciting had to do with multi-processing.

System 7 doesn't support multi-processing seamlessly, and a few companies offered varying ways to let a single user benefit from more than one processor. The most general-purpose solution was from Radius. A few months ago it launched the Rocket, a NuBus card with a built-in 68040, but this seemed doomed to a short life with the advent of the Quadras (to which Ilex and Ili owners can upgrade). Instead of giving up, doughty Radius cut the Rocket price by 20% to £1999

and invented Saturn V technology.

With Saturn V and a Rocket installed, users can have two desktops — one for the native Mac and one for the Rocket itself, sharing the same storage. While the Rocket works away on a lengthy image transformation in PhotoShop, say, the user can switch to the other desktop to do something else. You can't yet use both processors transparently at the same task — programs have to be specially written to do that. But at least two companies are working on the problem.


Using Inter-Application Communication and Apple Events on System 7, Strata and RayDream are both working on products that will be able to use spare processing power on Macs across a network to speed up the rendering of complex images. The RayDream product, dubbed 'DreamNet', was shown running on the Quadras at the company's launch, but a launch date and pricing has not yet been set for it.

Strata's product, RenderPro, is based on similar ideas, and again details are sketchy. All three companies probably aim to have something a little more solid at the MacWorld Show in San Francisco in January.

Contacts: Computers Unlimited, distributor for Radius, is on 081-200 8282. Amtech, distributor for Raydream, is on (0202) 476977. Gomark, distributor for Strata, is on 071-731 7930.

David Brake


Keeping track of walking files

 The opportunity PowerBooks will give people to work away from their desks can also cause problems — notably, how to keep desktop files up to date with portable files. Apple has promised to build a solution into the software. In the meantime, Dantz Development, publisher of Retrospect Remote, has adapted its backup software to the purpose. Its new Intertie lets you designate files to be kept current, so that whenever you connect two machines with the software loaded, it automatically replaces obsolete files with the latest version.

Contact Principal on (0706) 217744.

David Brake

New-look IBM shows off smart multimedia kit

 Things are changing at IBM. The new attitude was reflected by a Comdex stand staffed not with men in blue suits, but with boys and girls in tennis shoes and red jackets. The company launched a number of multimedia products under the monicker Ultimedia.

The IBM PS/2 Ultimedia Model M57 SLC is IBM's first PS/2 with built-in multimedia features (see also 'CDTV struggles' on page 124). It is based on the IBM Model 57 but has a significant number of enhancements. There is a built-in CD-ROM drive. Bundled software includes DOS 5, OS/2 version 2, and Windows 3.0 with multimedia extensions, all on CD-ROM. Demo software includes IBM's Audio Visual Connection, Storyboard Live!, Mammals, Presidents, Authorware for Windows, MacroMind Action, Mediasource and Asymetrix Toolbok 1.5.

The ROM drive is billed as a high-performance unit conforming to CD-ROM XA with an access time of 380ms. The machine has XGA graphics which give 65K colours in 640x480, or 256 colours in 1024x768.

Sound is provided by a 16-bit audio capture card. The mono microphone jack, stereo headphone jack, and volume controls are built into the front panel.

The 20MHz CPU is IBM's new variation on the 386SX, the IBM 386SLC, which adds a cache and improved design to the Intel chip. IBM claims this boosts performance by 88%. It's due to be shipped in March (though some of the software is clearly not yet ready) but the price will be \$5995.

Sometimes IBM pulls a rabbit out of the hat: IBM PS/2 ActionMedia II adaptors which capture and play back digital audio and video are suitably fluffy. Using the Intel DVI chipset, the ActionMedia II claims to be the first all-digital multimedia solution to provide both display and capture of high-quality motion video, audio and still images on a board for a single slot. The frame rate of 30 full-screen per second is amazing; the audio quality seems good (although it is hard to tell in an exhibi-

tion hall) and the XGA still graphics look good.

Software support includes a programming language called Audio Visual Kernel (AVK), designed to provide a stable interface for application development but it will cope with multiple-authoring systems. The ActionMedia II runs under OS/2, and there are plans to provide DOS/Windows support.

The card is available for MCA and 16-bit ISA machines. Both cost \$1995. The daughterboard, which provides video capture, costs \$890, and the developer's toolkit \$510. All these parts are due at the end of March 1992 except the ISA card which won't ship until late June.

The IBM PS/2 TV is a video adaptor, tuner, speaker and software for \$500. This, like the device from FAST, lets you watch TV in a window. At a similar price to a colour TV it is not quite the bargain it first seems but is an interesting departure for IBM. No details of a UK (PAL) version were available.

IBM is firmly committed to producing a pen-based machine and a 5lb prototype was on show. The demonstrator was loth to give too much away, but the unit seemed meatier than rival units from Eden, NCR and Samsung. But it was interesting in having a backlight, while using a pen which is not tethered.

There are ports for serial, parallel, floppy disk, a fax modem and a custom comms port, plus non-standard Flash ROMs made by Sundisk.


The decision not to use cards conforming to the PCMCIA standard seems shortsighted, although it does mean IBM could use 10Mb cards as opposed to the 8Mb PCMCIA cards, currently the highest capacity available. The machine is expected to run only Go!'s PenPoint, although Windows for Pen Computing might ultimately be considered. There is no DOS or OS/2 system.

Simon Rockman



IBM PS/2
Ultimedia
Model 57 SLC

Gates opens up on Microsoft plans

 The first version of Windows NT will support enough OS/2 to run Lan Manager. But NT will eventually be able to run LM with no OS/2 help, and Microsoft will encourage LM users to move over completely to NT. Bill Gates indicated to me that it was no longer considered important to put a Presentation Manager front end on NT, saying that Windows is the only system worth writing for.


Gates is untroubled by IBM's plans to price a bundle of DOS, OS/2 and Windows at less than the price at which Microsoft sells Windows alone. Microsoft gets royalties on the three parts and will make more on the IBM trio than it would on a copy of Windows.

Microsoft sees a future for the Macintosh operating system and will continue to support the Apple machine. But two significant applications planned for 1992 will hit the PC market first. They are an improved network mail program and Microsoft's long-promised database, although no details more specific than 'next year' were forthcoming.

After a surface-skimming demo of Windows 3.1 Gates said future versions would merge File Manager and Program Manager. Let's hope it will provide for long filenames. He also said that anyone who wanted to run Windows would be 'silly' to use DRDOS.

Simon Rockman

'Unknown' Philips launches media PC and plans for 1992

 Philips is not a big name in America. The company split up during the Second World War so that US divisions could continue trading, and their names (Roloco and Magnavox) have lived on in the US. So it was at a Philips press conference that a new range of Magnavox products was announced. First to ship will be a PC, imaginatively called the MPC-386SX, based on the MPC multimedia specification. The 386 machine, with a 512K SVGA video card and 4Mb RAM, will be bundled with headphones, a mouse, MIDI sequencer, ASCII-to-speech software and Windows with multimedia extensions. The European launch is slated for early 1992. Magnavox will also have a 486SX version.


More exciting developments are planned for 1992, including a 486SX colour notebook and the

first of a range of pen-based machines. The latter will use a resistive digitising tablet which can be written on with a pen or a finger (you can use the pen for annotation and your finger as an eraser). The screen is pressure sensitive, allowing the line thickness to be varied. There will be a plug-in keyboard, support for both PenPoint and PenWindows, and eventually a notebook with a pen as an accessory.

The prototypes of a novel design of pen computer is being built now with a view to putting it on sale in 1993. But while Philips is working towards a pen and keyboard machine, two companies are already there: NEC and Momena (see page 112, and below).

Simon Rockman

Momena pens itself a hit

 The second major pen and keyboard computer at Comdex was from the new company Momena (see 'Newsprint', PCW December), which dominated the show's West Hall with a massive screen floating over a 6ft hand. Easily the sleekest of the new machines, the Momena was quite a hit. The company has coined the name Pentop for the way it expects the system to be used. Bill Gates said in his address that Microsoft favoured systems which offered both a pen and a keyboard, and the implication was that he was talking about the Momena. (Politics may play a part here, because the Momena will be offered with Windows for Pen Computing and its own PenDos. Go!s PenPoint is not on its options list.)

Packaged with the machine are a number of Pen-based programs created specifically for the Momena. These include a spreadsheet, a word processor, a presentation graphics program, a calendar, an address book and a notepad. Programs being written for it by third parties include PenCell, a spreadsheet which will be bundled with the system. There is a pen-based database-access program which uses SQL, and a word processor with character recognition.


All these special programs use Momena's own gestures, which are very different from those associated with other pen-based systems: when you select an object, a compass appears with the tip of the pen at its centre. Sliding the pen in the direction of one of the compass points performs an action. With practise this seems to work well, if not totally intuitively.

The pen is copper tipped, with replaceable tips — the idea being that it is better for the pen to wear out than the screen. As a result, the Momena does not have the nice pencil-on-cartridge paper feel of the graphite-tipped pen systems. The pen is tethered to the screen, which squidges as you write. It's easy to use. But having only used it on the stand at the show, surrounded by hype, I remain sceptical.

The machine is 386-based and weighs just over 6lbs. It can use NiCad, Nickel-Hydride and non-rechargeable AA alkaline batteries. It has 4Mb RAM, expandable to 8Mb, and a 40Mb hard disk — which seems a bit small for a Windows machine. The Momena will sell for \$4995. For more details contact the company on 0101-415 969 3876.

Simon Rockman

Mac PowerBooks steal PC limelight

 The stars of Comdex were the new Apple computers (see PCW November). Apple does not usually attend Comdex, and this was the first time the show has been used to launch new Macs. It was part of Apple's strategy to attack the mainstream PC market. John Sculley said at the launch that while most people cannot choose their office computer, an increasing number can pick their own portable — and he hopes they will choose a Mac.

In addition to the new Mac portables, the 68040-based Quadra machines and a 68030-based Mac Classic were introduced. This required much co-operation between different Apple divisions, because the portables were originally targeted for an



earlier launch for the Christmas market. The Quadras were to be launched a bit later and the Classic later still, to coincide with a new school term in July. The PowerBooks were certainly popular — Apple was giving away 25, and anyone wearing an Apple badge stood a chance of getting one. As a result many unlikely people were sporting the Apple logo — even security guards.

David Brake

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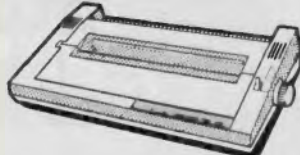
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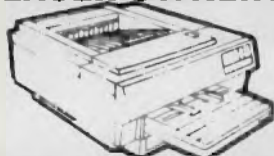
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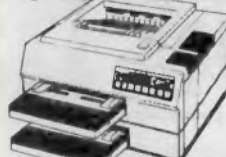
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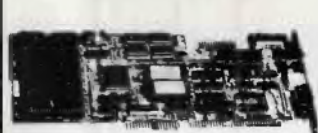
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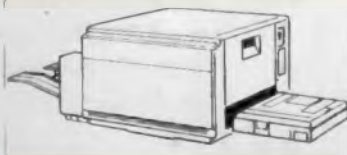
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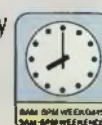


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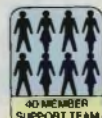


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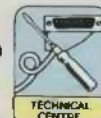


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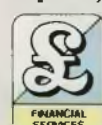


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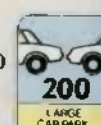


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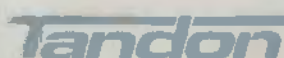
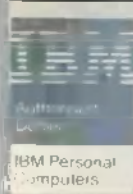


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NEC notebooks offer a serious challenge to reign of the desktop PC

 NEC had a wide range of new products at Comdex, including a new 486-based server called the Powermate Express. The range is designed to be upgradable as a modular system, and offers the inevitable 20MHz 486SX, and the 25MHz and 33MHz 486DX, with the promise of a 50MHz 486 board.

▼ The NEC ProSpeed 486SX/C



The machines are unremarkable and moderately expensive (a diskless 486SX costs \$2999; a 486/33 with a 120Mb drive, \$5199). The more interesting features include a BIOS in Flash ROM, allowing it to be upgraded from floppy disk (useful if you don't know the specifications of all future processors, and there is bound to be something after the 486/50) and the inclusion of an ESDI hard-drive option.

But the device which made the NEC display special was the Ultralite SL/20. This was the only one of nearly 40 386SL-based notebooks at the show to have a pen-based version, the Ultralite SL/20P. The 9.4 in (238.8mm) white-on-black LCD was very clear with a white-on-black display, offering an alleged 32 grey shades. The pen is made by MicroTouch Systems and is tethered. There is software support in the form of a program called UltraDraw and Windows for Pen Comput-

ing. DOS 5 and a Phoenix BIOS complete the firmware. The specifications of the rest of the machine are quite impressive: 2Mb RAM as standard (expandable to 8Mb), an 80Mb hard disk, and an all-up weight of 6.8lbs (3kg) including the pen.

The machine, due out for the Christmas market, gives a typical battery life of three to seven hours (depending on how often it gets to sleep) and offers the usual SL power-saving features. US price is \$4499. It is available now, minus pen, for \$4199.

A less glamorous addition to the Ultralite range is the Ultralite III, a 386SX machine which lives up to its name by being exceptionally light and thin. Weighing 4.8lb (2.1kg) and only 1.5 in (38.1mm) thick, it has a 60Mb hard-drive and an external floppy drive.

The move to replace desktop machines with notebooks, rather than complementing them, is instanced by the last of the NEC range — the ProSpeed 486SX/C, where C stands for Colour. The screen is a 640x480 by 256 colour (from a full 4096 palette) active-matrix display. With scope to add a 487SX (essentially a 486DX) processor, 2Mb RAM expandable to 20Mb, and a 120Mb hard disk, the machine is halfway to offering the features that most users want from a computer.

A full 32-bit EISA slot completes the picture. Admittedly there is only one slot but in a machine measuring 375.9x396.2x106.7mm this is quite an achievement. There is always the option to use a docking station, which has three full 16-bit and one half-size 8-bit slot, plus two drive bays. The 386SX/C weighs 16.8lbs (7.6kg) and has a US price of \$8999.

NEC is on 081-993 8111.

Simon Rockman

Logitech sells Fotoman digital camera



 The major new product to be launched from Logitech is the Fotoman camera, manufactured under licence from the Californian company Dycam.

The FotoMan is a 256 grey-scale digital camera with a built-in flash and wide-angle fixed-focus lens. The 168x81x30mm device, weighing 284 grams and powered by a rechargeable battery, is capable of storing 32 pictures at a 376x284 pixel resolution.

Shutter speeds range from 1/30th to 1/1000th and the light sensitivity is equivalent to 200ASA film. Images are held in RAM until you download them into your base


computer, where they can be put to the tender mercies of Fototouch, Logitech's Windows-based retouching package. The image is transferred through the serial port, so Fotoman does not need a board in the PC.

Logitech is selling only an IBM-compatible unit, but Dycam has Mac and Momenta options. The Dycam is shipping now at \$999 while the \$799 Fotoman will not be available for several months. The UK price is expected to be under £600.

(See also 'Inkware boost' story on page 126.)

Simon Rockman

UK-bound Copam cops a writ from aggrieved Elonex

 A dispute over support has developed into a heated row between manufacturer Elonex and its former supplier, Taipei-based Copam. The row developed after Copam announced its intention to sell machines under its own name in the UK, undercutting Elonex. More controversially, Copam offered to support Elonex customers in the UK, claiming that it felt responsible for users of Copam-made machines. Elonex issued a writ claiming Copam was insinuating that Elonex was not supporting its own customers adequately.

Copam's five-year relationship with Elonex ended in August. Copam claims that the decision to split was mutual, but Elonex managing director Ari Gershuni says it happened because the speed and direction of Copam's research and development was not in keeping with the UK firm's ideas. Elonex has since started to build more of its own machines, although it still rebadges those of other companies in certain cases.

Copam itself launched into Britain on 19 November, with very competitive prices ranging up to £1795 for a 33MHz EISA-based 486 with a 200Mb hard drive. The Elonex equivalent costs £2595. Copam is aiming for a 3% UK market share by 1995.

The support policies of the two companies are broadly similar. Both offer as standard a year's back-to-base warranty. Elonex charges £25 extra, regardless of configuration, to farm a year's on-site support to a maintenance company. A second year

will cost you 6.5% of the original invoice. This promises a basic one-day response time, rising to four hours or better for the 'Gold Service'. Copam charges an additional £35 for a year's on-site support, again regardless of configuration. This rises to £50 after the first year. The typical response time is 16 hours, although like Elonex, this can be cut to four hours.


Will users choose to go for the Copam support because it comes from the original manufacturer? Will Copam be allowed to offer that support? The Elonex writ was served on 11 November after the press carried pre-launch statements by Copam's UK sales and marketing director Barry Lloyd. The writ was placed against both Lloyd and his employers. According to the writ, Lloyd insinuated that Elonex is either unwilling or unable to support computers that it has sold. It claims damages for slander and/or malicious falsehood, and also an injunction against Copam restraining them from making the claim again. Elonex warned that Copam must obey or contest the writ within 14 days.

At the time of writing, Lloyd claimed that Copam had insinuated no such thing, but was merely offering users a choice of support. Whatever happens, the competition looks like it will drive hardware prices down, which has to be good news.

Contacts: Copam is on 081-961 9555; Elonex is on 081-452 4444.

Danny Bradbury

Claris adjusts to the IBM Mac word

 Apple is clearly looking outward much more than ever before. CEO John Sculley's favorite catchphrase at the moment is 'In the '80s we were all by ourselves in our own sandbox. Now we are out on the beach.' The new Apple-IBM alliance is the biggest example.

Claris' purchase of IBM's highly-rated Hollywood presentation graphics product (allegedly despite a higher bid from Borland) shows the Apple subsidiary at last moving into the Windows market. Claris, second-largest Mac software developer, is known to have been working on Windows ports for its products. Apple's 1990 decision against letting Claris go onto the open market was seen as a stop on Claris developing PC products. Now the climate has changed and cross-platform development has accelerated.

Hollywood will be the first Claris PC product. Initially it will be re-badged, but by next year a faster edition should be out with Claris documentation and a more Claris-like interface. Claris has agreed to develop a version for OS/2 version 2. In the first half of 1992, PC editions of Claris Mac products will start to emerge — probably led by

FileMaker Pro, an easy-to-use flat file database.


Sensing the way the wind blows, the Berkeley Mac User Group — one of the oldest and most well-established US user groups — announced at Comdex that it is starting to offer Windows support. No name change is planned.

Claris is on 081 756 0101.

David Brake



Sharp's stunning SL colour notebook steals the show

 As the manufacturer of perhaps the best colour LCD screens available, Sharp is a major component supplier, but the company is taking advantage of its wide range of components to produce some special devices.

The JX 320, the world's first SCSI-2 colour scanner, will scan images as large as A4, or as small as 35mm slides, in full 24-bit colour or in 256 greys at a resolution of 300dpi (600dpi with interpolation). A direct-print option can be used, in conjunction with Sharp's JX 730 or 735 printers, to build a cheap colour copier. In this mode a front panel on the scanner allows the user to make colour and brightness adjustments. A UK price will be announced when the scanner ships in March.

Sharp showed a number of office equipment products: a colour fax, a \$3000 laser fax, and home entertainment equipment like a rather good video projector. But the products which stole the show were its SL notebooks, the monochrome PC6781 and the stunning active-matrix PC6881. Both incorporate an 11mm Alps trackball. However the

cursor disappears on the mono model, despite a high-speed triple-twist paper-white display with a 16:1 contrast ratio. The 6881 cursor is clear, only vanishing under very fast movements.

The machines come with 2Mb RAM (expandable to 8Mb) and an 80Mb hard disk. The PCMCIA slot will take RAM or ROM cards, or one of the new generation of add-on cards such as a fax-modem or LAN adaptor. Thanks to the 20MHz 386SL chip and a Phoenix BIOS (upgradable in flash EPROM) the machine has good power management, and suspend/resume works in Windows enhanced mode.

But what makes the new Sharp special is the colour screen. Here at last is a notebook with a display rivalling that of a desktop. The 8.4in screen is a Thin Film Transistor active matrix display which requires a third less power and is half the thickness of previous Sharp active-matrix displays. Under VGA emulation, 256 colours are available from a palette of 256,000. Some rival machines at the show were more highly specified but the 6881 was clearly the most desirable notebook there. No price has yet been announced and only the 6781 is currently available in the US, with UK sales to start in January. The colour machine will go on sale in the second quarter of 1992.

The smallest PC at the show was also a Sharp. The PC-3000 is Poqet-sized, with a better keyboard than the improved Poqet (also at the show). The PC-3000 has a squashed aspect ratio 7.25in LCD CGA screen which supports 80x25 characters, and resolutions of up to 640x200. The processor is a 10MHz CMOS 8088, and the system has 1Mb RAM, 1Mb ROM and dual PCMCIA slots. The 77-key keyboard sufficed but could not keep up with fast typing. An external parallel interface and a 3.5in disk drive are available as options.


Not much bigger than a Psion Series 3, the PC 3000 measures 111.8x223.5x25.4 mm. No UK price has yet been decided, but the US price of \$1000 is a good starting point. The PC 3000 was designed in Britain by DIP but will not reach here until January.

Simon Rockman

▽ The Sharp PC 6881 active matrix colour notebook



Pop-off screen aids work in the field

 The most innovative pen-based design I saw at Comdex came from Telepad, of Reston, Virginia. Normally, the clipboard is central to pen systems, with the keyboard attached as an afterthought. Telepad's integrated unit looks like a normal notebook, but the screen pops off to double as the pen slate for use in meetings or the field. Pop it back on the keyboard unit and you can dump new info back to the notebook unit.

IBM's 4lb pen-based notebook, using the Go!

PenPoint operating system, was not necessarily the best at the show, but with the right software will get some attention in its target corporate market. The Samsung PenMaster, weighing just below 5lbs, also deserves attention. Its best feature is a backlit screen offering easy viewing of both graphics and text. The basic 9.35x11.5x1.48in unit uses a 20MHz 80386SL chip and has a 60Mb 2.5in drive, 4Mb RAM and a wireless pen. Cost is under \$4000.

Tim Bajarin

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Intel's double vision provides speed enhancements for 486's

 Intel is fighting back against real competition from the likes of AMD and Chips & Technologies. It showed a number of new developments at Comdex, both on the stand and behind closed doors. A 75MHz 486 was used to demonstrate Windows NT on both the Intel and Microsoft stands. This may be an indication of the kind of systems Intel expects to be prevalent when NT ships, or it may reflect the horsepower NT requires. Either way it was an impressive demonstration, with more than 100 threads (program fragments) operating at once.

The unit seemed quite solid but the man from Intel was loth to try anything more ambitious than pulling down a few menus, lest it fall over. The technology used to fabricate the 75MHz processor approaches wafer-scale integration — the die, measuring about 1.5in square, was mounted in a ceramic package which took up the full width of an AT expansion card. Both this and the 80MHz system shown to developers were technology demonstrations with no scheduled ship date.

In the meantime we will see the P24, the Intel two-times chip which promises significant speed enhancements for 486 users and helps clear up some of the FUD (fear, uncertainty and doubt) surrounding the 486SX. This is a pin-compatible replacement for the 486. You take out a 25MHz 486 and slot in a 25MHz P24 (a real name hasn't been decided).

The new chip runs twice as fast as the system clock internally, although outside it runs at normal speed. That is, it's a 25MHz chip outside and a 50MHz chip inside. This is only of real benefit if the data can be sent to the chip fast enough to be processed. This is so with the 486, which has both increased bandwidth and a cache; but not so with

the 386 or 386SX, which would only show a 10% speed improvement and thus would not justify the cost of an upgrade.

With the 486 the improvement seems to be dramatic. A mixed bag of (Intel supplied) benchmarks showed the chip's speed as 150% to 200% that of a single-clocked chip. The upgrade is designed for the 486SX, where plugging a P24 into the co-processor socket disables the main processor. I tried this on a demonstration system, and the most time-consuming part of the upgrade (given that the lid was already off the system) was the re-boot.

In theory you can upgrade all 486 machines in this way. Two-times upgrades will be offered in 1992 for 16MHz, 20MHz and 25MHz 487SX chips, and for 25MHz and 33MHz 486DX chips. No commitment has been made to a P24 version of the 50MHz chip.

Upgrading a DX is a little more complicated than adding the P24 to a 486SX machine. Not all 486 machines will be simple to upgrade. The major problems centre on the BIOS and physical design of the machines. BIOS chips that still use software timing loops are becoming less common with the advent of upgradable architectures, but any BIOS function which relies on a delay in processing speed will come a cropper with the new chip.

Cooling problems

This can be circumvented by upgrading the ROM. Or more neatly, you can write the upgrade to a Flash Eprom as found in the new NEC and Dell machines. The physical problems are mostly concerned with cooling: while a co-processor spends little time co-processing, a CPU gets very hot and the P24 will get significantly hotter than a 486.

Intel saw these problems when the 486SX specification was announced, and so specified extra cooling and BIOS fixes for machines using the new chip. The reasons were not explained at the time because Intel was not certain the P24 was feasible. Now the P24 makes the 486SX seem a less daft proposition.


David Cutler of Intel says he sees the major market for this chip as an upgrade. Companies unable to afford 486DXs will use SXs for a couple of years and swap-in P24s when they have the need and resources to upgrade. For a company large enough to have a technical support department this should be no problem.

The idea holds good beyond CPUs. Cyrix is looking at producing a two-times version of its 80387-compatible co-processor. The more integrated the chip, the faster it can run and the less expensive silicon it needs — so you gain both ways, without causing problems for the rest of the system.

No-one has yet committed to using the new chips in production machines, and no prices have been announced. But such a performance boost is bound to be snapped up sooner rather than later.

Simon Rockman

Firms see window for PowerBook monitors

 Manufacturers have been falling over themselves to provide display options

for Apple's new PowerBook portable which, as shipped, can't drive external monitors. In addition to the two SCSI-based solutions (from Radius and MacSolutions) mentioned in 'News' last month, there were four others at Comdex. Some fit the hardware ingeniously into the PowerBooks, while others build it into the monitor.

Unfortunately, at least two companies have no plans yet to distribute in the UK. But Envisio boards, which fit inside the PowerBook, are available from Principal Distribution at £499 mono and £1099 colour — the colour board also boosts the PowerBook 140 or 170 memory to 6Mb. Alternatively, a ClearVue/PD21 21in monochrome monitor, containing all the necessary hardware, is available from RasterOps. It has a SCSI input instead of the conventional video-in.

Envisio has also produced VideoSimms, a £450 display adaptor for the Classic II. It plugs into the memory slot, gives 2Mb of memory and allows the machine to drive most monochrome displays up to 21in.

Principal is on (0706) 217744, RasterOps (0256) 59283.

David Brake

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Dell delight over high-speed graphics courtesy of Intel

 Intel's second high-performance upgrade at Comdex also sidesteps the constraints of the PC, in this case the bus-imposed limitations on AT graphics performance. In co-operation with Dell, Intel gave a demonstration of a technique to produce high-speed high-resolution 2D graphics by directly coupling the graphics subsystem to the CPU. It's called 'processor direct graphics', naturally enough, and the results are impressive. The technique uses the 486 CPU as a blitter to manipulate the video frame buffer at system-memory speeds and eliminate the bottleneck of talking to the bus.

The system was based on a Dell 450DE. But instead of its usual half-length processor card, the machine had a full-length one carrying video elements in addition to the processor. The video side consists of 2Mb of 80ns VRAM, a bursting page-mode, an interleaved video RAM controller, a 64x64 hardware cursor, and a pass-through to allow a standard VGA card to talk to the direct-video card for applications which do not have the necessary custom drivers. Applications supported are Microsoft Windows, Dell Unix V.4, X Windows, the AutoCAD family, Intergraph Microstation, CADKey and Animator Pro.

It is difficult to quantify the improvement, compared with a bus-driven video card. Dell claimed its machine was two to three times faster than a Sun SPARC II on a number of Autocad operations. The literature claims that the system is five times faster (and a good deal cheaper) than a TI34020, or 15 times faster than a standard VGA display. Adding a custom blitter to the direct video system would further enhance performance.

This was a technology demonstration — the kind of thing shows are best for — with no commitment to build or prices. But no exotic parts were used and the improvements are spectacular — the Windows demonstration showed some good animations in a window — so I would expect the device to become generally available.

Another Dell technology demonstration was a colour SL notebook. The Dell System 325NC uses a passive matrix display from Sharp, and a 25MHz Intel 386SL processor in a standard 215.9x558.8x58.4mm notebook case. The 9.25in screen is limited to the standard 16-colour VGA 640x480 resolution and 256-colour 320x200 MCGA, but from an extended palette of 262,144 colours. The display on the prototype was rather muddy and streaky, and passive matrix displays are not generally as good as active matrix — but they are also a good deal less power hungry.

Between the lines

The other major passive matrix machine at the show was the AST Premium Exec, which AST claims uses a different display to the Dell — it is certainly significantly clearer. Sharp claims to have supplied both.


Reading between the lines, and given AST's reluctance to specify its supplier, it looks as though the screens are the same — quality differences being down to manufacturing tolerance. AST is shopping for a cheaper supplier. Both machines had a projected \$5000 price tag.

Dell claims that thanks to the SL chip, and a custom ASIC and Nickel Metal Hydride batteries, the Dell 325NC can run for as long as many monochrome 20MHz machines — up to three hours of normal use. The standard system is configured with 4Mb RAM expandable to 12Mb, with a 60Mb or 80Mb hard drive. Shipments may start as early as January.

Dell kit used to be comparatively cheap. Now, with a variety of cut-price rivals, it is just good value. The company is striking back with a cost-reduced notebook developed in conjunction with a 'strategic partner'. Unfortunately the \$2199 20MHz 386SX (2Mb RAM and a 40Mb hard disk) will be available only in the US.

Simon Rockman

PI-eyed about the 68000 for pen unit

 Most pen machines use an Intel processor. PI Systems of Portland, Oregon, has bucked the trend by using a Motorola 68000. President Jin Kim said the company decided to use its 68000 skills to exploit some 'important versatility' in the low-power chip to create an easily customisable system.

Market research showed many potential customers were looking at pen computing for a solution to a particular problem. This usually involved data collection, which normally uses some

form of keyboard entry on handheld terminals costing between \$1000 and \$2000. Kim says such customers believe pen computers can boost field productivity, but they are not interested in the weighty 'baggage' of Intel machines aimed at a broader market.

PI set out to create a simple object-based OS, with a friendly interface and software that can be easily tailored to specific tasks. The PI machine weighs just 2.5lb, has a 12-hour battery life, and retails for under \$2000. Kim says it

is getting a lot of attention from people seeking low-cost data collection — and who have been looking at Intel-based units of more than twice the weight and price.

Intel compatibility will be critical to some customers, of course. But Kim claims to be getting many enquiries from value-added retailers looking to buy hundreds and even thousands of data-collection units in the next couple of years. And Mac programmers with 68000 savvy see a way of getting into an area as yet untouched by Apple — a PI developer's toolkit is slated for early 1992.

Tim Bajarin



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Unlike many notebook PCs where the badge bears little relation to the machine's actual manufacture, the SuperNote was designed and manufactured entirely in Twinhead's own factory in Taiwan, where 10% of the revenue from every PC sold is ploughed back into research and development.

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New EISA chips

 Texas Instruments has a new smaller EISA chipset which should significantly reduce the cost of providing EISA slots.

Martin Wallman, UK Computer Segment Manager, says EISA adds \$1000 to the price of a computer. By the end of next year, once the new chips and others from competing manufacturers have hit the market, he expects the mark-up to have dropped to between \$200 and \$300.

David Brake

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Windows package from Rixworks in the US, is a true-colour image editor allowing graphic designers and illustrators to work in 16.7 million colours.

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Danny Bradbury

Mac to the future: it's a RISCy business, and colour is king

 After Comdex, Apple invited me to meet John Sculley and a pile of vice-presidents in charge of this, that and the other. Unsurprisingly, few seemed interested in being specific about new products and directions, but they let a few things slip.

On the possibility of a multi-processor Mac, signals are mixed but tend to the negative. Brodie Keast, Director of Desktop Computer Product Marketing, said the idea was 'interesting'. But Frank Casanova, Product Manager of High-End Products (who ought to know), reckoned that we wouldn't see one before the advent a few years hence of the new RISC-based Apple machines using PowerOpen. The original Mac OS was never designed to support multiple processors, and anyway Apple is encouraging people to use Unix if they want that kind of power.

The speed of take-up of RISC-based machines is also disputed within Apple. Everyone says that RISC machines will replace CISC machines when the market is ready. But while Casanova believes Apple will still be making 680X0 machines at the end of the century, Sculley said he expected Apple's entire range to be RISC-based by then.

People with a large investment in Apple's existing range might be disturbed by some statements made. Casanova said: 'The new RISC computer will be as significant to Macintosh as the Mac was to the Apple II.' I doubt users will want their Macs as badly supported in ten years as the Apple II is today. Casanova also mentioned that Apple will be 'assisting' customers to switch to RISC by reducing the number of CISC models available over time. At some point, mid to high-end Apple customers may have to go with RISC.

Colour is important to customers

Colour is probably the most important issue for many big Apple customers, particularly in publishing, and Casanova said Apple is currently doing a lot of work in the field. Colour matching technology is due to be incorporated into the system software, perhaps as early as the first half of next year. As for an Apple-badged colour printer,

Imaging Products manager Mark Gonzales said: 'I have no announcement to make... but gee, it would be a good idea.' That is, of course, about as close to a pre-announcement as you're likely to get.

Other peripheral news? We'll see RISC used in Apple printers within 12 months, probably earlier. Apple is in close contact with Kodak and Sony about digital cameras (like the Canon Ion and the Logitech Fotoman). And Apple intends to boost the capacity of its floppy disks but may not take the conventional route. Because storage needs are so large, particularly in multimedia and colour publishing, Apple is looking at 'floptical' disks storing about 20Mb. But it won't repeat NeXT's mistake of introducing technology before it is ready.

Randy Battat, Vice-President of Portable Product Marketing, suggested that Apple's portable development was going in two directions. At the high end, Apple aims to make portables as powerful as desktop machines. The low-end goal is a useful portable at the lowest possible price — that is, under \$1000.

As for pen-based machines, Battat said: 'There has been a lot of hype about this but we don't want to jump into it too soon.' Nonetheless, Apple is known to be looking at the area, and has already made a licensing agreement with Paragraph, a handwriting recognition specialist.


The key Apple added value will be communications, according to Battat and David Nagel, Vice-President of the Advanced Products Group. Appletalk Remote Access, which shipped with the three PowerBooks, is the first example. Future Apple system software will handle data reconciliation between portables and desktop machines, and improved communication with DOS PCs. Because the portable market is changing so quickly, Apple will be working closely with OEMs like Sony in an effort to develop more models faster.

Apple took two years to develop its first Portable (a dud). In future, it plans to come up with new products every six months. It plans to be third or fourth largest portable seller within a year.

Apple is on 081-569 1199.

David Brake

Authorware for Windows

 Authorware Professional, a multimedia development tool for the Macintosh, is now available in a Windows version for MPC computers and a version for Unix is planned. It seems to be attracting a lot of interest from some important manufacturers. Silicon Graphics will be bundling a copy of Authorware Professional for Unix with all of its IRIS workstations, including the rather tasty Indigo workstation we reviewed in October.

NEC is bundling a cut-down version with every MPC it sells in Japan, and IBM will be including a

demo version on the CD-ROM it sends out with its new MPC machine. IBM and Authorware have already announced a 'long-term development relationship', including the sharing of core software. It is rumoured that IBM, like NEC, will start bundling a reduced Authorware Professional with machines, instead of a demo version.

Some kind of cut-down version or bundling deal will certainly be necessary if it is to become at all widespread, as the package costs a bomb — £5430, or £811 for users in education.

For more information, call Interactive Developments, an Authorware dealer, on 071-700 4808.

David Brake



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Adobe homes abound


 Adobe Type Manager is spreading itself far and wide these days. Although Microsoft is sticking to its TrueType guns, both IBM and Apple have signed up to bundle ATM with their operating systems. OS/2 version 1.3 already includes it and OS/2 version 2 has signed up as well. Sun's Solaris OS doesn't include ATM, but its NEWS interface is based on Display PostScript.

Apple has announced that ATM will be included in System 7.1, due early next year, and it will also be offered for a minimal sum to all existing Mac owners.

Details were sketchy at press time — try asking your local dealer or ring Apple on 081-569 1199.

David Brake

CDTV struggles as CDI looks set to dominate in multimedia

 The multimedia phenomenon finally seems to be taking off this year... on the surface. There was the TIME show in October. Press coverage is growing. Product releases seem to be on the increase. The DVI applications base is also expanding. As the first CDI product emerges in the US, it's very hard not to get carried away.

However, it would be wise to take all this with a pinch of salt. The consumer-oriented CDI standard, for example, will not get full-screen video until the MPEG motion-video standard is fully ratified — hopefully, in 1992. Meanwhile US users will have to put up with a CDI product which can only display motion video in a window filling 40% of the screen at most. In Europe, Philips believes we won't be satisfied with anything less than full-screen motion video, and so won't ship the product until this can be obtained, probably in the second half of 1992.

Another company which has plummeted head-first into the multimedia market in an attempt to define its own standard is Commodore. Like Philips with its CDI machine, Commodore renounced the PC platform in an attempt to conquer the consumer market. Its CDTV computer, released in April 1990, was again centred on proprietary technology — basically an Amiga fitted with a CD-ROM.

Huge resources

This was a bold step, not taken lightly. Commodore has ploughed huge resources into the UK marketing effort, establishing a multimedia division, a range of multimedia centres which will benefit from extensive training, and an exclusive distributor in the shape of P&P.

Meanwhile, the MPC consortium (including Microsoft, Tandy and a division of the ubiquitous Philips) has assaulted the consumer sector with a base level configuration of a 10MHz 286-based PC with CD-ROM. This is not powerful enough for motion video, which means that vendors must give it an entertainment angle.

Some observers think the base MPC standard is ridiculous, and I agree. MPC seems to have gone for the 286 in a bid to capitalise on the large number of existing 286 users. But anyone interested will swiftly discover that they have to upgrade to a higher speed machine, with multimedia extensions built-in, such as IBM's Ultimedia computer. At least this would provide a motion-video option.

All this is destined to change, however. Microsoft recently released a demo disk showing the power of the MPC machines, only to discover that the base specification was not powerful enough to run it. Rumours in the US press (denied by UK sources) indicate that to meet industry criticisms a second specification is being developed, based on a 20MHz 386SX with 4Mb RAM and 16-bit audio. It will use the CD-ROM XA standard, a subset of CDI designed to provide a bridge to the PC world. CDI applications could conceivably run on this, but

they would have to be developed with both CDI and CD-ROM XA in mind, because the latter contains only some of the audio standards held by CDI.

But it looks as though CDI will beat CDTV in the consumer market. Multimedia experts believe the CDI kit quality is better, and that it will severely dent Commodore sales when it arrives here next year. Commodore recently cut the CDTV price from £599 to £499. At the CDTV launch, Commodore was predicting that around 80,000 players would be sold in the first year in the UK alone. Well, it's been more than a year now, but according to one source just 6000 CDTV decks have been shipped, some of which are probably gathering dust on dealers' shelves. It'll take more than a big Christmas ad campaign to rescue CDTV from oblivion.

The corporate multimedia market is hotting up, too. Intel's acquisition of the Digital Video Interactive technology from General Electric in October 1988 finally seems to be bearing fruit with a second generation of multimedia boards, developed in conjunction with IBM.

The company, which has been consolidating its component manufacturing operation with ventures into networking and multimedia equipment, claims that the Actionmedia II products will enhance multimedia on a desktop, enabling developers to produce applications with more detailed video at almost half the price of the original cards.

To complement the cards, some new software has also been developed. Labelled the Audio Visual Kernel (AKV), it is designed to make the boards platform independent, running on either OS/2 1.3 or Windows 3.0. IBM says that versions will be available for OS/2 2.0 and Windows 3.1 when these hit the shelves.

The original multimedia expansion was the two-board Actionmedia 750, which ranged in price up to £1600 for a 2Mb VRAM version. The equivalent latest release costs £1216. The MCA version is £1345, while the optional capture module is £446.

Good display

The new boards, based around the Intel B series i750 video processor, take up only one PC slot. They can compress and decompress, moving images in real time, meaning that a scene can be filmed on site and represented on screen. It can even be stored on a hard disk and/or forwarded on a network. If you want to store your video on a DVI-based CD-ROM, however, you must send it off to Intel in the States — and pay £250 for every minute of video compressed. The company claims that this is largely due to the vast processing power and storage involved, but if you can find a WORM drive which writes to disk at the same speed at which it reads, you might be able to manage it yourself.

The delivery board can display up to 16.8 million colours, providing the necessary hues for the display of video images. Even though prices have been cut by 40%, the boards are clearly aimed at the

► corporate market. They have to be bolted onto a PC, preferably with a CD-ROM drive, before they can be used — considerably jacking up the cost.

The display of CD-based video is surprisingly good. The real-time video display was not fully developed when I saw it, and could have been better. The system uses enhanced Real Time Video (RTV) and Production Level Video (PLV) algorithms. The company wasn't giving too much away, but it said that these worked by updating only the logical differences between screens, increasing the speed. Fast pans and shot changes are handled by inserting a reference frame every 15 frames or so, to keep the software up to date with what's going on.

One of the biggest names endorsing DVI is IBM, which co-developed the Actionmedia boards and is offering them as a motion-video bolt-on to its Ultimedia M57 SLC multimedia machine.

Interestingly, some companies within the MPC consortium have expressed interest in the technology. Tandy is looking to implement DVI standards within its MPC machine to help developers, for instance, although how this will be done remains to be seen — Intel maintains that the DVI boards are

not architecturally compatible.

Microsoft will be putting support for the boards in a future version of the AVI extensions, while Apple's John Sculley says he thinks they are ideal for the Quicktime multimedia solution.

SPC is planning to introduce DVI video capabilities into SuperBase 4 and Harvard Graphics for Windows. Intel's Actionmedia II Software Development Kit aids development of applications in Windows 3.0 or OS/2.0. It is supported by the Actionmedia II DOS library, which provides tools and routines to manipulate the DVI images.

Multimedia raises many complex issues, and the field is changing too fast for easy conclusions. The IBM/Apple agreement, for example, is still young. IBM says it is making heavy financial and philosophical investments in the DVI standard, so the odds are high that the joint multimedia company formed by the two large industry players will itself be heavily biased towards this technology.

Contacts: Apple is on 081-569 1199; Commodore is on (0628) 770088; Intel is on (0793) 696000; Philips is on (0306) 75777.

Danny Bradbury

NeXT speaks in tongues (and ISDN)

A nice aspect of NeXT Computer's smart black boxes is the way they reflect a multinational world. When you first fire up a NeXT Cube or NeXTstation, you get to choose English, French or German, and the operating system configures itself to the appropriate tongue. And NeXTStep does the job properly, unlike Windows 3.0 (though that handles internationalisation better than most PC software). You don't just get the ability to write a number in, say, the French way (1.234,56 for 1,234.56): all the text is also altered. So, File becomes Fichier, and so on (though OK buttons don't say Ça Va, unfortunately).

I recently spent an afternoon at NeXT's European HQ in the surreal Sophia Antipolis 'technopolis' just outside Antibes, talking to the company's European president, Theo Wegbrans. We talked about NeXT's rôle as an international company, and about new NeXT products due to be announced in March. It seems that the forthcoming version 3 of NeXTStep will support three more languages — Spanish, Italian and Swedish. This last may seem off-the-wall, but the Scandinavian market is larger than you might think (and relatively rich) and written Swedish gives suppliers access to the largest part of it.

NeXT's modular system design (NeXT uses the OO-word to describe it, naturally) makes adding new languages a relatively straightforward matter of adding a few new string tables for bolting into place at run-time. I wish more manufacturers would design software in this way.

Some of the NeXT stuff due in March — 33MHz 68030 processors, colour printer — has already been mentioned in PCW. Perhaps the most significant developments are in the networking environment. The new NeXTs will have built-in Novell support, a shrewd move which should help inte-

grate the boxes with PC networks (NeXTs already have built-in Ethernet, so the hardware support is there from the start).

More dramatic (although perhaps less immediately relevant to most) is an intention to give all new NeXTs hardware support for ISDN, the international standard for high-speed dial-up digital communications. By offering ISDN in the same way it offers local area networking (as part of the motherboard), NeXT should help us finally to get to grips with what is undoubtedly a Good Thing. Wegbrans suggested that the new products should work equally well with the various US and European ISDN systems (all of which are, obviously, slightly different).


The company is also rumoured to be porting the NeXTStep environment to other hardware platforms, specifically the i486. Details are sketchy, but it seems unlikely that any such port will ship until there is a PC version of the Berkeley/Mach Unix kernel (core of the NeXT OS) which is devoid of residual AT&T code and thus does not require the payment of massive royalties to AT&T.

And NeXT is girding its loins to go public. Wall Street rumours set an 18-month time-scale, but Wegbrans told me: 'Give us a year.' This would put the flotation in the final months of 1992. NeXT has undoubtedly been involved for the past year or two in 'stealth marketing' (it costs a fortune and is totally invisible...). But more boxes have been shifted than many would suspect, and it seems not unreasonable to predict that the market will soon be offered a \$500 million business. NeXT is already, I was told, 'bigger than Apple when it went public, and bigger than Sun when it went public'.

No-one will mention precise figures (citing the US fiscal regulations which apply to companies nearing flotation), but it would appear that about 50,000 NeXTs have now been sold; not a lot compared to Sun's workstation sales, but much healthier than many observers have guessed.

Mike Hardaker

Inkware boost for pen systems

 With pen systems all the rage, there was naturally a lot of interest at Comdex in software to run on them. Go! Corporation bought a huge demo area for various software vendors to show off applications running under PenPoint.

Much interest was shown in a California startup called Ink Development Corporation, which has sold a forms package to Claris and has been working on pen-based software for about a year. Its first product, called InkWare Paper, allows you to use the screen like a piece of paper. It emulates various paper, pen and pencil types (soft pencil, hard pencil, thick lined and so on) and you can use 'fill'


and 'pattern' gestures to jazz up charts.

It's hard to explain just how it all works: you have to see it. But Inkware Paper could help pen-based systems to catch on very fast in the general business market. Inkware also has a license to use the Logitech Digital Camera (see page 112), and has written software for dumping its pictures straight into InkWare Paper.

One other PenPoint product that should be mentioned is Pen Perfect, WordPerfect's first product in this area. It plans to have a commercial version out when PenPoint actually ships in early 1992.

Tim Bajarin

Ambitron's Colorpoint upgrade is fast but pricey

 Berkshire-based printer company Ambitron has designed an updated version of its Colorpoint PS colour PostScript-compatible printer, released last year.

The new Colorpoint PSX machine, which is said to roughly 30% faster than the original model, has a 25MHz RISC processor over the original's 16MHz chip. It has three printer ports, AppleTalk, parallel and serial.

Ambitron has increased the size of the input buffer on each from 1.3Mb to 3.9Mb, and added two SCSI ports for data communications and an optional hard disk, bumping the total number of ports


up to five. It has also increased the output buffer size to 17.4Mb to increase printing speed.

However, users must pay the price for this faster technology. The old PS A4 model costs £5950, while the new one costs £7495. The old A3 printer costs £8450, while the new one will set you back £9975. This much for a little more memory, a higher clock speed and HPGL as standard means that those outside the high-end CAD market should think carefully about how high their throughput is and whether or not it warrants an expensive speed increase.

Ambitron is on (0635) 36555.

Printers down for Xmas



 Many printer prices were cut for Christmas, primarily on dot matrix models, the home-market favourites. Cuts include:

- **Mannesmann Tally** The 9-pin wide-carriage MT131/9 is down £30 to £479; the 24-pin MT130/24 is down from £569 to £539, and the wide-carriage MT131/24 is down from £679 to £629.
- **Fujitsu** The DL900, DL1100, and DL1200 are each down £50 to £249, £299 and £499 respectively. The DL3600 is down £100 to £699.
- **Star** LC24-10 is down to £249; the faster LC24-200 plummets from £319 to £299, and the colour version drops £20 to £349. The wide carriage LC24-15 is down £100 to £399.

The cheapest printer yet is from Seikosha, at £99. It's a 9-pin Epson-compatible, with no paper parking facility. It crawls at 48cps in NLQ, but boasts 192cps in draft. There is also a standard mode. Reseller Silica Systems throws in a starter kit including a Centronics cable and 200 sheets of continuous paper.

Contacts: Fujitsu is on 081-573 4444; Mannesmann Tally is on (0734) 788711; Silica Systems is on (081) 309 1111; Star is on (0494) 471111.

Danny Bradbury

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5, TIB LANE


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BRIGHTON

TEL. (0273) 562657



Xcheck


 The Xtree Company, best known for its file manager, has released a £95 security program called Allsafe.

The program includes a TSR virus checker, password-controlled bootup, an option to disable floppy booting, and serial port access control.

Details can be obtained from Ingram Micro on (0908) 260160.


Danny Bradbury

CA opens Windows

 Computer Associates has been scrambling onto the Windows bandwagon. Its £795 project management package, CA-Superproject 2.0, is now running under Windows, and CA-Textor for Windows was launched at Comdex. A DOS version of the low-end Textor word processor sells in the UK for £79. CA has also released Up To Date for Windows, a completely new personal information manager. Other CA Windows products promised include database and spreadsheet systems. CA is on (0753) 577733.

Danny Bradbury

Hard bargains

 The fixed-drive market has been busy recently with new product launches and price cuts. Quantum reduced prices on its Plus Hardcard IIXL machines by up to 34%. The 50Mb version plummets from £399 to £265, while the 105Mb model has been shaved from £579 to £389.

Conner, Quantum and Seagate have each made strides into the small form-factor market, with 2.5 and 3.5in models. Notable is Conner's Chinook, a 510Mb 5.25in drive with a 3ms seek time.

Contacts: Conner Peripherals (071) 409 0090; Quantum (0344) 780144; Seagate (0628) 890366.

Danny Bradbury




Optech CD-ROM bundle: price correction

It appears wires were crossed in our December 1991 issue, when we said Optech sold a Toshiba CD-ROM bundle for £380 (Short Reviews, page 158). The unit reviewed in fact costs £429, without the software titles which were supplied to PCW.

However, due to an overwhelming response to the review, Optech has kindly agreed to put together an exceptional deal for a limited period. The excellent Toshiba KT3301SM drive and the titles reviewed will be offered to PCW readers for £599, excluding carriage and VAT, until the end of December 1991. The company is on (0252) 714340.

Apologies to Optech and our readers, and a special thanks to the company for putting this new bundle together.


New Sharp flat display

 Sharp has introduced a flat, colour 10.4in TFT monitor, the LC-10C1. It has 640x480 resolution, a dot pitch of 0.33mm and can display 4096 colours. The screen is subjectively not as bright as a CRT, but looks very crisp. The monitor is compatible with both the IBM VGA standard and NEC's 640x400 resolution. The entire unit is 58mm thick (85mm including the stand) and weighs 2.5kg. In direct contrast to the low power consumption normally associated with flat displays, the LC-10C1 is rated at 45W, similar to a normal monitor.

Sharp sees the screen also being used for point-of-sale displays and for 'commuter TV' (you can watch TV on some Tokyo trains). Shop prices are around ¥535,000 (£2300).


Paul Hardy

Yuppie puppy

 Lotus (0753 532443) and Filofax are selling a £149.99 cut-down version of 1-2-3, with personal-organiser templates and the ability to print to Filofax paper. It comes with a leather Filofax. The 1-2-3 version can't be upgraded, so too bad if it lacks features you want. This once-in-a-lifetime offer may end soon, so rush out now and snap one up.

David Brake

Pen name

 Notable Technologies is launching a suite of applications programs for pen-based computers. The suite includes a spreadsheet (PenCalc), a comms package (PenComm) and PenCrush, a disk-frugal file compacter.

David Brake



Our new QuietPrinter is so quiet, you might want a second opinion.

To be honest, it's so quiet we didn't quite believe it ourselves; which is why we had it tested against strict independent ECMA standards.

But it's true: due to its revolutionary new diamond shaped 24-pin printhead, our KX-P2624 is quieter than many ink-jet

and laser printers*. And the beauty of it is that you can have this blissful serenity and super print quality without sacrificing the speed you normally associate with matrix printers.

Quite the opposite, in fact.

With, for example, eleven print styles, including Super Letter Quality, a top speed of 300 cps in draft mode (100 cps LQ), plus superb paper handling, the KX-P2624 is ideal for any office environment. And because it's based on impact technology,

you can still print on all formats of multi-part stationery. With all this, and more, you could be forgiven for finding it hard to believe that the running costs of the KX-P2624 are less than half of a typical laser or ink-jet printer. But, again, it's a fact.

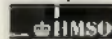
All in all, the QuietPrinter is a real breakthrough: a matrix printer which, while it does its thing, lets you get on with yours. To find out more, call us free on 0800 **Panasonic** Printers 444220.



*ECMA 74 compliant front bystander tests returned the KX-P2624 at 43.2dBA in SLQ Super Quiet mode.

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PCW is cool says young fan

I am very happy that you have made some changes to the magazine. I have been reading *PCW* for a year and like it a lot. I have looked at *Byte*, *What Micro?* and *PC Magazine*. They are full of adverts and the reviews are short and not interesting.

I am glad you got rid of Workshop as it was mainly programs in lots of different languages. For those of us that don't have the languages they are a waste of space! Hands On however is very informative. Group Tests are a good idea as you test a selection of the market. Could I see Group Tests on 20MHz 386SX's and on spreadsheets, please?

I am thinking of buying a Dell 320SX with a Hewlett-Packard DeskJet 500 printer to run Microsoft Word for Windows and Works for Windows. The system will have 4Mb of RAM and a 40Mb hard disk, and a colour VGA monitor. Can you please tell me if this is a good choice.

Michael Birshan (age 11)
London W4

Funny you should ask for a 386SX Group Test. We thought this would be a good idea too, and we covered spreadsheets in excruciating detail last issue (Excel for Windows won). Your set-up looks OK to us, though a 40Mb hard disk is a bit small — try 80Mb. Where are you getting the money for all this stuff, anyway? My pocket money only used to run to an ice lolly once a week...

Hassles! Hassles! Going cheap!

Some of the lowest computer prices are listed by little-known mail order companies, and readers wondering whether to send them money might like to hear of my experience.

I picked a supplier offering the best price for the system I wanted, and was told: 'Your system will be with you in less than two weeks.'

Two weeks later I had not even had an acknowledgement of my order and I was not best pleased to be told that the details had been lost due to a computer error in the supplier's office. Hardly the best advert for the company's products!

I played the outraged customer to the full, demanded written confirmation of my order and rang one particular individual on a regular basis to ensure matters progressed. Eight days later I was informed that the machine had been despatched for next-day de-

livery, two days previously.

There then followed a somewhat curious chase through the system of a well-known parcel delivery firm (which would have made an excellent plot for a Peter Sellers film), although that was hardly the fault of the supplier. However, it would appear from TV advertisements that it is quicker to send your parcels via the USA at the moment.

At 9pm one evening three weeks after placing my order, the beast was delivered, minus the mouse. All the system disks were supplied on 5.25in format — not a lot of use with a 3.5in drive. One final bizarre incident came when I rang to chase the missing mouse: the person I had been dealing with appeared never to have been employed by the company!

A friend who knows about these things tells me I did the right thing in using my credit card to buy the machine. This gives some protection under credit control legislation. Also, getting written confirmation of an order can be very important. You can also ask for the names of satisfied customers and speak to them *before* ordering.

I think a lot of small mail order firms are likely to be young companies high on enthusiasm but low on commercial expertise. The old adage about 'you get what you pay for' must be just as true today as ever. So if you go for a cut-price product you should expect difficulties, albeit ones which do not compromise the usefulness of your purchase.

And the computer? I bought a 33MHz 80386DX computer with 64K cache: it's brilliant! And on balance, I'd probably buy from the same place again.

Derek McCoy
Ware

As you say, you get what you pay for. If you are willing to accept the chance of some hassle, you can get some bargains. And it isn't impossible you could have had similar problems with a more established company.

Bad at figures

As an occasional purchaser of *PCW* during the past three years — and a subscriber from the first of the 'new style' issues — I welcome the changes. But why, I wonder, did neither you nor any of your complimentary correspondents mention what is surely the most significant improvement — the change to a readable typeface.

Now, if you'd just get rid of those awful page numbers....

Allan Daniell
Ongar
Essex

Your font won't hold water

Your assertions (Editor's reply, 'Letters', November) that the two spellings *font* and *fount* 'allow us to clearly differentiate between two very different things...' is nonsense. The word simply describes the size and appearance of characters. These characters may well be electronic in origin, and then spend a short life on screen while they are manipulated before being printed — but we are still talking about character styles, so *fount* is correct. Indeed to use your own terminology, once your *font* had been printed on paper it would no longer be electronic, so you would have to call it a *fount*!

The truth is that most software using *font* is American and constitutes many people's first exposure to the term. The word 'fount' (unlike 'colour') is not in common use, so *font* was not spotted as an Americanism and so gained currency through ignorance.

By coincidence, this and similar topics were discussed among my fellow engineers a few weeks ago: the verdict was that *program* could be justified on conceptual grounds, whereas *disk* and *font* are merely foreign spellings.

English is indeed 'a living language', but this should not be used as an excuse for the adoption of unnecessary spellings, or other forms of illiteracy that weaken rather than enhance communication. *Either for each, anticipate for expect, and faster speed for higher speed*, are three examples that occur frequently in the computing press.

On the subject of ignorance, isn't it strange how high-density 3.5in disks have become by repetition to be called '1.44Mb'. Twice 720K cannot possibly equal 1.44Mb, as there are 1024K in 1Mb. The actual figure is close to 1.4Mb: shorter and more accurate. So a big stack of brownie points to Hyundai, which gets it right, and a must-try-harder to IBM which gets it wrong and embosses '1.44' on the eject button of PS/1 machines. How embarrassing.

Steve Parsons
Newton Abbot
Devon

Cheesed off about mice

As a representative of the confused and disappointed cats owned by your readers, I wish to protest in the strongest possible terms about the abuse of English perpetuated by *PCW*.

I refer of course to the many words

used deliberately to confuse: not just 'font', to which such exception was taken by Mike Kay ('Letters', PCW November), but particularly the word 'mouse'.

Recently I came across a box clearly labelled 'mouse' and hung around while my human opened it. I could barely contain my excitement and as the contents tumbled out I leapt on them, going for the plump grey shape. I am now undergoing extensive corrective dentistry and stress counselling.

How can cats (or humans) be expected to appreciate that the innocuous word 'mouse', when used in your magazine, refers not to a small, furry and edible (by me) rodent but to a grey, plastic, screen-pointing device?

I think you should place an explanatory paragraph at the beginning of every article using the word 'mouse', making it absolutely clear that you are not referring to small rodents, thus dispelling the slightest chance of confusion and potential disappointment. While I have little sympathy with rodents, imagine also their intense displeasure should one of your readers mistakenly connect it to a computer.

You owe it to a loyal readership to maintain your high standards of technical accuracy throughout your excellent magazine. I hope this letter may serve as a useful reminder to continue doing so in every detail.

Claude Underfoot
Woodbridge
Suffolk

Turned off by Tandon

I have joined the ranks of computer fanatics relatively late in life, and when I purchased our first machine I knew I would have to make some expensive mistakes. In fact, I bought an excellent 286 machine and was sufficiently encouraged by progress to consider buying a laptop (just when other notebooks were still a bit pricey).

I bought a Tandon LT/386 for about £1600 and it was only when I progressed to more heavyweight programs that I realised the implications of this strange thing called memory... Having started to buy your magazine, I was aware that memory could be bought and that it was not expensive. No problem with the 286 — £200 bought me 4 Mb and the machine goes beautifully. The Tandon? What a rip-off!

I was informed memory could only be supplied by Tandon — £375 + VAT for a 2Mb chunk. Tandon confirmed this to be the case and offered scant

comfort or apology. I am otherwise delighted with the machine and prefer its feel to the newer notebooks. However, to bring it up to speed with other machines now on the market would cost about £2350 + VAT. I could have purchased a new notebook with 5Mb of memory and a 60Mb disk for under £2000 in Tottenham Court Road yesterday, and it could be beefed up to 16Mb at little extra cost.

I am typing this myself on the Tandon, using Word for Windows. The machine can barely cope and I am forced to pay the outrageous price for memory or scrap the machine. Can you find out from Tandon why they are ripping their customers off in this way?

RV Stroud
Solihull

The problem is that Tandon, like many other laptop manufacturers, uses a proprietary memory expansion card rather than industry standard memory SIMMs. Currently, the machine is not popular enough for there to be third-party suppliers, so you're stuck. But one memory supplier says you may be in luck: a company is working on it for your machine, which should be cheaper. Give it a few months, then ring some of our advertisers.

Browned off for nothing

Like Geoff Brown ('Letters', November) I have Excel 3.0 and an HP DeskJet 500 printer, but was lucky enough to read Steve Cassidy's six-month test (PCW September) before combining the two. I have no idea what 'PRINTRESFAC=0' means or does, nor am I terribly interested, but I do know how to edit WIN.INI using Notepad. Result: perfect printing. Mr Brown is the loser if he ignores Excel because of this one fault.

Mark Campbell
Durham

Under-critical path analysis

I was disappointed with November's PCW Software Group Test, 'Master Planners'. I have been trying for some time to find an unbiased comparison of the performance of different project management packages but I found no real mention of performance in the article.

You tell readers how easily they can enter, modify and print out data. You do not tell them how well the package can plan their project, especially if their

resources are limited.

I teach critical path analysis as a sideline. I was interested in checking the ability of different packages to carry out this task and found that all those that I could get access to do this equally well. I then thought I would check their abilities in rescheduling a project with resource constraints. This is a fundamental requirement for these packages and one that a buyer would expect not to be in doubt.

The results on my simple test varied enormously. I took a project of 17 activities which required a maximum of five personnel and then constrained it so that only three personnel were available. The theoretical minimum time for the project now became 46 days. Only one package came near this — the rest took up to 58 days. I believe you would help readers by including a test such as this in your next review or as an addendum to this review.

DW Taylor
Stroud

Your findings caused some surprise among project management software users but none among PM software developers we spoke to. You are right: different packages will produce similar results on critical path analysis but very different results when re-scheduling with limited resources. To explain this fully would fill the rest of the magazine with mathematical theory and algorithms.

Basically, short of using centuries of computing power, the problem can be made manageable only by making certain assumptions (ie. taking shortcuts). Different software authors make different assumptions and so, unsurprisingly, produce different results. Don't, however, fall into the trap of believing that the package which produces the shortest project time for Project A will also perform as well for a completely different Project B. This is most definitely not the case: hence the extreme difficulty of 'objective' testing. Your letter has, however, revealed an interesting and (to us) unexpected variance between the packages we tested and we'd love to hear from any PM suppliers on this subject.

Archie gets too much flak!

When you go so far out of your way to knock a superb educational machine like the Archimedes ('Letters', November) you really should choose a coherent rationale. Instead we are told that schools should 'expose children to the same type of equipment in schools that

they will encounter when they leave.' Your own journal in the same issue makes it clear that most children at school today will, when they leave, encounter hardware and software systems that do not now exist, and that the current most common processor architecture is becoming obsolete.

Had you not noticed that Apple and IBM are putting their enormous joint resources into developing hardware and software which will make 386 machines and Windows 3.0 as daft in five or six years time as the Z88 in November's 'ChipChat'? (The same Z88 was state of the art just a few short years ago when today's sixth formers were already tackling GCSE.)

In a rapidly advancing situation, the most sensible choice for schools is the most advanced GUI machine available at an affordable cost. That, as you admit, is the Archimedes. Since it is accompanied by educational software often far superior to anything available for the machines you tout, the case for the Archimedes in many sectors of education is unanswerable. Acorn's latest, the A5000, is more than a match for any 486, particularly when, as Karl Dallas pointed out on page 376 of the same issue, 'you'll need 8Mb (of RAM) to get Windows to work at anything like reasonable speed.' In another article Guy Swarbrick says: 'The PC is coming towards the end of its useful life.' Schools must ditch their Arcs for this?

GUI skills learned on the Archimedes are easily transferrable to the Mac — I know this from experience. I also know that any affordable Mac is dull and slow, and that Apple has chosen ARM (rather than Motorola) technology for an exciting comms portable which many of today's children will indeed use when they leave.

The final straw for me was your drooling fetish about boxes shifted (Apple sells 125,000 Classics in a month while Acorn can't sell more than 120,000 Arcs in four years). Are you seriously suggesting that schools should base their choice on market figures for business-based computers? If so, why not also promote *The Sun* as an alternative to Shakespeare in English Lit?

As a teacher, with two children at secondary school, I must tell you, first, that children, parents and schools have educational purposes of far greater variety and importance than your dismal horizon (churning out company reports by the sound of it), and second, that journals such as yours have far more important things to do than tout commerce-based obsolescence to school children, most of whom will certainly never use it when they leave.

One of them would be the addition of an educational section to a magazine which evidently knows (and cares?) very little about the computing needs of schools and children.

Sean O'Conaill
Coleraine

My comments on the original letter were a little ambiguous, and for that I apologise. I did not intend to imply that computers should only be used for vocational training. The computer is, potentially, an educational tool second to none. It gives children the chance to explore situations that would never be open to them in real life (and, indeed, that could not exist in real life). Projects like Alan Kay's Vivarium are only beginning to hint at the possibilities. But vocational training is important — and computers in schools should be capable of both. That means using PCs or Macs.

The A5000 is no match for a 486, in either performance or utility terms. I did indeed say that the PC is coming towards the end of its useful life. There are things that you want to do that simply cannot be done on a PC. That's also true of the Archimedes.

The only progress is US progress?

It appears that my last letter (PCW September) has struck a chord of sympathy with fellow Archimedes owners, and this says much for the machine. I have used many computers since the Commodore PET we had at school, and seen many fail. But it has always seemed to me that to make it in this world, you just have to be American.

I watch my 8MHz Archie heave wind-downs about as fast as a 33MHz i386 (maybe faster), and reflect that my humble British CPU costs a tenth as much as the multimillion bug-ridden transistors that Intel made the world standard. But in the end, I must give way to progress, and accept that in a few more years we will all have Microsoft Windows, Apples, or for the brave, Unix.

I wonder what would have happened if Commodore had made the Archimedes, and Acorn the Amiga. Presumably Commodore would now be snapping at Apple's heels. And Acorn? Probably sunk without a trace.

F T Smith
Sheffield

P.S. I'm getting rid of Archie and going for one of those new Silicon Graphics Indigos, or maybe a NeXT. Does anybody want him for their museum?



Hindsight

Will tomorrow's 'automated office' consist of powerful PCs installed in employees' homes and inter-connected by a high-capacity communications network designed for handling data, facsimile and video? I venture to suggest that the technology for this is with us right now.

David Hebditch, January 1979

'Personal computer networks are at last appearing in Britain... First off the mark was Frederick Brown in Hull... He has a 48k TRS-80 with four disks, linked to a modem and available to all callers.'

Guy Kewney, January 1981

'There are still no IBM Personal Computers for UK users, more than a year after they started being provided to US users. People have gone bust waiting.'

Guy Kewney, January 1983

'Denon, Philips and 3M have announced the development of a CD-based optical ROM system. A single 4 3/4in CD ROM has a capacity of over 550Mb — about the equivalent of 500 double density floppy disks.'

David Ahl, January 1985

'If ever there was a time to seriously cast doubts on the future influence of Bill Gates, head of Microsoft, prime purveyor of MS-DOS and attempting purveyor of Windows, this is it.'

Guy Kewney, January 1987

'Apricot has decided that the 286 chip is a dodo and has switched its production to the 386SX... Prices were pretty good — a diskless workstation costing £1200, a 30Mb Winchester system costing £1900.'

Guy Kewney, January 1989

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Rupert Goodwins

As you may know, I'm a Usenet addict. For those who don't, Usenet is a most curious creation, a sprawling, unkempt worldwide network through which programmers, scientists and students chatter away on a thousand different topics. In the past, I've written about the personal contacts it's possible to make across continents and cultures through Usenet, but recently it gave me a glimpse into a completely different aspect of computing. You can eavesdrop on any number of conferences where scientists chatter among themselves, and sometimes a real bombshell whistles past.

'Synthetic organisms have been created...' started the abstract from the School of Life and Health Sciences at the University of Delaware. What? Genetic engineering is exciting enough, but there's been little progress in the area of creating life from scratch since God or nature first pulled it off. Nobel prizes all round, surely. '... based on a computer metaphor of organic life.' Oh well. No Nobels. Perhaps a PCWA Award for software innovation. As I read on, though, I wasn't so sure that my first reaction had been so wrong.

What Tom Ray, Tom Uffner, Dan Pirone and Marc Cygnus have been up to in Delaware has involved no test tubes, chemicals or electrodes. Instead, they've built an artificial environment within a computer where programs compete with each other for memory and are corrupted by random events (stand up the fellow at the back who said 'Windows').

The instructions in the programs were equivalent to the genes in our chromosomes; they governed everything about how the program behaved and they were occasionally changed by a random effect built into the program which monitored everything.

Having set the rules, they then seeded the program with 'simple rudimentary ancestral creatures' (which could replicate themselves but not much else) and sat back while the computer churned through a few billion instructions. That done, they cracked open the vat and poked among the sludge for anything that twitched.

Advanced ecology

What they found was an advanced ecology where programs had evolved into a wide variety of forms with varying degrees of success. Some had become parasites that needed to subvert others in order to replicate. Others had developed immunity to those parasites. Some parasites had developed ways around the immunity, and some had become parasites on the parasites themselves. A thriving culture was cooking.

That, by itself, is not too earth-shattering. Afficionados of the more mathematical bywaters of computing have long been fond of *The Game Of Life*, where geometric patterns grow among 'cells' that depend on having the right number of neighbours in order to survive or multiply. Some of those patterns can become surprisingly complex while still surviving in a recognisable form, and many a stoned hippy and mathematics professor have thought deep thoughts about the way real life works while staring at a computer screen running the game. Where the new guys score is in the introduction of mutation and having the ability to trace the development of their little monsters.

They gave an example, in the Usenet article, of a particularly successful animal that had been discovered after 15 billion instructions. This had, within its structure, examples of programming techniques that are considered reasonably clever by normal human standards, yet had been evolved through random mutation. An ancestor of the animal had a vital bit of program that

copied itself into a new place — the rough equivalent of an amoeba splitting into two.

The descendent of that animal had an adapted version of that bit of program, much more complex but taking less time to do its job. This adaption involved correctly inserting ten instructions, in the right order, into the right place; blind chance and evolution got it right. When it got it wrong, as it must have done thousands of times, the resulting mutant died. The one time it was right, though, the new animal thrived and quickly displaced those without the advantage conferred. You can trace the evolutionary pattern, as you can with real genetics, and see the way the process worked.

Natural laws

What's more, said the article, this sort of thing happens time and again. You don't have to be lucky to get a good result: it seems that whatever natural laws underlie evolution, they work in computer simulations just as well as in real life.

This has fascinating implications in all sorts of fields. I look forward to reading the reactions of those who think that theories of evolution are wrong and that divine creation produced everything — one of the real pleasures of Usenet is that I'll be getting those reactions in a day or so, from Finland, Albuquerque and New Zealand.

The obvious field where these techniques will make a difference is biology; evolution is such a potent force in the development of living organisms that any tool which allows the nosy to examine its mechanisms has the potential to reveal much that is new and unexpected. For a while, anything of reasonable complexity will require fast, capable, expensive hardware, and the technique is so new as to require a lot of development before it is more than a thought-provoking curiosity.



Yet evolution has the ability to produce superb results in any field. The Earth is full of beautifully constructed machines that could fly, swim and think long before Ford produced the Cortina (which can do none of these things); with faster computers and better software we can use the same laws that resulted in a planet full of living creatures to design just about anything we want. It's a completely different approach to engineering to the ones we normally use, and it has the potential to produce startlingly original solutions.

Two more things: firstly, a reasonable 80386 would take around 25 minutes to go through the 15 billion instructions that produced the animal with the optimized software. Secondly, an MSDOS version of the program should be available by the time you read this. I've always envied Dr Frankenstein...

Matthew May

Are British businesses about to inundate us with letters and documents that look as though they are written by a 14-year-old? Or perhaps you feel that manufacturers' jazzy sales literature and other business bumph is now so over the top that they already do. If so, there is at least some research to support you. The one outstanding development in the personal computer world this year has been the widespread adoption of what are clumsily entitled graphical user interfaces or GUIs.

The success of Windows 3.0 has firmly established that what was once the distinguishing feature of Apple computers has been so neatly hijacked that any personal computer user can now wallow in a plethora of icons, graphics and picture-based symbols to their heart's content.

That GUIs are no longer limited to Apple has meant that they are rapidly

appearing on the desktops of Britain's offices. But in case you are thinking of rushing out in a spirit of festive cheer to treat yourself or another to something that will provide screenfuls of pretty graphics — a word of caution. Easy to use they may be, but will they damage the content of what you produce?

Fluffy topics

Now that the world seems to have embraced GUIs as the way of the future, it is worth mentioning some US research done on the topic. At the time, early last year, the results were largely overlooked in Britain as they were presented purely as whether people using an Apple Mac produced worse documents than on an IBM or its many clones. But as the IBM clones that came under scrutiny were limited to text-based screens, what it was really looking at was whether GUIs did the damage. The study, from the University of Delaware, suggested quite seriously that using them leads to 'sloppier writing and fluffier topics'.

In a comparison of students using both machines it was discovered that less than a third of Mac users came up with complex sentences and they averaged only 16 words, while half the IBM clone users managed complex sentences and an average word length nearer 23 words.

Even more damning, the research applied a standard educational test to the outpourings and claimed that Mac authors were only at the educational level of 14-year-olds compared to 18 for the IBM clone group. It puts the phrase 'easy-to-use computer' in a different light.

When later in the year the survey was published in the *Academic Computing Journal*, it resulted in gleeful articles in the American press which were largely variations on the same theme: Does using a Mac make you stupid? It was seen as a victory for the corporate suits of IBM and Compaq

users over the freewheeling spirits of their Mac counterparts, though any joy felt by IBM at Apple's embarrassment must have been short lived as one of the results of the recent and curious alliance between the two will no doubt be a GUI-type screen.

The chief author of the research, a writing instructor called Marcia People Halio, decided that the GUI screen format of the Macintosh was guilty of encouraging 'a simple sentence structure and childish vocabulary'.

'Never before in 12 years of teaching had I seen such a sloppy bunch of papers. Words were misspelled, commas were placed haphazardly, semicolons were non-existent. Such fine points as quotation marks, apostrophes and question marks were treated with gay abandon.'

Even the topics chosen were different. 'Mac students chose to write about such topics as fast food, dating, bars, television, rock music, sports, relationships. These topics struck me as very different in a fundamental way from the essays on capital punishment, teenage pregnancy, nuclear war and drunk driving that I was accustomed to receiving from the IBMers. 'She did find one nice thing to say about the Mac users however: their work was 'often creatively illustrated'.

Such studies must be treated with the greatest caution. Are long and complex sentences necessarily better than short and simple ones, and were the groups truly comparable? If they chose which machines to use themselves, those with a tendency to 'creative writing' may well have gone for the machine with a GUI.

Encouraging aggression

The avid use of computers has been accused of far more serious crimes than poor writing. Some psychologists have claimed that extensive use can encourage aggression and even lead to treating

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other people in the same way as a computer — getting fed up with them if they don't produce the 'right' answer fast enough or are ambiguous.

But if GUIs continue to predominate next year — and Microsoft, the author of Windows 3.0, is claiming that four out of five software packages are being designed to run under its GUI — the topic must be worth further research just to reassure ourselves that we are not in danger of gaining creativity at the expense of our writing ability.

David Morton

One of the more irritating properties possessed by any hi-tech product is known pejoratively as 'creeping featurism'. Each release of hardware or software has to have new features. The word processor grows drawing tools, the drawing package text-processing facilities and before you know it each neat little utility has grown into a leviathan. Some people manage to be strong — sticking with the version of their favourite word processor that does all that they want, and steadfastly refusing to upgrade for bells and whistles they don't need.

I'm not one of those people. I love to see a new version of a program, and to find out what extras have been added that I never knew I needed, but which, in three weeks time, I will insist are indispensable.

Frustration and irritation

Creeping Featurism, more than anything else, renders our computers obsolete long before their components are showing signs of age. Unless you're one of the strong ones who can resist those tempting upgrade offers, your pride and joy can become a source of frustration and irritation within 18 months. It's not any slower than when you bought it, but version three of the soft-

ware is now doing seven times as much, and in ten times as many colours.

If you're lucky the lack of performance will be down to one weak component in your system — a slow hard disk or video card can let down an otherwise adequate machine. There have been some remarkably unwise hardware combinations sold as standard to an unsuspecting public. Long ago I was unfortunate enough to be responsible for the purchase of an early 16MHz 386DX system which — I discovered later — came supplied with a 30Mb hard disk with a 65ms access time: the processor spent most of its life waiting for the hard disk. With my Commodore 286 portable running Windows, the weak link is the lack of memory: Windows in standard mode on a 12.5MHz 286 is usable, but only if you have a few megabytes to play with. Obviously, if this is the case, upgrading that weak link will be the wisest choice, but the big problem arises when that weak link is the processor itself.

Increasingly, PC manufacturers are recognising the need for the hardware to keep pace with the software, by making upgradeable machines. AST and ALR have for several years made machines with the processors on so-called 'daughterboards' which plug in to the main system board, and recently they have been joined by Dell and Compaq. In AST's CUPID design, the daughterboard contains both the processor and the system RAM, leaving the motherboard fairly sparsely populated.

My own ALR — one of the company's PowerFlex machines — adopts a different solution, with just the 386SX CPU on the plug-in card. The ALR motherboard contains a complete 16MHz 286 chipset, but when the SX board is plugged in to the special 'feature connector', the faster CPU takes over. Away from the mainstream PC world, Steve Jobs' NeXT cubes adopted a similar approach, early versions be-

ing offered a new lease of life with a replacement processor card.

While this is a good way to address the problem of upgrading a machine to a more powerful CPU, it does suffer from a couple of problems: it's expensive because the processor cards are proprietary and thus single sourced, and you may be left with some rather strange anomalies — my ALR, for example, can have a 486/25 processor plugged into its feature connector but is still limited to 5Mb of memory on the motherboard.

In the last few years clone motherboards have become commodity items, freely available and widely advertised in magazines such as this one. Although removing an old motherboard and installing a new one may seem a rather drastic action, in practice it isn't significantly more difficult than installing an additional floppy disk drive or a hard card. Indeed, upgrading machines by replacing the motherboard has an impeccable pedigree: Apple has offered replacement motherboards as a means of upgrading Macs for some time.

This approach doesn't work for every PC clone; there are those which have odd-sized motherboards or an unusual number of slots. If your system has its expansion boards mounted horizontally, for example, then you're likely to find your range of options limited, though there are replacement units that may fit the bill. You don't have to just swap the motherboard in the same case, of course, you may well decide to upgrade that too. Tower and mini-tower cases with extra drive bays are available too.

As long as the applications programmers keep pouring on the features, our poor hardware is going to be struggling to keep pace. Thankfully as PCs — even highly specified 486 PCs — and their component parts become standard commodity items, this isn't as difficult, or

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as costly, as it once was. Of course we could all be strong and ignore the creeping features, but I think these days a multilingual spelling checker is *de rigueur*, n'est-ce-pas?

Jack Schofield

One problem with running a weekly features page like *Computer Guardian* is that you can easily be 'scooped' by someone who works on a daily schedule for the same paper. Fortunately there's an easy way to check: just dial up the Profile/World Reporter database in sunny Surbiton and do a search on the key words in the story. Unfortunately this isn't foolproof, because there's no way of knowing if the key words have been used.

I was caught out a few times in the early days. I'd search for an obvious phrase or abbreviation such as 'Open Systems Interconnection or OSI', not find it and assume my story was new. I'd then be told off for repeating something that had appeared on, say, the City page, using some phrase like 'agreed way for computers to talk to one another'. I'd search for 3090 only to find the original journalist had written about 'a new range of large-scale computers for corporate users' or whatever. The examples are fictitious, but you get the idea.

There's an argument for periphrasis. It is claimed that the average reader — the archetypal Man on the Clapham Omnibus — doesn't know the difference between a PC and a mainframe, let alone the meaning of obscure contractions such as modem, OSI, DOS, RAM and RISC. My reply is that if you don't use the industry-standard terms, two things happen. First, the computer-literate people who want to know the facts will find the story so imprecise as to be infuriating. Second, the people who are pig ignorant about computing

will stay that way: they'll never learn to understand what's going on if you talk down to them the whole time.

I can understand the reason for a phrase like 'horseless carriage'. Way back when, presumably everyone knew what a horse was, and what a carriage was, so they could imagine a horseless carriage without stumbling over jargon words like 'car' and 'automobile'. Perhaps there was a later stage when writers who used 'car' would add 'a four wheeled vehicle propelled by a motor', or whatever. But the roads were soon jammed with the things, and even non-drivers could cope with complex technical terms such as radiator, boot, mudguard, and white-wall tyres.

Computers are common

Nowadays, computers — using the term in its broadest sense — are as common as cars. Millions of people have terminals or PCs on their desks or in their homes or even in their pockets. If they don't have a 'proper' computer they have a games console, which is only a specialised version of the same thing. If they don't even own a calculator, they must bump into computer technology whenever they book a flight or hotel room, take cash out of their building society or bank account, place a bet or check out groceries in a supermarket.

Modern society has been completely penetrated by the microelectronics revolution: anyone who hasn't noticed must be stupid. That people who can translate Hamlet into primitive high Germanic using their historical knowledge of phonetics should be proud of such stupidity is horrifying. For the 'mass media' to encourage it is unforgivable.

I used to apologise for using computer jargon, but now if someone complains about it, I give them a good telling off. Computing is at least 45 years old, the microprocessor is 20 years old, and the PC has been around for a decade. Hundreds of TV programs and

thousands of books have been produced to explain it all to even the most obtuse and uninterested person. Anyone who doesn't understand the basics by this time must have been deliberately looking the other way.

Every subject has its own terminology, its own jargon. How about 'Woosnam took a wedge to the 15th green and birdied for three under par' or 'the pitcher walked two to bring the pinch-hitter to the plate for his first at bat'? Golf and baseball reports, like knitting patterns and cookery books, are incomprehensible without some sort of familiarity with the 'technical terms'.

Of course, the sort of things hackers say to one another are not the sort of things you would want to put in print — except in a lexicon like *The New Hacker's Dictionary* (The MIT Press, 1991). Slang is one of the things that binds a community together, but it works partly because insiders understand it while outsiders generally don't. It's the difference between saying 'Reset the system by pressing Control, Alt and Del' and 'Give it the three-finger salute'. People can't be assumed to know the meaning of *grep*, *guru* or *kludge*, the significance of 'hitting the metal' and so on. A lot of slang isn't widely understood *within* computing, let alone outside it; that's why so many systems have jargon files. But where do you draw the line?

The problem is, acceptable usage often comes out of slang. My Concise Oxford Dictionary has computerish definitions for boot ('put (a computer) in a state of readiness'), crash ('a sudden failure which puts a system out of action') and hacker ('a person who uses computers for a hobby, esp. to gain unauthorized access to data').

Perhaps instead of trying to avoid the use of computer jargon we should be promoting it, esp. to dictionary compilers who, nowadays, depend on computers as heavily as the rest of us.



Mark

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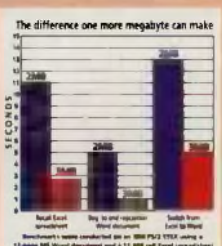
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PCW 1/92



AstroMart

No more guessing what's in the stars for you — AstroMart checks out all those playful planetary influences. You have to believe, though, and Wendy M Grossman doesn't.

It has been proved many, many times that there is no scientific basis for astrology. That does not, however, stop astrologers from peddling their illusory security to people who would rather believe that their destinies are written in the stars than that the universe takes no personal interest in what happens to them. Most people don't realise that astrology is a billion dollar industry. Book publishers do. Advertisers do. And now, computer companies have begun to notice it as well.

This is a logical development: a lot of the work of casting a horoscope is pure drudgery. As any 'serious' astrologer will tell you, sun-sign astrology, the kind you find in tabloid newspapers, magazines, and those thin (but popular) paperbacks, is simplistic. Casting a proper horoscope involves calculating the positions of the moon and all the other planets.

Therein, in fact, lies one of the scientific arguments against astrology: why did astrology fail to predict the existence of the planets Neptune, Uranus, and Pluto (which astronomy did predict), and why, when those planets were discovered, did their inclusion in astrology not invalidate any of the previous horoscopes, cast without considering their influence?

Calculations

AstroMart is one of a number of programs designed to ease the astrologer's lot. No more hunting through tables to find the positions of sun, moon, and planets. AstroMart does the calculations for you, and puts the results — a tabulation of planetary positions, masculine and feminine signs, earth, air, fire, and water signs, and so on — up on screen in a matter of a second or two. Saving the chart is easily done — so easily that I didn't think the program had saved anything, so I saved the same

chart five or six times without realising it until I looked at the directory.

Once the basic calculations have been done, you have choices. You can display a graph of the horoscope. You can display charts of the conjunctions, transits (at stepped intervals), and aspects. You can call up an analysis of the horoscope (it's amusing to note that you can go into the program and edit the analysis text — so much for astrology being an exact science). You can even print out horoscopes, although the list of supported printers is quite short.

This program is really designed for the dedicated techno-astrologer. Most of the information it generates is too complicated to be interpretable by (or of interest to) anyone else. It is also not the most user-friendly piece of software you could imagine: navigating among the menus is a shade on the clunky side, simply because you have to cancel each menu before you move on to the next. Also, the function keys that select the options only work from the menus, so there aren't really any shortcuts.

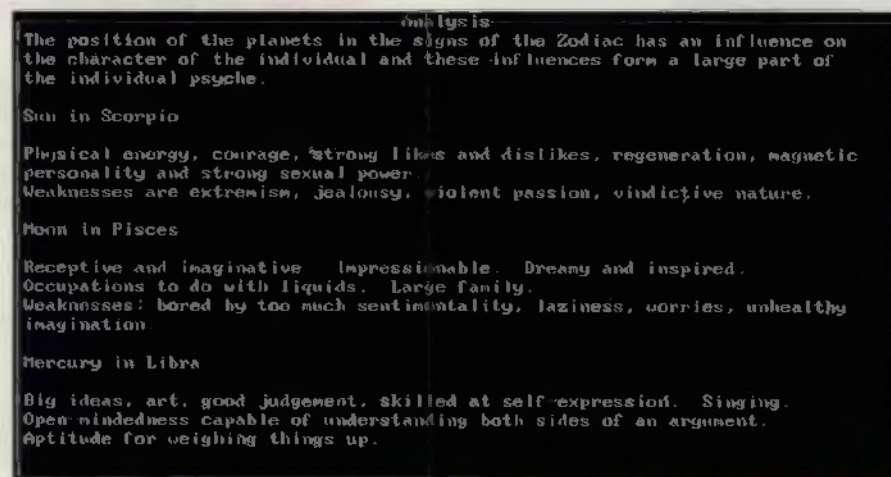
But AstroMart could find a role as a

party game — set up the computer and let each guest type in his or her name and birth date, time, and place. They can even, if you like, hit the Print Graph option to have the computer put up a nice little zodiacal chart. Then get someone else to take the computer away and print out all the horoscopes, removing the names and identifying them only by a code number (that guest should then leave, taking with them the list of names and matching code numbers). Then let the remaining guests try to guess which horoscope is theirs. Prediction: you will prove that the laws of chance work.

The French connection

AstroMart comes from a company on an industrial estate near Grenoble, France. The accompanying blurb claims that copies of the program have been sold to large French companies like Bull and Cola, and to 'matrimonial' and recruitment consultants. It's sad to say that this may well be true. Both astrology and graphology are used in recruitment in France and in London.

You may think this doesn't sound so unreasonable — job recruitment is an



inherently unfair process anyway — but when companies eliminate applicants on the basis of their sun-signs the result is just as bigoted as applicants' being eliminated on the basis of their race, gender, or sexual preference. You might call it 'signism'.

Bear in mind that this product is not being sold as a party game. When you hit F7 for analysis, the program puts up

a message: 'The position of the planets in the signs of the Zodiac has an influence on the character of the individual and these influences form a large part of the individual psyche.'

This is a specific claim, and one which is not borne out by either evidence or logic. AstroMart costs £58. A copy of *Astrology: True or False?* by Roger B Culver and Philip A Ianna

(Prometheus Books) costs £13.95 and contains the results of many studies of astrology (one, for example, shows that people rate a horoscope more highly if they believe it's been personalised just for them). Go for the book. It's cheaper. And better for you.

AstroMart is available from Langway on 010 31 764 1315.

Borland C++ & Application Frameworks

Borland's latest programming package features two C++ class libraries which, says David Gristwood, have real benefits for application development. But the price is high.

Borland C++ & Application Frameworks (BC&AF) combines the company's highly acclaimed C++ 2.0 compiler with a set of object-oriented development libraries for DOS and Windows programming. The Application Frameworks part of the package consists of two separate C++ class libraries: Turbo Vision for DOS applications, and ObjectWindows for Microsoft Windows applications. Borland uses the phrase 'Application Frameworks' to describe the way these class libraries are intended to form a basic framework or structure around which applications can be built.

BC&AF is no lightweight: it comprises 12 manuals and requires over 22Mb of disk space for a full installation. The 7Mb or so used by the class libraries is partially accounted for by the large number of sample programs and the library sourcecode. Fortunately, the manuals that accompany the C++ libraries are up to Borland's usual high standard, and come complete with a comprehensive tutorial section.

The class libraries slot neatly into the C++ Integrated Development Environment (IDE), as reviewed in the April issue of *PCW*. However, the usually lightning-fast compile and link times slow down dramatically when either of the class libraries are used. The use of the protected mode version of the compiler, which requires a 286 (or above) and at least 1Mb of extended memory, is essential to prevent the compiler running out of memory and switching



to its painfully slow disk swapping mode.

The release of BC&AF is a rather unusual move for Borland, as many people were expecting the next version of the C++ compiler to include a full Windows-based IDE as found in the Turbo Pascal for Windows package. Although Borland is being tight-lipped about its plans, a full-blown Windows package must be in the pipeline. It may also include the company's newly released Resource Workshop which is, surprisingly, not included in BC&AF.

Turbo Vision and Object

Both Turbo Vision and ObjectWindows comprise a set of C++ objects that cover the varying elements of a user interface, from windows through to dialogue boxes and buttons. They use the data abstraction properties of the C++ programming language to create objects that can be used as the building blocks for the user interface.

The functionality of these objects is already built into the objects themselves: for example, windows know how to resize themselves and dialogue boxes know how to respond to user input. The real power of C++ lies in its ability to create new objects that inherit the properties of existing objects, but which can be modified as required.

This type of software reusability not only reduces development time, but minimises the chances of introducing new bugs into programs. For example, using the ObjectWindows library, the traditional 'Hello World' program amounts to a mere 35 lines. More importantly, once the basics of the libraries are understood, such code is a lot more readable than its C counterpart.

Turbo Vision is an event-driven character-based user interface for DOS programs. It is a powerful library which supports a wide range of user interface features, such as multiple windows, pop-down menus and dialogue boxes. Borland users, though they may not know it, will already be aware of its power, as Turbo Vision was used to write the company's IDE.

ObjectWindows is similar in many respects to Turbo Vision, but is specifically for Windows applications. In an attempt to provide some continuity with Turbo Vision it uses a similar naming convention for the object, though there are differences due to the more complex nature of the Windows environment. Unlike several other Windows

libraries, such as CommonView or the Zinc Interface Library which provide a platform-independent programming environment, ObjectWindows allows programs low-level access directly to the Windows API but from within an object-oriented framework. This approach works well, provided programmers don't mind developing Windows-specific code.

The ease of access to Windows is achieved in part through the use of a new technology Borland refers to as

Dynamic Dispatch Virtual Tables (DDVT). Using a numeric index into an object, DDVTs allow the compiler to turn any Windows message into a call to a particular member function using a consistent programming interface. Although this is an unusual technique, there has been talk of Borland offering this technology as a non-proprietary standard.

Turbo Vision and ObjectWindows show that C++ has real benefits for application development. For Windows

development it is streets ahead of Microsoft's Software Development Kit (SDK). The only down side is its relatively high price: with every release, Borland's C++ compiler gets that little bit more expensive, now running to just under £400. It will be interesting to see how the competition, in particular Zortech and Microsoft, react.

Borland C++ & Application Frameworks costs £399.95. Borland C++ 2.0 users can upgrade for £89.95.

Code Translator

Sequiter Software's Code Translator is a dBase-to-C program translator built around the Code Base database library. David Gristwood found that it really needs more attention.

Despite the fact that dBase has become the de facto standard in the PC database market, over the last few years it has been overtaken by clones and add-ons offering more facilities and better development environments. One of the latest products to join this market is Sequiter Software's Code Translator, a dBase-to-C program translator. It is aimed at programmers wishing to migrate to C, or who simply want to produce standalone compiled dBase programs.

In actual fact, there is surprisingly little to the Code Translator package; just a slim spiral-bound manual and a single high-density disk. The reason for this lies in the way Sequiter has built Code Translator around Code Base 4.2, its dBase-compatible database library. Code Base is a set of C library routines that can be used to create dBase-style programs, but in C. Given that much of the work has already been done in producing this dBase library, a dBase-to-C translator was an obvious next step for Sequiter.

Why compile?

Many dBase programmers will be perfectly happy with the environment it gives them and will quite rightly question the advantages to be gained from converting dBase programs to C. One of the key benefits to be gained lies in Code Translator's ability to convert dBase programs, albeit via C, to standalone .Exe files. dBase is an interpreted language which, while ideal for

program development, is not without its drawbacks for application programmers. In particular, compiled code is faster than its interpreted counterpart, offering users tangible speed benefits. Moreover, compilers allow programmers to protect their valuable source code from unauthorised viewing and alteration.

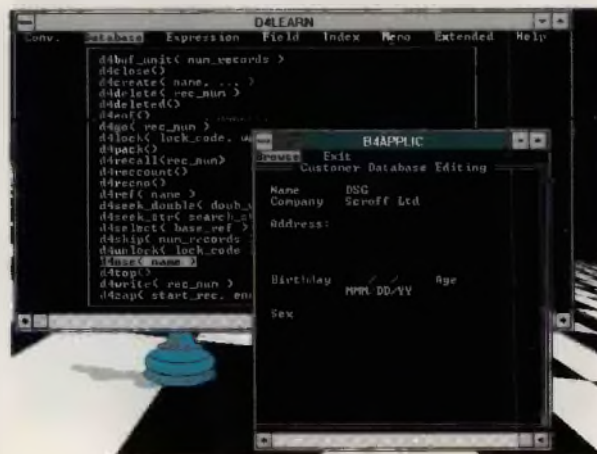
One of the other major advantages lies in Code Translator's ability to liberate programmers from the dBase language. As this translation process produces standard C code, and the source code is available to the Code Base library, in theory it should be possible to port a translated dBase program to just about any platform that sports a C compiler and has an MSDOS-style filing system. In particular, in cases where dBase functionally must form an integral part of other applications or programming environments, such as Microsoft Windows, then Code

Translator is an obvious candidate.

Code Translator is a four-pass translator that generates a set of C source code and header files from a dBase program. Overall the product lacks the slickness users will have come to expect from mainstream software; installation is a manual process, and using the translator requires the user to fiddle around ensuring the right files are in the right place. Getting to grips with it requires a reasonable level of familiarity with C compilers.

In theory, just about any near-ANSI C compiler can be used to compile the C files created by Code Translator, although in practice Sequiter has a bias towards Microsoft and Borland compilers. As both dBase and C are block-like procedural languages, the C source code produced is actually fairly readable; dBase comments are passed through to the C source code, database information is wrapped up in C structures, and a consistent naming convention is used for variables.

The acid test, though, lies in Code Translator's ability to produce accurate C translations of dBase programs. But it doesn't support all dBase commands, nor does it handle all the varying formats of the commands that it does support. Most of the commands it won't handle are specific to the dBase development environment. But some of the omissions are not so easily explained, especially as they are handled by other



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- 512K 16 bit VGA card, (1024 x 768)
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 - ☐ 40 MB IDE MS disc.....£ 140
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- Hardware LIM EMS 4.0 compatible
- Shadow RAM

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- Slide in desktop case
- 102 UK Cherry Click Keyboard
- 1.2 MB or 1.44 MB Floppy drive
- IDE disc and floppy drive controller
- 2 serial / 1 parallel 1 game port
- 512K 16 bit VGA card (1024 x 768)
- Monochrome VGA monitor

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 - ☐ 40 MB MS IDE disc.....£ 140
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- Monochrome VGA monitor

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- 80486 DX-33 main board
- Landmark (V 1.14) 150 MHz
- 8K internal CACHE
- 256K CACHE on board
- 4MB RAM on board (expandable 32 MB)
- 230W power supply, Tower Case
- 102 UK Cherry Click Keyboard
- 1.2 MB or 1.44 MB, Floppy drive
- IDE disc and floppy drive, controller
- 2 serial / 1 parallel, 1 game port
- 1MB 16 bit VGA (1024 x 768) 256 colour
- Monochrome VGA monitor

- Add on
 - ☐ 80 MB 18 MS IDE disc.....£ 230
 - ☐ 210MB 16 MS IDE disc.....£ 520
 - ☐ Super VGA 256 colour MULTISYNC (1024 X 768) (30-38KHz).....£ 145
 - ☐ Super VGA 256 color NON INTERLACE (1024 X 768) (30-38KHz, 47-50KHz).....£ 185

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- 8 KB internal CACHE
- 128K CACHE on board, expandable 256 KB
- 1MB RAM (expandable 32 MB)
- 200W power supply
- Desktop / Mini Tower Case
- 102 UK Cherry Click Keyboard
- 1.2 MB or 1.44 MB, Floppy drive
- IDE disc and floppy drive, controller
- 2 serial / 1 parallel
- 1MB 16 bit VGA card (1024 x 768) 256 colour
- Monochrome VGA monitor

- Add on
 - ☐ 80 MB 18 MS IDE disc.....£ 230
 - ☐ 210MB 16 MS IDE disc.....£ 520
 - ☐ Super VGA 256 colour MULTISYNC (1024 X 768) (30-38KHz).....£ 145
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to find the right key combination, it is an incredibly fast method of word processing.

Within the word processor is a facility for creating forms, which can then be adapted to form a records list and from there, treated as a database. All, or portions of, the records list can be selected to produce mailings, reports and even to fill in invoices. Prisma Office also includes a communications interface that can make and receive modem calls, and in multi-user environments, it gives access to the Prisma Office email and on-line bulletin boards.

Appointments and reminders can be recorded in the calendar or diary, and an alarm can be set that beeps and

opens a half window on the screen to display details of the reminder. Up to four different activities can be in operation at any one time, each held in Prisma Office's own system of windows. They can exist as full editing screens, or the screen can be divided to show two or four of the windows simultaneously.

The impact of the GUI

The result is a highly efficient document processing system, but at a time when the Graphical User Interface is having the same impact on computing that sliced bread once did on sandwiches, it is going to look pretty unfriendly to new users. It will make little difference to most word processing

work whether it takes eight keystrokes or two to produce underlined text, and many simple word processing packages have the same formatting functionality as Prisma Office.

It is the database management and communications features that make this program more than a word processor, but that may not be enough to compete with the better presented WP packages. When the Windows version comes out next year, it may finally take the torture out of using Prisma Office.

Prisma Office costs £425 (single-user), £1650 (five-user), £2950 (10-user), £1350 (Unix eight-user), and £2100 (Unix 16-user). Xios Systems is on (0753) 680768.

Tahiti Mini Tower II

The Tahiti Mini Tower II optical drive is a viable alternative to other data storage devices. It's a durable medium with definite security advantages, says Helen Johnstone.

How data is stored depends far more on what it is stored for than on the price. An optical disk can provide a gigabyte of storage for around £150, but it won't be much use if you have to access the data frequently or quickly. The problem is not the disks themselves, but the optical drive, which has always been much slower to access than hard or floppy disk drives. The Tahiti Mini Tower II, however, is threatening to change all this.

An optical disc drive that works with both erasable and non-erasable cartridges, it is capable of almost all that a hard drive can do. The 'seek time' of the drive has been lowered to just 25ms for the 1Mb cartridge format and with a transfer rate of 1Mb per second, it is faster than many other storage devices. So, in theory at least, it is now practical to use optical storage with real-time applications and, to make it easy to integrate it into existing systems, an embedded SCSI controller has been included.

It's all done with mirrors

In common with other optical drives, laser light is used to write to the optical cartridges and to read from them. The Tahiti, however, has also incorporated magnetic technology and a system of mirrors to direct the laser to increase the accessing speed.

Coupled with a 16MHz microprocessor and 256K buffer, it has doubled



the access time of the previous Tahiti Mini Tower version I.

The footprint of the drive is only 20 cm x 15 cm, and calling the Tahiti a 'tower' is an exaggeration as it's only 8cm high. It wouldn't be inconvenient on the desk if it weren't for a rather noisy fan on the back, which circulates air through the drive to keep it at the correct operating temperature.

There's so little to the actual drive that setting it up is relatively easy. It plugs straight into the power supply and an interface kit, in this case CorelDriver, provides the SCSI adaptor and installation software for the PC, workstation or file server to which it is connected. On the back of the drive is the power port and two SCSI ports, one to connect to the PC and the other to link with other SCSI devices. Using this last port, a chain of optical drives could be set up to provide a vast on-line database capacity.

Disks are loaded into the drive

through a slot at the front and can be ejected either through software or by using the eject button on the front. The manual eject was annoyingly unresponsive. I found myself pressing it several times whenever I wanted to remove the disk, as it felt as if it hadn't moved and there was a 1-2 second pause before the disk was actually ejected. Two LED indicators on the front show when the power is on and when the drive is active, and the slats on the front conceal an air vent for the fan.

The CorelDriver software used with the drive provided a means of making the drive bootable, a feature that enables the entire application, operating system included, to be held on an optical disk cartridge. To take advantage of the capabilities of versions of DOS 4.0 and above, CorelDriver offers two different cartridge formats, getting around the problem of versions 3.3 and older that are unable to cope with logical partitions greater than 32Mb in size by using a 'patch' system. DOS is then able to make the most of the 1Gb memory on the optical cartridges.

Test drive

In tests, the drive ran most of the applications tried on it and, in terms of speed, there was no noticeable difference from a hard disk. Unfortunately, installing some software directly from floppy disks was a difficult operation. The idea of loading disk-consuming

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60MB Hard disk
now supplied as
standard

The new Viglen Dossier packs unrivalled power into an A4, notebook sized computer. Designed using the latest state-of-the-art technology, the Dossier boasts a 32 bit 386SX processor running at 20MHz, with 2MB RAM (expandable to 8MB) and 60MB hard disk as standard (expandable to even higher capacity in future). A super fast paper white LCD screen with 32 grey levels and VGA resolution gives superb display quality with the ability to connect to an external VGA colour monitor if required. With an average battery life of 3 hours and over, the Viglen Dossier is the ideal portable office for those people on the move. Truly A1 performance from an A4 sized computer!

<p>Dossier</p> <ul style="list-style-type: none"> ■ Fully IBM PC/AT compatible, will also run 32 bit software written for the 80386/80486 processors. ■ 80386SX processor with 80387SX co-processor socket. ■ Speed of 6/20MHz. ■ 2MB RAM (384K shadow RAM) expandable to 8MB. ■ Fast 60MB hard disk, option for higher in future. ■ 1.44MB 3.5" floppy drive. ■ Super fast paper white LCD screen with CCFT side light. VGA display with 32 shades of grey and EGA/CGA/MDA emulation. ■ Low profile 81 key keyboard with click feeling contact switch. ■ MS-DOS 5.0 with Shell. 	<p>386SX20</p> <p>£1599 + VAT</p> <p><small>GOOD VALUE! What to Buy for business</small></p> <ul style="list-style-type: none"> ■ 1 parallel/external floppy port, 1 serial port, 1 external keyboard socket (PS/2 or AT), external colour VGA monitor socket, AT expansion bus socket. ■ Size 297mm(W) x 216mm(D) x 51mm(H). ■ Weight 2.97Kg (6.6lb) with battery. ■ Fully removable and rechargeable ni cad battery. ■ Battery life average 3 hours. ■ Universal AC adaptor. ■ Carrying pouch for Dossier and accessories. ■ Landmark speed (ver 2.0) = 22.68MHz. ■ SI (ver 4.5) = 21.1, powermeter MIPS = 3.52
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Options

A host of options are available for the Dossier including external monitor, keyboard, external floppy drive etc. Some of the more popular ones are listed below.

<ul style="list-style-type: none"> ■ 2MB extra RAM factory fitted on motherboard £159 + VAT ■ 2MB RAM module £159 + VAT ■ 4MB RAM module £316 + VAT ■ Worldport 2496 fax/data modem £479 + VAT 	<ul style="list-style-type: none"> ■ Worldport 2400/MNP5 external modem £379 + VAT ■ Acoustic coupler to either modems above £49.95 + VAT ■ External ethernet module £249 + VAT
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MS-DOS 5.0
MS-DOS 5.0 is supplied as standard with all Viglen computers.

MS-DOS 5.0 upgrade
Existing Viglen computer users can upgrade to MS-DOS 5.0 from previous versions of MS-DOS by purchasing either the MS-DOS 5.0 STANDARD package (as supplied with new systems) or the MS-DOS 5.0 UPGRADE package (which provides for easy upgrade). The price for the MS-DOS 5.0 STANDARD package is £49 + £5 carriage + VAT and the price of the MS-DOS 5.0 UPGRADE package is £69 + £5 carriage + VAT. Please state the serial no. of your computer and disk format required when ordering.

Open your eyes to Microsoft Windows 3.0
Now included FREE with all Viglen computers

What to Buy for business

In the 1991 "What to buy for business" consumer report, Viglen once again achieved the highest number of recommendations. Look out for the stamps on the following pages.

Genie and Vig ranges ...

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Vig RANGE

The standard Vig range case

The Vig is a range of IBM compatible systems featuring outstanding performance and specification. Its innovative design using state-of-the-art technology and British manufacture have made this range one of the most popular computer systems in the UK. All models in the range share a common elegant look providing both a 1.25" and a 3.5" floppy drive as standard along with a very high specification and plenty of room for future expansion. The special case design also allows the case to be stood on its side as a mini tower system. The Vig range can also be ordered in a much larger tower case as an option (refer to the options section

The Vig range can also be ordered in a tower case option as shown above. Refer to the options section below.

General Specification The Vig models all have the following common specification:

- Fully IBM AT, MS OS/2, Xenix and Unix compatible. The Vig SX, Vig III and Vig IV also run 32 bit software written for the 80386 and 80486 processors
- 1 x 1.2MB and 1 x 1.44MB floppy drive.
- Enhanced 102 key keyboard.
- 2 serial, one parallel printer and one game port.
- 16 bit 1024 x 768 resolution super VGA card using the very latest industry standard WD paradise chip set
- Standard Vig range small footprint case dimensions (170(H)x370(W)x410(D)mm) with 200 watt power supply.
- Microsoft compatible mouse.
- MS-DOS 5.0 with Shell and Microsoft Windows 3.11 installed, pre configured and ready to use (just type WIN to get started in Windows).
- Industry standard BIOS.
- EMS LIM 4 support.

Vig SX



80386SX

Vig SX-20 HD40VM VGA Mono

- As general Vig specification and with
- 32 bit 80386SX processor running at 8/20MHz with socket for 80387SX co-processor
- New ultra high speed 40MB hard disk (<18ms, 1:1 Interleave, 32K cache), option for up to 1.2GB

- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 25.6
- 1MB RAM upgradeable to 32MB on motherboard

£949 + VAT

Vig SX-20 HD40VC Super VGA Colour

- As Vig SX-20 HD40VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1099 + VAT

Vig III



Now 4MB as standard

80386DX

Vig III/LS HD80VM VGA Mono

- As general Vig specification and with
- 32 bit 80386DX processor running at 8/25 MHz with socket for 80387DX co-processor
- VGA monochrome monitor with resolution of 640 x 480
- 4MB RAM upgradeable to 32MB on motherboard

- New ultra high speed 80MB hard disk (<18ms, 1:1 Interleave, 32K cache), option for up to 1.2GB
- Landmark speed (ver 2.0) = 27.7MHz, SI (ver 4.5) = 26.3, powermeter MIPS = 4.53

£1149 + VAT

Vig III/LS HD80VC Super VGA Colour

- As Vig III/LS HD80VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1299 + VAT

Vig III/33 HD80VM VGA Mono

- As Vig III/LS HD80VM but with
- 33MHz with 64K of cache RAM upgradeable to 256K

- Landmark speed (ver 2.0) = 55MHz, SI (ver 4.5) = 39.7, powermeter MIPS = 7.70

£1249 + VAT

Vig III/33 HD80VC Super VGA Colour

- As Vig III/33 HD80VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1399 + VAT

Vig IV/SX

80486SX

Vig IV/SX HD80VM VGA Mono

- As general Vig specification and with
- 32 bit 80486SX processor running at 8/20MHz with socket for 80487SX co-processor and Weitek 4167.
- Upgradeable to full 80486DX running at 33MHz.
- 8K cache internal to processor and 64K secondary cache upgradeable to 256K

- 2MB RAM upgradeable to 32MB on motherboard
- New ultra high speed 80MB hard disk (<18ms, 1:1 Interleave, 32K cache), option for up to 1.2GB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 66.8MHz, SI (ver 4.5) = 31.3, powermeter MIPS = 8.93

£1449 + VAT

Vig IV/SX HD80VC Super VGA Colour

- As Vig IV/SX HD80VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1599 + VAT



COMPUTER WEEKLY

The 1991 independent survey, the 'Quality of IT Suppliers' by Computer Weekly, ranked Viglen No.1 overall for its quality as a PC supplier, for its technical staff, general capabilities, for its products and for competitive pricing.

below). There is a wide choice of models to suit your applications starting from the 80386SX based Vig SX system to the top of the range 80486DX based Vig IV models. All the models are powerful enough to be used for all applications from high performance stand alone systems to the most demanding multiuser and networking applications. If even higher performance is required in a multiuser or networking environment, the Vig IV/33 EISA range should be considered as it is one of the most powerful systems of its kind.

Vig IV/25 & 33



80486DX

Vig IV/25 HD100VM VGA Mono

- As general Vig specification and with
- 32 bit 80486DX processor running at 8/25MHz with built Maths co-processor and socket for Weitek 4167.
- 8K cache internal to processor and 64K secondary cache upgradeable to 256K
- 4MB RAM upgradeable to 32MB on motherboard

- New ultra high speed 100MB hard disk (<18ms, 1:1 Interleave, 32K cache), option for up to 1.2GB
- VGA Monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 83.53MHz, SI (ver 4.5) = 39 powermeter MIPS = 11.3

£1699 + VAT

Vig IV/25 HD100VC Super VGA Colour

- As Vig IV/25 HD100VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1849 + VAT

Vig IV/33 HD100VM VGA Mono

- As Vig IV/25 HD100VM but with
- 32 bit 80486DX processor running at 8/33MHz

- Landmark speed (ver 2.0) = 110MHz, SI (ver 4.5) = 50.7 powermeter MIPS = 14.70

£1799 + VAT

Vig IV/33 HD100VC Super VGA Colour

- As Vig IV/33 HD100VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£1949 + VAT

Vig IV/33 EISA

80486DX

Vig IV/33 EISA HD200VM VGA Mono

- As general Vig specification but with
- 32 bit 80486DX processor running at 8/33 MHz with built Maths co-processor and socket for Weitek 4167.
- 8K cache internal to processor and 128K of secondary WRITEBACK cache
- VGA monochrome monitor with resolution of 640 x 480
- 4MB RAM upgradeable to 32MB on motherboard.

- New ultra high speed 200MB hard disk (<15ms), option for up to 1.2GB
- 8 32 bit EISA slots (fully ISA compatible), 6 free slots
- 6 bus master slots.
- Landmark speed (ver 2.0) = 111.52MHz, SI (ver 4.5) = 51.6 powermeter MIPS = 14.76

£2949 + VAT

Vig IV/33 EISA HD200VC Super VGA Colour

- As Vig IV/33 EISA HD200VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£3099 + VAT

Vig IV/33 EISA SCSI200VM VGA Mono

- As Vig IV/33 EISA HD200VM but with
- 32 bit EISA SCSI caching hard disk controller (fitted with 1MB of cache RAM upgradeable to 4MB)

- 200MB SCSI hard disk

£3549 + VAT

Vig IV/33 EISA SCSI200VC Super VGA Colour

- As Vig IV/33 EISA SCSI200VM but with
- Super high resolution 14" super VGA plus .28 dot pitch colour monitor.

£3699 + VAT

Options

- For each extra MB RAM please add £44.00 + VAT. The total RAM configuration of the Vig ranges shown must be one of the following: 4MB, 8MB, 16MB, 20MB and 32MB. Note that RAM prices are valid when ordered with a system. Due to the nature of RAMs and the many combinations and types of DRAMs available, the cost of upgrading at a later stage may differ.

- For the full system to be incorporated in a tower case add £159.00 + VAT.
- A full range of other options including co-processors, higher capacity hard disks, network cards, CD ROM systems, tape backup systems, modems, OS/2, Xenix, Unix, Novell etc are available. Please call us as there are too many options to list.



Viglen colour VGA systems are now supplied with the latest very high resolution .28 dot pitch 14" super VGA plus colour monitor with full FCC, TUV, UL, CSA and DHSS safety approvals. This monitor displays 1024x768 resolution and is IBM high resolution 8514/A and XGA compatible. The results speak for themselves: none of the screens displayed in this advertisement were simulated - all were photographed directly off-screen



The Viglen Genie range incorporates ingenious British design and the latest state of the art technology to provide the smallest footprint IBM compatible computer currently available with so much power and so much expansion capability. Despite its small size, the Genie manages to make available 5 free expansion slots (3 of which can take full size and full AT height add on cards) and to provide hard disk expansion capacity of up to 500MB. There are three main models in the current range starting from the 80386SX based Genie 3SX, and extending to the Genie 4DX which is one of the most powerful personal computer systems currently available and is based on the 32 bit Intel 80486 processor running at 33 MHz. The Genie is ideal for most applications, from the basic high performance single user system to the most demanding multi user applications.

General Specification

The Genie models all have the following common specification:

- Fully IBM AT, MS OS/2, Novell, Xenix and Unix compatible. The Genie 3 and 4 also run 32 bit software written for the 80386 and 80486 processors.
- Industry standard BIOS
- EMS LIM 4 support
- 1 x 1.44MB floppy drive with option for external 1.2MB floppy drive or streamer.
- Enhanced 102 key keyboard
- 5 free expansion slots (4 x 16 bit 3 of which are full length and full AT height and 1 x 8 bit)
- 2 serial and one parallel printer port
- 16 bit 1024 x 768 resolution super VGA card using the very fast industry standard WD paradise chip set with 512K of RAM as standard
- Very small footprint case size 100 (H) x 315(W) x 380(D)mm
- Microsoft compatible mouse
- MS-DOS 5.0 with Shell and Microsoft Windows 3 all installed, pre configured and ready to use (just type WIN to get started in Windows)

Genie 3SX 80386SX

NOW 20MHz £849 + VAT

Genie 3SX HD40VM VGA Mono

- As general Genie specification and with
- 32 bit 80386SX processor running at 8/20 MHz with socket for 80387SX co-processor
 - 1MB RAM expandable to 32MB on motherboard and more with expansion card

- New ultra high speed 40MB hard disk (<18ms, 1-1 interleave, 32K cache), option for up to 500MB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 20MHz, SI (ver 4.5) = 18

Genie 3SX HD40VC Super VGA Colour

As Genie 3SX HD40VM but with

- Super high resolution 14" super VGA plus 28 pitch colour monitor.

£999 + VAT

Genie 4SX 80486SX

NOW 20MHz £1349 + VAT

Genie 4SX HD40VM VGA Mono

- As general Genie specification and with
- 32 bit 80486SX processor running at 8/20MHz with socket for 80487SX co-processor and Weitek 4167. Also upgradeable to full 80486 DX running up to 33MHz
 - 8K cache internal to processor and 64K secondary cache upgradeable to 256K

- 2MB RAM expandable to 32MB on motherboard.
- New ultra high speed 40MB hard disk (<18ms, 1-1 interleave, 32K cache), option for up to 500MB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 66.8MHz, SI (ver 4.5) = 31.3, powermeter MIPS = 8.93

Genie 4SX HD40VC Super VGA Colour

As Genie 4SX HD40VM but with

- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1499 + VAT

Genie 4DX 80486DX

WHAT MICRO? BEST BUY £1549 + VAT

Genie 4DX HD40VM VGA Mono

- As general Genie specification but with
- 32 bit 80486DX processor running at 8/33 MHz with in built Maths co-processor and socket for Weitek 4167.
 - 8K cache internal to processor and 64K secondary cache upgradeable to 256K
 - 2MB RAM expandable to 32MB on motherboard.

- New ultra high speed 40MB hard disk (<18ms, 1-1 interleave, 32K cache), option for up to 500MB
- VGA monochrome monitor with resolution of 640 x 480
- Landmark speed (ver 2.0) = 110MHz, SI (ver 4.5) = 50.70, powermeter MIPS = 14.70

Genie 4DX HD40VC Super VGA Colour

As Genie 4DX HD40VM but with

- Super high resolution 14" super VGA plus 28 dot pitch colour monitor.

£1699 + VAT

Options

- For each extra MB of RAM please add £44.00 + VAT. The total RAM configuration of the Genie 3SX can be one of the following: 1MB, 2MB, 3MB, 4MB, 5MB. The total RAM configuration of the Genie 4 range must be one of the following: 4MB, 5MB, 8MB, 16MB, 20MB and 32MB. Note that RAM prices are valid when ordered with a system. Due to the nature of RAMS and the many combinations and types of DRAMS available, the cost of upgrading at a later stage may differ.
- Price for higher capacity hard disk drives instead of the 40MB are as follows: 80MB £129 + VAT, 100MB £199 + VAT, 200MB £429 + VAT, 300MB £769 + VAT, 400MB £949 + VAT, 500MB £1099 + VAT.
- Please call for many other options.

Why Choose Viglen?

BEST VALUE FOR MONEY

Spec for spec Viglen offers the best price performance systems available.

BUY WITH CONFIDENCE

From a company with experience, Viglen are a British company who have been in the manufacturing business for 18 years; a lot longer than many personal computer companies.

QUALITY AND SERVICE

The quality systems and service from Viglen is second to none. All Vig and Genie systems are designed and built in the UK under one of the most stringent quality control and test procedures.

RELIABILITY

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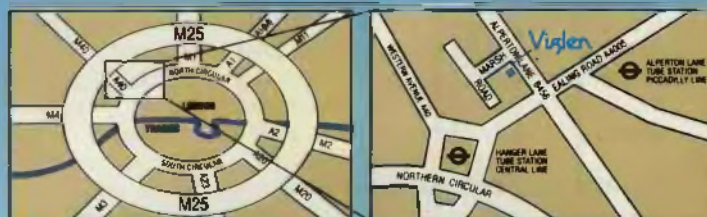
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applications straight to the optical drive was very appealing, but several times the drive refused to boot, despite the presence of all the relevant files. Transferring applications from the hard drive was much simpler. It took around five minutes to load the entire operating system, applications and files from the PC's hard drive and they ran just as they had before.

The security advantages of being able

to keep an entire system on a single optical disk, 5.25in in diameter and only a little thicker than a floppy are obvious and the convenience of being able to back up data in a few minutes, without having to feed in a stack of floppies, is a major attraction.

Optical storage is also more durable than most methods of data storage. The data life expectancy ranges between 25 and 40 years currently, depending on

the type of disk, and the disks themselves last a lot longer. Whether it can beat the hard drive for speed and convenience is another matter, but for the moment, the versatility of the Tahiti makes it a viable alternative to many of the other data storage devices on the market.

The Tahiti Mini Tower II costs £2772 from Maxtor Europe on (0276) 858811.

Techno Plus CD-ROM bundle

The Techno Plus CD-ROM package features Philips hardware and disks from Software Toolworks. As an introduction to the world of PC CD-ROM it's ideal, says Mat Beard.

In 1978, Philips unveiled the world's first Compact Disc Audio system, and after a shaky start and a deal with Sony, it became the company's biggest success to date. A few years later, in 1981, along came the IBM PC and soon got a firm foothold in the personal computer market. With the development of bigger and better PCs came the demand for bigger and better data storage techniques, and since the data on an audio CD is stored in digital form, it seemed the obvious place to start. Philips and Sony took the challenge and it was only a few years later, in 1985, that CD-ROM was launched.

CD-ROM drives have come a long way since then, and are now available in a variety of shapes and sizes. The Techno Plus bundle features the new CM50 series from Philips, aimed squarely at entry level, and like all the gadgets I seem to be getting my hands on these days, it's small. It measures 215 x 155 x 52mm and weighs 0.85kg (that's without a CD in it), about the same as an early portable CD player.

Green and orange lights

There isn't not much to say about the case except that it's grey, which is good as it matches the Kyocera I've got it connected to. At the front, a green light tells you when it's switched on, and an orange one lets you know it's busy. At the rear is the data I/O and power socket (the drive draws its power from the PC), an on/off switch, a headphone socket and a volume control (yes, it plays audio CDs too!).



The disk bay is accessed by pushing a long, thin button on the top, marked 'OPEN', and then manually lifting the lid. This doesn't reveal anything exciting, but it's a good way to get the CDs in.

Everything you need to install the drive is provided (apart from a screwdriver, which was the only problem I encountered) and installation is quite simple. The 18-page manual goes into some detail on what to do if you are installing more than one drive, but otherwise you just plug the host adaptor card into your PC and plug the ROM drive into that. It's then simply a matter of installing the software, which is provided on 3.5 and 5.25in disks, and rebooting your machine.

Two essential changes are made to

your system configuration in order for your PC to recognise and utilise the CD-ROM drive. These changes are made by the two programs MSCDEX.EXE and CDROM.SYS: the former are extensions to MSDOS which allow it to overcome the problems of handling data of such a strange nature; the other, CDROM.SYS, is a device driver to support the host adaptor card. There are options for manually setting up all the software drivers, but if you stick to the default values chosen by the installation program, you can't go far wrong.

Other programs on the disks are a TSR (Terminate and Stay Ready) utility which allows you to play digital audio disks on the CD-ROM drive, and a Windows 3.0 version of the same.

Running either of these brings up a picture of an audio CD player, with all the normal CD player controls: play, pause, skip and stop. There is also a random track selector. Unfortunately there are no audio CDs supplied with the drive, and I don't have a huge CD collection (at the last count there were none) so I couldn't test the audio capabilities, but the Techno package includes three CD-ROM disks so I gave them a go.

Playing games

The three disks are from Software Toolworks and the first I tried was the CD Game Pack. This contains six games and comes with the manuals for all of them: Chessmaster 2000, Life & Death, Bruce Lee Lives, Gin King, Cribbage

King, and Beyond the Black Hole which also comes with a pair of glasses for 'True Stereoscopic 3D', but as far as I can tell they are only for looking at the pictures in the manual.

More interesting are the other two disks, the Toolworks Reference Library and World Atlas. The Reference Library contains all the information from various reference books and has a simple search system for easy data retrieval.

Included are Webster's New World Thesaurus, Dictionary, Dictionary of Quotable Definitions, Dictionary of 20th Century History, Guide to Concise Writing, and The New York Public Library Desk Reference.

The CM50 handles disks with a maximum storage capacity of 635Mb, and has a transfer rate of 176.4K per second. Access time varies between an average of 850ms and a maximum of

1500ms, which may sound slow when compared to hard disks but you've just been spoiled — 850ms is not a long time.

As an introduction to the world of PC CD-ROM, the Techno Plus CD + software bundle is ideal.

The Techno Plus CD-ROM package costs £399.99 and is available from Software Circus on 071-436 2811 and 071-404 4492.

Threadz Organiser

Threadz' Organiser is a Windows personal filing system that is considerably more than just a pretty face — it impresses in every way. Nick Beard thinks it deserves to do well.

It has been a long time coming, but at last there is a fully WYSIWYG Windows 'Filofax' — and it's a very good one. Threadz' Organiser is a personal filing system combining diary, address book, calendar and anniversary and notebook functions on an attractive desktop that fully exploits the graphical interface of Windows 3.0.

There is far more to the Organiser than its admittedly pretty face. A mere diary would hardly be noteworthy, and simple address databases are truly uninteresting. Organiser of course includes these utilities, well executed too, and supplements them with data linking and other features to create a powerful personal data management system that is remarkably easy to use.

Power up and play, and you can soon have lots of data in place, with links between diary events, to-do reminders and addresses. These are easily established through the iconic toolset. For example, the anchor tool drops a hook into one section, and anchors it to another. You might have a date to meet Boris and Felicity on Thursday 19th, so point to that date in the diary and enter the venue. Add a link to their address, and a chain-link mark appears on the page. Point and click on this, and you can jump to the address book page. Add a 'to do' entry to remind you to book the restaurant table three days before, and link that to Boris and Felicity and to the restaurant entries in the address book.

To break links use the axe tool. Another nice touch is the wastebin, into which you drop unwanted text — spent



appointments, out-of-date telephone numbers and so on — by picking them up with the magnet tool. As the item hits the bin, a small flame flares up to show the rubbish being destroyed.

Though the diaries and address books are hardly novel notions, they have been well implemented here. The diary opens at a full year calendar, from which jumping to a specific date is just a matter of pointing at it. Alternatively, from any place in the system, clicking on the 'roller' calendar just below the toolset icons also calls the diary.

A 'confidential' flag can be set to prevent others looking over your shoulder to spot the date with the headhunter or trip to the Dungeons and Dragons Convention. The diary manages alarms, can associate costs with time, schedule groups of diaries over a network, and even run other programs at preset times.

The address book presents itself as a blank data entry form into which any information can be used as the basis of a search for an entry. The address entry

screen is the same, though the display of data once entered is not cluttered with empty fields and boxes. It handles phones well, logging calls made if you use it for automatic dialling.

The Notepad is not to be confused with a simple text editor like the Windows accessory. You can put whatever you like into it, such as text, images (Organiser comes with an example file which includes data on classic cars, plus pictures) or even DDE links. The pages stored in Organiser can be fold-out just like the year planners found in paper-based systems.

The to-do list allows different priority levels to be assigned to tasks, with start and stop dates alongside each. Once a task is overdue it turns red on screen to remind you that it may be about to embarrass you. Once the job is done, you can either remove the item from the list or have it left *in situ* complete with deletion line. For those of you who need to track ticked-off lists of accomplishments each day, this will be reassuring.

Organiser requires Windows 3.0 running in standard or enhanced mode, and consumes just under 2Mb of hard disk space, including the CBT directory. It needs more than this for the installation routine, as it comes archived and requires some unpacking space.

This is an impressively paradoxical combination of power and ease of use — how Windows products should be. It deserves to do well.

Threadz' Organiser is available from Neow on (0628) 668334.

TravelMate 3000 WinSX

We wanted to like it, we really did, the first portable PC to be designed around Windows 3.0. But Guy Swarbrick found its TravelPoint clip-on trackball a real drag ...

The Texas Instruments TravelMate 3000 WinSX has quite a pedigree. At the top of the family tree is the TravelMate 2000, better known on this side of the Atlantic as the Sharp PC-6220 (or the CompuAdd Companion). The first real notebook computer, the TravelMate, albeit wearing a Sharp badge, was voted Best Portable Computer just a year ago in the first PCW Awards.

The next generation, the TravelMate 3000, was the first 386SX notebook and, as the Group Test in our September issue proved, is still one of the best. In fact, the biggest problem with the TravelMate 3000 (and, for that matter, most of the other top-flight notebooks) is that they're too good. The screens are of sufficient quality and the processors of sufficient speed to run Windows 3.0 sufficiently well that applications we use on our desktops can be used on the move as well.

Or rather, not as well. Most Windows applications can be used without a pointing device, but few are anything like as easy to use from the keyboard and with many some, or in some cases all the features are unavailable.

There have been third-party solutions. Both Logitech (the Portable TrackMan and Microsoft (the oddly named BallPoint Mouse) have trackballs which clip on to the side of the keyboard and provide varying amounts of control. Good though both are, they have problems, not least of which is that they won't physically fit many portables and when they do, they often cause one or two keys to jam on.

The news of the TravelMate 3000 WinSX, then, was greeted with some enthusiasm in the PCW office. We readied the page space to accept 2500 words, and appropriate pictures, to describe the arrival of the first portable PC to be designed around Windows 3.0.

So why is the review here, across a single page in the Short Reviews section? Because we didn't really want to waste the space. Not that there's anything wrong with the WinSX... well, nothing serious. It just isn't very exciting. It isn't very new.

It's a pretty good package for Windows users. The base specification is for a 4Mb RAM, 60Mb hard disk ma-



chine with TI's excellent TravelMate case, keyboard and screen surrounding them. A 20MHz 386SX provides the processing power and everything you would expect to find is there, at first glance. The right number of ports, the right number of screen controls and LEDs, a floppy drive. And no pointing device.

Or at least, no built-in pointing device. Instead, there is a clip-on trackball. Sound familiar? It isn't really. I can guarantee you've never seen anything like this. I can't guarantee you'd want to. I should point out here that I'm not anti-trackball. Far from it. I use PC and Macintosh flavoured TrackMan's at home and in the office and a BallPoint Mouse on the move. I just don't like the TravelPoint.

Slightly larger than the ball in a desktop TrackMan, the TravelPoint has a tiny, slippery, hard-to-move ball in the centre, two round buttons above and a square button and LED below. The ball has to be pressed so hard to actually move the cursor that your thumb hurts.

The top two buttons behave like the buttons on a Microsoft mouse and the bottom one is a sort of toggle button which stays on between clicks, making dragging easier. That horrible ball makes sure dragging is never easy. Presumably this lockable button is one of the patented features (nothing else looks like it could be) but it's been done before.

The TravelPoint fits into a bracket which can be set at various angles, just

like the BallPoint Mouse, and clips to the side of the case like its competitors' products. The clip is thin. It has to be: the TravelMate is one of the notebooks whose keys were jammed by other portable trackballs. But it's strong enough, and fixes semi-permanently to the case with a thumbscrew into the socket originally intended for the numeric keypad. Still, you didn't want both, did you?

The machine boots straight into Windows 3.0. Or at least, it did once I'd edited the Config.sys and Autoexec.bat files to make it work. Once there you find the final thing that makes the TravelMate deserve the WinSX appellation. There are ten icons which seem to be Windows utilities. Most aren't: they are simply icons which launch the DOS utilities that have always come with the TravelMate. One or two, though, set up functions specific to the WinSX. Chief of these is a cursor utility which replaces the standard Windows cursors, whether they are arrows, hour glasses or I-bars, with cursors of your own design. Or better still, the big Duplo cursors TI has designed for you. The big arrow's OK, but the Texas-shaped TI logo is much more fun.

On other laptops, this utility would be a huge plus point. The fact that the TI's screen is so good lessens the impact, but it's still a good idea and well worth having, even if you decide you'd like something between the original cursors and TI's replacements.

Beware, though, of one of the utilities provided with Windows, the mouse section of the control panel. It will allow you to swap the left and right-hand buttons, but the button lock operates on the physical left button, not the logical one.

Mixed bag

All in all, the TravelMate 3000 WinSX is something of a mixed bag. The TravelPoint, which looks like an accessory for one of HP's late 70's programmable calculators, is a great idea badly done, but there can be little doubt that the machine itself is a great Windows platform and some of the supplied utilities really are worth having. Pity the BallPoint Mouse doesn't fit properly...

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The Complete Writer's Toolkit

The Complete Writer's Toolkit is grammar-checking software that could have done with some checking itself. Helen Johnstone found it poor help for the serious writer.

Grammar-checking software is notoriously bad. Most packages would barely pass a CSE in English, and many consistently make serious grammatical mistakes. One of them I know always fails on the difference between 'it's' and 'its', while another is over-zealous on advising how to hyphenate but ignores wrongly conjugated verbs.

Part of the problem is that a grammar checker is usually tacked onto a word processor as a utility; an afterthought to the formatting and editing of the program, rather than an operation in its own right. The Complete Writer's Toolkit appears to take the subject more seriously, as it concentrates on the writing, not the appearance of the document. It combines a grammar and spell-check program with a dictionary, a thesaurus, an abbreviation expander, a dictionary of quotations and a reference section on the principles of grammar and style. In total the program takes around 600K of RAM, but as each module can be selected separately, the user is free to choose which are worth the disk space.

The CorrecText Grammar and Spelling Correction System is a self-contained program and runs from DOS, but the other five modules, or Reference Tools, can be added to a group of 15 word processor packages that covers WordStar, Multimate, Word and Samna. Unfortunately, Windows Write is currently the only Windows program, but the Reference Tools can also be easily accessed from DOS.

Pretentious Words

The Grammar Correction System checks the file against a selection of grammar rules and points of style, ranging from Subject-Verb Agreement to Pretentious Words, which are chosen by the user from a total list of more than 35. When it finds a problem, it stops and highlights the complete sentence in one colour, marking out the incorrect word or phrase in another colour. There is then a choice between ignoring the problem and letting the Grammar Check



move on to the next problem, or viewing the program's advice and making any corrections.

It would have been a priceless piece of software if it could have cut all the grammatical mistakes and badly expressed ideas from a piece of writing and changed them to perfect prose, but it couldn't. On matters of style, it offered very little advice. In fact, try as I might, I couldn't find a Cliché or Jargon Expression that it would reject.

An option to count the 'statistics' also analysed the style, calculating the Flesch Reading Score, the Flesch-Kincaid Score and Gunning's Fog Index for the document. These indices, developed in America as a way of indicating the reading level required for the text and the clarity, are based on the length of sentences used and the average number of syllables per word. So, anything written in four-letter words, no matter how much ambiguity or contradiction it contained, scored well.

The CorrecText Grammar Correction System (which clears the Jargon Expression examination) does know the rules of grammar better than most Grammar Check packages, but not surprisingly it is no help on style. In a similar way, the Reference Tools are of limited value. The thesaurus, Roget's II Electronic Thesaurus, was neither better nor worse than the average word processor thesaurus.

The Abbreviation Expander, which seemed to be pitched at the level of a ten-year-old, was next to useless. It didn't contain BBC, or even the American ABC or CNN. There were no entries for ASCII, VGA, RAM or CD-ROM, only abbreviations such as a.m. and etc.

The dictionary was perhaps the most useful of the Reference Tools. Despite the off-putting name, the American Heritage Electronic Dictionary contained a comprehensive selection of words and full, informative definitions. Pitted against the Concise Oxford Reference dictionary, there were only two or three definitions out of twenty that it missed. Its only fault was

in pronunciation, where it obviously tailored to the American accent. Consequently, 'monument' is given the pronunciation 'mahn-yuh-muhnt'.

The Concise Columbia Dictionary of Quotations was the Reference Tool that attracted the most attention, but was also the biggest disappointment. It adds a little frivolity to the package, but despite containing 6000 quotations, it is frustratingly difficult to find a subject or author that is covered and although it is a matter of taste, I found the entries dull, pompous and even a little out of date. There was nothing from Gorbachev, although Ronald Reagan had five or six (including 'Nothing does as much for the insides of a man as the outsides of a horse') and the four or five Groucho Marx quotes were the best we could find for humour.

The final reference Tool, The Written Word III, is an information section covering grammar and style rather sketchily but with some useful details on public records, libraries and books for further reading for anyone based in the USA. Like all of the Complete Writer's Toolkit bar the Dictionary of Quotations, The Written Word was developed by Houghton-Mifflin, a partnership I suspect is better at software design than grammar instruction.

The package is well presented and easy to use, but poor help for the serious writer. Part of the problem is that it was designed for America and hasn't travelled well across the Atlantic. A UK English version would be interesting.

The Complete Writer's Toolkit costs £115 + VAT from the Software Compatibility Centre on 081-319 1478.

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Zinc Interface Library

The Zinc Interface Library is a powerful DOS and Windows development environment with a steep learning curve. The intrepid David Gristwood got to grips with it.

The current popularity of object-oriented design and programming has led to an increasing number of object-oriented tools specifically designed to hide the complexities of Windows programming. One such product is the latest version of the Zinc Interface Library, a C++ class library that works with the Borland and Zortech C++ compilers to create both DOS and Windows applications.

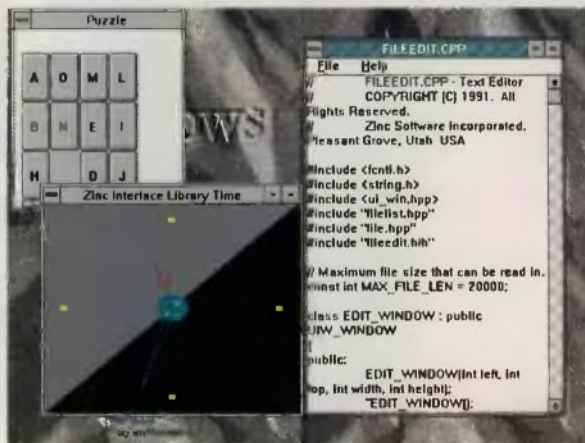
The Zinc Interface Library is a C++ class library that creates a user interface around an object-oriented programming model. Objects in the Zinc library cover everything from windows, buttons, menus and icons to input devices and events. In C++ parlance it is a non-cosmic class library; the classes are not derived from a single master object, but are instead derived from a number of different base classes.

In the Zinc library, apart from a few miscellaneous time and date classes, most of the objects are derived from a set of linked list base objects, allowing logically related objects to be grouped together. As the base classes overload the '+' operator, whole lists of objects can be linked together using just the '+' sign, a simple but effective feature that makes for more legible source code.

The Zinc library is built around an event-driven message-passing environment not too dissimilar from the Windows paradigm. A window manager controls the screen, and the display of all the windows and window objects, while an event manager acts as a message centre for all internal and input-driven communications. Built around this are a number of support services, including a help and error system, and an object storage and retrieval manager. Within the Zinc environment, the main program acts as a backplane, controlling the flow between the different parts of the system.

Controlled access

By wrapping the complexities of the underlying system within C++ classes, handling potentially complex operations is considerably simplified. Creating windows and window objects can be achieved with just a line or two of



code. The public interface to these objects ensures that access to the objects is strictly controlled. Moreover, existing objects can be used as a basis for deriving new objects that can be customised as required. The Zinc library allows these new objects, whether they be new input devices or window objects, to be easily integrated into the system.

Window objects can also be created using Zinc's persistent object editor. This is a windows-based application that lets users create and edit objects such as scroll bars, menus and buttons in an interactive environment. These objects can subsequently be loaded by an application with just a simple library call. Such an approach is much more in line with the latest Windows programming tools, and is a more natural way to handle such objects.

The Zinc library supports not only Microsoft Windows, but native DOS in both text and graphics mode. What makes this particularly unusual is that it can be achieved with just a single source code file. A few '#define's are all that's needed to create a program that will compile to either a DOS or Windows application.

The text version uses the PC's box and line drawing characters, and though the result looks somewhat dated, it is functional and it will run on just about any PC. The graphics version is much slicker, and looks and feels very much like Windows itself. Zinc has achieved this by developing its own windowing system for DOS which mimics much of the functionality of Windows. The penalty is the compile-time overhead: the Windows version of a simple 'Hello

World' program is 70K, while the graphics DOS version is over 160K.

Despite the many benefits offered by Zinc's object-oriented approach, getting to grips with it requires a lot of work on the part of the programmer, and while using C++ classes is easier than developing them, the process requires a fairly good understanding of both the Zinc library and C++.

Fortunately, the package is accompanied by three excellent manuals: a System Overview, a Tutorial Guide, and a hefty 600-page Reference Manual.

There were a few minor problems with the Zortech version of the Zinc library reviewed here. The persistent object editor would not load and save objects, a problem which Zinc should have fixed by the time you read this. A few of the sample programs had minor bugs, in particular the Windows versions didn't always redraw themselves correctly. These minor problems aside, the package was quite stable.

Zinc intends setting up a UK office early next year. In the meantime, Zortech will be selling and supporting the Zinc library until the end of the year. Borland users will have to rely on their dealer or Zinc in the USA.

Heavy commitment

The Zinc library is very much a programmer's tool, and one aimed at experienced programmers at that. Despite the inclusion of an object editor, this is not a visually-oriented programming tool in the same vein as, say, Microsoft's Visual Basic. It has a steep learning curve and requires a heavy commitment to Zinc's design philosophy.

But there is no doubt that the Zinc library is a powerful development environment that will appeal to programmers who want to be shielded from the complexities of Windows programming. The object-oriented approach certainly makes for cleaner code, and the ability to re-use objects should speed up program development.

The Zinc Interface Library 2.0 costs £150. Zortech is on 081-316 7777. Zinc is in the US on 0101-801 785 8900.

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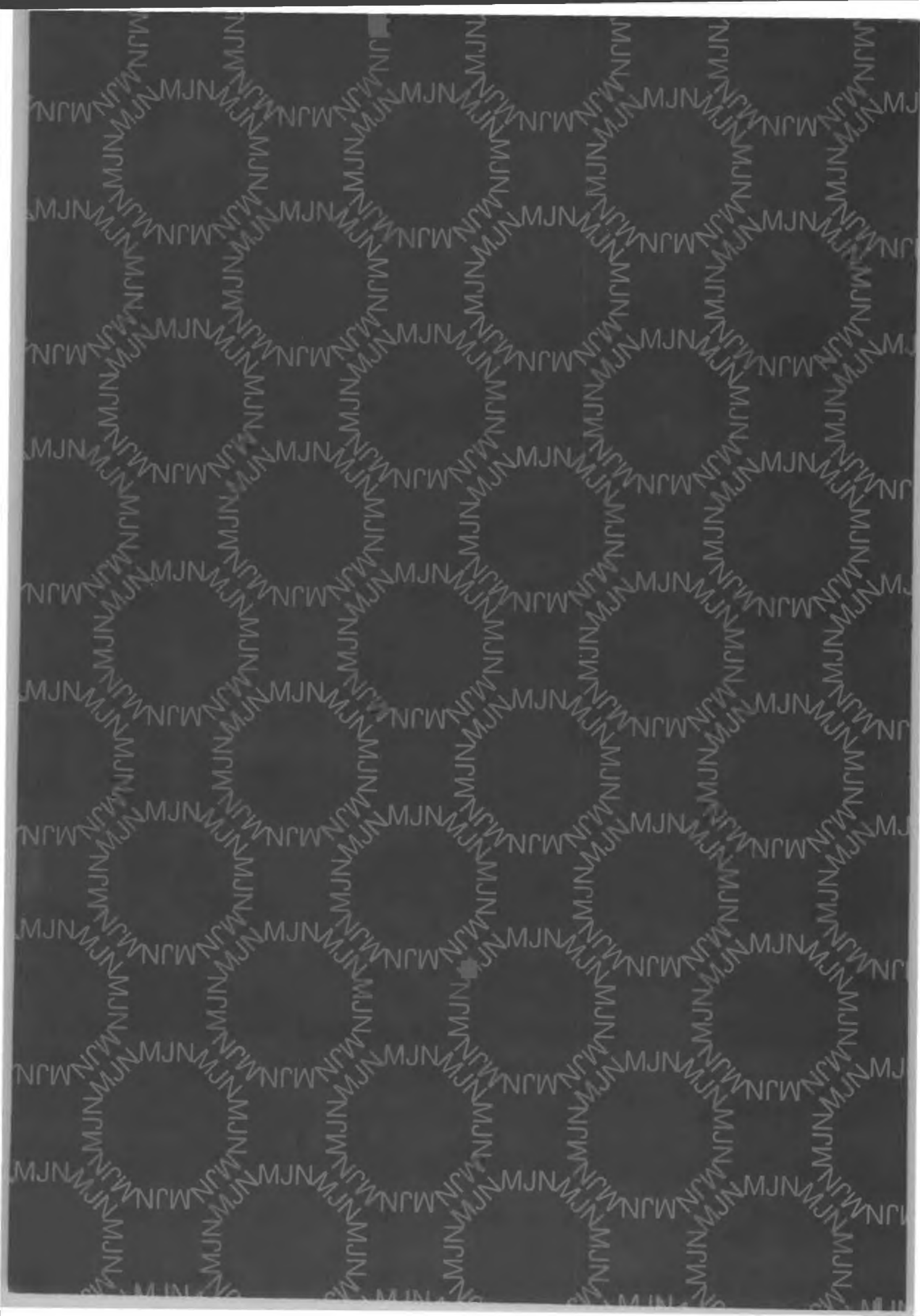
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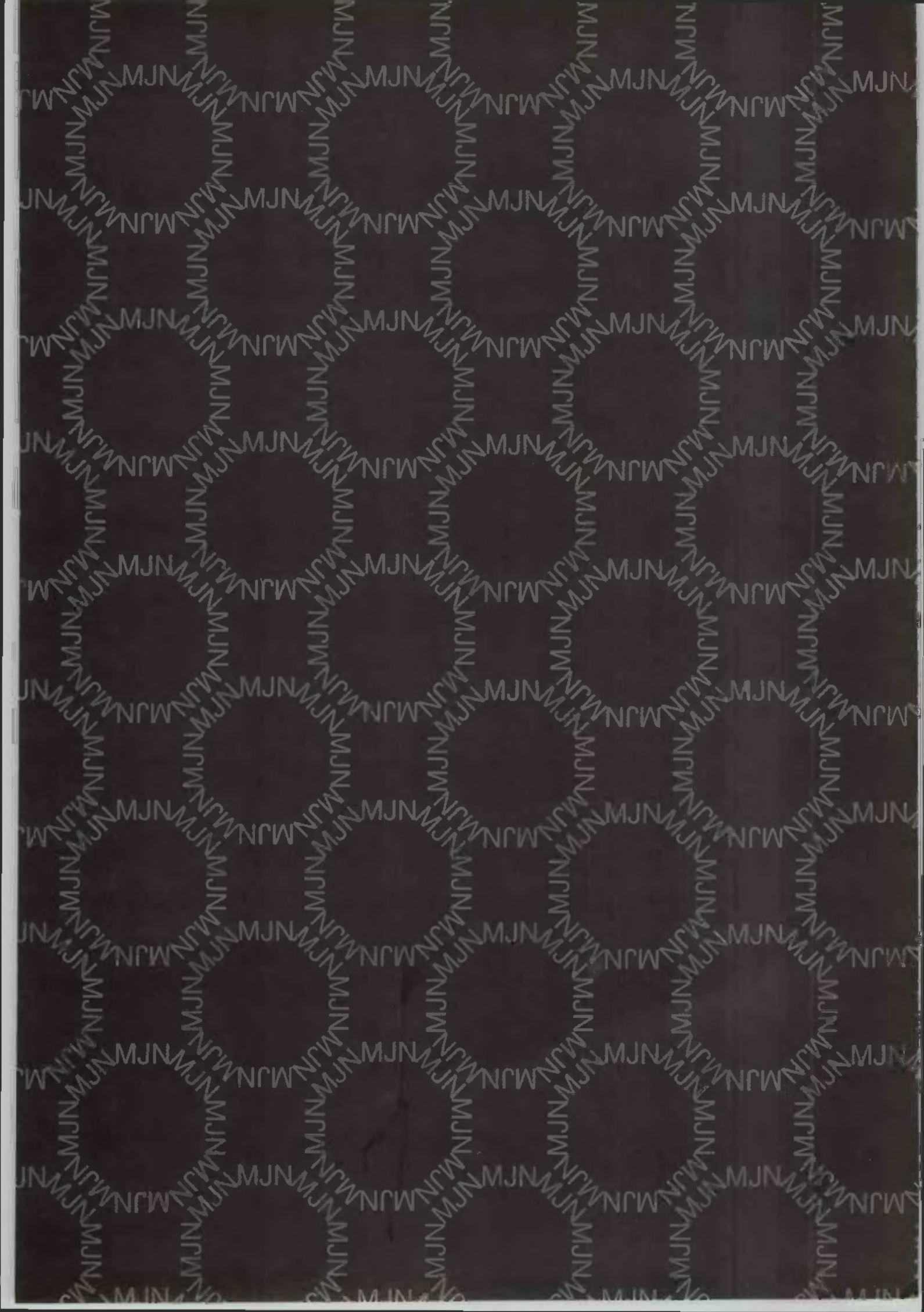
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Hit for SX!

The once-proud 286 is history. A 386SX, preferably clocking 20MHz or more, is the least you need for serious computing — and 386SX/20 machines are among today's best and most various bargains. Nick Edmunds got our test team to put 45 through their paces.

There are more makes of 20MHz 386SX PC on the market than any other type of machine. We review most of them over the following pages in one of the biggest Group Tests in computer publishing history. If you want to buy a 386SX/20 machine, this is the place to look.

This is also the time to buy. It's the 386SX/20 heyday. SX machines clocking 16MHz are on their way out, and 25MHz versions (based on the AMD chip) are coming in. But in the run-up to the Christmas computer-buying splurge, with prices still dropping, we at PCW regard a 386SX/20 IBM compatible as a great buy.

Only a few years ago, the 386SX chip (cut down from the faster and dearer DX) was regarded seriously only by business users. After all, who really needed all that power? Today the scene has been changed dramatically by plunging hardware costs and power-hungry software, in particular the epoch-making Windows 3.0 from Microsoft.

Windows 3.0

We believe that if you are remotely serious about personal computing, for either private or business use, then for the next few years at least, Windows

3.0 is the way to go (if you don't go for Macs, that is). It is more than just an excellent windowing interface to the DOS operating system. It is a standard by which different software packages can communicate with each other, and also present the user with similar ways of working. You can keep your word processor and spreadsheet and database programs open on-screen at the same time, and mouse-click between them without having to re-boot your brain for each application and its different commands.

This all sounds marvellous. The snag is that Windows 3.0, and the increas-

The evolution of the 386SX processor



All the IBM PC clones that have ever been made have one feature in common: an Intel 8088 compatible processor, capable of running MSDOS. For its time, the 8088 was not a particularly wonderful processor. But IBM chose it, and it became a standard within a couple of years.

It possessed 16-bit registers internally but from the outside appeared to be an 8-bit CPU with a built-in memory pager — a way to extend the 64K memory limit imposed by 16-bit addresses, by swapping blocks of RAM in and out of the processor's view. Paging was a bodge but it did allow 20-bit addresses, or 1Mb of address space, to be used.

Intel realised that the 8088, and its 16-bit cousin the 8086, would not stand the test of time even with IBM backing, so a few years later it brought forth the 80286. This operated in two modes: 8088 compatible (called 'real'), and a new mode called 'protected'. When in real mode the 286 ran MSDOS just like an 8088 but faster. Protected mode allowed 24-bit addressing, giving 16Mb of RAM, and had a more powerful instruction set.

The idea was to wean people off MSDOS and onto OS/2 by providing a processor which could run both. But the world stuck with DOS. People who wanted something more powerful than DOS could run Unix on a 68000, which was a better processor range anyway.

Then came the 80386. Like the 286, this could pretend to be an 8088, allowing MSDOS software to run. But in protected mode, it had 32-bit registers and 32-bit addressing, together with some much nicer instructions. Still the world wanted

MSDOS, but slowly software crept into use which took advantage of the fact that it was running on a 386. This included the likes of Windows 3.0, Novell networks, SCO Unix, DesqView-386, and Paradox-386. Eventually users decided that this enhanced software was worth running, leading to a demand for 386-based PCs.

Unfortunately the 386 processor uses 32-bit data and address buses. There are 32 tracks running from the processor to its RAM, which is faster but costs money to arrange. The 386SX was produced to allow 386 machines to be made more cheaply. The SX appears to the software to be a standard 386 (now referred to as the 386DX), but has only a 16-bit external bus. The narrower bus is slower as well as cheaper, but as long as it runs the software this may not matter to most people.

Now Intel has produced the i486, a faster version of the 386 with yet more additional instructions and a built-in maths co-processor. But the software industry has standardised on the 386 for now.

Windows 3.0 will run on an 8088 processor, but many Windows programs require at least a 286 and to get a reasonable performance you need 386 enhanced mode.

Anyone buying a PC to run new software should carefully consider a 386-compatible processor for some time to come. The number of 386-only packages is growing daily. If cost is a problem, a 386SX is a good compromise. It will run all the 386 software, although rather slower than its big brother.

ingly sophisticated applications designed to work under it, have proved to be hungry for CPU power and disk space. Window does run on a 286, but take our advice: don't bother, it's too painful.

Herein lies the heart of this Group Test: the 386SX/20s under test are designed to run Windows 3.0. We asked each manufacturer to supply what we regard as a well-balanced Windows machine, with 4Mb RAM and an 80Mb hard disk. This specification is a minimum: the 2Mb RAM most machines come with as standard is not enough to run Windows properly, keeping a number of applications in memory.

Hard disk

Likewise the hard disk. My first 10Mb one in 1985 lasted me five years and was still only half full when I upgraded. My latest six-month-old 40Mb hard disk is already full... catch the drift?

80Mb is a minimum: at least 100Mb is recommended. With the latest version of Word for Windows using 9Mb, you must think of the future when purchasing today. You want this machine to last three years (with upgrades), so buy big now and look for expandability for the future.

Each of the test machines comes from a different manufacturer — different not only in name. There's giant IBM at one end of the scale and tiny one-man-and-a-dog outfits at the other. This variety raises another concern for the buyer: how much to pay for the name?

This is a personal decision. A good reputation is worth paying for, but how much depends on how confident a user feels about DIY troubleshooting. The location of a supplier is important: if you have problems, or need advice, proximity helps. Many of the smaller suppliers build systems to order by buying in (often identical) casings to fit out to their own designs. You get standard components — a plus — but as can be seen from our reviews, you sometimes get a rather haphazard assembly. One supplier (not reviewed here) actually told us that a hardware problem wasn't his fault — it was down to the power-supply manufacturer! But up to a point you get what you pay for. Certainly a warranty of between one and three years will provide that much-needed reassurance when dealing with a lesser-known brand.

The 386SX/20PC has become a commodity, like televisions. Even we were surprised by the variety available, so how on earth can the average buyer make an educated assessment? This is the aim of the Group Test. We got our

staff writers and consultant reviewers to give these machines a good run for their money and report back. They looked inside. They looked outside. Most importantly, they used them to run their favourite software.

But first we benchmarked all the machines in our test lab, and the results are displayed beside the review of each machine. The market is moving so fast, with prices dropping all the time, that there may be small differences of detail in the reviews and in our final features table, which goes to press last.

One thing we do know is that there are some bargain Windows machines out there. So happy reading, and Happy Christmas!

ALR Powerflex 20CSX



ALR is an example of the sort of low-priced, high-specification computer company that successfully competes with the Far Eastern onslaught. Like Tandon, it has become enamoured of the idea of the upgradable processor: the sales patter has it that this means you can follow the latest fashions in speed and silicon. The true attraction could well be that the company has to design and stock only one species of motherboard, thus reducing overhead and exposure in these considerably straitened times.

The machine reviewed is one of the PowerFlex series, and has a 386/20 MHz cached processor board. At 150x420x370mm, it's a small but not low-profile desktop machine; the only control on the front panel is a large oval power switch. Alongside are two lights for power and hard disk. Only one 3.5in floppy drive is fitted as standard although there's room behind the front panel for up to two half-height drives. The 40Mb Western Digital IDE hard drive is bolted to the side of the 150W

power supply; there's no room in the unit for more storage devices.

One serial and one parallel port adorn the back panel, along with the keyboard connector and six ISA expansion slots — five 16-bit and one 8-bit. These are all full-length, though the final 16-bit slot is probably best left for shorter cards because a long one might foul the processor board.

Proprietary slot

This sits towards the front of the computer in its own ALR-specific slot. This illustrates a snag of CPU-upgradable computers, contributing to their relative lack of success: each manufacturer makes its own CPU board, tying you to the one source. If the manufacturer goes bust or drops the range, you're stuck with what you've got. There are signs that this may change, with the industry moving towards a multi-manufacturer standard. But the risk remains for PowerFlex purchasers.

The processor board contains the 386SX, an Austek cache controller, and 32K of cache RAM. There's no way to plug in more than that, although there is a socket for a 387SX maths co-processor. The rest of the processor board is taken up with logic chips and a handful of PALs, a form of programmable chip.

The motherboard contains the interface circuitry for the hard and floppy drives, the printer and serial ports, and just about everything else. The one exception is the video board, which is a Western Digital (that is, Paradise) 16-bit SuperVGA with 512K video RAM and spare sockets for the same again. The system RAM comes in two chunks: 1Mb permanently wired into the motherboard, and up to 4Mb in SIMM sockets. For more you'll need an expansion card, which slows things down considerably.

UK driver

The BIOS is the standard Phoenix firmware, with a built-in setup program that the manual says can be accessed by pressing Ctrl-Alt-Esc at the DOS prompt. Not quite: you have to do this before the UK keyboard driver is loaded, otherwise nothing happens. Since the BIOS is on the motherboard and not with the processor board, it can't be the 386SX variant found on comparable computers. In fact, the motherboard is almost a complete 286 computer; it's even got a socket for the processor chip.

The monitor supplied was an NEC Multisync 2D. This was the bee's knees a few years ago, but it's been overtaken in most areas. Still, it can give a good picture, although the review display

ALR**Powerflex 20CSX****Processor**

20MHz 386SX

RAM

Maximum 5Mb supplied

ROM

Phoenix BIOS

Mass storage

40Mb 18ms Western Digital hard disk, 3.5in floppy

Storage

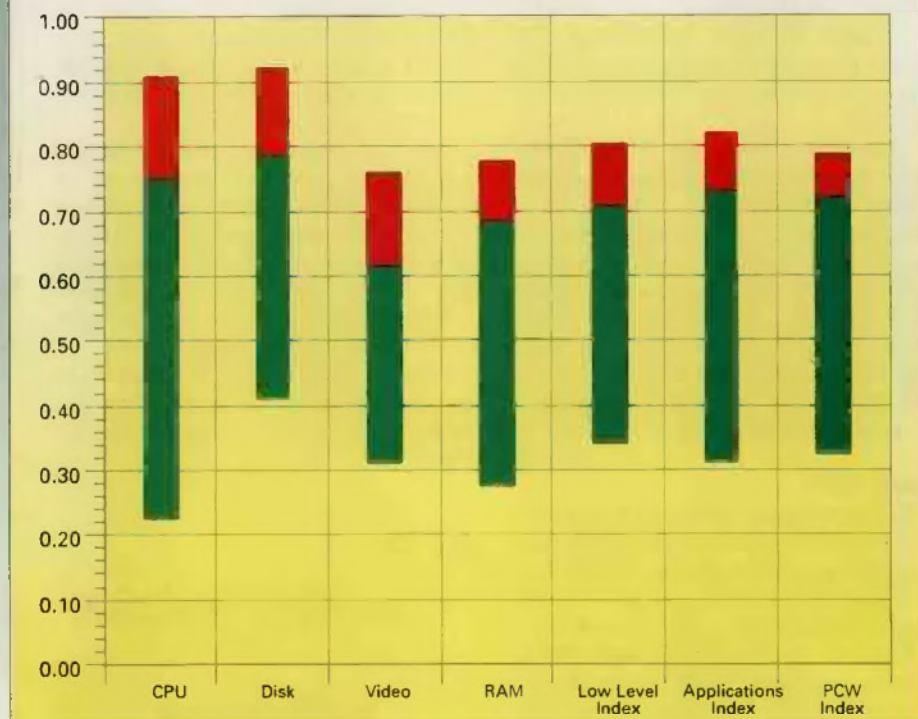
Four drive bays (two free)

Expansion

Five 16-bit and one 8-bit slots (four 16-bit, one 8-bit free)

Supplier

ALR (0635) 521922

Good Points Nippy box from a long-running contender.**Bad Points** Limited on-board RAM, documentation could be better.**Conclusion** Worth considering, but it won't shake the world.

was set up with an active area considerably smaller than the screen size. It coped well with the higher-resolution modes available from the Paradise VGA card, albeit with a clatter of relays at every mode change.

Speedy

The keyboard is Thai and nice, with a faintly clicky action and a pleasant feel. The documentation isn't so hot: two booklets, one for the motherboard and one for the processor option. The former is mostly devoted to the various nooks in the Setup program, which lets you configure the machine down to the level of choosing where your serial ports are. There isn't much to say about the processor board, and the handbook for that covers the area adequately. But neither is well organised or particularly easy to use.

The ALR was speedy enough in use. It didn't make too much noise and ran what I asked it to. Most of the technology in the machine is getting on for two years old and so should be reliable; on the other hand, the maximum motherboard RAM of 5Mb now seems a little limiting.

Rupert Goodwins

Amstrad PC 4386SX

Amstrad's entry in this Group Test is the PC 4386SX, an amazingly small

machine suited to just about any desktop. Measuring 250x70x264mm and finished in the usual two-tone cream scheme, it has to be one of the most compact and cute computers around. Despite its size the unit boasts all the usual interfaces, and most are located at the rear as with larger machines. From left to right, the back features sockets for the monitor and power, a 15-way VGA connector, a parallel port and a serial socket.

The front houses a 3.5in high-density floppy drive and a flap covering connectors for the keyboard and Amstrad's own mouse. If you decided not to connect the latter, no-one would hold it against you: Amstrad's mouse is ugly and uncomfortable and I don't think I've ever met anyone who liked it. The 102-key AT keyboard, on the other hand, has a particularly pleasant feel and doesn't look too bad.



The monitor is a 10in Trinitron, which complements the machine well and provides a good-quality display. It does look like something out of *Alien* but when you get used to it, it's rather nice. The size of the unit didn't strain my eyes, but it did make some graphical images appear to be of a higher resolution than they actually were.

Internally, this petite PC features a genuine Intel 386SX alongside a 387 maths co-processor socket. The PC chipset appears to be Amstrad's own though, as are the AT-compatible BIOS routines that make the whole thing go. Four SIMMs were supplied in the review model giving 4Mb of 80ns RAM, which you can expand to 16Mb. Unfortunately, as with a number of clones, the SIMM connectors are made of fragile plastic, making a nerve-racking job of installing extra RAM.

The machine comes with 64K of cache memory as standard, and video is supplied by a Cirrus Extended VGA chipset. This puts out a maximum resolution of 800x600 pixels with 16 colours, but you'll need a multi-frequency screen to go higher than 640x480. Of course, you can always upgrade the video by using an expansion card. The 4386SX houses two 16-bit ISA slots. Due to the size of the box, however, users are restricted to half-size cards.

Limited applications

Standard mass storage is a 3.5in 19ms 80Mb hard drive, and the way it hugs the casing around it suggests Amstrad

Amstrad PC 4386SX

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Amstrad BIOS

Mass storage

80Mb 19ms Sony hard disk, 3.5in floppy

Storage

Two drive bays (none free)

Expansion

Two free 16-bit slots

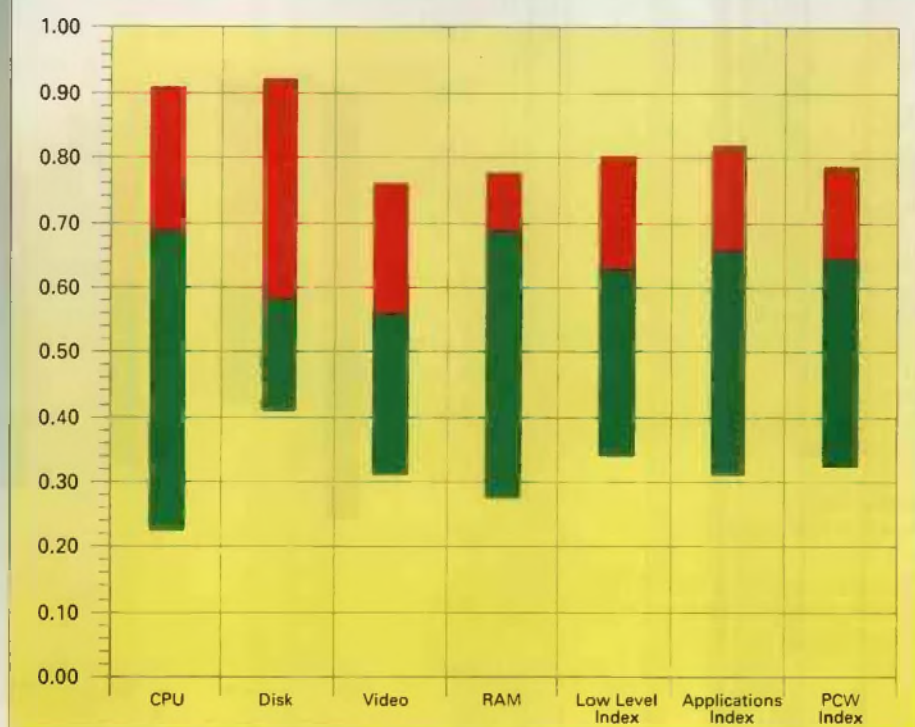
Supplier

Amstrad (0277) 262376

Good Points Tiny.

Bad Points Noisy.

Conclusion Dinky and competent.



believes it's there to stay. But it's fast, and 80Mb is perfectly adequate for most users.

The Amstrad comes complete with DOS v3.30A, Windows 3.0, a cut-down promotional copy of Microsoft Excel, and Amstrad's Program Manager. The latter allows standard Windows accessories to be accessed with amazing ease, and I have to admit to being impressed. Pity that the applications themselves are so limited.

The unit proved to be more than adequate for Windows computing, and processor-intensive operations were faster than on many of the other machines. The Amstrad ran rings around Goldstar's product in particular, and was also faster than offerings from Brother, Dan and Tulip. Only the fan and mouse provided something to moan about: the former could do with a silencer, while the latter needs extensive plastic surgery.

The 4386SX has made me rethink my view of Amstrad. I could certainly use this product for general office computing. With two half-size expansion slots it's not a machine for power users, but the size, feel and overall cuteness makes it perfect for a number of tasks.

Chris Cain

Apricot LS Lanstation

The Apricot LS is the odd-one out in this Group Test. It is the only machine

specifically designed to be connected to a network. We were hoping to get hold of Apricot's new 20MHz Zen S 386SX, due for release soon (probably before this article goes to press), but Apricot wouldn't release one from the factory. The LS is not much of a compromise though. It competes very well with the other machines in the test, and really only fails on the lack of expansion capability — and to be fair, it isn't designed to be packed with expansion cards.

It isn't as small as the Amstrad PC4386, but it isn't exactly huge: 350x323x57mm and weighing 5.2kg, little more than early laptops. The stylish front carries a large grey power switch, four LEDs (showing hard and floppy access, power and LAN connection) and a black plastic rectangle (of which more later). The 3.5in high-density drive on the right side of the case

carries a second floppy LED. The box looks like it may have been designed by a famous Italian car manufacturer.

The rear shows further differences between this LAN station and other machines in the test. There's an Ethernet card ready installed, a security loop to anchor the machine, and a cover lock. The other ports at the back are fairly standard: one parallel and two serial, plus video and keyboard connectors. Actually, the parallel port is not included as standard: the one on the test machine was mounted on an optional daughterboard. Apricot has left room for a power-out plug, something omitted on other small test machines.

Removing the cover is simple: you don't even need a screwdriver. Turning two bolts at the rear releases the lid, which then slips forward taking the front panel with it. But to get further I had to consult the manual, because there seemed no way to get past a secondary cover. It turned out that you need only move three small clips on a hinged metal plate, which takes the floppy drive up with it when lifted.

Unusual features

This reveals an entire motherboard which has a few unusual features. There is an Intel 386SX/20 chip and a socket for a 387SX co-processor — nothing strange about that. But there are no SIMM slots, free or otherwise. This is odd, as the machine arrived with the maximum 8Mb RAM, which had to be somewhere. I found it on a small bank



Apricot LS Lanstation

Processor

20MHz 386SX

RAM

Maximum 8Mb supplied

ROM

Phoenix BIOS

Mass storage

100Mb 17ms Quantum hard disk,
3.5in floppy

Storage

Two drive bays (none free)

Expansion

None

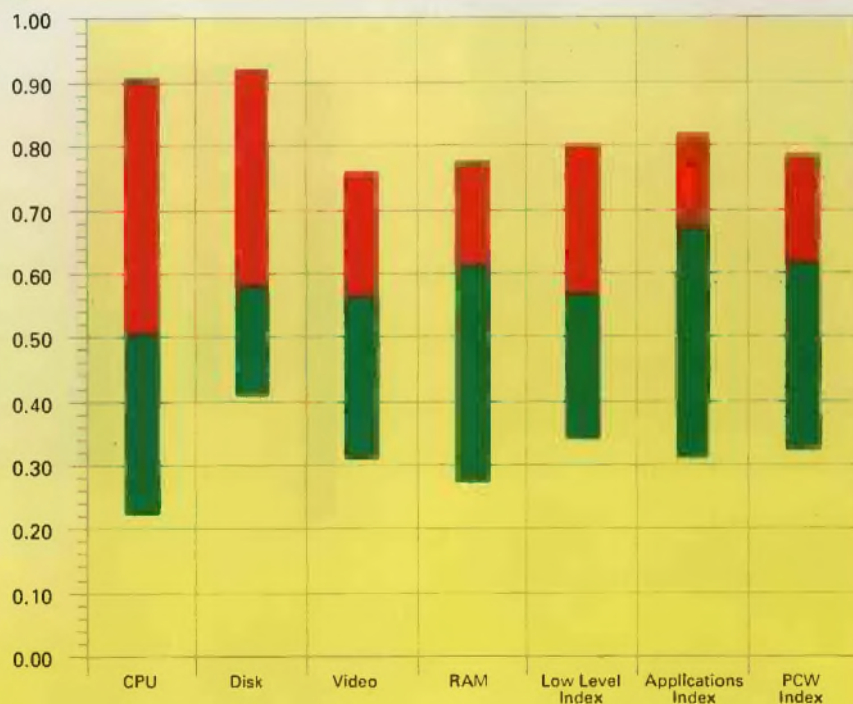
Supplier

Apricot 021-717 7171

Good Points Yes, lots of them.

Bad Points Not really.

Conclusion I want one.



of chips mounted on a daughterboard measuring approximately 2in square.

The motherboard carries 256K of video RAM and there's 256K more on another daughterboard next to the RAM. This gives the required memory to support the high resolution produced by the Chips & Technologies enhanced VGA BIOS. The ROM BIOS is an Apricot/Phoenix design, and for some reason two spare ROM chips came with the kit.

The review machine came with the full range of security features. The black rectangle on the front panel mentioned earlier is an infra-red detector which must receive a signal from a credit-card sized security key before anything will work. Once the correct key has been activated you have to enter a correct user name and password before the system will boot up. Subsequent activation of the security key makes the screen go a dark red colour and halts any operation until the key is used again. A host of other options can produce a security system akin to that at Fort Knox.

The monitor supplied is a very high quality 14in dual sync Trinitron, which supports all resolutions up to 1024x768. I don't know if Apricot sells the monitor separately; if not, it should certainly consider doing so. The keyboard is also of high quality and has a similar look to that of an Archimedes, having the top corners cut off. It is also has a good feel (no clicks).

As a LAN station, the Apricot LS

would be highly satisfactory. As a standalone desktop machine it fails only on its lack of expansion capabilities. I look forward to the release of the Zen S. If it's as good a machine as this one, it'll be hard to beat.

Mat Beard

Aria 386SX_i



I'd never heard of Aria Computers before trying this machine, and feel now that I would like to know more details about the company's full range. The 386SX_i initially created a very good impression: it was aesthetically pleasing and seemed excellent value. This initial impression was quickly shattered, but nonetheless I feel Aria constructs its machines with careful

attention to detail.

The casing is fairly good quality, and owing to the lack of height gives an impression of being smaller than it really is. In fact, the footprint is rather large. The front panel looks uncluttered, sporting a 3.5in floppy drive, a large power switch, and a small black panel which houses an LED clock speed display, a hard reset, an (inoperative) Turbo button, and LED indicator lights for Power, Turbo mode, and hard-disk activity. Normally I object to unnecessary paraphernalia, but on the Aria it is unobtrusively implemented and the overall look is smart.

The monitor supplied gives a stable, clear display although I was a mite concerned at a loud buzzing noise. Driving the monitor is an Oak SuperVGA card. Aria supplied the drivers for this on 5.25in diskettes, although the machine has just a single 3.5in drive. The Oak card was surprisingly quick, considering that it uses the Trident chipset which is widely regarded as one of the slowest.

The 102-key Taiwanese keyboard is quite acceptable, with a nice firm click, though considerable force is needed to operate the space-bar.

Nice touch

A co-processor is fitted as standard — a nice touch (though its effect was removed from the benchmarks to make comparisons fair). The machine runs fairly quickly except on disk-intensive tasks, when the speed drops off sharply.

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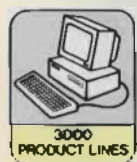
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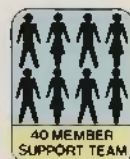
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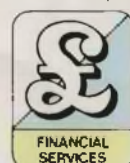
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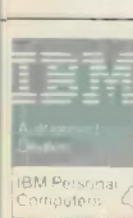
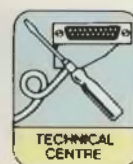
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Aria 386SX

Processor

20MHz 386SX

RAM

4Mb expandable to 5Mb

ROM

Award BIOS

Mass storage

120Mb 17ms Conner hard disk,

3.5in floppy

Storage

Four drive bays (two free)

Expansion

Five 16-bit slots (three free)

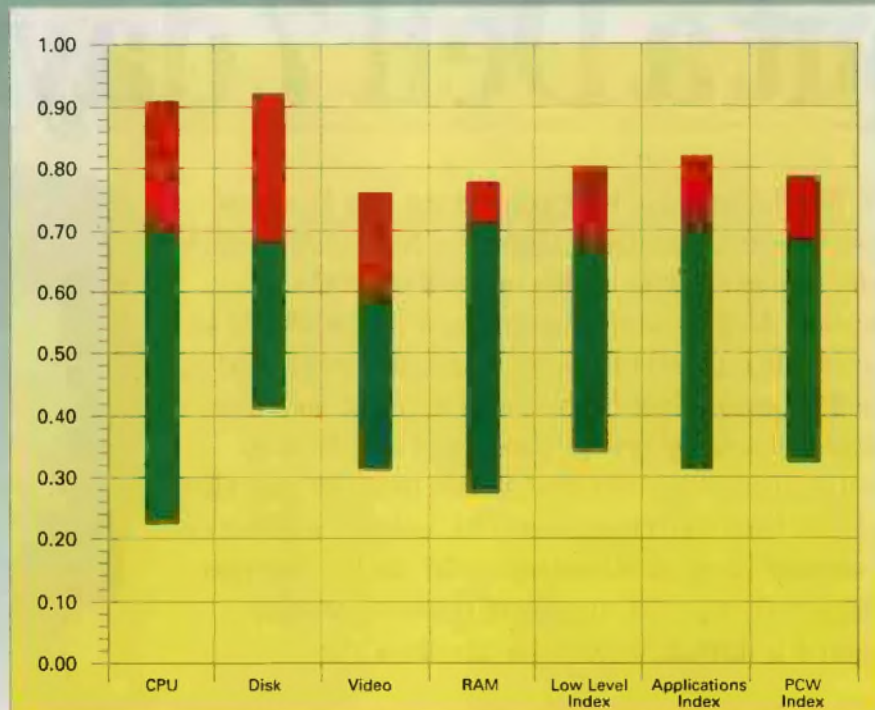
Supplier

Aria 081-993 1475

Good Points Appearance, performance, price.

Bad Points Expandability.

Conclusion A good buy if you get a good one.



I suspect this must be the IDE disk controller's fault rather than the drive itself: with cacheing software, the throughput improved. The machine was delivered with a 119Mb Conner drive.

Ports available (unlabelled) are one parallel, two serial (one 9-pin, one 25 pin), games port, VGA connector, and a 5-pin DIN keyboard socket.

So far, so good, I thought. But when I opened the box, I wanted to close it again immediately and pretend I had been hallucinating. The jumble of cables looked like platefuls of multi-coloured spaghetti. Worst of all was the way the expansion slots had been implemented. To fit the system into its case, Aria has plugged a backplane adaptor into the central motherboard slot, rendering eight slots on the motherboard useless. The adaptor provides just three 16-bit and two 8-bit slots. Two of the full-length slots are already occupied, by the VGA card and the disk controller card, leaving only one long slot and two short ones free.

My main worry concerned safety. Insulation on the live and neutral leads to the front power switch had been largely scorched away during soldering. The casing was earthed and therefore safe, but the wiring did not inspire confidence.

The standard of components was very good, and they were well assembled in a sturdy chassis. The motherboard in particular looked like a quality item. Memory was provided by

four 1Mb Panasonic SIMMs, with four empty sockets for upgrading. There's room in front of the 200W dual voltage power unit for two extra half-height disk drives if required.

I liked this machine, despite misgivings about its expandability. If Aria paid a shade less attention to the external appearance and more to slots and wiring, this would be a good bet.

Jon Silver

AST Premium II



From the outside the AST Premium II looks like any other small-footprint PC clone. It's not particularly ugly, but neither is it likely to win any design awards — at least not on its external

appearance.

The front panel sports the usual power and reset switches, as well as a case lock. The review machine had a single 3.5in floppy drive, leaving room for two more half-height devices. The hard disk is mounted vertically inside the machine, with space for a second 3.5in drive. The monitor supplied with the review machine was excellent, with a sharp display and good convergence. The keyboard was much less satisfactory, with a nasty, spongy feel — if this machine were going to be mine I would specify a better keyboard.

The AST internals are rather more interesting. At first sight, everything seems normal. One of the six ISA bus slots is occupied by a full-length card. But this is not the VGA card or disk controller you might expect: it's the entire 'guts' of the PC — processor, memory and the necessary 'glue' logic — using the Intel chipset, and a hardware memory cache to buffer the CPU from the ISA bus. The card has SIMM sockets for a total of 16Mb of memory, as well as a socket for a 387SX maths coprocessor.

The idea is that the user can start with an inexpensive moderate-power machine and upgrade to a more powerful processor when necessary. Processor cards available include: a 16MHz 386SX (the cheapest), a 20MHz 386SX, a 386DX/33, a 486SX/20 and the top-of-the-range 486DX/33.

Other PC manufacturers have offered replaceable processors, but usually with

AST Premium II

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AST BIOS

Mass storage

40Mb 18ms Conner hard disk, 3.5in floppy

Storage

Four drive bays (two free)

Expansion

Three 32-bit (two free), two 16-bit, one 8-bit slots

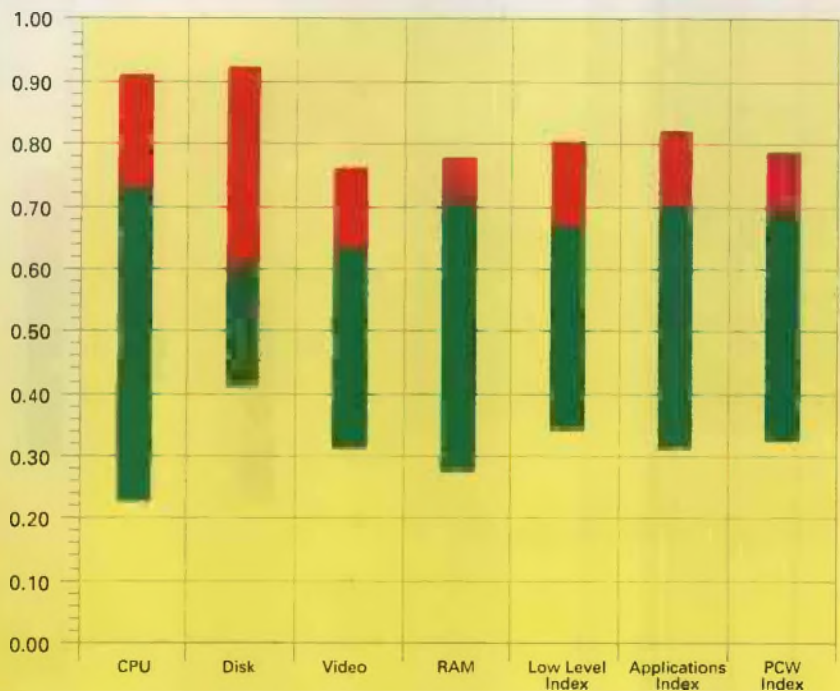
Supplier

AST 081-568 4350

Good Points Replaceable processor board.

Bad Points Limited graphics support, poor keyboard.

Conclusion Quality PC of interesting design.



less success than AST. One reason is that their designs created a bottleneck by putting the processor on the add-in card, with the memory on the motherboard or the ISA bus. AST has given the problem rather more thought, and has included three special 32-bit slots, known as CUPID slots. These are extended versions of the ISA bus, but to AST's own proprietary design. The processor card goes in one of these, leaving two spare into which can be fitted other AST-designed cards—most notably its memory cards.

When the AST memory expansion cards are used, it's as if the memory were on the same board as the processor—the processor has full-speed access to the memory on the expansion card, and isn't subject to the normal speed restrictions of a memory card plugged into the PC expansion bus.

Almost mundane

Once past the clever CUPID slots, the rest of the machine is almost mundane: the motherboard has an on-board controller for the Conner 40Mb IDE drive, as well as a super VGA graphics chipset capable of all modes up to 800x600 with 16 colours. Also included on the remarkably neat motherboard are two serial ports, a parallel printer port and—a nice touch—a separate PS/2-compatible mouse port.

The AST motherboard is very well made, but I wasn't happy with the on-board VGA. This uses the Western Digital chipset and is a perfectly respectable

offering as far as it goes, but it doesn't go nearly far enough for my liking. As PC graphics applications get more and more sophisticated, many users are going to want a VGA which can support 256 colours as a minimum. Sadly the on-board VGA has no options for expansion. The only upgrade option I could discover was to disable it and add a completely new VGA adaptor. For a machine oriented so well towards upgrading, this is a serious oversight.

The idea of a PC with a replaceable processor on a card seems an excellent idea. Unfortunately AST doesn't seem to have carried the idea through to the other components of the system. Perhaps more worrying still is the high cost of the replacement processor cards: the 486/33 card with 4Mb, for example, is more expensive than some complete 486/33 systems with the same amount of RAM, as well as a hard disk and SuperVGA monitor. But if you're looking for an exceptionally well made PC, with the possibility of manufacturer-supported processor upgrades in the future, then you couldn't do better than this AST.

David Morton

Atomstyle 386SX/20

Atomstyle has been around for nearly ten years, but for various reasons this is the first time one of its PCs has been

reviewed by PCW.

First impressions were very good. The nameless North London PC (only corporate badges appear on the outside of the case) isn't just small, it's tiny. Under a hinged flap at the front there are switches for power and turbo, each with a status LED, plus a reset switch and a third LED indicating hard-disk activity. A tinted plastic panel in the hinged flap allows you to see the LEDs, more or less. It isn't very well positioned.

Next to the buttons is the single 3.5in floppy drive and next to that a blanking plate designed to look like the aforementioned floppy. Round the back you'll find what appear to be two keyboard connectors, a mouse port, a parallel port, and one of each flavour of serial port, plus the video-out connector. Technically there are three slots, but as you can clearly see from the



Atomstyle 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

Mass storage

100Mb 18ms Fujitsu hard disk, 3.5in floppy

Storage

Three drive bays (one free)

Expansion

Three free 16-bit slots

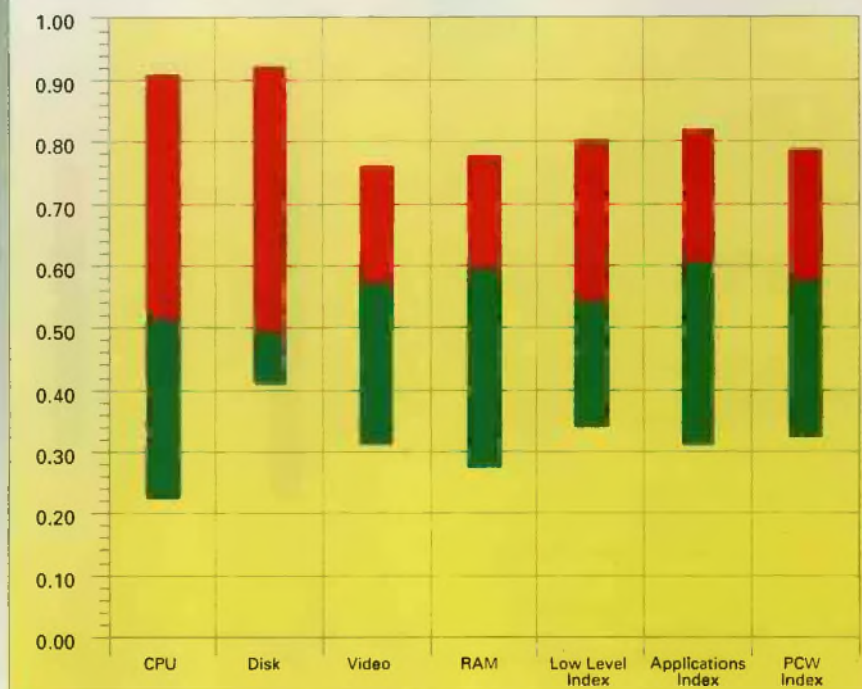
Manufacturer

(0532) 442767

Good Points Cheap...

Bad Points ...and nasty.

Conclusion Last resort budget PC.



outside, one is filled with the 25-pin serial port.

There's a surprising amount of space inside the tiny case, although ridiculous cable paths (particularly that for the 100Mb Fujitsu hard disk drive) do their best to disguise it. The front of the case is all disk drive, with the hard and floppy drives taking up both the available bays. The motherboard, which consists almost entirely of Western Digital support chips, occupies less than two thirds of the floorspace.

By far the most old-fashioned looking of the three machines I reviewed, the Atomstyle had a vast amount of TTL glue holding the circuitry together, albeit SMT (surface mount technology) TTL. Yes, it's cheap (£799), but it feels cheap; from the flimsy board the expansion slots are mounted on, to the cheap SIMM sockets (which on the review machine contained 4Mb of 70ns Samsung-equipped Century SIMMs), from the tacky power switch to the bargain-basement connectors. The Fujitsu hard disk looked decidedly out of place.

Barred slots

If the fact that only two of the three slots are free bothers you, I'd better not tell you that full length cards won't fit in the case at all, or that the cables will get in the way, or that the two spot-welded strengthening bars across the top make it impossible to get a card in one of the free slots. It might put you off.

If not, the performance probably

would. It wasn't the slowest machine on test, by a long way, but it was no more than average.

The big surprise is the on-board video. Horrendously slow, it nonetheless provides 800x600 in 256 colours and 1024x768 in 16.

The Atomstyle is almost so cheap that I could recommend it as a games machine, except that it would need a sound card and a joystick interface — in the one available slot. That it ran everything we threw at it is hardly surprising these days, but reassuring anyway. Windows 3.1 ran happily, even in its fragile late-beta state, and the new 800x600 16-colour SuperVGA drivers worked fine.

The one feature, hard disk aside, that isn't particularly cheap is the keyboard. It isn't exactly my cup of tea, but it has that intrusive clack that typewriter exiles seem to love so much. It sounds cheap, but it doesn't feel cheap. Along the top there's a flip-top lid which carries a selection of function-key templates. Pre-printed WordPerfect 5.1, Lotus 1-2-3 and dBase IV templates come as standard, with blank templates on the reverse, but of course more can be added. Not essential, by any means, but quite a nice touch.

The Atomstyle is very cheap, but given its build quality and the total lack of expansion capabilities (OK, one half-length slot), it needs to be.

If you have to install a network on a shoestring, the Atomstyle and a half-length network card would probably

do the trick (although we can't recommend putting a network in on a shoestring). If you know you are never going to need to expand the basic machine and are happy with mediocre performance, you won't find many 20MHz SXs cheaper than this one.

Guy Swarbrick

Brother BC3386SF



The Brother BC3386SF is one of the runts of this particular litter, coming in among the tail enders of the PCW benchmark tests, at some 71% of the speed of the fastest machine. Speed is important but it isn't everything, and the Brother does have more than a few redeeming features.

Brother BC3386SF

Processor

20MHz 386SX

RAM

4Mb supplied

ROM

Quadtel BIOS

Mass storage

105Mb 16ms Quantum hard disk,

3.5in floppy

Storage

Two drive bays (none free)

Expansion

Two free 16-bit slots

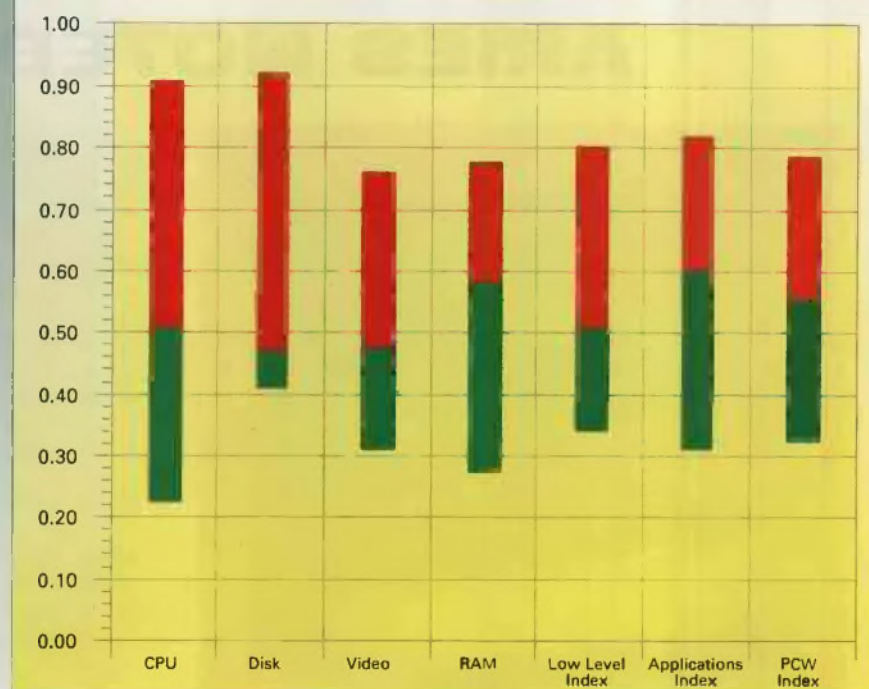
Supplier

Brother 061-330 6531

Good Points Quiet.

Bad Points Slow.

Conclusion Worth considering.



The first I noticed was the small size of the system unit — indeed, I thought it had gone astray when the system was first delivered, because there didn't seem to be a box big enough to hold even a small-footprint CPU. My second surprise came when I started it up — this machine is quiet. I don't mean the usual 'less deafening than most' description that applies to supposedly quiet desktop PCs. This, despite its fan, is no noisier than my fan-less laptop. The hard disk makes a little noise when it's being accessed, but even so this is one of the few desktop PCs I have tried which can be used in the same room as someone watching television, without the domestic strife indicator heading for the red zone.

The explanation isn't difficult to track down: the fan can be tiny, because Brother's power supply is tiny — just 60W, less than a third that of many AT clones. This is reasonable because the expansion potential of the Brother is relatively limited: just two 16-bit ISA slots, mounted horizontally over the motherboard. The manual states that the main board memory cannot be increased beyond 4Mb, and that there are four SIMM sockets, but the review machine had eight SIMM sockets. The manual said only 256K or 1Mb SIMMS could be used, suggesting a maximum memory expansion on the review model of 8Mb. However, the manual supplied was actually for the earlier 16MHz model and didn't correspond too accurately with the actual hardware.

Model manual

This newer motherboard design may well be able to take 4Mb SIMMs, permitting expansion beyond 8Mb. Otherwise the manual is a model of clarity, combining a beginner's guide to DOS, a summary of DOS commands (unfortunately for DOS 4, which is supplied as standard), and information on configuring the hardware.

Internally the Brother is exceptionally well made. The power supply sits in a long, slim box that runs down one side of the case. Next to that is the 105Mb Quantum hard disk drive — a make with an enviable reputation for reliability and longevity. Alongside, in the only other drive bay, is the 3.5in floppy drive. The motherboard, using the Intel chipset and the Quadtel BIOS, is neatly laid out. Access to the 387SX co-processor socket will require agile fingers, but not the major dismantling demanded by some machines. Included on the motherboard are two 9-pin serial ports, a parallel port, the hard-disk controller and the VGA adaptor. This is a SuperVGA adaptor using the Trident chipset and BIOS. The standard configuration has 256K of video RAM; the review machine came with 512K, and this can be expanded to 1Mb by plugging in memory chips.

The monitor supplied with the system also carried the Brother logo — I wasn't able to establish if this is a rebadged OEM monitor or Brother's own. It was sharp and well converged,

with no serious errors in its geometry. The keyboard and mouse were equally workmanlike. The two-button serial mouse looks like Microsoft's but is rather flatter. The keyboard was a little spongy, but had a reasonable amount of tactile feedback — it's certainly far from the worst keyboard on trial here.

For all the limited expansion potential (two slots) and a less than spectacular performance, the Brother is a very neat little machine. If I were looking for a home PC in this category, I'd be very interested.

Dave Morton

Chipset 386SX20



Let's be honest, Chipset are an upstart lot. Not much of a history, no reliability record to look back on, no base of in-

Premier performance

ARIES NOTEBOOKS



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- ▲ 1Mb standard RAM user up-gradable to 5Mb
- ▲ Password protection
- ▲ 20/40/60Mb 24ms IDE hard disk
- ▲ Built in 3.5" 1.44 Mb floppy drive
- ▲ External port for 5.25" floppy drive
- ▲ Triple Super Twist LCD screen
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- ▲ Nine pin serial port, 25 pin printer port
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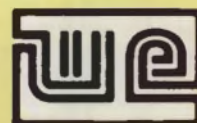
Extra 3... Security. The hardware we supply is of the very best quality and backed by a free 12 months parts and maintenance warranty. Every machine is rigorously tested before it leaves us and fully configured so you can get up and running straight away. Our desktop PCs are covered by 12 months on-site service in mainland UK.

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20 YEARS OF
SERVICE

We are able to deliver such price/performance value because, over twenty years, we have grown big enough to enable us to negotiate the best deals from our suppliers and develop the technical excellence to afford to provide an unrivalled support service. The sort of service which keeps our customers coming back to us time and again.

Buying Aries direct from Watford Electronics, you are secure in the knowledge that you are dealing with one of the longest established computer specialists in the UK. We have been in business for 20 years and are reliable.

Our Aries range and the other products we supply are often the first choice of local government, educational and corporate specifiers. Special prices are available to these groups and anyone buying in large quantities.



Watford Electronics

A member of the Jessa group of companies.

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VAT: UK customers, please add 17.5% to value of order and carriage.

Watford Electronics

YOUR ONE STOP COMPUTER SHOP

Offers and all items are subject to availability. Prices may have to change for reasons beyond our control. Specifications of all products are correct at time of going to press and given in good faith, but may change without notice. Phone for the very latest prices and the quickest delivery options.

Despite appearances, we offer you very little choice.



At Watford Electronics, we will only offer any product when we are convinced that we can sell it at the best price with the right level of support. It's an approach that our thousands of customers appreciate, for we are now celebrating twenty years in the business. So as you look through all the lists of items that follow and discover how competitive we are, you'll discover just how little choice you have. You simply must call us.

Aries 14" Mono Monitor

This State of the Art monitor has a chemically etched, non-glare flat screen, IBM, MDA & Hercules graphics compatible, high resolution (720 x 350 lines).

• ArM1000A - High Resolution Amber £68

Aries 14" VGA Monitor

Monochrome: 14" Flat Screen, Non-Glare, High Resolution paper white, VGA Monitor. Caters for CGA, EGA, VGA. Supplied complete with Swivel base.

- VGA Mono Monitor £85
- Colour Super VGA: The state of the art, flat screen, colour monitor supporting a high resolution of up to 1024 x 768. Complete with Swivel base.
- Super VGA Colour Monitor £269
- Super VGA Card (8/16 Bit) £65
- Super VGA Monitor + Card £299

Aries Multiscan Monitors

"...provides unquestionable picture quality at VGA...it supports VGA in 1024 x 768 in non-interlaced mode."

"The huge bandwidth of the monitor means that it should be able to support display modes not even invented yet, certainly XGA."

"In the not too distant future, monitors with this level of sophistication are going to become commonplace for PC users. But for the moment, the Aries MC3000 is state-of-the-art."

Computer Shopper Nov 1991

Alphascan Plus

This new 14" colour monitor provides automatic adjustment for horizontal frequencies between 50 and 90 Hz. This, combined with its 0.28mm dot pitch tube and anti-glare treatment, gives sharper text and graphics resolution up to 1024 x 768 on a non-interlaced flicker free display (XGA standard). Operation is made simply by use of the front mounted controls for comfortable and easy setup. Supplied with tilt and swivel base.

Aries Alphascan Plus £325

Aries MC3000

Watford Electronics' new microprocessor controlled 14" colour monitor brings a new concept in display technology to the PC world. Now you can set up to 8 different optimum screen displays using push-button controls for vertical and horizontal size and position. The monitor will then select your ideal settings when displayed screen resolutions are changed.

Flicker free operation at up to 1280 x 1024 resolution is the norm with its support for 30 to 64KHz horizontal frequency and 50 to 120Hz vertical frequency. Its other features include 0.28mm dot pitch tube, push button controls and removable tilt and swivel base.

Aries MC3000 £395

Multiscan Colour Monitors

• Eizo 9060S	£380	• Taxan 770LR	£375
• Eizo 9070S	£569	• Taxan 775	£370
• NEC 2A	£245	• Taxan 795-PC	£405
• NEC 3D	£323	• Taxan 875	£669
• NEC 4D	£629	• Taxan Viking II	£1199
• NEC 5D	£1179	• Taxan 1000 20	£1225

Printer Ribbons & Various Dust Covers

Type	Ribbons	Dust Covers
IBM PCs pair		£7.75
DMP2000/DMP4000	£3.75	£4.85
RX/FX800/850/MX80	£2.95	£4.95
RX/FX100/1000	£3.95	
Kaga/Taxan KP810/815	£3.25	£5.00
EX/LQ500/550/800/850	£3.50	£6.00
EX/LQ1000/LQ2500	£4.00	£5.50
LX80/86/400/800/850	£3.00	£5.00
NEC P2200	£6.00	£5.00
Panasonic KX1080/81	£2.95	£4.75
Star LC10/NL10	£4.00	£5.00
Star LC24-10	£2.95	£6.00

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

Canon Bubblejet Printers

Printer	CSF	Bin	Ink
BJ10EX	£184	£43	£16
BJ300	£320	£88	£12
BJ330	£374	£110	£12

• Spare Battery pack for BJ10EX £33

Citizen Printers

• 1200 Plus	£95	• Swift 24	£203
• 124D	£139	• Swift 24X	£269
• PN-48	£199	• Swift 9	£129

• Swift 24 Colour Option £32

• Swift 24 Ribbons: Black £4 Colour £13

Star Printers

• LC15	£173	• LC20	£110
• LC24-10	£143	• LC24-15	£292
• LC24-200	£175		
• StarJet-48 360 dpi			£179
• XB24 Colour Kit			£29
• LC24-200 Colour			£216
• XB24-200 Colour			£306
• LC200 Colour			£152
• XB24-250 Colour			£369
• ZA-200 Colour			£319

Cut Sheet Feeder

• LC10/24-10/200	£85	• LC15/LC24-15	£125
• XB24-10	£80	• XB24-15	£139

Serial Interfaces

SPC-10 LC10; LC10-11; LC10-Col;	
LC15; LC24-10; LC24-15; LC-200;	
LC24-200	£49
8K Ser FR10/15; LC-200; LC24-200;	
XB24	£60

Buffers

• 32K Ram Card for LC/XB24-10; 15 & 200 £55

Ribbons

• LC10; LC10-11; LC15	Black £4	Colour £6
• LC-200; LC24-200	Black £5	Colour £12
• XB24-10; XB24-15	Black £5	Colour £12

Hewlett-Packard Printers

• #Desk Jet 500	£289	• Pantjet XL	£1045
• Desk Writer	£317	• Quiet Jet Plus	£384
• Desk Jet Cart.	£14	• HP Think Jet	£265
• Paint Jet Colour	£444	• Rugged Writer	£915
• Desk Jet 500 Colour	£499		

Now 3 years extended Parts & Labour warranty

3 years on-site warranty £50

• Paintjet Cartridges Black £19 Colour £25

Desk Jet 500 Accessories

• DJ 500 256K RAM Cartridge	£129
• DJ Epson FX Emulation Cartridge	£59
• DJ IBM Proprinter Emulation Cartridge	£59
• DJ 500 Wordperfect Cartridge	£89

HP Apple Talk Interfaces for:

• Scan Jet	£299	• Paint Jet	£104
• Desk Jet Unlimited (Book No VAT)	£19.75		

Laser Printers

All laser printers include 12 months on-site maintenance

• Canon LBP-4 4ppm	£569
• Canon LBP-8 III 8ppm	£1479
• Canon LBP III 8ppm	£976
• Epson EPL-4100	£1179
• Epson EPL-7100 6ppm	£619
• Epson EPL-7500 Postscript 6ppm	£1179
• HP Laserjet III 8ppm	£1019
• HP Laserjet IIO 8ppm	£1639
• HP Laserjet IIIP 4ppm	£669
• HP Laserjet IIS 2M RAM 16ppm	£2515
• Panasonic KX-P4420 8ppm*	£629
• Panasonic KX-P4450i 11ppm*	£982
• Panasonic KX-4455 Postscript 11ppm*	£1528
• Star LBP-4 4ppm Postscript	£815
• Star LP-4 4ppm	£649
• Star LP-8 II (2 Bin) 8ppm	£1195
• Star LP-8 III 8ppm	£936
• Star LP-8 8ppm Star (post)script	£1159
• HP IIP Wordperfect Font Cartridge	£98

* 2 years on-site warranty

Laser Toners

• Canon 2, 3 & 4	£46	• KX-P4420/50	£19
• Epson GQ	£12	• HP II, IIO, III, IIID	£48
• Epson EPL7100	£82	• HP IIP, IIIP	£42
• Star LP-8	£56	• NEC S60/60P	£75
• Qume Crystal (3)£58		• IBM 4019	£142

Laser RAM Upgrades

• IIP & III 1MB	£56	• EPL7100 512K	£39
• IIP & III 2MB	£88	• GQ5000 512K	£42
• II & IIO 1MB	£64	• KX4420/50 1M	£75
• II & IIP 4MB	£99	• P4420/50 2M	£115
• II & IIP 4MB	£146	• P4420/50 4M	£195
• Star LP8 1M	£139	• Star LP8 2M	£275
• Canon LBP4 1M	£105		
• Canon LBP8-2 2M	£125		

Jetpage Postscript Cartridge

• HP IIP/II	£239	• IIO & III	£240
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Various Add-Ons

• Laserjet Appletalk Interface	£139
• HP Adobe Postscript	£399
• Jetpage Postscript for Laserjet 2	£235
• Jetpage Postscript for HP 2P/3	£229
• Pacific Page Postscript	£259
• HP Premier Font Collection	£28
• Laserjet Various Font Cartridges	£45
• Jetfont Superset for II & IIO	£129
• Jetfont Superset International for IIP & III	£145
• Canon LBP8 III Adobe Postscript Interface	£579
• HP IIP Wordperfect Font Cartridge	£98

NEC Pinwriter Printers

• P20	£179	• P70	£405
• P30	£215	• P90	£545
• P60	£325		

Panasonic Printers

• KX-P2624	£90A	• KX-P1624	£285
• KX-P1123	£144	• KX-P1654#	£339
• KX-P1124	£194	• KX-P1695	£285
• KX-P1170	£109		

*Price includes 12 months on site warranty

Panasonic Cut Sheet Feeders

• (P35) KX-P1540	£175
• KX-P1592/1595	£175
• (P36) KX1124	£75
• (P37) P1123/P1180	£86
• (P38) KX-P1624/1695	£119

Panasonic Printer Buffers

• P12 4K Buffer Board for 1081	£55
• 32k Buffer for 1123/24/80; 1592/95; 1624/54/95	£16

Panasonic Serial Interfaces

• P17 P1081/1592 £32	• P19 P1124/1180 £49
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Original Panasonic Ribbons

Guaranteed to last 3 million characters	
• P110 for KX-P1081, 1592, 1595 & 1695	£6
• P115 for KX-P1180	£6
• P145 for KX-P1123/24	£6
• P140 for KX-P1540	£8
• P155 for KX-P1624	£8
• Colour Ribbons for KX-P1081, 1592, 1595 & 1695 Brown, Blue or Red	£9 each

Epson Printers

• DXF5000	£1059	• LQ860 Colour	£459
• DXF8000	£1965	• LQ860 Colour	£459
• EX1000 Colour	£428	• LQ1050+	£459
• FX350	£272	• LQ1060 Colour	£609
• FX1050	£346	• LQ1070	£325
• FX1060	£595	• LQ1170	£449
• LQ400	£156	• LQ2550+	£685
• LQ450	£175	• LX400	£105
• LQ550	£204	• LX850	£146
• LQ570	£215	• SQ850	£425
• LQ950+	£377	• SQ2550	£628

Cut Sheet Feeders for

• LX400/800/850/LQ400/500/550	£69
• EX800/FX800/850/LQ800/850	£130
• FXLQ1000/1050/SQ850	£159
• LQ2550	£176
• SQ2550	£390

Tractor Feed for

• LQ800	£44	• LQ850/FX850	£69
• LQ1050/FX1050	£85	• LQ2550	£90
• LQ2550	£90		

Accessories

• EX800/1000 Colour Option	£55
• EX800/1000 Colour Ribbon	£18
• LQ2500 Colour Option	£65

Epson Printer Interfaces

All these interfaces fit inside the printer	
• RS232	£32
• RS232 + 2k Buffer	£52
• IEEE 488	£95
• RS232 + 8k Buffer	£75

Printer Leads

• IBM Parallel Lead 2 metres	£4
• IBM Parallel Lead 5 metres	£10
• IBM Parallel Lead 10 metres	£15
• Double ended 36 way Centronics lead 4' £7	
• Double ended 36 way Centronics lead 6' £9	
• RS232 lead (various) POA	
• IBM Keyboard extension	



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Watford Electronics
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Universal Printer Sharers

Connect up to 5 micros to 1 printer or 5 printers to 1 micro with our combined Sharer/Changerswitch boxes.

Standard Low Cost Sharers		
Connects	Serial	Parallel
• 2 to 1	£10	£11
• 3 to 1	£13	£14
• 5 to 1	£16	£17

Professional Sharer Units		
Connects	Serial	Parallel
• 2 to 1	£17	£18
• 3 to 1	£22	£25
• 5 to 1	£34	£38

Handy Printer Switch

A handy 2 way compact printer switch. Enables one micro to be connected to 2 printers or vice versa.
Centronics £18 Serial £17

Auto Printer Sharer Switch

Connects	Serial	Centronics
• 2 to 1	£38	£40
• 4 to 1	£59	£59
• 8 to 1	-	£89

256K Multi Spooler

These Auto Centronics Printer Sharers have built-in 256K of Printer Buffers. They can be used as Auto Sharers, Printer Buffers or both.

- 2 in/2 out £135
- 4 in/2 out £169
- 8 in/1 out £199

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

Compact Converter Units

• Serial to Parallel	£36
• Parallel to Serial	£37

Listing Paper (Perforated)

• 1,000 Sheets 9.5" x 11" Fanfold	£7
• 2,000 Sheets 9.5" x 11" Fanfold	£11
• 1,000 Sheets 9.5" x 11" NCR 2 Part Fanfold	£21
• 1,000 Sheets 15" x 11" Fanfold	£9
• 2,000 Sheets 15" x 11" Fanfold	£16
• 1,000 Sheets true A4 Fanfold Paper 70gms	£11
• 2,000 A4 Fanfold Paper	£19
• Teletypewriter Roll (Econo paper)	£4

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached.)

Printer Tables

(On continuous fanfold backing sheet)

• 1,000 90 x 36mm (Single Row)	£6.00
• 1,000 90 x 36mm (Twin Row)	£6.25
• 1,000 90 x 49mm (Twin Row)	£7.50
• 1,000 102 x 36mm (Twin Row)	£6.75

Laser Printer Labels on A4 Sheets

• 3750 - 70 x 29mm (3 Rows)	£13.50
• 3000 - 70 x 37mm (3 Rows)	£13.25
• 2625 - 70 x 42mm (3 Rows)	£13.00

Maths Co-Processors

• 8087-5MHz	£53	• 80387-16	£119
• 8087-8M	£74	• 80387-20	£99
• 8087-10M	£98	• 80387-25	£129
• 80287-6	£45	• 80387-33	£125
• 80287-8	£46	• 80387-40	£189
• 80287-10	£48	• 80387SX-16	£75
• 80287-12	£51	• 80387SX-20	£89

Memory

• 4164-10	£1.55	• 1MB-10 DIL	£4.50
• 4464-10	£3.50	• 1MB ZIP	£4.50
• 41256-10	£1.50	• 256K x 4 ZIP	£4.50
• 4256-8	£2.00		

Simm & Sips

• 256K x 9-10	£14	• 1MB x 9-10	£36
• 256K x 9-8	£14.50	• 1MB x 9-8	£39

BOOKS (No VAT)

Carriage on books varies between £2 to £3.50, depending on their weight

• 1-2-3 Mastering - 2nd Ed	£20.95
• 1-2-3 Using - Release 2.2	£25.95
• Ability & Ability Plus on PC	£11.95
• Accountancy software in Business - Using	£14.95
• Advance C Tech & Application	£19.95
• Amstrad 9512 - Using the	£10.95
• Amstrad Basic 2 - User Guide	£9.95
• Amstrad PC Programmers Ref Guide	£15.95
• Amstrad Technical Manual for 1640	£19.95
• Autocad 4th Ed - Mastering	£31.50
• Autocad - Inside 6th Ed	£32.45
• Autocad - Inside Release 10	£27.95
• Business Companion on the 1640	£12.95
• C - Introducing	£12.95
• C - Programming Language 2nd Edition	£26.95
• C - Teach Yourself	£19.95
• Clipper - Using	£27.95
• Computer Users Dictionary	£9.95
• Coral Draw 2nd Ed - Mastering	£25.50
• Coral Draw made easy	£24.95
• Coral Draw v2 Quick Ref	£8.45
• dBase IV - Handbook	£19.95
• DOS & BIOS Function - Quick Ref Guide	£7.95
• DOS Power tools 2nd Ed	POA
• Excel for + - Quick Ref	£8.95
• Excel IBM Version - Using the	£27.95
• GW BASIC Users Guide & Ref	£12.95
• GW BASIC - Quick Prog Ref	£8.95
• IBM PC & PS/2 3rd Ed	£21.70
• IBM PC AT - Inside the	£21.70
• IBM PS/2 Handbook	£19.95
• Microsoft GW BASIC	£17.95
• Microsoft Windows - Illustrated	£21.95
• Microsoft WORD 5.0 - Using	£20.45
• MS DOS Bible 3rd Ed	£24.95
• MS DOS First Book	£15.50
• MS Windows 3 2nd Ed - Using	£22.95
• MS-DOS for Beginners	£14.95
• MS-DOS Masters - Tricks of 2nd Ed	£21.70
• MS-DOS Users Guide 2nd Edition	£27.95
• MS-DOS - ABCs of 2nd Ed	£17.95
• MS-DOS - Running 4th Edition	£19.95
• MS-DOS - Supercharging 2nd Edition	£17.95
• MS-DOS - Using	£19.95
• MS-DOS 5 - Using 2nd Edition	£22.95
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• Novell Network - Mastering	£27.95
• Novell Network - The ABC of	£21.95
• Novell Network - Using	£27.45
• Pagemaker - Using	£22.95
• PC Crash Course 2.0 2nd Edition	£19.95
• PC Tools - Quick Ref	£8.45
• PC-DOS Using 2nd Edition Ver. 3.3	£20.45
• PC-DOS Using 3rd Ed	£21.95
• PCs and Compatible for Beginners	£17.95
• Programming Guide to EGA & VGA Cards	£25.95
• Quattro - Mastering	£21.95
• Quattro Pro III - Using	£25.95
• Smart II - Using	£22.95
• Smart, tips, tricks and traps (QUE)	£22.95
• Smartware II - Using	£22.95
• Supercalc 5 - Using	£27.50
• Supercalc Professional	£17.95
• Symphony 4th Edition - Mastering	£24.95
• Symphony Made Easy	£16.95
• Symphony - Using Special Ed	£27.45
• Teach Yourself C	£19.95
• Turbo C Bible	£27.95
• Turbo C++ - Using	£22.95
• Turbo Pascal - Advanced Techniques	£22.85
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• Upgrading and Repairing PCs	£27.45
• Ventura Mastering - 2nd Ed	£22.95
• Ventura Tips & Tricks	£18.95
• Ventura - Instant Reference	£10.95
• Ventura - Tips & Tricks 2nd Ed	£27.95
• Window 3.0 Programming	£27.95
• Window 3.0 Quick Ref	£8.45
• WORD for Windows - Using	£22.95
• WORD for Windows Made Easy	£15.95
• Wordperfect for Beginners	£17.45
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• Wordperfect 5.1 1st Book of	£14.95
• Wordperfect 5.1 - Mastering	£24.95
• Wordperfect 5.1 - Using Special Ed	£25.95
• Wordperfect Mastering Ver 5	£21.95
• Wordperfect Using Ver 5	£21.95
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• WordStar 6.0 Made Easy	£16.95
• WordStar Release 5.0 - Mastering	£20.45
• WordStar User's Ref. manual	£12.50
• WordStar Using 5.5 & 6 3rd Ed	£25.95
• Xerox Ventura Publishing - Inside	£27.95

Hard Disk on Cards

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

• WD-XT 20MB	£129
• WD-XT 30MB	£149
• WD-XT 40MB#	£159

Now supplied with ViewMax - the hard disk management program.

Hard Disk Drives (bare units)

• WEHD20 21 MB Hard Disk	£95
• WEHD30 30MB RLL Hard Disk	£119
• WEHD40/28ms 42MB HD including partitioning software	£179
• WEHD65 65MB HD RLL	£185

Disk Controller Cards

• WEXT100C XT Hard Disk Controller card and cables	£29
• WEXT200C/RLL XT Hard Disk Controller card and cables	£39
• IDE AT - 2HD/FDC/Parallel/2 Serial Games port for AT	£25
• FDC-Plus PC XT Controller card to interface High/Low Density 3.5" or 5.25" Floppy Drives	£35
• FDC-4 PC XT Controller card to interface up to a 4 High/Low Density 3.5" or 5.25" Floppy Drives	£65
• AT Embedded Drive Adaptor 2 x FDD/HDD only	£15

Hard Disk Kits

• WEHD20(KIT) 21 MB HD with XT-Amstrad Controller + Cables	£125
• WEHD30(KIT) 32 MB HD with XT-Amstrad Controller and Cables	£179
• WEHD40(KIT) 42 MB HD with XT-Amstrad Controller and Cables	£235

Floppy Disk Drives

• UC200 5.25" 360K 48tpi Double Sided Disk Drive	£47
• UC600 5.25" 1.2M 96tpi Double Sided High Density, Disk Drive	£57
• UC35/4 3.5" 720K Drive with 5.25" kit	£51
• UC35/6 3.5" 1.44M Drive with 5.25" kit	£59

Tape Streamers

• WE 5000 - Tape for XT & AT. 60MB external kit with software, short controller, cable and documentation. Backs up 60MB in less than 12 minutes.	£449
• WE 2000 - Low cost internal Tape Streamer. Up to 120MB capacity. Software included	£199
• External Case, PSU & Lead for above	£79

Add-On Cards

• EGA Card, 256K RAM, compatible with CGA & EGA	£49
• Monochrome Graphics Card (incl. Parallel printer port)	£19
• CGA Card - RGB Colour and Mono Composite Video (Includes parallel port)	£32
• RS232 Card with 2 ports	£15
• Multi I/O Card includes FDC, Real Time, Clock/Calendar, Serial/Parallel/Games	£25
• Serial/Parallel/Game Card (+ 2nd Serial Optional port)	£9

3M Diskettes

• 10 x 3.5" D/5 Side D/Density 720K	£7
• 10 x 3.5" D/S D/D Formatted 720K	£7
• 10 x 3.5" D/5 Side H/Density 1.44	£12
• 10 x 3.5" D/S H/D Formatted 1.44	£13
• 10 x 5.25 D/5 Side D/Density 360K	£5
• 10 x 5.25" D/S D/D Formatted 360K	£6
• 10 x 5.25" D/5 Side D/Density 1.2M	£8
• 10 x 5.25" D/S D/D Formatted 1.2M	£9

(Lifetime warranty on above Disks)

Large Capacity Hard Disk Drive

SCSI			
• 91MB	3.5"	20ms	£485
• 180MB	3.5"	20ms	£595
• 330MB	F/H	18ms	£1095
• 670MB	F/H	16ms	£1449

AT IDE Drives			
• 44MB	3.5"	28ms	£125
• 100MB	3.5"	18ms	£225
• 200MB	3.5"	16ms	£370
• 337MB	H/H	16ms	£795

HD Controller Cards

• SCSI Hard Disk Controller Card	£199
• ESDI Hard Disk Controller Card	£165
• AT IDE Hard Disk Controller	£15

PC 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 3.5" - 360K Drive	£69
• PCS-5H2 3.5" - 1M2 Drive	£89

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

PC Software

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

• Autoroute Plus v4	£182
• Autoroute Express GB	£47
• Autosketch v3	£64
• Clipper v5	£295
• Coral Draw v2	£230
• D/Base III+	£339
• D/Base IV	£348
• Dataperfect	£233
• Datatalk v4	£82
• Data Ease	£382
• Display Writer v5	£245
• DR DOS v6	£45
• Draw Perfect	£249
• Foxbase	£182
• Grammatik for Wordperfect	£45
• Haward Graphics v3	£239
• Laplink III	£64
• Lotus 123 v3	£294
• Lotus Freelance	£245
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Chipset 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16MB

ROM

AMI BIOS

Mass storage

88Mb 19ms Seagate hard drive,
3.5in and 5.25in floppies

Storage

Four drive bays (one free)

Expansion

Six 16-bit (four free), two 8-bit slots

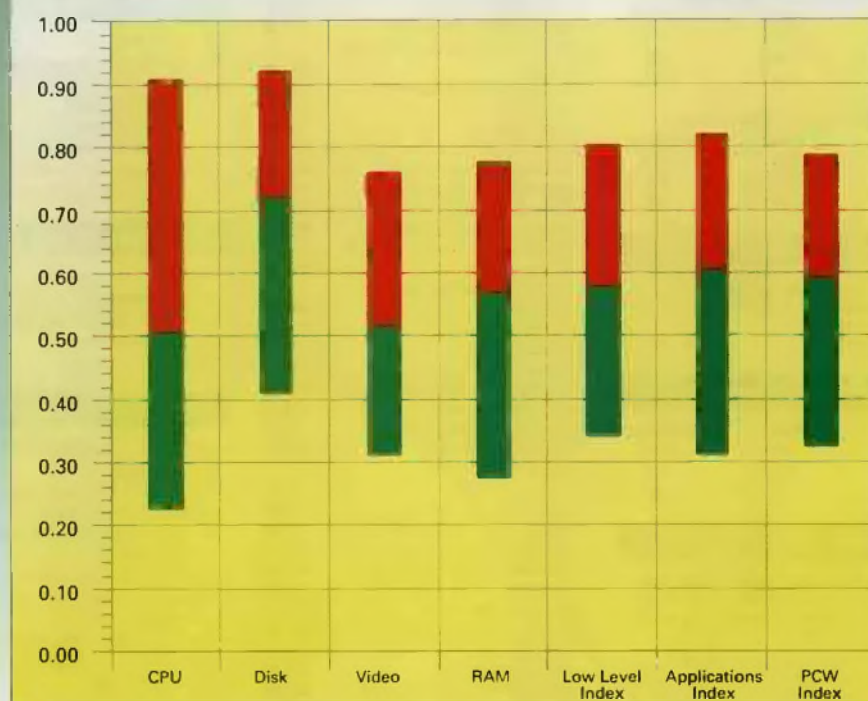
Manufacturer

Chipset (0483) 797959

Good Points Good video card.

Bad Points Try installing a large full-length card.

Conclusion An also-ran.



stalled users. Like a lot of other start-ups (to use the more familiar term), Chipset is competing for your money by offering systems whose principal selling point is their conformity to a standard. Its 386SX20 comes in a grey box, with lots of screws showing on the back and bottom.

Some of the screws, three on the back and four spread between the bottom edges, let you into the grey box. This is thick steel, and a fair amount of wrestling, banging and thumping is needed to get in. The power supply is at the right rear, with a floppy-drive cage in front of it. There's a tiny, empty, sideways strap-on mount for a third-height hard disk drive. The installed 88Mb hard drive sits in a cradle beneath the two supplied floppy drives. The holding rails were loose on the review machine, so that the drive could slide to and from as it was moved.

Curious experience

Lifting the system up to indulge in some chip-spotting is a curious experience. The metal straps supporting the power-supply unit are reminiscent of bricks holding up a car with its wheels stolen, and there's enough room for another PSU beneath the installed one. But the space holds blanking plates for up to four additional I/O ports. A multifunction card in the system's card cage provides a fine complement of serial and parallel ports, plus a games adaptor, and it also feeds the floppy and hard drives. Sadly, its position at

the first motherboard slot seems fixed so that ribbon cables to any additional I/O ports would have to go around the multifunction card — an entertaining prospect.

Joystick adaptor

The Chipset at least shows how different a design can be within the narrow specifications of this Group Test. Here is a machine with a joystick adaptor, a co-processor socket, enough expansion slots to drive a walking robot, and ports enough (even if blanked off) to support four more users. It's a shame that not quite enough thought seems to have gone into the design.

For instance: memory slots into the motherboard in a set of SIMM sockets. The siting of these SIMMs is a tough choice in smaller cases: several of the review machines slant their sockets to prevent SIMMs snagging expansion cards. In the Chipset machine, the SIMMs are in upright carriers sited between full-length expansion slots. I can think of several fat expansion cards which would bash against the SIMMs, or (worse) subtly distort them.

The video card is a 1Mb Trident, and the monitor a Samsung SVGA. It's rather an early model of the Trident card, but the performance is nonetheless stunning on this journo's inevitable test run of Fractint. DOS 5 is supplied, but no mouse. Neither is a copy of Windows, though that is by no means an inexcusable omission.

Steve Cassidy

Cometdata 386SX/20



Cometdata's machine looks anonymous, and not just because of its bland mini-tower case: there was no brand label to be seen on the review system. Still, the configuration was easy to work out. The mini-tower case has two half-height 5.25in and two third-height 3.5in bays accessible from the front panel, alongside the mains switch, turbo and reset buttons, a keylock, the usual indicator lights, and the two-digit display that seems to have become a standard without having any obvious purpose.

As in so many low-end machines the mains switch and reset button are far too prominent and easy to knock against. At the rear are two 25-pin serial ports

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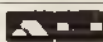
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Cometdata 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Microid Research BIOS

Mass storage

80Mb 18ms Western Digital hard disk, 3.5in floppy

Storage

Five drive bays (three free)

Expansion

Four 16-bit (two free), two free 8-bit slots

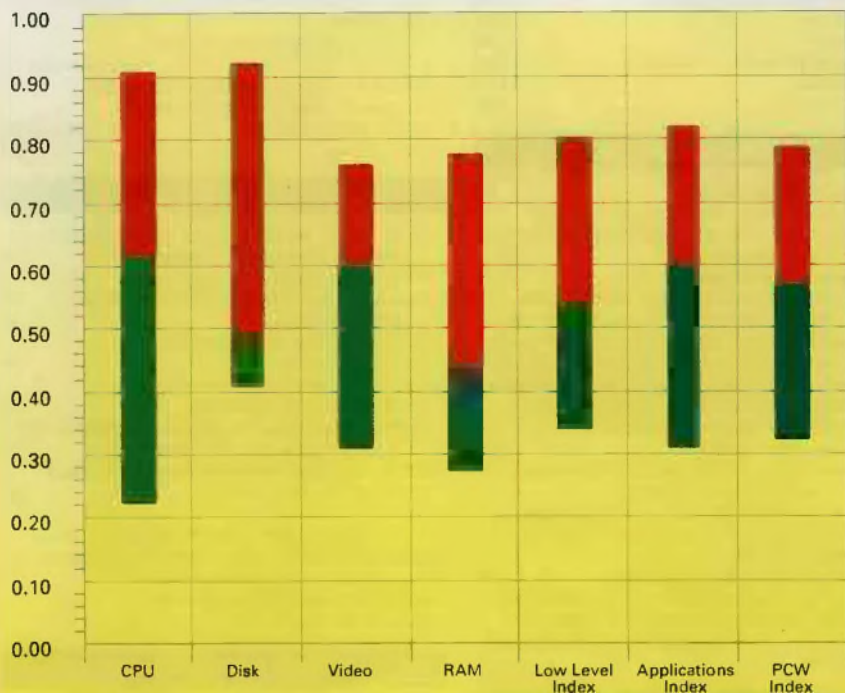
Manufacturer

Cometdata 081-452 6006

Good Points Good monitor, although interlaced.

Bad Points Limited expansion, incorrect initial configuration.

Conclusion Nothing special.



(in panel cut-outs rather than taking up an expansion slot plate) and a keyboard socket, along with VGA, parallel and game port connectors on expansion boards. Inside the case is a tiny Octek-built motherboard, no more than 8in square, using the OPTI chipset, an Intel 80386SX processor, and a BIOS chummily and rather off-puttingly named 'Mr BIOS'.

The motherboard has four SIMM slots along with a set of sockets for standard RAM chips; the maximum RAM capacity is 16Mb using SIMMs only and 2Mb using chips only. There is a Western Digital tinge to the rest of the review system. The hard disk was a WD Caviar 280, while the video board used a Western Digital/Paradise chip with 1Mb of video RAM; the multifunction disk controller board had no brand name but was built around an Acer custom chip.

The tower case promises rather more expansion than it can deliver. There are five drive bays, for example, but the floppy and IDE controllers on the multifunction board can only address a total of five devices. Adding a second controller board would take up another 16-bit slot, when there are already only two free in the minimum configuration; there are six slots in total, but two of these are 8-bit. The maze of cables criss-crossing the interior of the case would make sorting out connections from a second controller to additional devices rather tricky.

There are only four SIMM slots, so

an upgrade from 4Mb would require at least some existing SIMMs to be thrown away. As the benchmark figures show, the Cometdata machine is average in CPU performance and less than that in hard disk speed.

Video mismatch

The only major problem in use was that the video board was not correctly matched to the CTX-made monitor, that could manage a 1024x768 resolution — but only in interlaced mode, as used by IBM's 8514/A standard. The video board, on the other hand, was configured to drive that resolution in non-interlaced mode. This caused chaos in the Windows 3.0 display. Changing a switch on the video board and reinstalling the Windows 3.0 1024x768 256-colour driver, supplied with the board, solved the problem but left the Windows display with the typical and annoying interlace flicker. This flicker is unacceptable for serious work, particularly with small text on a 14in display, and users would be better advised to stick with 800x600 resolutions.

Otherwise the monitor was excellent, with all controls on the front panel and sharp displays even at the highest resolution. It would have been helpful, though, if the manual had mentioned the interlaced-only display anywhere other than in a footnote on page 14. The keyboard was another small and light NTC model, and the mouse was another plasticky three-button Genius model with appropriate drivers and

adaptor. Both worked fine, but would not be my first choices.

The same goes for the whole machine, really. The limited number of expansion slots and the restriction of two of them to 8-bit operation, the limited RAM expansion and the confused interior design, combined with average performance, make this a cheap but flawed system.

Peter Jackson

Compaq 386S/20



Compaq, long-time leader in the PC-compatible market, is changing direction after some disappointing financial results and the departure of co-founder Rod Canion. It seems to be moving from being a supplier of innovative technology, like EISA and multi-processors, to



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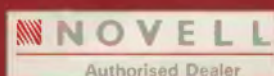
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Compaq 386S/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Compaq BIOS

Mass storage

60Mb 19ms Conner hard disk,

3.5in floppy

Storage

Five drive bays (three free)

Expansion

Four free 16-bit slots

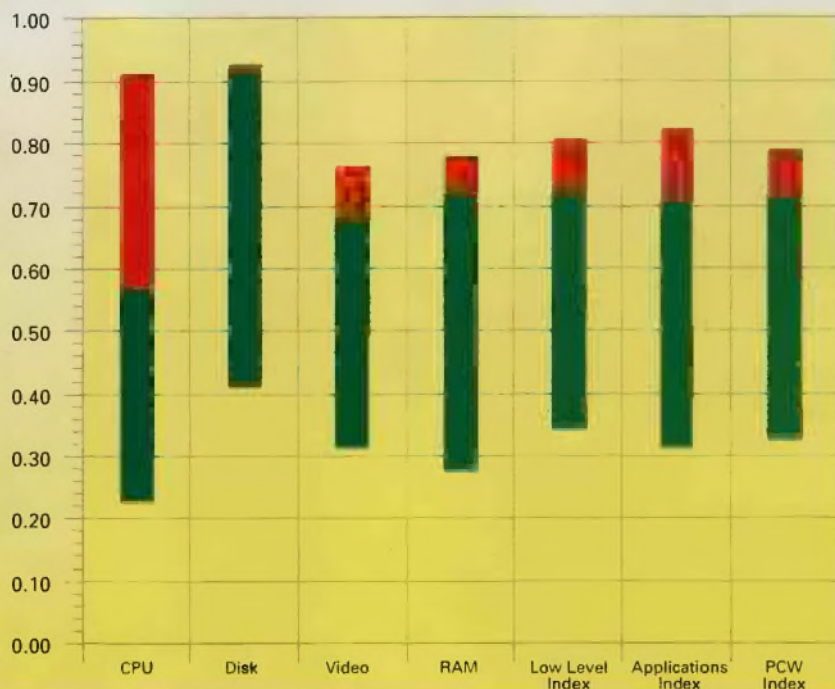
Manufacturer

Compaq 081-332 3000

Good Points Fast, reliable, secure.

Bad Points 'Typically' very expensive — even DOS costs extra.

Conclusion A good machine for those with deep pockets or deep discounts.



making high-quality, price-competitive, standard products.

There is some Compaq added value in the 386S/20, notably several built-in security features, on-board enhanced and accelerated VGA graphics, and a proprietary cache design, that help bring it close to the top of its class performance league. On the whole, however, this is a reasonably straightforward machine. A newer version, the 386S/20N, is aimed more at network use and includes even more security in a smaller footprint, with only two slots.

The machine is well engineered, as you would expect. The case comes off easily — you just loosen three thumb-screws on the back and lift the back away. Inside, everything is very tidy. The four expansion slots are reasonably well spaced and there is plenty of room around them for full-height, full-length cards. The motherboard is, unsurprisingly, completely surface-mounted, which means it should be reliable. The hard drive comes from Conner, which has an excellent reputation. All the I/O support is on-board — that includes a mouse port, a parallel port, a serial port and a video port. It would be nice if Compaq had provided two serial ports as standard, but the mouse port helps to compensate. Unfortunately there is no power-out plug, so the monitor and computer use two plugs.

The VGA graphics are accelerated, which shows up in the benchmark results (speed second only to the Sprite), and they also support more colours

than normal — 256 colours from a palette of 256,000 (supported by Windows, AutoCAD and other software). An 'ugly mode' option supports 132 text columns instead of the usual 80.

Tilt control

The screen is OK and it includes the kind of flexible tilt and swivel control that EEC directives are going to make mandatory in the next few years. The keyboard is a standard extended one, but with an irritating key click and a spongy feel. Bizarrely, the 'u' key was labelled 'y'. I presume that is a fluke rather than an attempt to add value to Compaq's keyboards.

The documentation is as readable as computer documentation ever is, and well-illustrated. It is, however, somewhat out of date, as it doesn't include some of new security features. There are more ways to make this machine secure than you can shake a stick at. There is, of course, a lock on the case and an optional power-on password.

Altogether, this machine has few real flaws. Except, that is, for the price. Compaq has announced a new pricing policy — instead of an RRP, it have a new concept called the 'typical buying price'. If the price quoted is typical, then this machine is in big trouble: four of the twenty 33MHz 486 machines we reviewed in November cost less than this. And the price quoted doesn't even get you a mouse, never mind Windows or other bundled software.

If you are getting a pretty hefty corporate discount, there's nothing wrong

with the Compaq. If you are going to pay anything close to the 'typical' price, why not buy someone else's 486?

David Brake

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Sanyo 386sx-20



DT18 105Mb 1Mb RAM

Special features
Three year warranty
Panasync Super VGA Colour
4 drive bays, 4 slots.

£1149

or rent for just
£10.19
per week*

Tandon 386sx-20



MCS 105Mb 2Mb RAM

Special features
Time-Proof: Upgradeable Processors
Enhanced system with Microsoft mouse and Windows 3
Panasync Super VGA Colour, 7 slots, 4 drive bays.

£1299

or rent for just
£11.52
per week*

ALR 486sx-20



Powerflex 105Mb 1Mb RAM

Special features
Time-Proof: Upgradeable Processors
Panasync Super VGA Colour
4 drive bays, 6 slots.

£1499

or rent for just
£13.29
per week*

Sanyo 386-25c



DT19 105Mb 2Mb RAM

Special features
Three year warranty
Panasync Super VGA Colour
5 drive bays, 6 slots.

£1699

or rent for just
£15.07
per week*

ALR 486sx-20 EISA



Business-Station 105Mb 2Mb RAM

Special features
32 bit EISA architecture. Panasync Super VGA Colour
Time-Proof: Upgradeable Processors
2 EISA slots, 3 ALR slots, 3 drive bays

£1599

or rent for just
£14.18
per week*

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Lancs. BB2 1EJ.

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Tandon and ALR systems are upgradeable to the next generation of processor by a simple exchange of the CPU module. ALR full 32 bit EISA based upgradeable systems provide even further protection from obsolescence.

4. Three Year Warranty

All Sanyo systems come with three year warranty as standard. Three year Time-Cover option is available on Tandon and ALR systems for a small additional charge. Time-Cover provides comprehensive extended parts and labour warranty with full provision of loan equipment should yours need repair.

5. Super-VGA Graphics.

1024 X 768 Super-VGA card with 512K video RAM (upgradeable to 1Mb). Tandon systems and Business-Station have integral Super-VGA with 256K RAM expandable to 512K.

6. Panasync Colour Screens.

All systems come with Panasync 14" screens: True Multifrequency colour upto 1024 X 768 resolution. 0.28 dot pitch. 2 year onsite warranty. Simply the best 14" screen!

7. Fast IDE Hard Drives

NEC 105Mb (19ms) drives are standard. 40Mb, 200Mb (15ms) or 340Mb (12ms) hard disk models also available.

8. Ample RAM Memory

Systems are available with a wide range of RAM. We recommend a minimum of 2Mb/4Mb. Please call for details.

9. Full Complement of Standard Features

Ample storage drive bays and slots for expansion. MSDOS 5 or 4.01. 102 keyboards. 3.5" 1.44Mb floppy drive (5.25" is standard on B-VEISA). Serial & parallel ports etc. Tandon systems also come with Microsoft mouse and Windows 3.

10. ST Models

Special Time models include extra items such as a mouse, business software packages & more. Please call for details.

11. Flexible Lease Rental Terms

Business users may lease all equipment (subject to status.) *Lease rental prices shown are for approximate weekly costs Ex. VAT payable quarterly. (3 year lease).

12. Free Configuration Service for Options

Any options are installed and the systems are fully tested. Hard disks are formatted and DOS is installed ready for use.

- Additional 5.25" or 3.5" floppy drive £79.
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- Mouse & Paint package £39
- Higher capacity hard disks. Please call for pricing.
- Maths co-processors. Please call for prices.
- Extra RAM memory £50/Mb
- 17" Panasync screen £600 more than 14" models.

13. Complete Solutions

All systems are also available with matrix, inkjet or laser printers, complete with appropriate software. Time are Novell Authorised to provide complete network solutions.

**We have the solutions.
You have the choice.**

This includes RAM, 105Mb hard disk & special features as specified & keyboard, DOS, Panasync Super-VGA colour screen & 1 floppy drive (second floppy drive and tape streamers are optional extras).

ALR 386sx-20c



Powerflex 105Mb 1Mb RAM
Special features

Time-Proof: Upgradeable Processors
32Kb CPU cache to further boost performance
Panasync Super-VGA Colour. 6 slots. 4 drive bays.

£1199 or rent for just
£10.63
per week*

ALR 386-33 EISA



Business-Station 105Mb 1Mb RAM
Special features

32 bit EISA architecture. Panasync Super-VGA Colour.
Time-Proof: Upgradeable CPUs. 3 drive bays, 2 EISA slots.
64Kb Cache optional extra.

£1399 or rent for just
£12.41
per week*

Tandon 486sx-20



PACII (Data Pacs extra) 2Mb RAM
Special features

Time-Proof: Upgradeable Processors. 5 slots.
Panasync Super-VGA Colour
Optional SCSI Data pacs. 3.5" drive. Mouse & Windows 3

£1499 or rent for just
£13.29
per week*

Tandon 486sx-20



MCS 105Mb 4Mb RAM
Special features

Time-Proof: Upgradeable Processors. Enhanced system.
Microsoft mouse & Windows 3. Panasync Super-VGA Colour
4 drive bays. 7 slots. Powerposter write buffer feature.

£1699 or rent for just
£15.07
per week*

ALR 486sx-20 EISA



Business-VEISA 105Mb 2Mb RAM
Special features

32 bit EISA architecture. Panasync Super-VGA Colour
Time-Proof: Upgradeable CPUs. Opt. 64Kb cache available
4 drive bays, 4 EISA slots. 2 ISA slots. 3 ALR slots

£1799 or rent for just
£15.95
per week*

Tandon 486-33



MCS 105Mb 4Mb RAM
Special features

Time-Proof: Upgradeable Processors. Enhanced system
Microsoft mouse & Windows 3. Panasync Super-VGA Colour
4 drive bays. 7 slots. Powerposter write buffer feature.

£1999 or rent for just
£17.73
per week*

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TIME
Computer Systems Ltd

typical product, in that it's designed by the company itself and with the aim of leaving as few reasons to call the hotline as possible. Which is just as well: the wrong telephone number was prominently displayed on the box.

The 11x42x39cm system unit is pleasantly low-profile and dully grey. There's no power light: apart from LEDs on the two disk drives (3.5in and 5.25in), the only indicator, hidden away behind the label, is for hard disk access. The machine looks rather attractive, in comparison to some of the Taiwanese designs. The mains switch is tucked away on the right-hand side, and everything else is brought out to the back panel. The usual complement of ports cluster along the bottom — VGA, two serial and one parallel, keyboard and mains input.

To get inside, you undo six easy-access screws and the top lifts off, with no guide rails to miss or tabs to disentangle. Inside, CompuAdd's own motherboard takes up just over half the base area, with room alongside for one hard disk and the small 150W power supply. The two floppies take up the only other two drive bays; you cannot bolt any other storage device onto this chassis.

There are six expansion slots, arranged in the normal low-profile configuration, on a small daughterboard that fits onto the single expansion slot on the motherboard itself. Of these six, three are for half-length 8-bit cards and three for full-length 16-bit ISA. None of

the slots is filled when you get the computer, because absolutely everything is integrated onto the main board.

Joystick circuitry

Absolutely everything includes a Tseng ET-4000AX based VGA circuit, with 512K of display memory. Sockets allow you to make this up to the full megabyte. There's a Goldstar floppy controller and IDE interface elsewhere on the motherboard; the circuitry for a joystick interface is also present, but you'll have to fit a short lead and connector if you want to use it.

The main system RAM plugs into an array of eight SIMM sockets; this has room enough for 32Mb, and the review machine came with a healthy 4Mb fitted. There's also 32K cache RAM on board, with an Austek cache controller — odd to suffer the bus limitations of a 386SX processor in order to save money, and then add a cache to speed things up again. You can compound this oddness by adding another 32K.

Two DIP switches on the motherboard let you configure your ports if you add an expansion card that clashes. These are — glory be — clearly marked, as are all the sockets and other important bits on the board. It is quite possible, therefore, to disable the internal VGA, if you're adding another display adaptor, without having to refer to the handbooks you lost six months ago. And without having to phone up that support hotline. You can reassign the onboard parallel port to LPT2, which is

nice (I've needed to do this more than once in the past); but you can't change the interrupts assigned to the serial ports, which isn't nice. The monitor supplied was OK — it displayed the standard VGA modes adequately, although the picture sat rather to the left of the screen. Resolution and linearity were passable, but nowhere near the best I've seen from cheap monitors. Rather disappointingly, it couldn't cope with the higher resolution modes that the onboard VGA could produce: 640x480 graphics are the limit.

The keyboard was a little mushy, but the sculpturing more than made up for this. It'll never inspire a poem, but you could write your life story on it without any bother.

The CompuAdd is quiet and well-behaved, even if the cache doesn't bestow quite the benefits one might hope for. The documentation is excellent, using what appear to be ray-traced graphics to good effect. Again, fewer calls to the hotline, higher margins for CompuAdd and happier users to boot.

Rupert Goodwins

Dan Technology 386SX/20

Dan Technology sells most of its systems by telephone and mail order. However, unlike other companies that sell this way, it has a showroom for people who like to see what they are buying.

CompuAdd 320SC

Processor

20MHz 386SX

RAM

4Mb expandable to 32Mb

ROM

Phoenix BIOS

Mass storage

120Mb 18ms Western Digital hard disk, 3.5in floppy

Storage

Three drive bays (one free)

Expansion

Three free 16-bit slots, three 8-bit slots (two free)

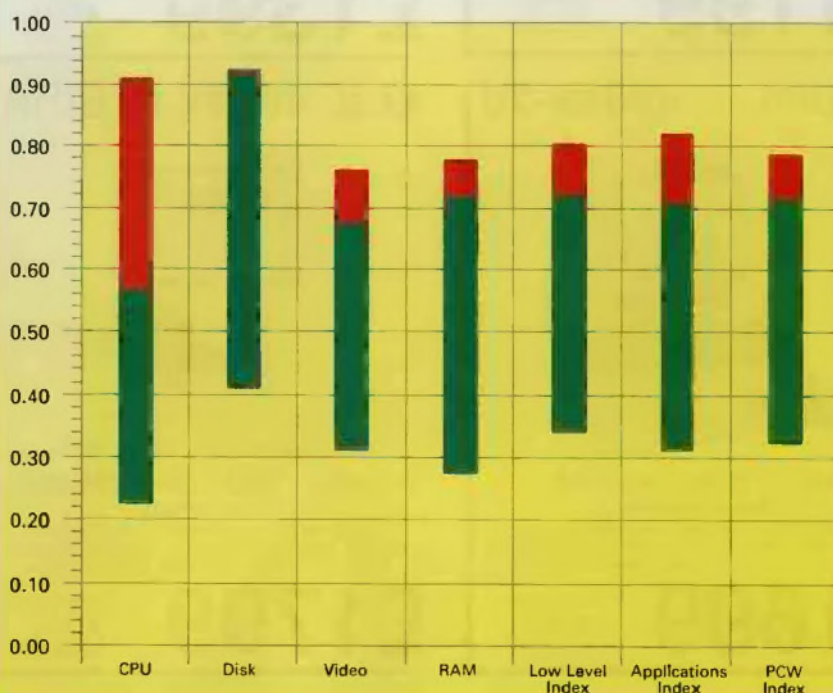
Manufacturer

CompuAdd (0800) 373535

Good Points Neat, well-designed and easy to expand.

Bad Points No room for more disks.

Conclusion Competent, with some nice features and few oversights.



Dan systems are something of a mix and match—you start with a particular unit and then add the video and drive options of your choice.

I was impressed by the small size of the system unit, which looks quite attractive. On the front are the customary turbo switch and LED, power switch and LED, hard-disk LED, and a reset switch mounted flush with the fascia to prevent accidents. The only remaining feature is the 3.5 in floppy drive. The case is too small to fit a 5.25 in floppy—if you want one, don't ask for the slimline case.

At the back, from left to right, are the power-in plug, power-out plug for the monitor, two serial ports (one 9-pin, one 25-pin), a parallel port, a games port, a keyboard port and a video port.

The layout inside is reasonably neat, with ties to tidy up surplus cabling. To keep the case small, Dan has laid the

add-in boards on their sides. The unit as supplied contains five 16-bit slots, three of them filled (one with the I/O card, one with the Tseng Labs video card and one with the disk drive controller). One of the available slots will take only a half-length card because the floppy drive gets in the way. You will need to remove the power supply to get the card in.

The video card has a full 1Mb of memory, enabling it to display 256 colours at a resolution of 1024x768. The disk drive controller is a Promise Technology cacheing version which on the review machine had the maximum 4Mb of memory. At first this seems like good value for money, but the cacheing disk controller is not normally included: it costs an additional £411. As the machine comes near the bottom of the pile in the Disk section of the benchmarks, your money would be better spent on a better disk.

Light feel

The 14 in Dan-badged monitor is capable of displaying SuperVGA. It has the usual brightness and contrast wheels on the front, and side knobs control the position and size of the image. The standard enhanced keyboard had a light feel, and a hollow-sounding key click. The Microsoft-compatible mouse, as supplied with the review machine, will set you back about an extra £20.

The machine came preconfigured with Microsoft DOS 5 (which is included in the price) and Windows 3.0 (which isn't). Windows had already

been set up by Dan Technology to use the highest resolution of the video card. Corel Draw and Symantec's On Target may seem an odd combination but they are normally a good way to test a machine's performance. In this case, both packages ran well.

Currently 386SX/20 machines are regarded as the entry-level PC, so they must be capable of providing a level of performance that is sufficient for the average user. For DOS users the Dan will be more than adequate. The real test of a machine's power normally comes when you try running Windows, especially in enhanced mode, and even here the Dan machine still performs. I would have no qualms about using it on a daily basis.

Ian Morris

Dart 386SX/20

This is a very sleek machine, not unnaturally narrow but low. Yet it avoids making too many compromises in its expandability and facilities.

The front panel squeezes in all the most important features: a reset button, power and hard-disk activity lights, a keyboard lock, and a genuine Big Red Power Switch, well-shielded against accidental operation. There are bays for one 5.25 in and one 3.5 in drive, both filled on the review machine. Inside is a third bay for a 3.5 in hard disk.

All the main ports are grouped at the back in a neat row. There's a VGA socket, printer port, two 9-pin serial



Dan Technology 368SX/20

Processor

2MHz 386SX

RAM

4Mb expandable to 20Mb

ROM

AMI BIOS

Mass storage

88Mb 19ms Seagate hard disk, 3.5 in floppy

Storage

Two drive bays (none free)

Expansion

Five 16-bit slots (three free)

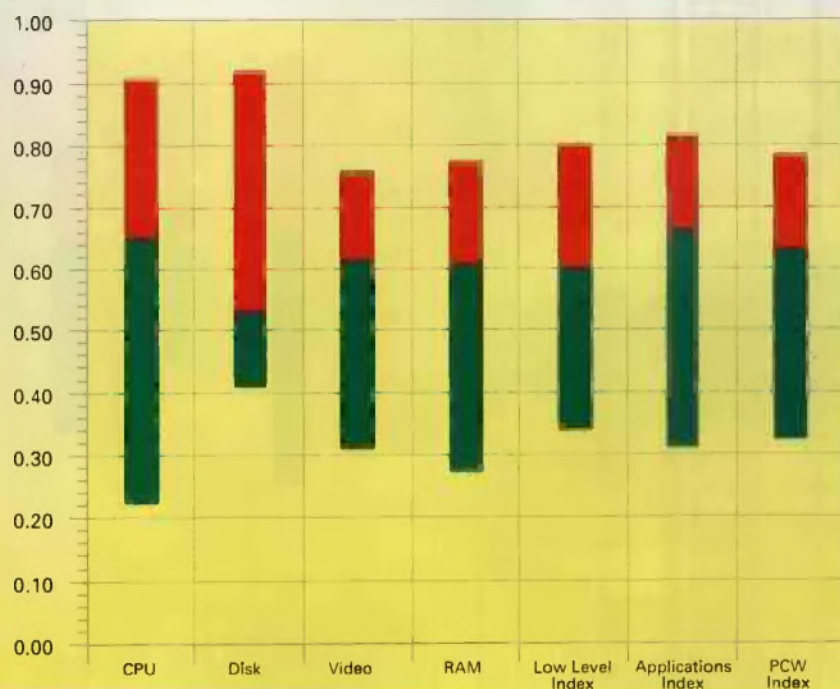
Manufacturer

Dan Technology 081-961 6959

Good Points Small footprint.

Bad Points Sluggish disk, even with the cacheing disk controller.

Conclusion Well built with good performance.





ports and PS/2-type mouse and keyboard sockets. Having two serial ports and a mouse port is unusual and welcome on a budget machine. There is also a mains outlet for the monitor, something you don't always get on such a slimline computer. The fan is loud but not uncomfortably so.

Dart has overcome the limitations of the compact case in one intriguing way. The five 16-bit expansion slots are all free, because the I/O including the SuperVGA come from the motherboard. Fitting cards into two of the slots might prove tricky as you need to slide the cards between the vertical mount holding the sockets and the power supply. But the other three slots are easily accessed.

Five slots is at least one more than you might expect from such a slim machine. However, on the review machine, one of the openings for the slots

at the back of the machine was occupied by the socket for the games port. The motherboard has the circuitry for the games adaptor but no socket for it. In the unlikely event that you need all five expansion slots, you're going to have to remove the games socket.

The SIMM sockets are nicely in the open. The 387SX maths co-processor socket, while surrounded by cables and drives, shouldn't prove too difficult to get to. Indeed, while the inside of the machine is necessarily busy, given its compact dimensions, maintenance and upgrading present no real difficulties.

Application drivers

The machine comes with a smart Silitek two-tone keyboard. This has a very positive feel without being heavy to use. It has a standard AT-style plug but comes with an adaptor cable for the PS/2-style socket on the machine. That could be useful if you want to use another keyboard.

The SuperVGA display supports resolutions up to 1024x768, and comes with support disks with drivers for applications such as Windows, Lotus 1-2-3, WordPerfect 5, GEM and AutoCAD. The monitor is sharp and has a reasonably square screen.

Compared with the rest of the review machines, the Dart's performance is about average, turning in benchmark speeds that usually just beat the mean figures. Given that 386SX machines are rarely bought for the kind of applications that demand high performance,

this means you're unlikely to be disappointed on the grounds of speed. But if you want to do some serious number crunching you might appreciate a little more.

Note that the machine Dart is now selling is slightly different from the review sample in that it has a different VGA section, so treat the display benchmarks with caution.

The Dart comes with a choice of MSDOS 5 or DRDOS 6. You can buy the machine with 1Mb of memory to start with, but doing that means using 256K SIMMs. If you want to upgrade you're going to have to throw these away, so it's better to start with 2Mb made up of 1Mb SIMMs. The maximum you can plug into the motherboard is 16Mb.

The review machine, with 4Mb of memory, colour SuperVGA and a 104Mb hard disk, would set you back £1079, which is excellent value. If you're happy with 2Mb of memory you can knock £80 off that price. All prices include a pleasant two-button bus mouse. It all amounts to a very competitive product.

Steve Mansfield

DECstation 320

The Digital Equipment Company, otherwise known as Digital or just simply DEC, might not be the largest vendor of IBM compatibles (although it doesn't do badly, shifting around \$1 billion worth a year) but it is one of the world's

Dart 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

104Mb 22ms NEC hard disk,

3.5in, 5.25in floppies

Storage

Three drive bays (none free)

Expansion

Five free 16-bit slots

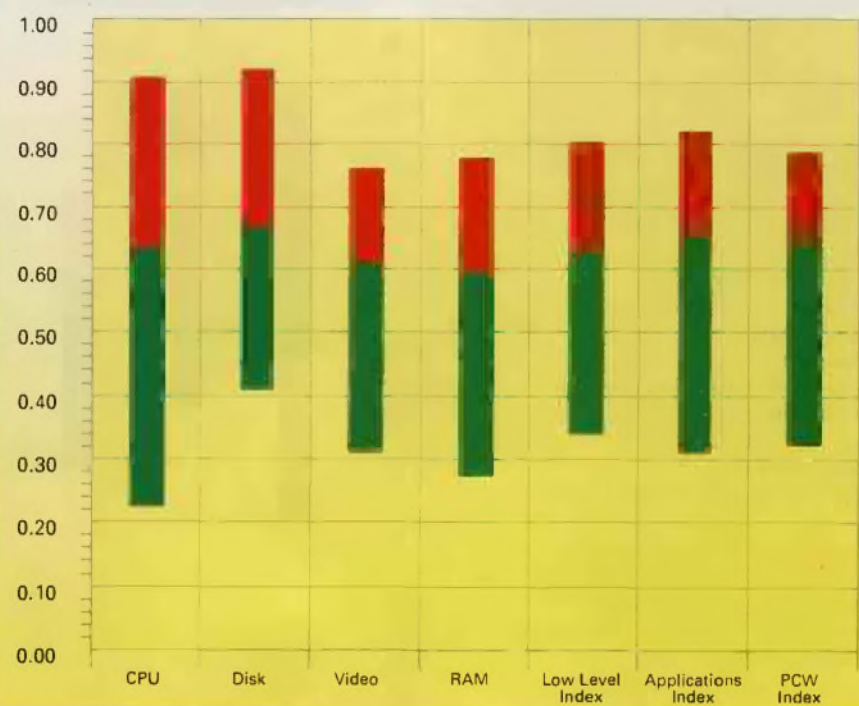
Manufacturer

Dart (0794) 511505

Good Points Well designed with good keyboard.

Bad Points Noisy fan.

Conclusion Worth looking at.



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largest computer companies with 120,000 employees and a history stretching back to 1957.

DEC's first venture into the PC market was the rather unsuccessful VaxMate, which you could connect to your corporate VAX and run DOS. It was expensive and, combining IBM and DEC cultures, produced an unhappy mix.

Today DEC markets the full range of PCs, from the 386SX-based DECpc 320SX notebook (complete with strange finger-nail driven mousepad) up to the 486-based DECpc 433 workstation, in addition to integrated PC networking products like PATHWORKS.

The review machine, the DECstation 320, is DEC's 386SX desktop model, running at 20MHz. My first impression was that this wasn't just another Taiwanese clone. The system unit, monitor, keyboard and mouse are all unique, designed and built DEC products. DEC's

multi-nationalism became clear as an Irish three-button mouse, and an Italian system unit and monitor, met a Mexican keyboard for the first time on our office floor, after journeying thousands of miles.

Volume control

Everything had the look and feel of quality. The very angular system unit faces the user with the usual lights and switches, which include a system-reset button, cover security lock, and a curious vertically-sliding knob which turned out later to be exactly what it resembled — a volume control! A single 1.44Mb drive is positioned above removable panels for an additional 5.25in or 3.5in drive.

Neatly labelled at the rear of the unit were the ports — one parallel, one 25-pin serial, video, PS/2 mouse and keyboard — and the power input/output sockets and four expansion backing plates.

The heavy (15kg) radiation-shielded monitor was counterbalanced by a light (6.5kg) system unit which though constructed of plastic was also shielded. Undo two screws and the system unit lid comes off faster than an Ayrton Senna pit-stop — it's all in the design.

Inside, everything is neatly laid out. Lots of elbow room is available for fitting your co-processor, up to 12Mb of RAM (with SIMMs, on the motherboard) and four full-length expansion cards. Everything is on the motherboard, including the video hardware. A 100Mb Conner hard disk sits beside the floppy drive at the front. The

remaining space is taken up by a large 110W power supply.

Not so impressive are four patch wires soldered on to the motherboard, overcoming a design error. No doubt these will vanish on the board's next release but it's still not what you would expect from DEC.

The very light weight of the system unit is due to the extensive use of plastic in its construction. The unit is not as robust as an equivalent metal box but it is lighter, and this lack of dead weight could be very attractive to some users — myself, for one.

In use the machine was as competent as most. Our benchmarks put it about three quarters of the way up the performance ladder. It ran Windows 3.0 and Microsoft's Flight Simulator smoothly and without any problems. The keyboard was nicely sculptured but with a feel that I thought too firm. The screen performed adequately and was stable and clear but was a little too curved for my liking. The fan was relatively silent.

DOS 3.3 was loaded on the test machine when it arrived, but it came without the associated manuals. A real customer would get full documentation, including the useful if unnecessarily bulky five-language guides that we did receive.

In summary, the DECstation 320 is a competent machine that will do the job. But buying just a single machine is expensive. It is aimed rather at the corporate market, where 100-plus PCs are sold at a time.

Nick Edmunds

DECstation 320

Processor

20MHz 386SX

RAM

4Mb expandable to 12Mb

ROM

Olivetti BIOS

Mass storage

120Mb 19ms Conner hard disk,
3.5in floppy

Storage

Three drive bays (one free)

Expansion

Four free 16-bit slots

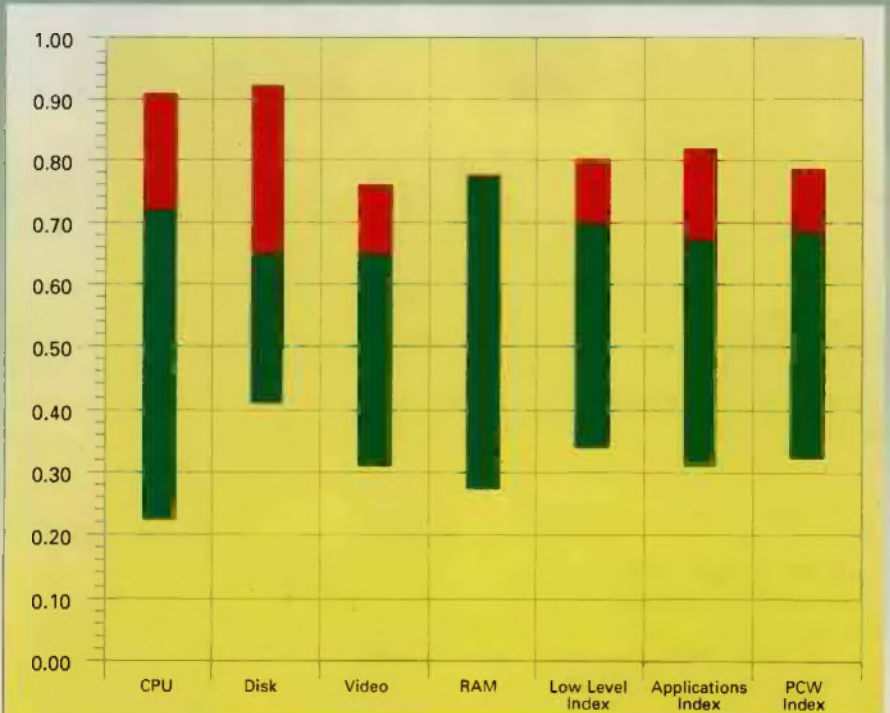
Supplier

DEC (0800) 393200

Good Points Lightweight system unit and a supplier that should be around tomorrow.

Bad Points Expensive and maybe too lightweight.

Conclusion Nice corporate machine with big-company backup.



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**COMPUTER
BUYER
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Dan-486c/33

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• 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

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Add £42.00 for every additional 1MB RAM.

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64K CACHE SYSTEM**

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• 40MHz Main board with i80386-40 Microprocessor, AMI BIOS, 64KB (upgradable to 512KB) cache memory & Shadow RAM for System & Video BIOS
• 1MB RAM on board (32MB max) • 200W Power supply • Small footprint case • 102 UK Keyboard
• 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO	14" COLOUR
NO HDD	£ 630	670	824
40MB (28ms) IDE	£ 808	849	1002
88MB (19ms) IDE	£ 891	932	1086
125MB (19ms) IDE	£ 973	1014	1168
200MB (15ms) IDE	£1134	1175	1329
300MB (16ms) IDE	£1485	1526	1679
420MB (14ms) IDE	£1802	1842	1996

Add £42.00 for every additional 1MB RAM.

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

£527

• 33MHz Main board with i80386-33 Microprocessor, AMI BIOS, 64KB (upgradable to 256KB) cache memory & Shadow RAM for System & Video BIOS
• 1MB RAM on board (32MB max) • 200W Power supply • Small footprint case • 102 UK Keyboard
• 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO	14" COLOUR
NO HDD	£ 601	641	795
40MB (28ms) IDE	£ 779	820	973
88MB (19ms) IDE	£ 862	903	1057
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200MB (15ms) IDE	£1105	1146	1300
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SYSTEM**

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• 1.44MB Floppy drive • IDE Hard & Floppy disk controller • 1 Parallel & 2 Serial ports.

MONITOR	12" MONO	14" MONO	14" COLOUR
NO HDD	£ 515	555	709
40MB (28ms) IDE	£ 693	734	887
88MB (19ms) IDE	£ 776	817	971
125MB (19ms) IDE	£ 858	899	1053
200MB (15ms) IDE	£1019	1060	1214
300MB (16ms) IDE	£1370	1411	1564
420MB (14ms) IDE	£1687	1727	1881

Add £42.00 for every additional 1MB RAM.

**IDE HDD CACHE
CONTROLLER**

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*The addition of the hard disk caching controller gives the balance that you'd otherwise need an EISA-based system for, but at considerably lower cost. You could opt not to buy the caching hard disk controller, and save £285. But that'd be a false economy. You'd be the first to kick yourself if you experienced what the machine is capable of with it.
Computer Buyer, AUG '91

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Tandon MCS

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486sx-20 105Mb

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486-33 105Mb

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Tandon PAC II

■ New SCSI based PAC II. 386sx-20c, 486sx, 486-33.

486-33 £1699

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■ Optional floppy drives (3.5", 5.25", or both). Optional fast 15ms SCSI Data PACs (40Mb to 400Mb).

486sx-20 £1399

386sx-20c £1099

Prices shown are for complete VGA mono systems with Tandon mouse, Windows 3.0 and DOS 5. PAC II exclude PACs & drives

Model	MCS 386sx-20				PAC II 386sx-20c
	RAM	42 Mb	105 Mb	200 Mb	400 Mb
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4Mb Enhanced	£1099	£1249	£1449	£1949	£1199
8Mb Enhanced	£1299	£1449	£1649	£2149	£1399
16Mb Enhanced	£1649	£1799	£1999	£2499	£1749

286-16 £100 less 386sx-20 Cache £100 extra
486sx-20 £300 extra 486-33 £600 extra

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☐ Tandon VGA colour screen £100 Extra
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☐ 17" Panasync screen alone £750 extra
☐ 14" Panasync bundle £250 Extra
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☐ Streamers: 120Mb £299 250Mb £399

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option available with all Tandon MCS & PAC II systems

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Enhanced 102 keyboard

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Dell 320SX



Dell is one of the most widely recognised of the clone makers, with a good reputation for service and for competitively priced high-quality systems. The review machine, bearing a label saying it was built in Ireland, had an impressively clean, business-like appearance. The system unit was robust and not oversized, and the front fascia was uncluttered by needless buttons and lights, although I was rather surprised at the lack of a hard-reset button. The case is well constructed and gives an overall quality feel to the machine.

A 'personal message from Michael Dell', thanking me for purchasing the machine, came with the clear and comprehensive set of user manuals.

On powering up, the first sign of life was a grating sound from each of the floppy drives. The usual booting-up

sequenced didn't take too long, and I was then introduced to Michael Dell's auto-running 'Hello and Welcome' program, and a utility for making bootable DOS diskettes. This is a sensible precaution for inexperienced users who are about to configure their system.

The monitor supplied is a fairly standard VGA model, of reasonable quality and with an easy-to-use swivel-action base. The display is stable, with good colours, but the on-board VGA controller (of no discernable brand) is very slow when displaying graphics. It looks as though Dell decided to offer the bare minimum in this department.

In use the machine is fairly quiet, with the exception of the two floppy drives which grind away rather alarmingly. The keyboard would swamp the average desk, but has a pleasant action and is sensibly laid out, with large Enter and Backspace keys.

Limited options

The hard disk supplied was an 82Mb IDE unit, with the controller integrated onto the motherboard — again limiting options for future expansion. It operated reliably and with reasonable speed, although the disk-activity light on the front panel refused to operate. Also fitted as standard were two serial ports (both 9-pin), one parallel port, a PS/2-style mouse connector (no mouse supplied), and a PS/2-type keyboard port.

When I opened the box up, disappointment set in. A rat's nest of cables, crammed between the drives and the PSU, was in danger of being severed by

the case as I slid it open. The motherboard was generally neatly laid out, but the choice of components seemed geared to cost rather than quality (the supplied 4Mb SIMM contained no less than three different brands of chip!). The maximum memory is 8Mb, comprising two 4Mb SIMMs.

Three 16-bit slots are available for expansion, which I think is insufficient. A totally unpopulated card, in an MCA-style slot, is labelled JCACHE. On removing it, the machine refused to start and I can only suppose that it's an option for upgrading the caching capability, but I could find no reference to it in any of the manuals. Fitting a maths co-processor should be a doddle, as the socket is easily accessible.

The chassis is incongruously rock-solid, given the quality of the other components used. Similarly, the PSU is an excellent Astec unit, which is beefy and should smooth out many spikes from poor mains supplies.

I expected more from a renowned outfit like Dell. The machine performed excellently but lacked the quality one anticipates. I would question the long-term reliability of a large proportion of the components used, and I was surprised at the limited opportunities for future expansion in a system which purports to be a full-blown PC rather than just a networked workstation. Nevertheless, it will appeal to the corporate market where Dell's name, pricing and good support will carry it through.

Jon Silver

Dell 320SX

Processor

20MHz 386SX

RAM

4Mb expandable to 8Mb

ROM

Dell/Phoenix BIOS

Mass storage

80Mb 17ms Quantum hard disk,

3.5in floppy

Storage

One spare drive bay

Expansion

Three drive bays (one free)

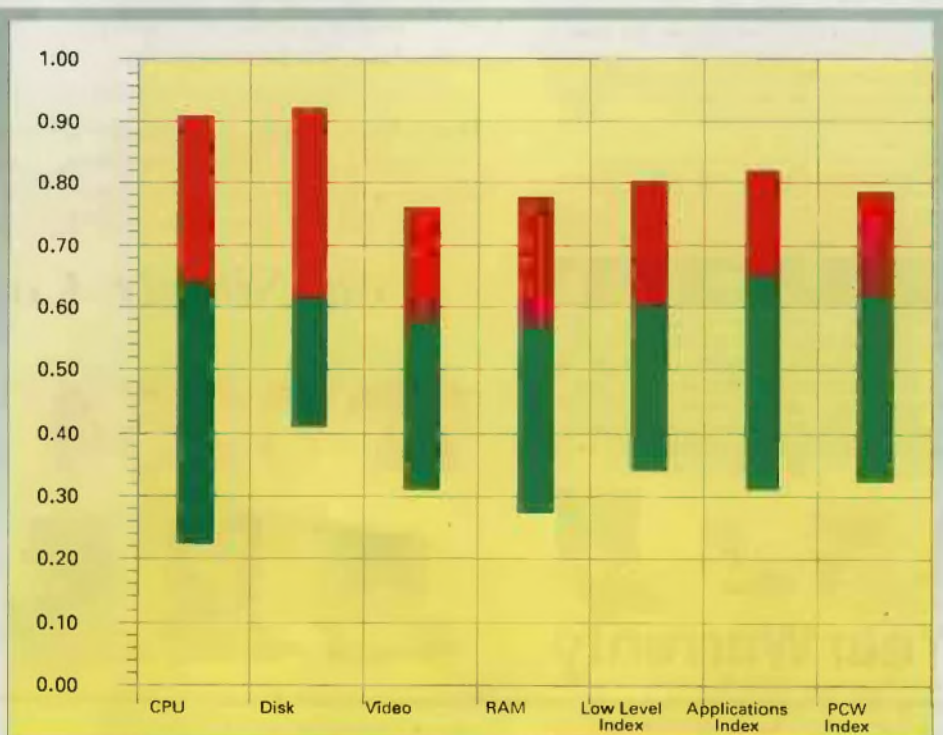
Manufacturer

Dell (0800) 414535

Good Points Speed

Bad Points Quality below expectations.

Conclusion Look at other offerings first.





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Digitask Axiom 386SX-20



Digitask has been on the scene for a while, coming along into a market that Amstrad had made acceptable. It has always concentrated on bread-and-butter clones, and it's interesting to see how the company is adapting now that its chosen marketplace is quite so crowded.

The Digitask Axiom 386SX-20 came, rather surrealistically, in a box on which were depicted mice playing tennis, cows smoking pipes, and so on. Inside was a different story, a standard Far-Eastern box with the three round buttons for Turbo, Reset and Power. And, as Einstein would have said had he forsworn physics for PC reviewing,

where there's a Turbo button there's a little two-digit LED display. Einstein would have been right in this case. There's also, of course, a tiny keyboard lock switch, a last ancestral echo of the original IBM AT.

And, if this is a standard clone, there should be two serial and one parallel port, together with a joystick interface. It is and there are, all courtesy of the same multi-function interface board that has filled a thousand slots. But I'm getting ahead of myself; to see the board, you must first take off three screws and lift away the top of the pressed-steel box.

Small motherboard

Inside lurks a very small motherboard, no bigger than an LP cover, with a UMC chipset. UMC, although not as famous as Chips & Technology or VLSI, has had a long history of producing cheap versions of fairly complex chips (such as the 6845 video controller at the heart of the CGA, MDA and Hercules video adaptors, and other PC-related interface chips). There are just two chips in this configuration, and the rest of the motherboard is sparsely populated.

There is, of course, a 387SX-20 coprocessor socket which this time is accessible without further ado. There is, of course, a tangle of wires connecting everything to everything else; the Digitask, however, has quite the largest clutch of twisted little pairs of wire, all different, that I've seen.

There's no provision for cache memory in this computer. Come to that, there's not that much for main RAM: you can fill the four SIMM sockets with 1Mb parts and then stick an extra megabyte in the DIP sockets next to them, but that's that. No more than 5Mb.

The display card uses a Trident video chip; these are less common than the ubiquitous Tseng, but still have a reasonable supply of third-party support when it comes to graphics programs and software drivers. This board has, as is increasingly common, 1Mb of video RAM which enables the production of 1024 x 768 x 256 colour high-resolution displays.

The drives are, as usual, one 3.5in and one 5.25in floppy and a Conner 80Mb IDE drive. This, with the 3.5in floppy drive, has a little 3.5in mounting bay away from the main area, which can hold up to three 5.25in devices. Since only one is taken up, this leaves enough room for oodles more hard disk. There are five 16-bit ISA slots and one 8-bit; two of the big slots are taken up with the interface and video adaptors. All are full-length, unencumbered by encounters with anything else on the board.

Poor documentation

The documentation is not good enough. Two manuals were provided: the video card handbook was OK, but the motherboard book was unclear, terse

Digitask Axiom 386SX-20

Processor

20MHz 386SX

RAM

4Mb expandable to 5Mb

ROM

AMI BIOS

Mass storage

80Mb 19ms Conner hard disk, 3.5in, 5.25in floppies

Storage

Five drive bays (two free)

Expansion

Five 16-bit slots (three free), one free 8-bit slot

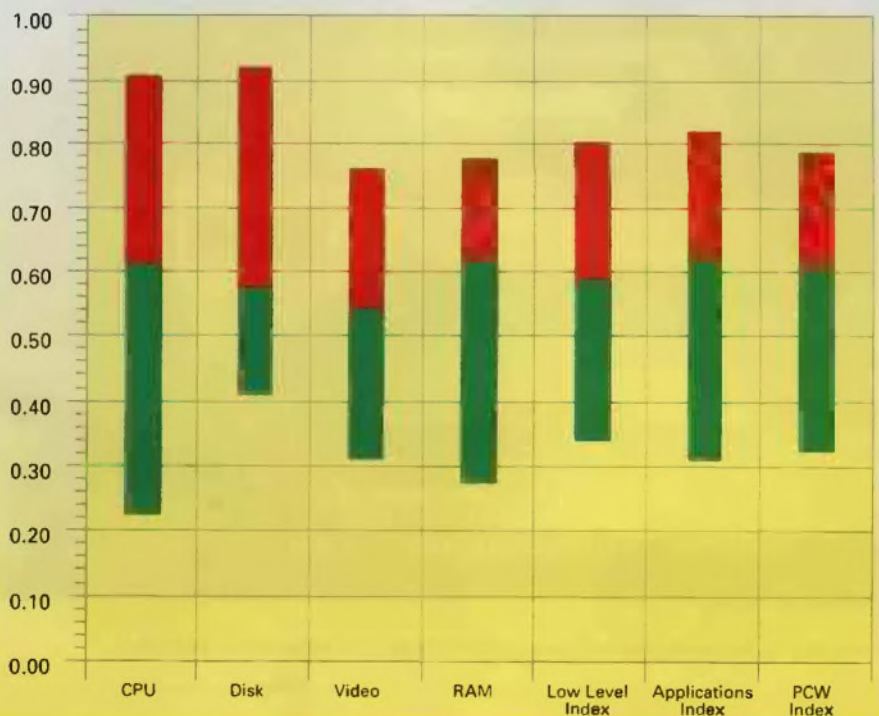
Manufacturer

Digitask (0293) 776688

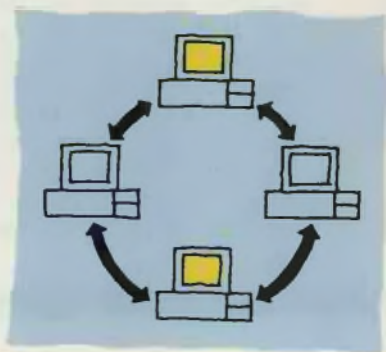
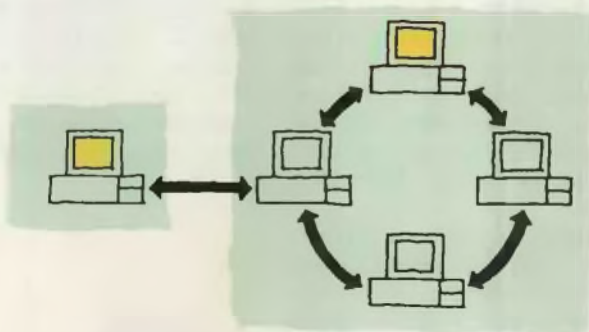
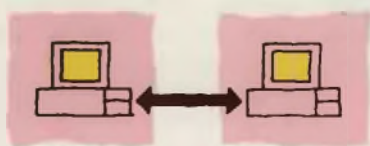
Good Points Comes in daft cardboard box.

Bad Points Untidy wiring, incomplete documentation, RAM limitations.

Conclusion Standard and slightly tacky.



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and even though it was only 18 pages long was mostly padding with incidental detail of the chips and IO addresses. There wasn't even a flimsy flier to let you know what to do if your modem card conflicts with something on the interface adaptor. Gah.

The keyboard was slushy and unresponsive. The monitor — a rebadged Mitac — was OK, although a little dim at some of the higher resolutions. It could cope with the highest that the Trident provided.

Could try harder

This is all fairly old technology, and some of the restrictions, such as maximum RAM size, are beginning to look as if they might be more important than they were when the basic design was finalised. No software came bundled with the machine, although deals offered by Digitask may be different in this respect.

I rather think Digitask should try a little harder with the internal neatness and the documentation for this computer. With those sorted out, it should appeal to those who are after a no-frills deal.

Rupert Goodwins

DS Computers DSi 386SX/20

The DSi 386SX/20 is one of the new PC breed using AMD's 20MHz clone of

Intel's 80386SX, and is also unusual in that it comes in a tower-style case with a mass of rear blanking plates covering potential serial ports for a terminal-based multi-user system.

The case also gives enough storage options for the machine to be used as a network server, although most users would require something a little more powerful for that job. There is space for two half-height 5.25in storage devices with access to the outside world, and two externally-accessible low-profile 3.5in drives. There are also two bays for half-height 3.5in and 5.25in hard disks.

The front panel has the usual indicator lights and Power, Reset and Turbo buttons, along with a two-digit speed indicator just above the 3.5in floppy drive bays. The review system came with one 3.5in floppy and one 5.25in drive, with a half-height 3.5in IDE hard

disk occupying the lowest bay.

At the rear the only motherboard connector is for the keyboard, and the parallel port, twin serial port, and VGA monitor socket are on expansion board plates.

Inside the box, the motherboard is dwarfed by the solid metal frame. The board is made by Peaktron, and actually comes in 80286 and 80386SX versions with the same expansion slot and memory configuration. The board is startlingly simple: just one custom Peak SA1 chip, the processor, and a few other chips including the AMI BIOS.

Memory configuration

The memory configuration is a little odd, since SIMM slots and sockets for ordinary RAM chips are provided, and users can add both types of memory if they wish. Using only the four SIMM slots, memory configurations range from 2Mb to 16Mb, while adding eight RAM chips along with two SIMMs can provide either 3Mb or 6Mb. A maximum of 36 RAM chips can be used, with each SIMM counting as nine, which explains the odd sizes.

On the review system 4Mb of RAM was fitted, using all four SIMM slots. The lack of functions on the motherboard means that all the interfaces are on expansion cards. The video board is a Tseng Labs MegaVGA/1024 using the highly-rated Tseng ET4000 chip, with 1Mb of video memory to support resolutions up to 1024 x 768 non-interlaced in 256 colours. The ac-



DS Computers DSi 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

105Mb 25ms Toshiba hard disk,
3.5in, 5.25in floppies

Storage

Six drive bays (three free)

Expansion

5 16-bit slots (three free),
1 free 8-bit slot

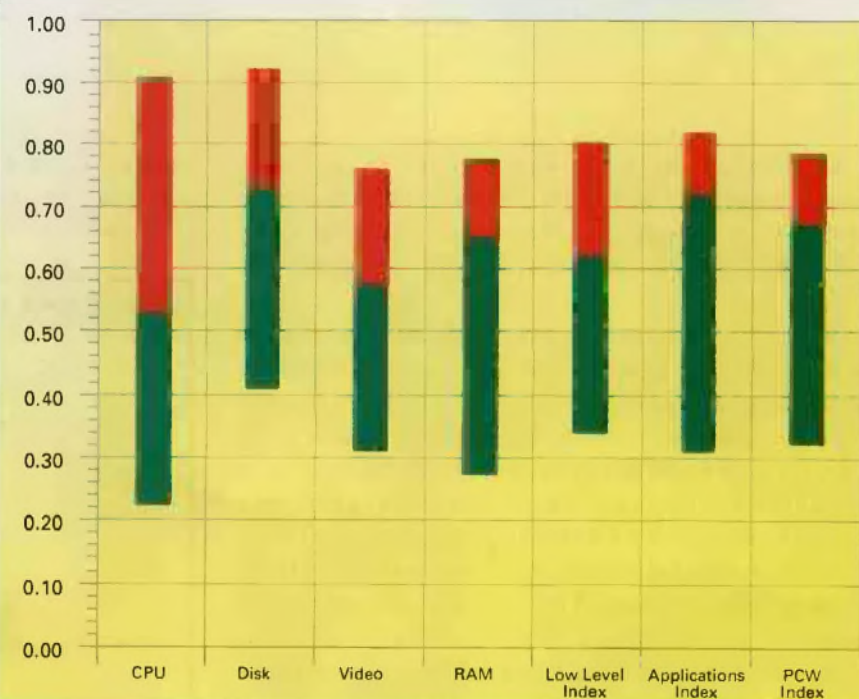
Manufacturer

DS Computers 071-281 5096

Good Points Solid casing, decent performance.

Bad Points Limited expansion.

Conclusion Looks like a file server, but isn't.



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386-25	36MHz	£675	£775	£795	£815
386-33 Cache	58MHz	£775	£875	£895	£915
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ST1144A	IDE	130MB	19ms	3.5"	£245
ST1239A	IDE	211MB	15ms	3.5"	£425
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ST2383A	IDE	338MB	16ms	5.25"	£795
ST157N	SCSI	49MB	28ms	3.5"	£199
ST177N	SCSI	65MB	20ms	3.5"	£275
ST1096N	SCSI	83MB	24ms	3.5"	£275
ST1126N	SCSI	111MB	15ms	3.5"	£385
ST1201N	SCSI	177MB	15ms	3.5"	£455
ST1239N	SCSI	211MB	15ms	3.5"	£450
ST2209N	SCSI	183MB	15ms	5.25"	£565
ST2383N	SCSI	338MB	16ms	5.25"	£799
ST2502N	SCSI	440MB	16ms	5.25"	£975

FULL HEIGHT

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ST4350N	SCSI	307MB	16ms	5.25"	£799
ST4702N	SCSI	613MB	16ms	5.25"	£1199
ST4766N	SCSI	676MB	16ms	5.25"	£1299
ST41200N	SCSI	1.05GB	15ms	5.25"	£1350
ST41650N	SCSI	1.42GB	15ms	5.25"	£1599
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CONNOR DISK DRIVES

HALF HEIGHT

MODEL	TYPE	SIZE	SPEED	FORM	PRICE
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CP-2064	IDE	60MB	19ms	2.5x1"	£475
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CP-4044	IDE	42MB	29ms	3.5x0.78"	£225
CP-30064	IDE	60MB	19ms	3.5x1"	£210
CP-30084	IDE	84MB	19ms	3.5x1"	£265
CP-3104	IDE	104MB	25ms	3.5x1.625"	£285
CP-30104	IDE	120MB	19ms	3.5x1"	£335
CP-3204	IDE	212MB	16ms	3.5x1.625"	£465
CP-3040	SCSI	42MB	25ms	3.5x1"	£185
CP-3180	SCSI	84MB	25ms	3.5x1.625"	£310
CP-3100	SCSI	104MB	25ms	3.5x1.625"	£315
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	CX83D87-20GP	£170
	CX83D87-25GP	£170
	CX83D87-33GP	£175

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80286-16	£70
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80386SX-25-Cache	£225
80386-25	£250
80386-33-Cache	£350
80386-40-Cache	£399
80486-33 Cache	£695

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M2614ET	IDE	105MB	19ms	3.5x1"	£245
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M2625A	SCSI	330MB	12ms	3.5x1.625"	£750
M26235A	SCSI	420MB	12ms	3.5x1.625"	£799
M26245A	SCSI	520MB	12ms	3.5x1.625"	£899
M26235A	SCSI	676MB	16ms	5.25x3.0"	£980
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QUANTUM 105MB	9ms	HARD CARD	£375

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ST41200N	SCSI	1050MB	16ms	5.25"	£1600
ST8384E	ESDI	155MB	14ms	5.25"	£850
ST4442E	ESDI	337MB	14ms	5.25"	£950
ST4766E	ESDI	676MB	14ms	5.25"	£1399

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Phillips 14" Mono VGA Monitor	£95
Tystar 14" Colour XGA (1024x768.28")	£185
Sampo 14" Colour Multi-Sync (1024x768)	£265
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VGA Card 16-Bit 512KB (Trident)	£60
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tual resolution attainable depends on the monitor connected, and the review system came with a Supercom SV1485 14in multiscan screen.

Graphics drivers at 800 x 600 and 1024 x 768 in up to 256 colours are provided for AutoCAD and AutoShade, all versions of Windows, and GEM and Ventura, and extended text-mode drivers are also there for Lotus packages and WordPerfect. Tseng also supplies utilities to switch graphics modes in software, edit and load custom fonts, and copy the video BIOS to RAM for faster operation.

The other board in the system combines floppy disk and IDE hard disk controllers, two serial ports and a parallel port, and as usual with these boards this involves a maze of cables from the board to the rear panel as well as from the board to the drives. Despite the size of the case there are only six expansion slots available, and one of those is an 8-bit slot. With the video board and interface board installed, only three 16-bit slots are available for expansion.

It would also be necessary to plug in another board to make use of all the storage bays, since the multi-function board only supports two IDE hard disks and two floppy drives. There seems something of a mismatch between the electronic design and the case size in this machine.

Joining the chase

In use, the machine performed much as expected. The CPU performance was barely average, but the speed of the 150Mb hard disk pulled it into the pack chasing the fastest machines overall. Interestingly, pressing the Turbo button switched the front-panel display between '20' and '26', but there was nothing in the documentation to show what this meant; the main oscillator was a 40MHz crystal, so it is hard to believe that it was driving the machine at 26MHz in turbo mode.

The mouse supplied was another unpleasantly-plasticky three-button type from Axelen, and the keyboard was another of the lightweight, compact-size units that are becoming increasingly common. Again, this NTC keyboard had a large Enter key and a small Backspace, which could confuse those used to larger layouts.

The monitor also performed well, with bright colours and minimal pincushioning even at the highest resolution, and front-panel controls can adjust horizontal and vertical sizing and position in different modes. Some adjustment was necessary, in particular to switch between 1024 x 768 graphics mode and 80 x 25 DOS text mode.

If buyers choose this machine, they should be aware that the bulky case does not deliver the expansion potential it promises. There is not enough memory capacity, and not enough expansion slots, for it to act like the server it resembles.

However, for those who like tower machines it makes a decent PC, even though the execrable documentation makes finding that out harder than it should be.

Peter Jackson

Elonex PC-320X



Elonex is one of the survivors of the British computer industry. While clone builders have come and gone, Elonex and a handful of others (most notably Opus) have simply edged up market. No longer a simple box shifter, Elonex sees itself very much as a supplier capable of satisfying everyone from corner shops to oil companies.

The company even took the radical step recently of having its systems designed for it, rather than buying in and rebadging a Taiwanese design. Inevitably, costs will rise. So, hopefully, will quality. But will it be enough?

Good looks

The PC-320X is certainly a good-looking PC. Smaller than most, it is still large enough to have sensible expansion capabilities with three free, accessible full-length 16-bit ISA slots.

The case is unusually light, thanks to an unusual (for the computer industry) construction of good-quality plastic parts (metal lined for emission control purposes) around a sturdy metal frame. You can't tell it's designed for Elonex, but you can tell it was designed.

There's not much about the outside of the case that will surprise you. The front panel has two 5.25in drive bays, one containing a drive of the same size,

one a 3.5in floppy. There's a pair of LEDs, for power and hard disk access, and a pair of switches, one to reset the PC, the other, one of a pair of power switches. Honestly.

There's a rocker switch on the back which directly controls mains input, and the switch on the front separates that from the internal components. Elonex calls it a standby switch, and in some ways it's quite elegant. The front of the case is a sensible place for a power switch, the opposite, rear corner the best site for the transformer. The usual solution is a complex mechanical system to push a button at the back when you push one at the front. On the other hand, do you really need two switches?

A second switch is the only odd thing at the back. You expect to find mains in and out, a keyboard connector (the increasingly popular PS/2 style), two 9-pin serial ports, one parallel port and a VGA connector. And that's what you get.

Cosmopolitan

No less than seven screws, one at the back and three along the bottom of each side, hold the lid in place. Once out, the lid comes off fairly easily.

Inside there's the one of the most cosmopolitan motherboards I've seen for a long time with silicon from Chips & Technologies, Megatrends, OPTi, Samsung and Goldstar. The BIOS is from relative newcomer Microid Research (the company name allows a cutesy MR BIOS label to be placed on the chip) and seems pretty solid.

That sums the machine up, really. The 100Mb Quantum drive is a high-quality component and, as the benchmark figures show, the controller does it justice. The only component which lets the side down is the on-board VGA which provides only standard VGA modes. VESA-compliant SuperVGA is standard on most PCs these days.

I know lots of people who'd like the keyboard. I hated it. From Key Tronic, a respected supplier, you can't fault the quality but the narrow, heavily-tapered keys feel small and cheap, even though the touch suggests the opposite. Maybe it's just me, but I like to hit each key square on the face, not on the edge as you invariably do with the Elonex unit.

Inoffensive mouse

Most of the SXs came with some sort of hardware and software bundle. DOS 5 you expect and Windows 3.0 is almost as common. Elonex provides both as well as an Elonex-badged QTronix mouse which is best described as inoffensive. It's a little too light to be really

Elonex PC-320X

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

MR BIOS

Mass storage

100Mb 19ms Quantum hard disk,

3.5in floppy

Storage

Four drive bays (one free)

Expansion

Three free 16-bit slots

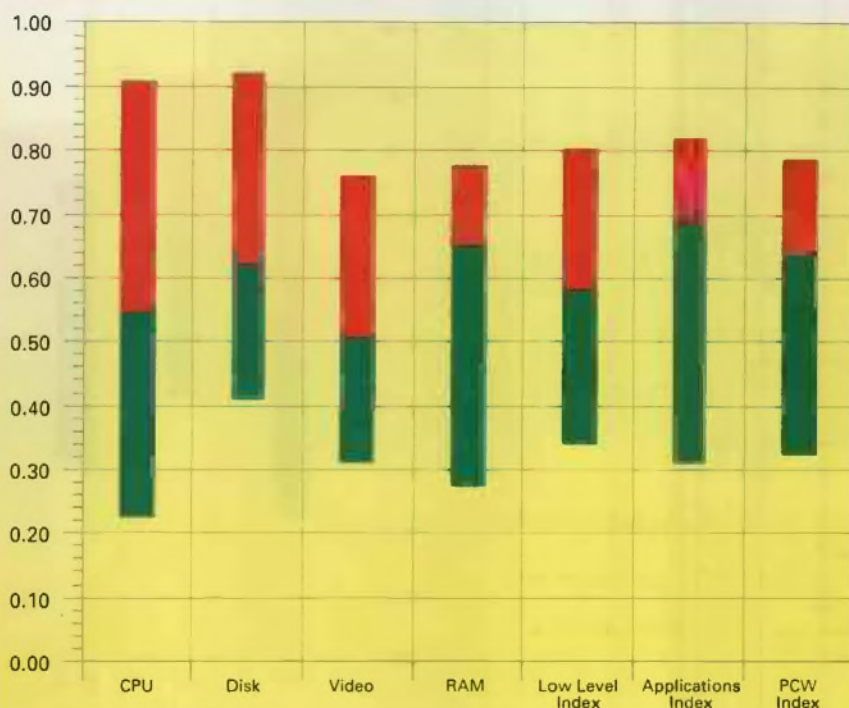
Manufacturer

Elonex 081-452 4444

Good Points Well built, well equipped.

Bad Points Poor VGA, by today's standards.

Conclusion Attractive, solid clone.



pleasant, but you can pay real money for worse.

Unlike most suppliers, both DOS and Windows manuals have an Elonex cover with an odd but not unattractive piece of pixellated artwork which matches the labels on the disks. I don't know why, but it makes them feel better somehow. The code is bog-standard, first-release Windows 3.0, rather than the 3.0a and 3.0b versions some manufacturers supply.

The Elonex is a well built, reasonably quick (that is, not embarrassingly slow) SX which has had a reassuring amount of care put into its design, construction and marketing.

Guy Swarbrick

Goldstar GS318

From time to time, reviewing a machine, I find myself wondering why the manufacturer chose to do things in a particular way. The Goldstar caused me to ask that question a couple of times, initially for a rather frivolous reason: I was somewhat puzzled by the choice of a particularly objectionable shade of aquamarine for the on/off and reset buttons on the front panel.

Opening the machine forced me to ask the question again, and this time for a less frivolous reason. The Goldstar has a rather unusual motherboard, in that the motherboard itself has just one expansion connector into which is plugged a separate card which houses

five expansion slots, one 8-bit and four 16-bit, so any add-in cards are located horizontally.

It's not unusual

There's nothing particularly unusual about this arrangement; well-respected manufacturers — Dell among them — have been doing it for a while. What is odd is the number of slots, since providing five slots means that the case is just as tall as it would be using the conventional arrangement. In their compact machines Dell, Apricot and others provide fewer card slots and mount the cards horizontally to allow them to reduce the height of the case.

Goldstar has produced a machine with the slight disadvantages associated with horizontal cards: cooling is a little less effective, and some of the chunkier hard cards can suffer from alarming 'sag', without gaining the ad-

vantage of a lower-profile case.

Although the Goldstar may be a little eccentric in some ways, in others it's a very sensibly designed machine. Having the VGA circuits and the hard-disk controller on the motherboard means that all of the five expansion slots are free. The lowest slot, a 16-bit one, does seem to be rather close to the memory SIMMs but it's a good deal better than many motherboards in this respect.

There are two banks of SIMM sockets on the motherboard; on the review machine one bank was filled with 1Mb 80ns SIMMs to give 4Mb of memory. Since no motherboard manual was supplied, it is not clear whether the motherboard can use the larger 4Mb SIMMs to expand the memory beyond 8Mb. The motherboard uses the Chips & Technologies chipset, which is moderately well regarded.

No machine manual

The on-board VGA circuit uses the Western Digital chipset and offers a maximum resolution of 800x600 pixels with 16 colours. As far as I can tell, there is no way of expanding the display memory of the VGA to offer more colours, which is a shame. Unfortunately the review machine was supplied only with manuals for the bundled copies of MSDOS and GW BASIC. No manual covering the machine itself was supplied.

Since the Goldstar uses the Phoenix BIOS, the setup is fairly straightforward, but I would have much preferred



Goldstar GS318

Processor

20MHz 386SX

RAM

4Mb supplied expandable to 10Mb

ROM

Phoenix BIOS

Mass storage

124Mb 24ms Toshiba hard disk,

3.5in, 5.25in floppies

Storage

Three drive bays (none free)

Expansion

Four free 16-bit slots, one free 8-bit slot

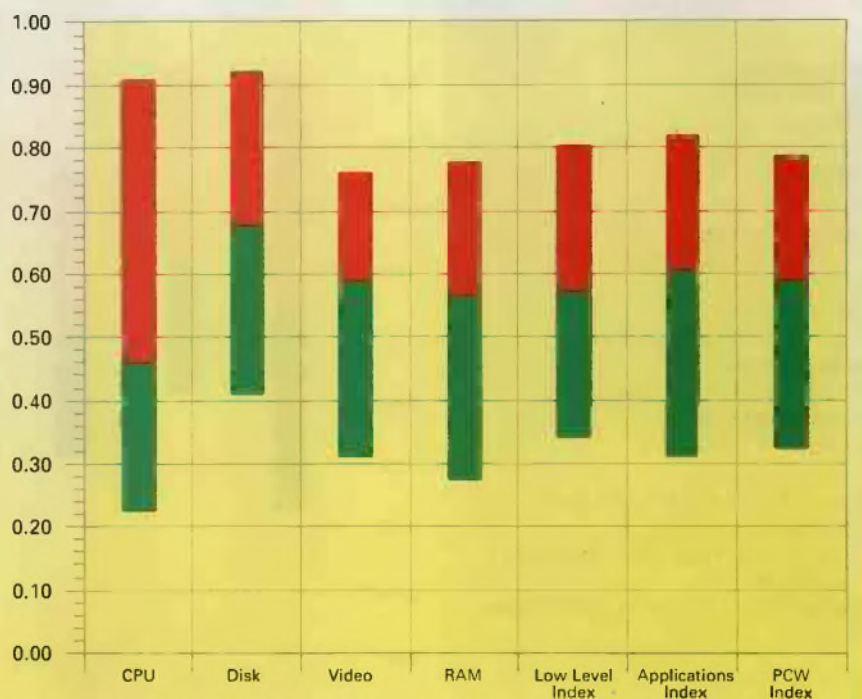
Manufacturer

Goldstar 081-309 1111

Good Points Keyboard and build quality.

Bad Points Not much expansion ability.

Conclusion Definitely worth a look.



to see some machine documentation. I would also have preferred a later version of MSDOS, since the Goldstar comes with DOS 4.01 which isn't my favourite version by a long way. Currently Microsoft is selling three versions of DOS to clone suppliers, and versions 3.3 & 4.01 are available rather more cheaply than DOS 5.

The review machine came with both sizes of floppy disk and a Seagate ST1144A 124Mb hard disk. With the two floppies fitted there aren't any drive bays left, which is unusual in a case of this size; normally you'd expect to be able to squeeze in another device. The monitor was badged as a 'Goldstar' and was quite impressive: it was sharp and well converged, and showed no sign of geometry errors.

The full-sized AT keyboard was rather pleasant too, with a moderate amount of click so that you know when you've pressed a key. Round the back there are parallel and serial ports, as well as a dedicated mouse port, although a mouse wasn't provided.

Goldstar grows on you

The Goldstar grew on me with use. It isn't blindingly fast—in fact, it's among the slower machines in this Group Test—but it does give the impression that it's well made and would be reliable. What I remained sceptical of was the lack of expansion potential, in both drive bays and the video card. While you could add an extra hard disk if you wanted, in the form of a hard card

(provided it was happy being mounted horizontally) a backup tape drive would have to be external. Overcoming the limitations of the video card would mean disabling the on-board VGA (except of course that without a manual, you aren't going to know how) and adding a new VGA card—rather more costly than a memory upgrade.

David Morton

HM Minstrel Workstation



The unusual design of this machine appealed to me as soon as it was unpacked. The first thing to attract my attention was the large sticker on the front facia which

declared 'Designed and Built in Britain'—a pleasant change from the usual Oriental or Yankee pedigree of such equipment. The box is lilliputian, the size belying the power lurking inside, and it's one of the few desktop machines which I would actually allow on my desktop. The sturdy metal case happily sat beneath the monitor without increasing its footprint on my (cluttered) desktop.

When powered up the machine quietly whirled into life, and after checking its memory, booted up the pre-loaded MSDOS 5. In use it is quiet. The Quantum hard disk supplied as standard made a low-pitched whine, and the cooling fan was noiseless. There is a hint of the noise of air rushing out of the slots in the side of the machine.

An Everex VGA card was supplied, which may need replacing if you want to run a lot of graphics-based applications since it is very slow despite being a 16-bit card.

Opening the case was straightforward. There are two screws at the back to undo, whereupon the case slides back, pencil-box style.

Marvel of miniaturisation

One side of the box is filled with the 3.5in hard disk drive and the compact power supply behind it. The other houses four vertically mounted 16-bit slots, one of which is occupied by the full-length processor card. On close inspection, this card is a marvel of miniaturisation, snugly housing the

HM Minstrel Workstation

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Quadtel BIOS

Mass storage

105Mb 15ms Quantum hard disk,
3.5in floppy

Storage

Two drive bays (none free)

Expansion

Five 16-bit slots (three free)

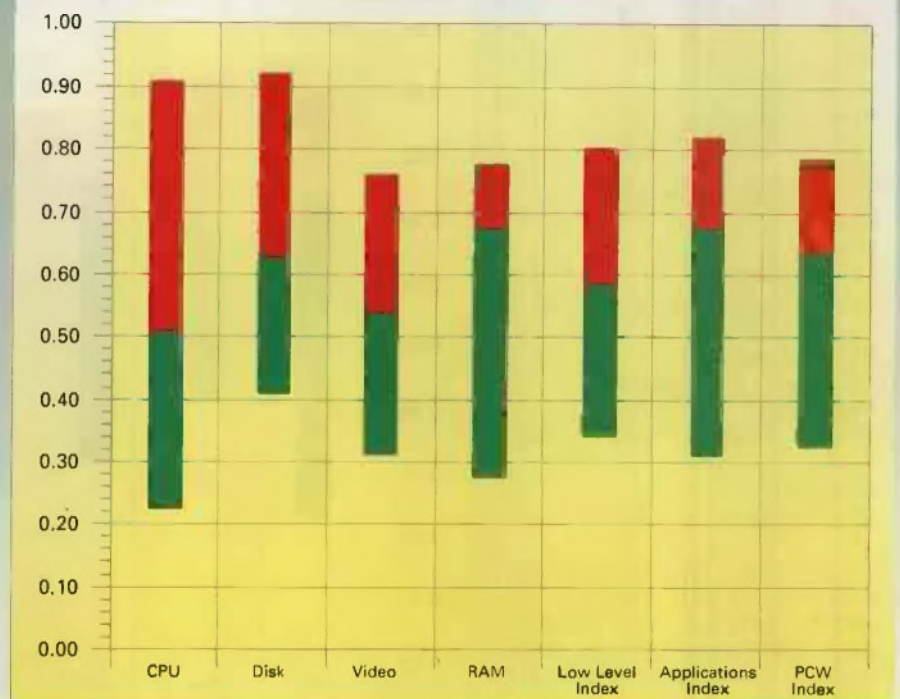
Manufacturer

HM Systems 081-209 0911

Good Points Superb design, well constructed, and it's British.

Bad Points Could do with more expansion ability.

Conclusion Go and buy one!



Intel 386SX processor, four 1Mb SIMM memory modules, and the controller for the hard disk, 3.5in floppy drive and serial and parallel interfaces. The slots are of the same high quality as the rest of the components, affording a secure and firm fit for the cards plugged into them.

The Everex VGA card occupies its own special slot which is mounted on the reverse side of the backplane board, above the power supply. This leaves just three empty slots for your own use, which might seem like a major restraint on expansion. Even so, the Minstrel will probably be used as a networked workstation, and will probably not need to house more than a couple of cards. More importantly, there is no way of expanding the disk capacity short of completely replacing the unit which is supplied as standard.

Internally, the layout is exceptionally neat. All the ribbon cables are of a sensible length and are anchored down to avoid fouling the other components. The components used throughout are well-known branded makes which should ensure higher reliability. The chassis and case is made of a slightly higher grade of steel than most other PCs, and is rock-solid.

Fitted as standard are two 9-pin serial ports and one parallel port. Also fitted at the rear of the machine are PS/2-style mouse and keyboard sockets (not labelled, unfortunately). Situated on the workstation's underside is a standard socket for an external floppy

drive.

The keyboard supplied is a 102-key model built in Ireland. It seems like a high-quality unit — the keys operate with a soft feel but without being spongy. I would be quite happy to use it day in, day out. The Minstrel also came equipped with a three-button Logitech mouse which performed admirably.

Muddy colours

The monitor supplied is a badge-engineered Kaga model, and gives a very stable and clear picture with a fine dot-pitch but with a slight muddiness in some of the colours, particularly blues. It is relatively compact, but the swivel/tilt base is a little stiff.

On the fascia are the usual LEDs indicating Power and Hard Disk activity (quaintly labelled Winchester Drive). Curiously there are two reset buttons, one small microswitch type and one large red one. Pressing the small one performs a hard reset on the machine, but the large one is fitted purely for show — the manual mentioned only that it could be connected as an option. The on/off switch is tucked away at the rear. The front panel is finished in a tasteful textured grey/brown plastic, and gives the machine a very well-finished appearance.

The best of British

On balance, the Minstrel is extraordinary. The high quality of components and construction should ensure

reliability, it's performance is good, and the unique British manufacture and styling makes a welcome change. It is one of the nicest pieces of equipment I have seen for a long time, and deserves strong recommendation.

Jon Silver

Hewlett-Packard Vectra 386/20N



Hewlett-Packard is a well-known company, but its renown in the world of PCs is from an expertise in printers, not computers. The company takes a 53% share of the laser printer market, but on PCs it can only lay claim to 2.5%. Apart from the palmtop developed with Lotus, the Hewlett-Packard range is lim-

Hewlett-Packard Vectra 386/20N

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Phoenix

Mass storage

52Mb 16ms Quantum hard disk drive; 3.5in floppy

Storage options

Two drive bays (none free)

Expansion

Three x 16-bit slots (one x 16-bit free)

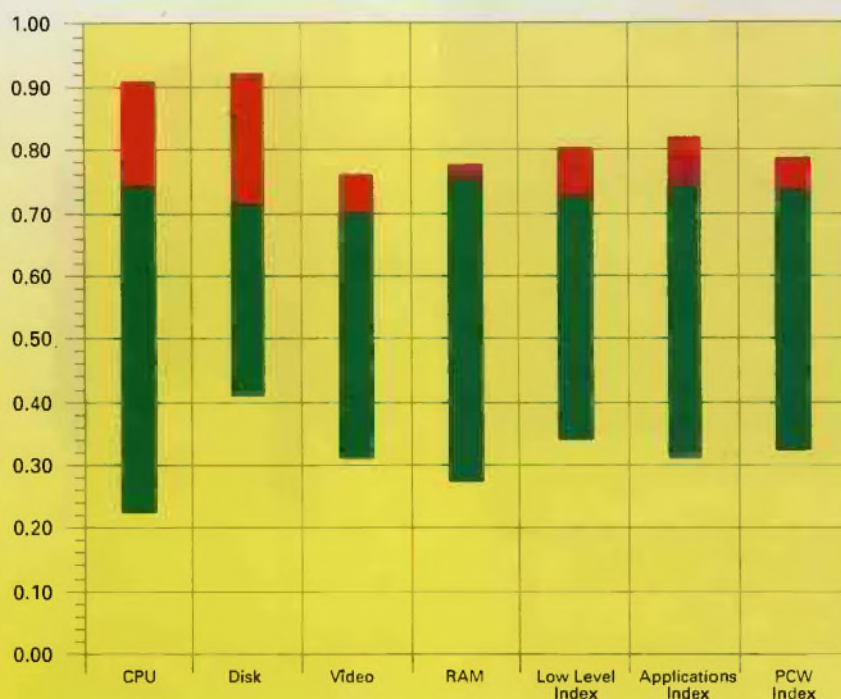
Supplier

Dealer only

Good Points Good performance.

Bad Points Position of power switch, keyboard, no 5.25in floppy drive, only three expansion slots.

Conclusion A good machine, if it supports the configuration you want.



ited to desktop machines.

This model, one of the Vectra range, was launched in September 1991, although the Vectra name was first introduced six years ago. It is a small, slim machine, designed to be as economical on desk space as possible. The footprint is 15.0x15.6 inches, and at around 4 inches high it is one of the more unobtrusive PCs.

I liked the sharp, angular style of the casing, and the interesting front panel, where the pale beige cover is cut away to reveal a darker beige moulding with the floppy drive and four indicators and switches. The on-off switch is on this panel, with an LED light to indicate power on, the reset button and two LED indicators for the keyboard/mouse lock and hard-disk activity.

Cable retainer

According to the brochure, the reset button has been set back in the casing so that it can't be knocked accidentally. Unfortunately, the designers don't seem to have noticed that the on-off switch still protrudes and that when the keyboard is set in front of the computer, the cable leaves the keyboard at a point very close to the on-off switch. If the cable is nudged, or if you fiddle with it, it can easily hit the switch and turn off the computer. This happened twice before I discovered the plastic 'cable retainer' along the back of the keyboard, which keeps the cable out of the way.

Along the back of the computer, the Vectra has two serial ports and a 25-pin parallel connector as standard, with mouse, keyboard and monitor ports. On the review machine, an extra parallel port and a LAN adaptor had been added to make it suitable as a LAN terminal.

One of the Vectra's features that Hewlett-Packard seems to be most proud of is the casing. It has no screws, so no screwdriver is needed to take the Vectra apart. Instead there are two tabs at the back of the case, on the top edge, that are unclipped by bending up the plastic. The case is then slid forward and lifted off. It's a simple method, but in practice the tabs are difficult to lift and I would have been much happier using a screwdriver. Once inside the Vectra, a screwdriver would be needed anyway to remove the expansion cards and drives.

The processor is an Intel 386SX, with Phoenix Technology's BIOS. Alongside the ROM BIOS there is a Boot BIOS, which enables the computer to boot for itself when it is being used as a LAN station. For some reason, two types of SIMM memory have been installed. Two of the total 4Mb are Hewlett-Packard 80ns RAM, but the other two are 70ns NEC cards.

There is room for three full-length expansion cards, two of which were being used on the review machine. One was taken up by the spare — and unnecessary — parallel socket, and the

other by the LAN adaptor board, giving the double LAN socket. As Hewlett-Packard is aiming the Vectra at the networking market, more than three expansion slots is perhaps superfluous, but three did seem restrictive for use as a standalone machine.

There is also room for only one floppy drive, and only one choice of drive type. There is no room for a second drive in the CPU unit and the space allocated in the casing for the drive is only big enough to accept the 3.5in size. Presumably, it is a result of Hewlett-Packard's decision to construct a computer specifically for the networking market.

Consistently fast

The Vectra was an easy machine to set up and it ran reliably. The only problem was the keyboard, which was unpleasant to use. The keys had been fitted at a strange angle, so that when the keyboard was flat on the desk, the keys were leaning backwards. In fact, the tops of the keys didn't seem to be at the right angle until the prop was set up and a magazine put under it. However, there were no problems with its performance, and as the benchmark results show, it is one of the most consistently fast machines in the test.

In the end it is reliability and performance that matter, and as the Vectra showed its strength in these areas, I would be happy to recommend it. With benchmark figures that are comparable

with those from the well-established Compaq and Tandon machines, it seems there is more to Hewlett-Packard than just printers.

Helen Johnstone

IBM PS/2 Model 57



This offering from IBM more closely resembles a hollowed-out breeze-block. Its spacious case is filled inefficiently and its rather plain looks lend it a rather archaic appearance. The manual indicates that two people should be available to lift it, probably to stem any claims for damages.

Like all IBMs, the Model 57 takes ages to boot (approximately 45 seconds), so fiddling about with configu-

rations can take several times longer than with any other make. In general use it is slow compared with other machines of the same class, and one wonders why this is.

Roaring and buzzing

The first thing that hits you when powering up this beast is the noise. The system unit makes a muted roaring sound, while the monitor buzzes annoyingly. The keyboard is the usual solid IBM type which fills half the desk space and gives you a hernia when lifting it, although it is pleasant to use. The keyboard lead is very long, so the system unit can be placed away from the desktop if required.

As usual the video controller is plain vanilla VGA, which is getting a bit long in the tooth now. Maybe IBM should think about using its new XGA standard more widely. The display, an IBM 8515, gives a good steady picture, although the colours on the review unit were patchy to say the least, giving completely different colours on one side.

The same old IBM mouse which has been available for the last six years at least was provided, along with a copy of IBM DOS 5. Also on the hard disk of my machine was a copy of IBM Virus Scan marked 'IBM Internal Use Only', and a reference-disk maker. No ready-made reference disk was provided. For those readers not well-versed with the workings of Micro Channel Architecture (MCA) machines, you need a disk

to set up and configure the various hardware components, which is fine until you can't find the disk for a particular machine and its contents.

The front panel is in the traditional PS/2 styling (if you can call it that), and is plain and uncluttered in the extreme. As usual IBM has deemed it unnecessary to include a reset button, but there is a case lock which may cause problems when you lose the key. At the back are the single serial and parallel ports, as well as an external SCSI port and the keyboard and mouse connectors.

On the inside are more cables than the National Grid. The layout is untidy, one of the major features being the complete metre of SCSI ribbon cable which flaps around over the motherboard. The dual-voltage power supply is enormous, taking one whole corner of the case and most of the right-hand side.

The hard disk is a fairly quiet 76Mb SCSI device, which gives a surprisingly slow data transfer rate of about 600K/s. Also included is one of the new 2.88Mb 3.5in floppy disk drives. Both of these seem to be good and solid.

The 2.88Mb floppy drives use a new type of disk, the ED. This will not reliably format to lower capacities, just as its forbear, the 1.44Mb HD, won't. Similarly, the HD disks will not format to the 2.88Mb capacity. Nonetheless, you can still use the older types of disks in the drive.

There are two free half-height drive bays and two spare connectors each for

IBM PS/2 Model 57

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

IBM BIOS

Mass storage

80Mb 17ms IBM hard disk,
2.88Mb 3.5in, 5.25in floppies

Storage options

Four drive bays (two free)

Expansion

Five free 16-bit slots

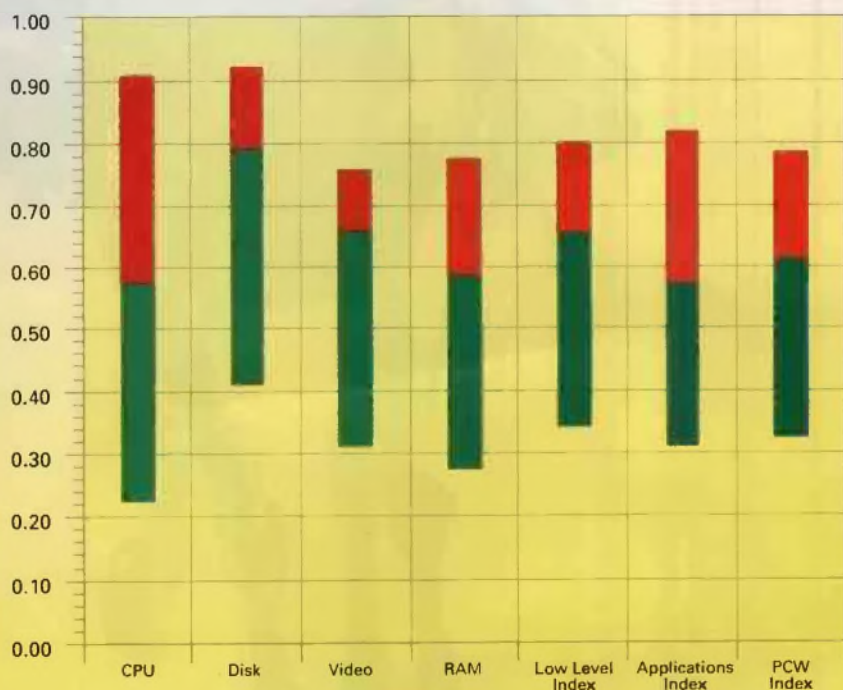
Manufacturer

IBM (0800) 181182

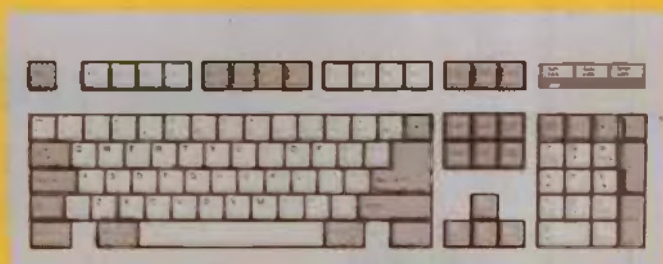
Good Points Solid construction, expansion, 2.88Mb floppy.

Bad Points Plastic case, speed, MCA, display, case lock, mouse, IBM.

Conclusion I think, therefore I wouldn't buy IBM.







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PROCESSOR	AMD 80386SX	AMD 80386SX	AMD 80386DX	i80486SX	i80486DX
PROCESSOR SPEED	25MHz	25MHz	40MHz	20MHz	33MHz
CACHE MEMORY	n/a	64Kb @ 25nsec	128Kb @ 25nsec	256Kb @ 25nsec	256Kb @ 25nsec
USER MEMORY	2Mb	4Mb	4Mb	4Mb	4Mb
FLOPPY DISKS	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb	1.2Mb & 1.4Mb
HARD DISK OPTIONS	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb	51Mb: 105Mb: 210Mb
HD ACCESS TIME	9msec*	9msec*	9msec*	9msec*	9msec*
IO PORTS	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN	2 x SERIAL, 1 x PRN
GRAPHICS CARD	Orchid IIS 1Mb	Orchid IIS 1Mb	Orchid IIS 1Mb	Orchid IIS 1Mb	Orchid IIS 1Mb
MONITOR	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600	COLOUR 256 1024 x 768 COLOUR 32768 800 x 600
MS DOS SOFTWARE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE	V 5.0 WINDOWS 3.0 + MS MOUSE
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* = Effective average access time with 64Kb DisCache on hard drive.

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hard or floppy drives. Also present are five free MCA expansion slots, one being slightly longer than the other four, arranged as a horizontal stack. On the review machine were two free SIMM sockets offset slightly from the occupied one, giving a motherboard memory capacity of 12Mb with 1Mb SIMMs.

High-quality construction

The construction of the PC as a whole seems to be very high quality. The metal-reinforced textured cream-coloured plastic case sits on top of a light steel chassis, and the whole thing hangs together with two of IBM's knob-type bolts. The components are either of IBM's own manufacture or from well-known names, such as the processor from Intel and the single 4Mb SIMM from Hitachi.

Altogether, this machine is something of a dinosaur. Its comparatively slow speed may be an obstacle for some users, but the quality is a redeeming factor. It will undoubtedly appeal to the corporate market because 'Nobody ever got sacked for buying IBM', although I can't understand why not.

Jon Silver

Kamco KC320C

Having examined a Kamco notebook PC for the September issue of *PCW*, I must admit to approaching this machine with less than an open mind. The notebook, which turned out to be in-

credibly similar to Vortec's offering, proved to be a little lame and so I assumed this would be too. But one should never judge a product before testing it — even if it is produced by a relatively unknown company.

At first glance, the Kamco bears a remarkable resemblance to many of the other units featured in this Group Test. Its compact and creamy-coloured casing can also be found on Unimart PCs, and Multiplex uses the same design for a number of different machines. Measuring 405 x 180 x 330mm, it's certainly not a bad body and is more than capable of taking the knocks it would be likely to get in the average office.

The front of the review model boasted 3.5in and 5.25in high-density floppies, as well as the usual Reset, Power and Turbo buttons. The rest of the fascia is somewhat bare, bar a green LED speed display, but a lot more can be seen at the

rear of the machine. All of the standard PC ports can be found lurking here and an analogue joystick or game port is also present — handy for a quick blast of Space Invaders.

Metal SIMM clips

Internally, as well as a 20MHz 386SX the unit features a maths co-processor socket and an AMI BIOS. Four 80ns SIMMs provide 4Mb of RAM and 32K of cache memory is also integrated into the system. A maximum of 16Mb of main RAM can be installed and, thankfully, Kamco has had the foresight to include metal SIMM clips. It's amazing how many companies still use the fragile plastic variety.

VGA output is provided by a plug-in 16-bit Trident video card, complete with its own 1Mb of dedicated RAM and Quadtel BIOS. The board also boasts a pass-through connector allowing it to play with other cards, and can deliver a maximum display of 1024 x 768 in 256 colours. Unfortunately, you need at least a 17in screen to be able to read text clearly at this resolution.

Expansion slots

Six 16-bit and two 8-bit ISA expansion slots are provided in total, but only six of these are actually available to the user. One 16-bit slot is occupied by the aforementioned graphics adaptor and another is home to a Multi I/O card, which has responsibility for things such as the game port and hard-disk control. The hard disk in the Kamco is a 5.25in



Kamco KC320C

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

112Mb 18ms Rodime hard disk,
3.5in, 5.25in floppies

Storage options

Five drive bays (two free)

Expansion

Six 16-bit slots (four free),
two free 8-bit slots

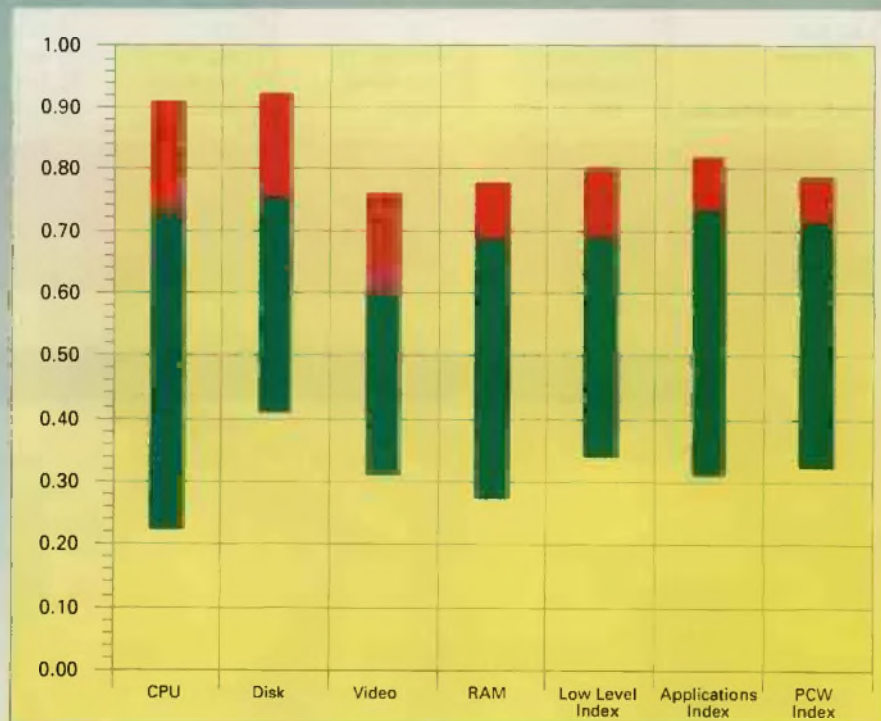
Manufacturer

Kamco 081-963 1031

Good Points Relatively speedy.

Bad Points Ancient monitor and BIOS, inaccurate manual.

Conclusion Cheap and cheerful.



112Mb 18ms Rodime device, a speedy affair that managed to gain a respectable result in our fixed-drive benchmarks. Two empty drive bays provide room for expansion in this area.

In use, the Kamco seemed as IBM compatible as any other clone, and despite numerous attempts I failed to make it fall over. That last sentence isn't strictly true as Windows 3.0 did freeze once, but then again, we are talking official Microsoft product here. Even when you use the latest technology, you can't expect these PCs to cope with everything.

The monitor and keyboard supplied provided a few surprises though — both managed to exceed my initial expectations. The 102-key AT keyboard seemed too soft at first but it grew on me, while the monitor gave quite a good picture even though it looked like Noah's own. OK, I'm used to black Trinitron screens so you could say I've been spoilt, but just take a look at the picture of the machine and you'll see what I mean.

Good results

In terms of performance based on speed, the Kamco easily outpaced machines from the likes of Viglen, AST and the corporate giant Tandon. It just goes to prove the theory that judging a computer by the name on the box doesn't pay and full-scale tests are what matter at the end of the day. I'm sure Kamco will be pleased with its unit's benchmark results.

The KC320C is capable and cost-effective, two of the most important things to look for when buying a PC. If you're looking for power without the price, this is certainly worth more than a cursory glance.

Chris Cain

Kyocera Multilight IIIsx



The Multilight IIIsx was first launched in April 1991 at the NEC in Birmingham, along with the 486/33 reviewed as part of the Hardware Group Test in our November issue. Kyocera has obviously put more effort into the case design of its PCs than many of its rivals. The Multilight IIIsx is finished in the same attractive colour scheme as the rest of the series — a dark blue front

panel on a pale grey case, and finished with sky-blue writing.

The small box has been designed so that it can be used as a conventional desktop, in which case it stands on four little pink rubber feet or as a mini-tower. If you go for the mini-tower, as I did, there are two supports that screw into the base and the whole machine stands about as high as a large book.

The front panel consists of a single 3.5in 1.44Mb floppy drive, a push-button on/off switch and three LEDs, two green ones for hard and floppy disk access and an orange one for power. The keyboard socket is also located on the front, adjacent to the power switch.

At the rear of the machine is the usual selection of plugs and sockets: two serial ports, one parallel port, VGA and external floppy drive connectors. There is also a connector for a Kyocera 16-colour LCD. This could be a good option if you were hard up for space and couldn't accommodate the rather large 14in multisync monitor Kyocera offers.

Inside

The top of the case can be taken off by removing two of the four screws that hold the casing together. Once inside it becomes clear (if it wasn't already) that this isn't a machine with enormous expansion capabilities. There are just two 280mm 16-bit ISA bus slots (not full length) mounted on a separate board, and there's no room for anything else.

Kyocera Multilight IIIsx

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Phoenix BIOS

Mass storage

100Mb 16ms Quantum hard disk,

3.5in floppy

Storage

Two drive bays (none free)

Expansion

Two free 16-bit slots

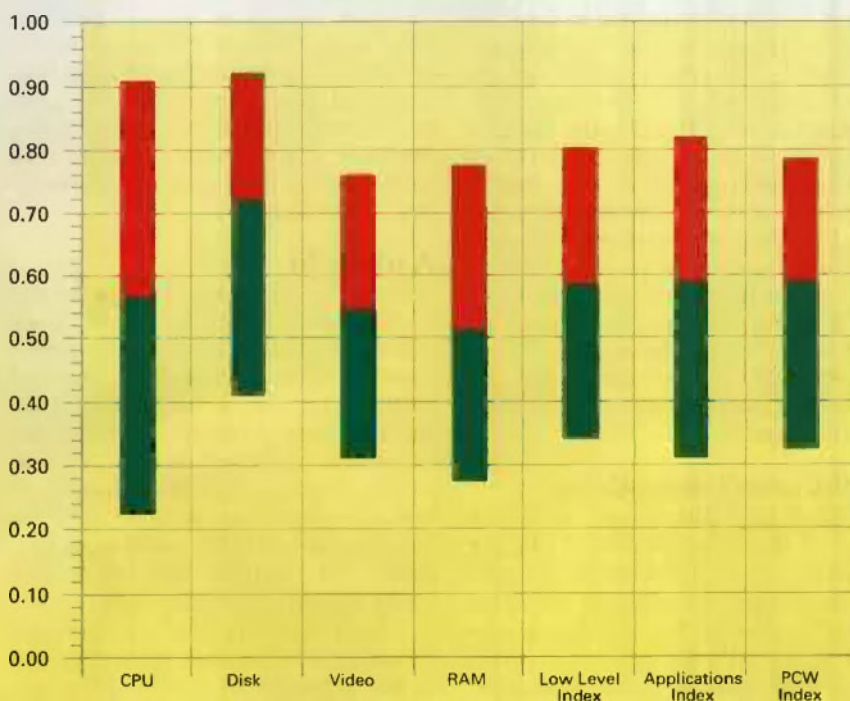
Manufacturer

Kyocera (0734) 311500

Good Points Excellent looker.

Bad Points Not such an excellent performer.

Conclusion Wouldn't look out of place, er, anywhere really.



The review machine came with 4Mb of RAM expandable to a maximum of 16Mb on board using 4Mb SIMMs. The Intel 386SX chip is hidden away under the 100Mb hard drive and it isn't immediately obvious how to get at it, but once you have found the right screws, the hard and floppy drives lift straight out.

More accessible are the Phoenix BIOS chips for the main system and the video, and a socket for a 387SX co-processor. The video BIOS is Paradise-compatible and supports a maximum resolution of 800 x 600 with 16 colours. There is no cooling fan at the back of the CPU, because it's located in the middle of the machine, under the cover. This explains why there are hundreds of small holes in the top of the machine. The fan only cuts in when it is needed, which makes it a very quiet computer.

Recommended option

The monitor supplied was Kyocera's excellent 14in multisync Trinitron EP-700; this is optional, but it is certainly an option I can recommend. Following the company's policy of unique design, the keyboard and mouse are somewhat odd-looking. They are both the same shade of grey as the case and are both shaped like an aerofoil. This smooth, contoured shape makes the keyboard pleasant to use, as you can rest the base of your palm at the bottom of the keys while you type. The scheme works equally well with the mouse, making this the most comfortable pair of input devices I've ever used.

Unlike most of the other machines being reviewed here, the Kyocera was not set up before being sent to the PCW office, so I had to format the hard disk and install DOS before I could run the benchmark programs. The setup procedure just involved putting the installation disk in the floppy drive before switching the machine on. The 100Mb hard disk is then automatically split into four partitions and there doesn't appear to be any way to avoid this.

Two manuals accompany the CPU: one is a user's manual, the other is for DOS 4.01. Each of these guides is approximately the same size as the machine itself, and the two together weigh about the same.

Looks aren't everything

The Multilight didn't seem as fast as some of the other 386SX's I got my hands on and this is evident from the benchmark results, although it is by no means the slowest. Kyocera should take note of the old saying, 'looks aren't everything', and put some more effort into improving performance. Having

said that, this is the best-looking machine in this Group Test and possibly that I've ever seen, although I may be biased as its colour scheme matches my living room.

Mat Beard

Leo CI/LEO



The Leo is quite an elegant-looking machine — or it would be if someone hadn't painted the letters CI/LEO on the front in bright red paint, and in a font that's about 20 sizes too big. It's not as tall as most small-footprint machines which makes for a rather neater package, but when you take the cover off you discover how the Centerprise designers have managed to lose those few centimetres, and it's not a very satisfactory solution.

Like many other compact machines, the Leo saves space by mounting the expansion cards horizontally. Most compact machines offer a reduced number of card slots, compensating for the lack of expansion potential by having serial, parallel and VGA circuitry on the motherboard itself. The Leo has five slots, and three are occupied with an I/O card, a VGA card, and the hard-disk controller.

A tricky fit

Taking the cards out to look at the motherboard, I was surprised to see that it had slots too. Closer examination revealed that this was a standard motherboard which had a bus expansion card plugged into it, and it was this expansion card that was used. The expansion card has slots on both sides, so that when cards are plugged into it the 'tails' on the end of the metal mounting plates can interfere, and it's a little tricky getting everything to fit.

I don't really like this arrangement: there's nothing intrinsically wrong with it, but it leaves the inside of the machine looking terribly cluttered, and

any attempt to upgrade the memory will involve removing as many as three expansion cards. You can't revert to using the card slots on the motherboard, unfortunately, even though there are more of them (six 16-bit and two 8-bit), because the case is too short and the lid won't fit.

When I finally reached the motherboard I found it quite reasonably laid out: modern motherboards never seem to have patch wires or modifications, and it's fitted with Phoenix BIOS ROMs. My only concern was that I couldn't see a familiar chipset, although that isn't to say it wasn't there. The Leo's motherboard is very hard to see among the clutter, and fitting a maths co-processor would be a nightmare job involving substantial further dismantling.

The review machine was supplied with 8Mb of RAM in the form of eight 1Mb 80ns SIMMs which completely fill the available sockets. These SIMM sockets cannot take the larger 4Mb SIMMs so upgrading further would mean buying a memory card.

Caching control

The review machine was supplied with both sizes of floppy and a 100Mb Fujitsu hard disk, leaving one 5.25in half-height bay free. The hard-disk controller was a Tentime, which has an on-board hardware cache. In this case it had 0.5Mb of SIMMs on the controller, but it can be expanded if necessary. Caching controllers like this one have a significant effect on performance during disk-intensive tasks, particularly if the computer has only a moderately powerful processor like the 386SX. In everyday use the Leo felt significantly faster than a 386SX with a conventional hard-disk controller and a software-only cache.

The VGA card uses the Tseng Labs chipset, which is an excellent choice, although the memory on the card supplied was only 256K. On a machine with as much memory as this one, this seems a little parsimonious since it restricts the graphics to 16 colours at the highest resolution of 800 x 600 pixels.

The monitor is a Samsung and is crisp, well converged with good scan geometry. The keyboard supplied had a good feel, with a decent amount of click to provide tactile feedback. DOS was also bundled: thankfully it was DOS 5 and not one of the earlier versions which some manufacturers persist in supplying.

A separate I/O card provides two serial ports — useful if you have a modem and a serial mouse — and a parallel printer port. The documenta-

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Leo CI/LEO

Processor

20MHz 386SX

RAM

8Mb maximum

ROM

Phoenix BIOS

Mass storage

100Mb 19ms Fujitsu hard disk

Storage options

Three drive bays (one free)

Expansion

Five free 16-bit slots

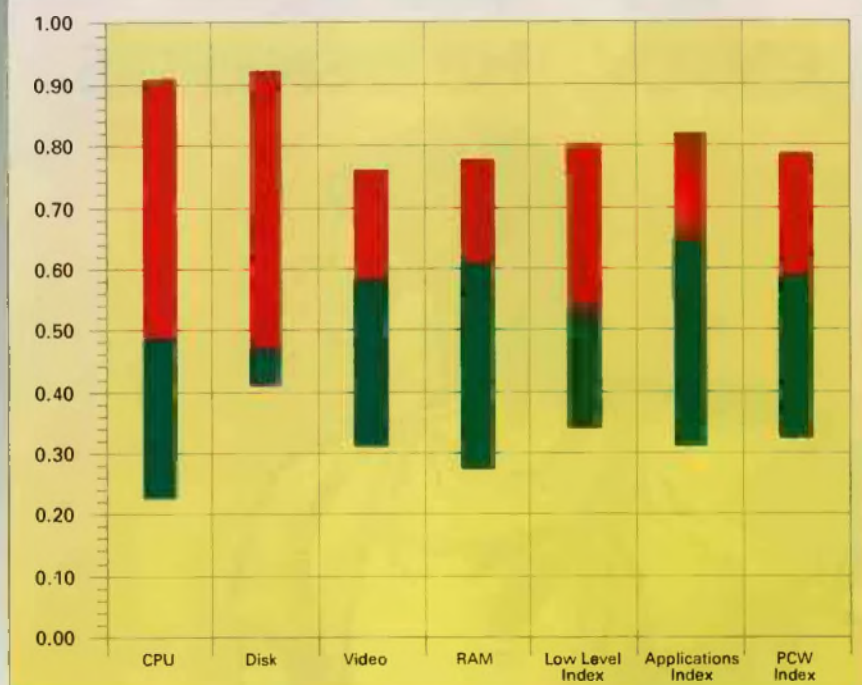
Supplier

Centerprise (0256) 463754

Good Points Compact.

Bad Points Things get too compact inside.

Conclusion Just another clone.



tion was rather disappointing: it was just a binder containing the manuals for the various cards used in the machine — all different page sizes, and with no overall index.

OK clone

The Leo isn't bad as clones go but I couldn't really recommend it to anyone who might want to expand, either by adding a co-processor to speed up a spreadsheet or an additional card or two, since it's just too cluttered and fiddly inside. The Leo would be a much better machine if it were a couple of inches taller and had its expansion cards mounted in the orthodox way.

David Morton

Locland 386SX/20

It's a Locland. The box is a little narrower than the others reviewed here, and the brand identity rather less strident. The monitor is produced by a company with the Taiwanese-sounding name of Magic View, and the keyboard, a remarkably faithful copy of the early 'thick plank' IBM AT keyboard, bears no badge at all.

Which matches the Locland profile, really: a relative newcomer to the market, a provider of strikingly cheap, plainly composed workhorses. Except, this machine has some entertainments in store for hardware fans: the first time

I opened the case, I spent a frantic minute or two looking for the hard disk. It's tucked neatly alongside the slim, neat power supply, held on its edge in a metal cage, and it's a Seagate ST3096A, rather less than third height and so neat and tidy as to be almost an afterthought.

This raises the question of exactly why this box, and many of the others, have to be the size they are. In the case of the Locland, there's actually an inch-wide strip of space on the right side of the chassis which is occupied only by this tiddly little hard disk. There's another of the edge-on drive cages on the right side of the main floppy device mounting, just above the motherboard. Locland could have saved some metal, given me a bit of desk back, and stuck the hard disk in that one rather than off down the back somewhere.

A tiny eight-inch deep motherboard occupies the back right-hand side of

the case, equipped with eight expansion slots, two 8-bit and six 16-bit. Two of the 16-biters are occupied, the first by a multifunction card which drives the parallel port, the serial port, and all the storage devices from a single third-length card; the second by an SVGA display adaptor badged as Trident. Again a third-length device, this features a few ancillary chips and a large Siemens-badged surface-mount chip, along with 1Mb of memory.

A wide variety of modes are supported though getting to them is not for the fainthearted, since what's delivered with the box is a shrink-wrapped collection of software packages: Windows with a Microsoft Mouse and DOS 5. Extra drivers to use those extra Windows screen modes are not evident, though a fair selection may be found on some online conferencing systems like CIX or Compuserve.

Given 1Mb of RAM some tempting display setups are attainable, but only with some low-level fiddling. There was 4Mb of RAM in SIMMs tucked under the ironmongery of the floppy drive cage, with room for another four alongside that.

Keyboard click and thud

The keyboard is a rather odd cross between IBM click and Compaq thud, and follows the defined style rather too closely for my tastes. It just seems so unnecessary to give over a large oblong patch of one's crowded desk to a fat slab of plastic, especially when it doesn't





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Locland 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 8Mb

ROM

Award BIOS

Mass storage

85Mb 19ms Seagate hard disk,
3.5in, 5.25in floppies

Storage

Three drive bays (one free)

Expansion

Six 16-bit slots (four free), two free
8-bit slots

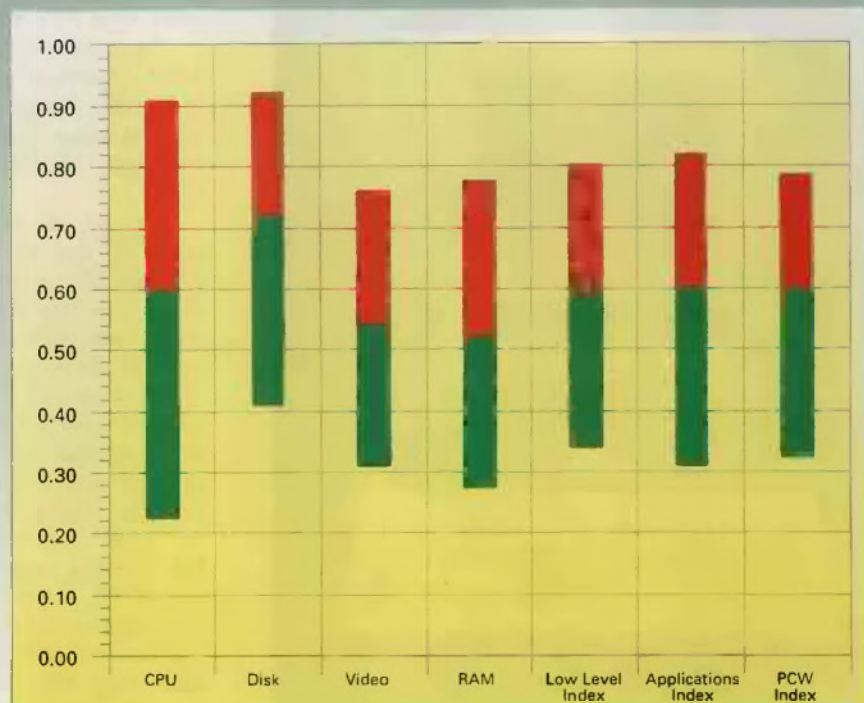
Manufacturer

Locland (03552) 28808

Good Points Neat interior layout.

Bad Points Plonky keyboard.

Conclusion Worth considering, if
you can find another keyboard.



even advertise the manufacturer or hold status lights. Given the styling of the case and its bad match with its contents, one begins to wonder whether there's some kind of cargo cult school of PC box design emerging here — make it look like IBM, follow the IBM 'lead', and you'll be all right. Except that the IBM lead these days is for slimmer, neater boxes if possible.

The BIOS is by Award and lights up the machine by describing itself as a "386SX-TOPCAT-06 'Modular' BIOS, by Award". If you're quick enough off the draw to hit Ctrl-Alt-Esc before the DOS boot engages, you're delivered to the CMOS setup program where you can set the date and time and other system parameters in an efficient, point-and-shoot manner.

Once through the tests, the Locland zips along. The display is faster than has been the norm, in character and graphics modes, emphasising the advantage these later systems have over earlier, CPU-dependent display cards. The disk, at 85Mb, whirs and clicks in a business-like and rapid fashion, all of which makes the dead plonk of the keyboard all the more frustrating.

Steve Cassidy

MBC 386

The prognosis for the MBC 386 initially looked gloomy: it arrived with a request from the PCW office to investigate the shocking benchmark speeds — it ran a bit like a tortoise on valium.

Happily, these were only manifest in the first (faulty) sample.

The casing is large and has a bowed front facia containing three buttons for hard reset, processor speed and power on/off, with the usual three indicator LEDs for power, turbo mode and hard-disk activity. The processor speed (10 or 20MHz on the second machine, although the first read 20 or 25 but appeared to have no effect on performance) is indicated on a separate numeric LED situated next to the buttons, and to my approval a keyboard lock is provided.

To clarify the matter of the disparate speeds at which the two samples provided ran, I ran the Norton Utility SI benchmark on both machines: the faulty machine gave a speed index of 9.5 running at a clock speed of 20MHz, and the replacement machine offered a much-improved index of 14. Unfortunately the replacement arrived too late for me to re-run the benchmarks, but its

performance was par for the course compared with the other machines I evaluated.

Impressive service

I was also impressed with the service MBC provided. I reported the fault on a Friday afternoon, and they turned up on the following Monday morning, checked over the faulty machine, agreed that it was running like a hippo and replaced it immediately. I can only hope that this level of service would be extended to all of MBC's customers, and that we were not given special priority on account of the machine being on loan for review.

MBC supplies the machine with a 102-key keyboard manufactured by Cherry. The key action is positive and it seems like a durable product. The monitor offers a clear, stable picture and is mounted on a swivel base which operates freely.

The VGA card fitted used the Trident chipset. A serial mouse from a company called Z-Nix is bundled with the system, and a suitable driver is already loaded on the hard disk: it operated very well. The hard disk was also pre-loaded with MSDOS 5.

Both samples of the MBC operated relatively quietly. The hard disk drives in particular were noiseless, even when pushed very hard, and the cooling fan issued only a low hum with a hint of air noise.

The hard disk fitted was a 87Mb IDE-type drive which offered respectable performance. Starting up standard



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MBC 386

Processor

20MHz 386SX

RAM

4Mb expandable to 8Mb

ROM

AMI BIOS

Mass storage

87Mb 17ms Seagate hard disk,
3.5in, 5.25in floppies

Storage

Five drive bays (two free)

Expansion

Six 16-bit slots (four free),
two 8-bit slots (one free)

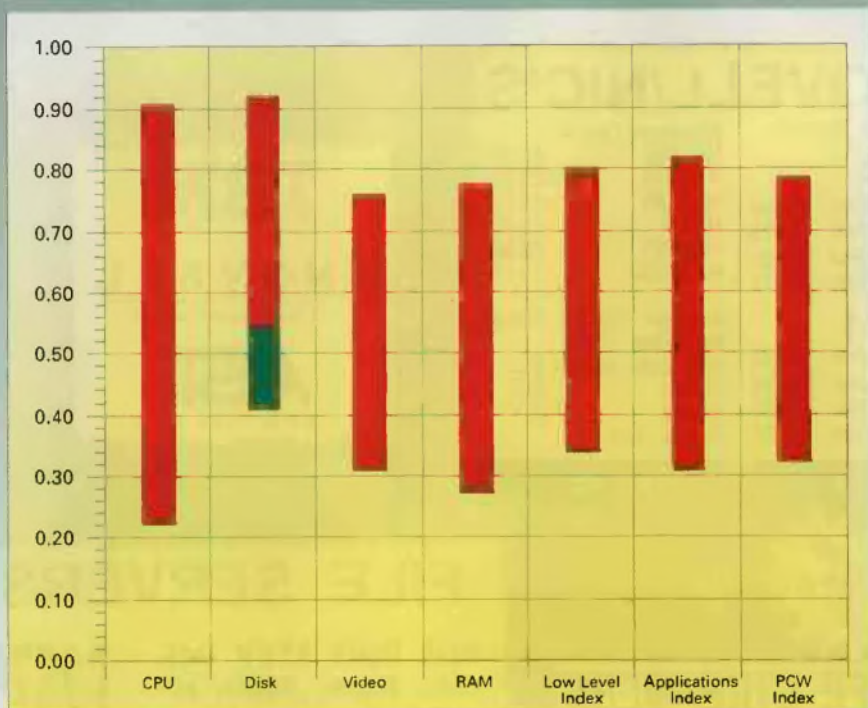
Manufacturer

MBC 081-963 0715

Good Points Value for money,
quality of construction.

Bad Points Chunky, bulky case.

Conclusion Quite a good all-
rounder; but that first machine?



mode Windows 3.0, for example, took roughly eight seconds.

The machine ran an AMI BIOS and was furnished with 4Mb of RAM — four 1Mb SIMMs. There was one parallel port and two serial ports — one 9-pin and one 25-pin. A games port is also provided. All the interface connectors are clearly labelled.

Shining example

Internally, the MBC provides a shining example of good construction techniques. All the cables are of a sensible length and are neatly tied up to prevent them flapping all over the place. The components used are of well-known origins and the motherboard is properly seated, which helps considerably when adding extra cards. The power supply is the usual 200W model.

The box has plenty of room for upgrading. There are eight expansion slots in all, two 8-bit and six 16-bit, and a socket for adding a co-processor which is, for once, accessible without entailing disassembly of the whole machine. There are two free drive bays, one 3.5in and one 5.25in.

On inspection, the motherboard appears to be of good quality and uses more modern technology than many other clones. My impression is that this machine should be very reliable in the longer term, owing to the care taken during construction. The case itself is fashioned out of good-quality steel, and is sturdy enough to withstand general day-to-day use (and abuse).

Despite the trouble encountered with

the first sample of the machine, credit is certainly due to MBC for rectifying the problem promptly, and the replacement redeemed my initially poor impression. All things considered, this was the best of the 'nameless' clones I evaluated, and I would have little hesitation in buying one for myself. Functionally it is more than adequate, and the aesthetics are really no worse than any other machine in its class. Taking into account all the extras supplied, it definitely offers top value for money.

Jon Silver

usual activity lights. The useful fittings are fairly standard, though, with two 5.25in half-height drive bays, a vertical 3.5in floppy bay, power button and key lock, and reset and turbo buttons.

These last two buttons are rather prominent, however, and the reset button actually protrudes from the front of the case. It is too easy to hit these by accident, and the machine was actually started up at 8MHz after installation because of this. Fortunately, the two-digit indicator panel showed this clearly.

Drawbacks

Inside the case the arrangement is conventional, with a power supply at the rear and space for eight 16-bit AT-bus expansion boards. This number of slots is impressive, but there are drawbacks. First, two slots are required for a video board and for a board combining floppy and IDE hard disk controllers, a parallel port, two serial ports, and a game port. And second, one of the slot sockets is almost underneath the power supply and could not have any boards put in it anyway. The blanking panel for this last slot is used for the game port and second serial port sockets instead.

The power supply is actually moved into the middle of the case to leave room for a half-height 5.25in hard disk, although the review machine came with a third-height 90Mb Fujitsu IDE drive. This positioning, combined with the motherboard design, also means that the eight memory SIMM sockets are hidden under the power supply. The

Mesh 386SX/20



The Mesh 386SX/20 certainly looks the part; the casing is reminiscent of a Gerry Anderson vehicle from *Captain Scarlet*, with a curved front panel, port-hole trim, and a smoked plastic panel to cover a speed indicator panel and the

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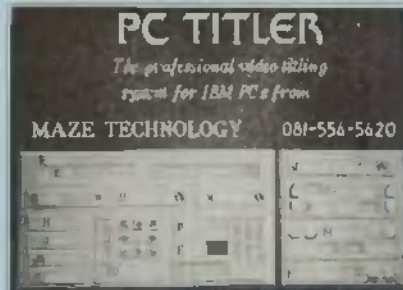
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supply must actually be removed to add extra RAM, a rather daunting procedure that is not described or even mentioned anywhere in the skimpy Mesh documentation. However, once the SIMM slots were located they were found to have solid metal clips rather than the usual flimsy plastic, and users prepared to dismantle the power supply can expand RAM in two-SIMM increments up to a maximum of 16Mb.

Interesting features

The motherboard has some other interesting features. It uses an unfamiliar Symphony chipset, for example, with an AMI BIOS tailored to allow the chipset parameters to be changed. And it has sockets for a RAM cache to be added, with either 16K or 64K of direct-mapped 25ns cache RAM. This was fitted in the review model, which explains the better-than-average CPU benchmark figure.

The video board supplied was a Trident SuperVGA type with 1Mb of video RAM, offering resolutions up to 1024 x 768 in 256 colours. There was also a good selection of graphics drivers, covering all versions of Windows, AutoCAD and AutoCAD/386, CADkey, P-Cad, GEM, and VersaCAD, and extended text mode drivers for FrameWork, Lotus 1-2-3 and Symphony, WordStar, WordPerfect, and Microsoft Word 5.x. There was even a Presentation Manager driver for OS/2, which is a rare sight.

The Mesh-badged multiscan monitor matched the board, with resolu-

tions up to 1024 x 768, but its 14in screen made Windows text at the highest resolution rather tricky to read. The contrast and brightness also had to be dimmed to stop the text fuzzing out at this resolution, making the screen rather dark, and there was some pincushioning at the sides. At 800 x 600, however, these problems were less noticeable. The monitor also had controls for vertical and horizontal centreing and sizing under a front panel, making the necessary adjustments in various modes much easier.

The Mesh-badged bundled mouse, too, is adequate, although it is made out of that horrible Taiwanese plastic that mars many low-cost notebook PCs. It is a three-button type shaped like the new Microsoft mouse, and has a switch at the bottom to change the emulation from Microsoft to Mouse Systems. An adaptor allows it to plug into either serial port on the back of the system unit, and it worked fine with Windows and the MSDOS 5 shell; indeed, its compatibility is shown by the fact that at boot-up a Logitech mouse driver had already been set up and worked.

The keyboard, as usual, was a lightweight disappointment although the feel was better than usual. It had an odd layout, with a large Enter key and a small backspace key with the hash key next to it; this caused some typing errors during the review.

Middle of the pack

As the benchmark figures show, the Mesh hardware turns in a good CPU

figure but is let down by the slow — and noisy — Fujitsu hard disk which returns it nearer to the middle of the pack. The only problem during the review was that the system was set up to use 3Mb of its 4Mb of RAM as expanded memory, stopping the pre-installed version of Windows 3.0 running in anything but real mode. And when running in this mode, the Windows Setup Program froze and needed a reboot. After some fiddling with Config.sys, though, everything worked as advertised.

The Mesh is a decent system, let down a little by the mismatch between motherboard and case design that makes the SIMM slots and one expansion slot inaccessible. But there is a lot of expansion space considering its size, and you really do get everything you need to set up and go as quickly as possible.

Peter Jackson

Multiplex 386 SX/20

Multiplex has come a long way since its humble beginnings and is now established as leading supplier to government, educational and corporate users including such notables as Sony, Rolls Royce, British Steel and the BBC. The company, Multiplex Technology Corporation, is built up of three subsidiary companies — Multiplex Computer Group plc, Nationwide Computer Maintenance and DMA Star. The first two

Mesh 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

90Mb 19ms Fujitsu hard disk,
3.5in, 5.25in floppies

Storage

Four drive bays (one free)

Expansion

Eight 16-bit slots (five free)

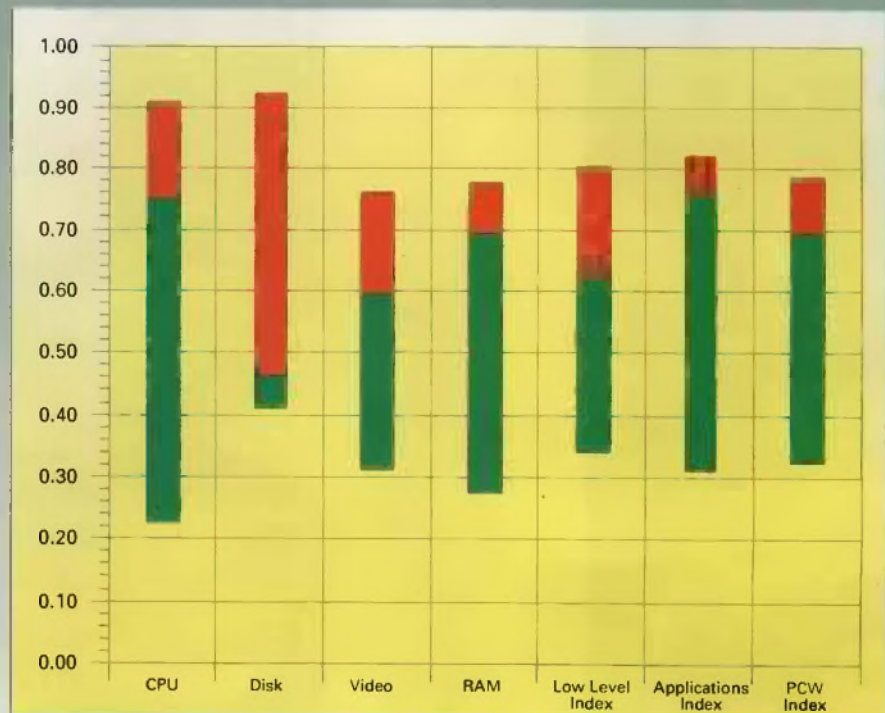
Manufacturer

Mesh 081-452 1111

Good Points All-in-one package,
RAM cache to speed CPU.

Bad Points Difficult to expand
RAM, slow hard disk, monitor
needs adjustment at highest
resolution.

Conclusion Decent, but not ideal.



are self-explanatory; the third was formed to produce tailor-made, multi-user systems.

Beginners start here ...

The machine arrived at the PCW office in two boxes. The monitor box contained a monitor (no surprises there), the other box contained the CPU and keyboard, a three-button mouse, MSDOS 5, Windows 3.0, a user's guide, a general guide to the motherboard and a video manual. As I'm a generally curious person, the first thing I did was watch the video. After the first 20 seconds or so it became clear that it was aimed at the absolute beginner: it was the line '...and this is the monitor or screen. This is used for displaying letters or pictures...' that gave it away. The rest of the video followed in the same vein — I don't think it'll be winning any awards on Barry Norman's *Film 92*.



The CPU is large in comparison to a lot of the other machines in this test. This has its advantages, but it has disadvantages too. The obvious advantage is expansion capability, and on the disadvantage side I found it ugly (an indication of how subjective attitudes are, as Chris Cain described the same box as cute in our August issue).

I don't know who supplies the case to Multiplex, but it's the same as the Kamco, QCS and others so they must be doing quite well. At the front there are both sizes of floppy drive, three buttons each with a LED above, a cover lock and the Multiplex badge. There is also a LED digital display, which shows either 10 or 20 depending on the position of the turbo button. The other two buttons are for power and reset. The LEDs are for the same, except for the hard disk access light which is above the reset button. The rear of the machine has the usual array of ports and connectors — two serial, one parallel, VGA, keyboard and joystick.

Getting into the machine is relatively simple — there are just three screws holding it in place. Removing these allows the cover to slip forward uncovering the motherboard and drive bays. Immediately visible are the AMI BIOS chips, and by moving some of the entangled wires, the Intel 386SX 20MHz chip shows through. Tucked behind the drive bays are the VLSI chips and under the video card is a large AMI keyboard controller chip.

The video card, which also houses the joystick port, has an Oak Technol-

ogy VGA BIOS chip and 1Mb of video memory. There are seven 16-bit ISA expansion slots, six of which are free, the other being taken up by the video card. It is only possible to get full or three-quarter length expansion cards in the top four slots, as the drive bays get in the way of the others.

Desire

I phoned Multiplex for some information on the machine, and I was sent a thin brochure and another video (and why not?). This second video was entitled 'Multiplex Sales Video' and it was just that — a sales video. It began by saying how wonderful Multiplex computers are, and that they are '...widely regarded as the world's most desirable compatible computers.' Exactly who finds them so desirable, I don't know.

The video did throw some light on the make of hard disk drive though, as the one in the review machine had had its label removed (it was still sticky). This seems rather odd, as according to the video it is a Mitsubishi and they are '...widely regarded as the best.' If this is true, why remove the label? The floppy drives are also supposedly Mitsubishi's, but in the review machine, the 5.25in was a NEC and the 3.5in had no label.

The monitor is of Taiwanese manufacture and has a maximum scanning rate of 70Hz. It has a remarkable feature at the top — a Multiplex badge. But this is only remarkable when you are told that each machine is tested for 72 hours non-stop, and nobody noticed that the badge is on upside-down. The key-

Multiplex 386 SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

115Mb 12ms Rodime hard disk,
3.5in, 5.25in floppies

Storage

Five drive bays (two free)

Expansion

Seven 16-bit slots (six free)

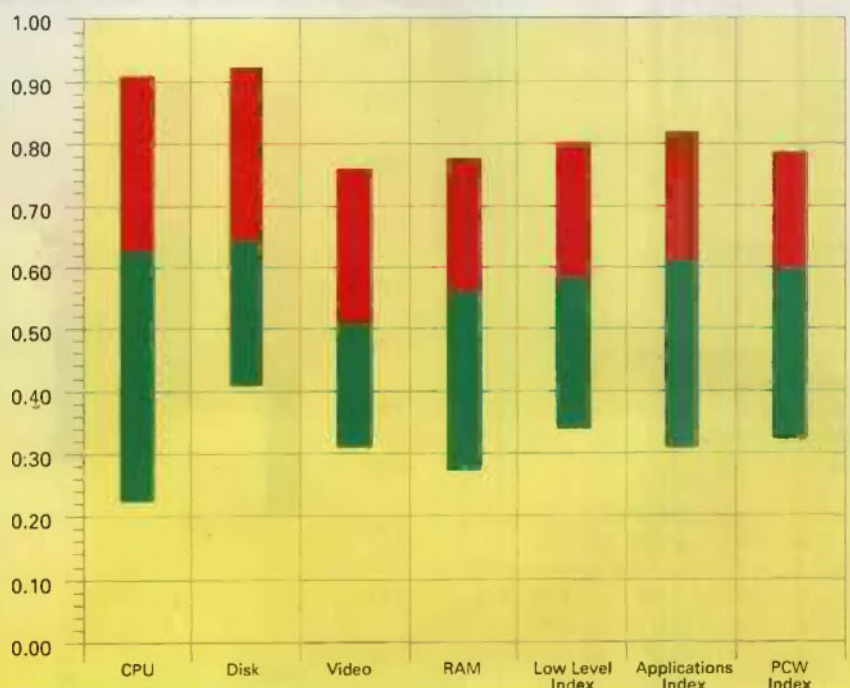
Manufacturer

Multiplex 071-498 1088

Good Points

Cheap.
Bad Points Can I change this to
strange points?

Conclusion An average machine,
below average price.



board is a Cherry positive-click 102-key enhanced model, which is OK if you like clicky keyboards. I don't.

Not bad, not good

Despite all its little quirks (I won't say dodgy features) the Multiplex isn't bad. It isn't good, either: it was neither top nor bottom in any of the benchmark tests. Its major plus point is the price — £1274 for the same spec as the review machine, but prices start at £899 for a SVGA machine.

Mat Beard

Ness 386SX-20



Like the monster of the eponymous loch, Ness has a history peppered with questions of whether it did, or did not, exist. However, past troubles appear to be behind the company as it is once

again sighted in the press and even, reports say, in a shop of its very own in London's Tottenham Court Road.

External features

Aquatic analogies aside, the Ness 386SX-20 undoubtedly exists. Through even the highest-power binoculars, though, it appears indistinguishable from many a similar Far Eastern composite monster. At the front it has the round Reset, Power and Turbo buttons typical of the species, next to the mating plumage of the glowing LED two-digit display that shows the clock speed. A vestigial keyboard lock also appears on the front panel; many other computers have lost these features altogether during their evolution without any loss of survival ability.

Evolution has equipped the Ness with two floppy disk drives of 3.5in and 5.25in sizes. Around the back of the beast are arrayed two RS232 ports, a parallel printer interface and a joystick connector. These, together with the Tseng-based VGA, take up three of the seven expansion slots; there are four additional cut-outs on the back which will take additional D-type connectors if you want to stuff the thing chock-full of serial ports.

Having bagged the blighter, inspection of its internal organs was hampered by the thick armoured skin held on with no less than seven rather badly-fitted screws. A little swearing later, the back came off to reveal an anonymous Taiwanese motherboard filling around half the base of the box.

A gaudy straggle of wires connects switches and lights to this board in a psychedelic rat's nest. The board itself is based around the Chips & Technologies chipset; there's room for up to 16Mb of SIMM memory (although there are eight sockets which can take either 256K, 1Mb or 4Mb parts, you can't fill them all with the largest size). There's also a socket for an 387SX-20 co-processor, although this is hidden beneath the disk drive bays and cannot be reached without a major dissection.

Drivers

The video board is a 16-bit ET4000-based SuperVGA, with a full 1Mb of video RAM giving a maximum resolution of 1024x768 at 256 colours. It comes with its own drivers on floppy disk, although you should be able to use any of the new range of faster Tseng software drivers that are now available.

All the other interfaces come from a single expansion board that holds the IDE circuitry, joystick, serial and parallel interfaces and the floppy disk controller. Of the seven expansion slots, six are 16-bit and one is 8-bit. All are full length, although four of the 16-bit slots run the risk, with full-size cards, of fouling SIMMs inserted into their sockets.

There are three drive bays, fully employed with the two floppies and a 40Mb Conner IDE hard disk. These are next to a rather beefy 220W power supply which, given that you can't easily add more hard disks, seems destined to spend its life loafing along well

Ness 386SX-20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

80Mb 18ms Conner hard disk,

3.5in floppy

Storage

Five drive bays (three free)

Expansion

Six 16-bit slots (four free)

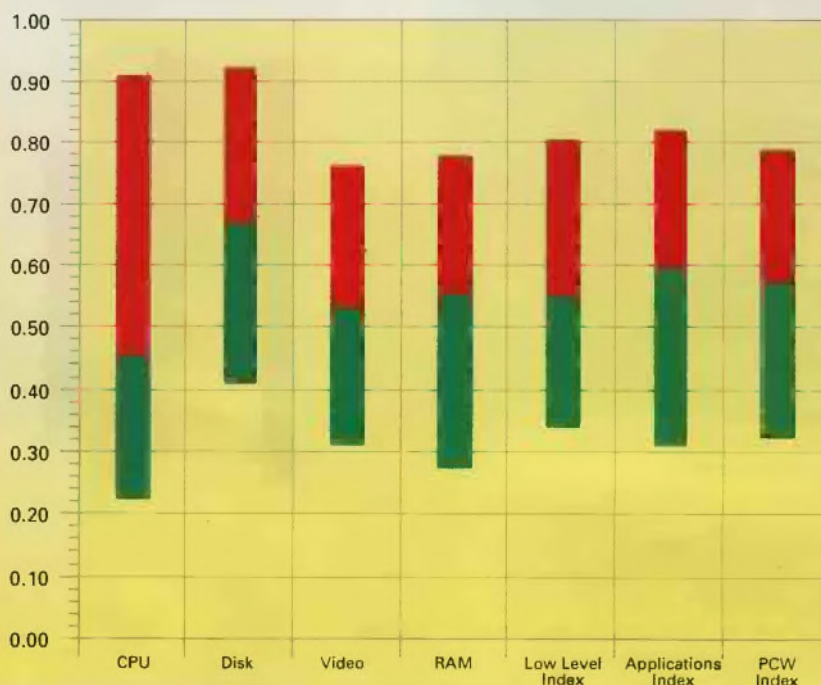
Manufacturer

Ness 081-452 8233

Good Points AMI BIOS and C&T chipset. What can go wrong?

Bad Points Build quality mediocre, documentation minimal, DOS 4.

Conclusion If you know what you're doing it might make a cheap workhorse.



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Colour		
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HDD		
Colour		
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below capacity.

The keyboard is good, the best of the batch I tested. I don't know what law dictates that the best keyboards are bundled with the not-so-exceptional system units, but it holds true here. The monitor, similarly, is good. It's a lightly-badged Samsung, whose picture stability, linearity and resolution were all perfectly acceptable. It can also cope with all the SuperVGA modes that the supplied video card could produce.

The documentation is, unfortunately, nothing more than the individual manuals that the manufacturers supplied to Ness with the components of the system. Individually they're OK but represent the bare minimum that Ness could get away with. The single A5 photocopied sheet that shows the jumpers which control all the interfaces does no more than that — I've had more comprehensive instructions with a three quid digital watch.

A good match

In use, the Ness behaved as expected. With no cache to compensate for the SX'edness of the processor, it was no speed demon, but the hard disk speed was a good match for the rest of the system. It's all standard technology, lumped together in a standard way, with little eye for detail.

Rupert Goodwins

Olivetti PC Pro SX 20

When Carlo Benedetti left the giant

Fiat empire, making the short journey north from Torino having fallen out with the powerful ruling Agnelli family, he was determined to turn the ailing Olivetti office equipment (read 'typewriter') manufacturer into an industrial giant to rival his former company. Whether he has succeeded or not is hard to say. Certainly Olivetti's profile has been raised, through links with AT&T in the US (now severed) and Triumph Adler in Germany. On the other hand, the products have been, well, odd.

There has been some nice output, including a couple of nice printers, but for the most part Olivetti's PCs have been — let's be charitable — uninspired. Good-looking mostly, if a little over-designed, but mediocre performance at a premium price. Except of course for the PC1, sold off at what would have been a bargain price had the machine been worth buying,

through Dixons.

Initial impressions of the snappily-named PCPro SX 20 did little to suggest that there might have been a revolution in Ivrea. Finished in two-tone grey with green and white logos and the normal Olivetti quota of drilled grilles and fake Tuscan columns along the base, the case is attractive in a fussy sort of way. The large power switch and hard-disk icon with the size of the drive moulded into it are nice touches. But Olivetti PCs have (almost) always looked good. It's what's inside that counts.

On the side

Most PC Pro owners will never find out. Undo a simple catch (a million-Lira coin will do fine, or a 2p piece, whichever is the cheaper) and the left-hand side of the case comes off, giving easy access to the three 16-bit ISA slots. Easier still if you stand the machine on its side, which is possible with this case, unlike some of Olivetti's earlier offerings. You'll also find access to the 387 socket, a VGA features connector and two RAM sockets to upgrade the on-board VGA beyond 640 x 480 in 15 colours.

To gain access to that plate, you need to remove the rest of the case. If routine upgrades like adding a new card have been made easier, more complex operations have been made as complex as possible. To get the rest of the case off you simply remove the back panel which is held on with two screws, undo a single screw at the front left corner, pop out two tabs on the bottom right-hand edge of the case and pull the plastic case in every possible direction



Olivetti PC Pro SX 20

Processor

20MHz 386SX

RAM

3Mb expandable to 17Mb

ROM

Olivetti BIOS

Mass storage

120Mb 19ms Conner hard disk,

3.5in floppy

Storage

Three drive bays (one free)

Expansion

Three free 16-bit slots

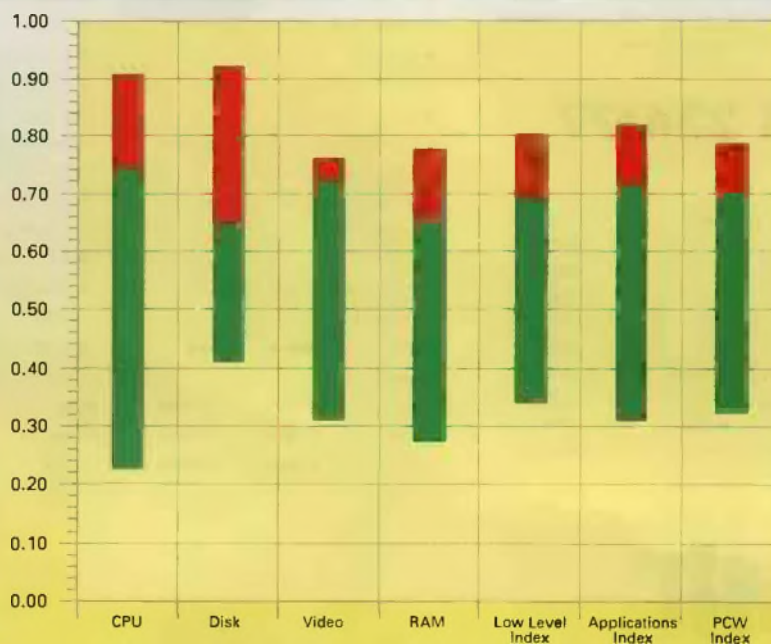
Manufacturer

Olivetti Office (0908) 690790

Good Points Looks good, goes well.

Bad Points Cheap, but not that cheap.

Conclusion Not quite cheap enough to be truly desirable.



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until it comes free. Simple? No, not exactly.

Once you have the plastic lid off, you can get at the two screws which hold the plate over the motherboard. Under there you'll find the tiny 386SX package and a very sparsely populated board, dominated by a Western Digital/Paradise VGA chip.

The rest of the motherboard, including the four SIMMs which hold 4-16Mb in addition to the 1Mb on board (the base configuration is 3Mb) and a couple of Intel support chips, is tucked under the power supply. Four screws and a large dose of manual dexterity are required to prise the unit out. At the front there are two 3.5in drive bays which, in the review machine, were filled with a 3.5in 1.44Mb floppy and a third-height 3.5in 120Mb Conner hard disk. Underneath there's a further 5.25in bay for either a second hard drive or an old-fashioned floppy.

At the back of the case you'll find the only really odd thing about the whole machine, plus PS/2 mouse and keyboard connectors, a VGA outlet, a parallel port and a single 25-pin serial port. You'll need that adaptor you threw out when you were trying to get your 25-pin devices to work on 9-pin serial ports a couple of years ago.

The only software that comes with the Olivetti is DOS; in the case of the review machine, 3.3 in a shrink-wrapped package and 5.0 on the hard disk...

Good performance

Oh, there is one more odd thing about the Olivetti — the performance: good enough to put the Olivetti comfortably in the top 5 on the test. Now that is a surprise, and a pleasant one at that. Good looking, fast and with a surprisingly low price for such a well-built PC.

Guy Swarbrick

Panrix 386SX/20



Just occasionally, a company seemingly appears from nowhere. The Panrix name has never been a household one, but it has all the characteristics of many other clone assemblers; a case, a motherboard, a couple of drives and a monitor making up a machine that fits

squarely into the commodity market that the 20MHz 80386SX business seems to have become.

And indeed, the mini-tower case is almost identical to that of the CometData machine reviewed here. The front panel has the same power switch, key lock, turbo and reset buttons, and indicator lights, although the area usually occupied by a two-digit speed display has a Panrix '3P' badge instead. There are four externally-accessible drive bays, two half-height 5.25in and two third-height 3.5in, and inside the case there is a further bay for a low-profile 5.25in hard disk.

At the rear are blanking plates for eight expansion slots, three of which are filled with sockets for the monitor, parallel port, two serial ports, and game port. The keyboard socket is oddly placed near the top of the case, just below the power supply, which might be awkward if the system is used on the desktop. The case actually has a covered hole at the bottom of the front panel that is obviously meant for a keyboard socket, but the positioning is actually dictated by the motherboard layout.

Motherboard

Inside the case, the motherboard turns out to be a sparsely-populated motherboard based on a Chips & Technologies chipset, an Intel 80386SX, and an AMI BIOS. The only interface is the keyboard socket, and again the hard

Panrix 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Zenith BIOS

Mass storage

105Mb 17ms Quantum hard disk, 3.5in, 5.25in floppies

Storage

Five drive bays (two free)

Expansion

Six 16-bit slots (five free), two free 8-bit slots

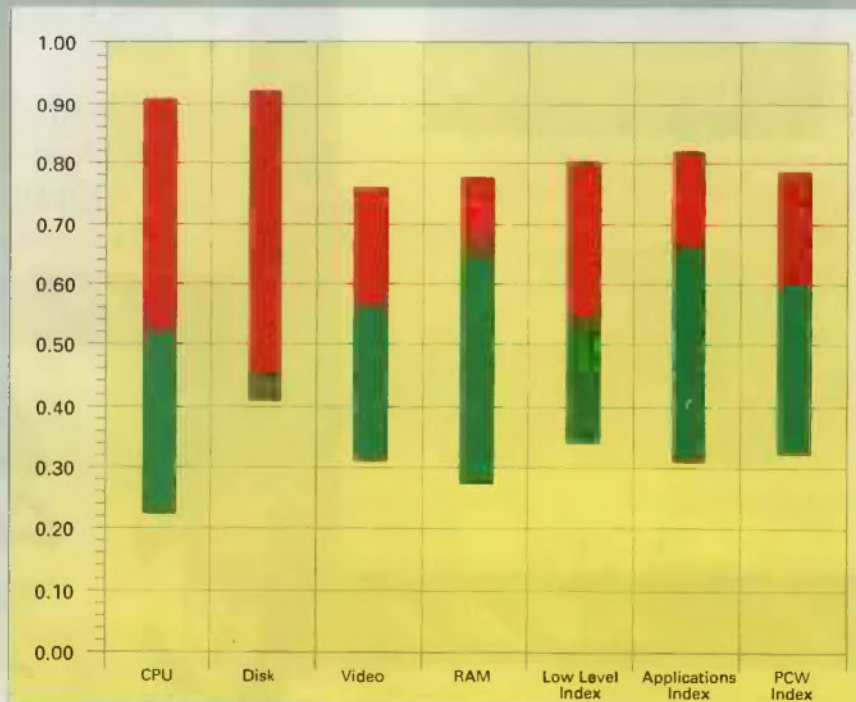
Manufacturer

Panrix (0532) 650214

Good Points RAM cache for CPU speed.

Bad Points Tangled interior, difficult maths co-processor installation.

Conclusion Equal among equals.



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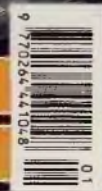


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- 1004 SPC.....Statistical analysis. V Good graphics (1)
- 1005 CURVEFIT.....Calculates best fit, co-efficients (1)
- 1013 EZ SPREADSHEETS.....User friendly spreadsheets (1)
- 1014 QUBE-CALC.....3D spreadsheet (1)
- 1017 LOTUS LEARNING.....Tutor (2)
- 1018 PIVOT.....Prints. Wks sheets
- 1022 ARCUS PROFESSIONAL.....Pro analysis system (HD4)
- 1023 ALITE.....Large simplified worksheets (1)
- 2001 PC-FASTYPE/CGA.....Typing tutor. Novice to advanced (1)
- 2003 MS-DOS TUTOR.....Beginners guide to DOS (1)
- 2004 LANGUAGES.....German, French, Spanish, Italian (B1)
- 2005 CASTAWAY.....Educational adventure games. All ages (1)
- 2006 EDUCATE 1.....Mathematics. Ages 9 to 14 approx (B1)
- 2007 EDUCATE 2.....Reading, counting etc. Ages 4 to 7 (1)
- 2009 ALGEBRA TUTOR.....Teaches Algebra operations (1)
- 2010 FUNNELS & BUCKETS.....Play & learn basic maths — 5-10 years (1)
- 2011 XY-SOLVE.....It's fun to learn (1)
- 2012 AMY'S FIRST PRIMER.....Numbers, alphabet, shapes etc — 4-8 years (1)
- 2013 PC QUIZZER.....Training & Tests (1)
- 2017 XY-SEE.....Graphics Maths for college students (2)
- 2029 SPELL GAMES.....Helps + Improves (1)
- 2023 DATAPLOT.....Scientific Data Plotting (1)
- 2037 ABC FUN KEYS.....Word Learning for Infants (1)
- 2038 AMANDA'S LETTER LOTTO.....For the very young (1)
- 2041 PROBABILITY AND STATISTICS (1)
- 2043 EQUATOR.....Math, finance, science (1)
- 2052 GCSE.....Physics (1)
- 2053 GCSE.....Computer Studies (1)
- 2055 FRACTIONS + MATH MAZE (1)
- 2057 BRANDON'S LUNCH BOX.....Five Educational Games (1)
- 2059 GCSE MATH.....(1)

EDUCATIONAL

- 2061 CHEMICAL.....Molecular Modelling (1)
- 2062 KRYPTO & ACROSTIX.....Create and solve puzzles (1)
- 2063 FORMULA 1.....Algebra learning college/unf students (1)
- 2064 PC LEARNING EGA.....A series of progs for 2-7 yr olds (3)
- 2065 SCIENCE.....UK Study program (1)
- 3002 'C'.....Small 'C'. Includes Tutorial (1)
- 3003 PASCAL.....Three compilers on one disc (1)
- 3004 A88/D88.....Assembler & Debugger (1)
- 3006 CHASM.....Cheap Assembler. Effective (2)
- 3007 FORTH.....Extremely good implementation (1)
- 3008 PROLOG.....With expert system example prog (1)
- 3009 LISP.....Two versions of this popular A.I. Program (1)
- 3011 EXPR SYS.....Ideal for beginners to A.I. (1)
- 3013 'C' TUTOR.....Perfect for beginners (1)
- 3016 MINI ADA.....PC version of Military Language (1)
- 3017 DISASSEMBLER.....8086/87/88 disassembler (1)
- 3018 MODULA-2.....Compiler, editor, linker, etc. V. Good (HD3)
- 3033 'C' Utilities.....Programmers tools (1)
- 3035 MORE 'C' Utilities.....Programmers tools (1)
- 3039 PERSONAL 'C' COMPILER.....Fast & Comp. (1)
- 3042 DDS FOR 'C'.....Database development system (1)
- 3044 CPM EMULATOR AND TRANSLATOR.....For conversion emulation (1)
- 3046 GRAPHICS C.....Library (1)
- 4001 TREES.....Genealogy program (HD1)
- 4002 FAMILY TREE.....Genealogy program (1)
- 4004 INSTANT RECALL.....Memory resident database (1)
- 4005 WAMPUM.....Dbase III clone. Networking (HD1)
- 4006 GENEALOGY.....Comprehensive family tree prog (2)
- 4010 CATALIST.....Mailing list, labelling, filefax (HD2)
- 4012 THE NIGHT SKY.....Watch your own planetarium (4)
- 4014 FILE EXPRESS.....Powerful easy learning (HD4)
- 4017 DEEP SPACE.....Starmaps + comets (2)
- 4021 CHURCH MEMBERSHIP SYSTEM (1)
- 4024 PUNTERS PAL.....Study form the easy way (1)
- 4043 FOOTBALL FORECAST.....Pools prediction (1)
- 4046 SAVE THE PLANET.....Global Warming DB(1)
- 4048 THE SAURUS PLUS.....(1)
- 4052 MULTIWORD.....Electronic Thesaurus (1)
- 4058 TELEPHONE COST CALCULATOR (1)
- 4061 BROTHER'S KEEPER.....Genealogy prog (HD3)
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- 5013 COGO.....Civil engineering 2D/3D modelling (2)
- 5015 CHEMVW EGA.....3D molecular structures (1)
- 5017 ALTAMIRA.....Graphics design and editor (1)
- 5020 FLO DRAW.....Chart design + tutorial (3)
- 5035 VGA CAD.....3D Design
- 5038 VGA PAINT.....Paint Prog (1)
- 5047 VGA CAD UTILITIES (1).....(1)
- 5049 VGA CAD UTILITIES (2).....(1)
- 5050 DRAFT CHOICE.....Impressive Graphics Tool (1)
- 5053 GRAPH TIME II.....The latest in graphing (2)
- 5057 PC-ROUTE.....Printed circuit program (1)
- 6002 BACKGAMMON, CRIBBAGE + DRAUGHTS.....Boardgames (1)
- 6003 PC-CHESS.....Graphic versions. Many levels (1)

LANGUAGES

- 6004 SLEUTH.....Detective graphic adventure (1)
- 6007 SAILING /CGA.....Simulation Game (1)
- 6008 CAVEQUEST.....Medieval strategy adventure (1)
- 6009 ADULT TRIVIA.....Strictly for adults (1)
- 6010 SAM SPADE.....Detective graphic adventure (1)
- 6014 CARD GAMES.....Bridge, Canasta, Hearts & Poker (1)
- 6015 ARCADE 1.....Collection of four games (1)
- 6016 ARCADE 2.....Collection of many games (1)
- 6017 ARCADE 3.....Collection of four games (1)
- 6018 ARCADE 4.....Collection of many games (1)
- 6019 STRATEGY 1.....Collection of three games (1)
- 6020 CASINO 1.....Collection of four games (1)
- 6021 COMPOSER CGA.....Compose and print your own music (1)
- 6024 GOLDEN WOMBAT.....Adventure game (1)
- 6026 AMULET OF YENDOR.....Initiative game (1)
- 6030 JUMPMAN LIVES.....Arcade Game. CGA/EGA/VGA (1)
- 6031 DARK AGES.....Requires 286 or better. (HD1)
- 6032 RETURN TO KROZ.....Graphics Adventure game (1)
- 6033 CAVERNS OF KROZ.....(1)
- 6034 ARTIC ADVENTURE.....(1)
- 6038 CROSSWORD CREATOR.....Customised Entertainment (2)
- 6040 MAZE.....Escape The Maze (1)
- 6041 FORD TEST DRIVE.....Driving Simulator (1)
- 6043 MOSAIX EGA/VGA.....Jigsaw puzzle (2)
- 6044 FORD SIMULATOR 2.....Driving simulator (2)
- 6045 VGA MAHJONG.....Classic Card Game
- 6046 CROSSWORD SOLVER.....(1)
- 6048 MORAFF'S ENTRAP + FLY.....Arcade Game (1)
- 6049 CAPTAIN COMIC EGA.....Adventure game (1)
- 6056 MORAFF'S SUPERBLAST EGA (1)
- 6059 MORAFF'S BLAST.....EGA (1)
- 6060 SOLITAIRE CARD GAMES.....inc Canfield, Vegas etc (1)
- 6062 COMMANDER KEEN.....(1)
- 6064 MONUMENTS OF MARS.....Requires 286 or better (HD1)
- 6065 DUKE NUKES.....Requires 286 or better (HD1)
- 6066 PHAROAH'S TOMB.....Graphics adventure (1)
- 6067 CAVES OF THOR.....Graphics adventure
- 7002 GALAXY.....Word Star clone. Very fast (1)
- 7007 QWERTY.....Beginners word-pro. Includes tutor (1)
- 7013 MINDREADER.....Artificial Intelligence Word-pro (1)
- 7020 CHILDREN'S WORD PRO.....A good intro for kids (1)
- 7021 HYPERHELL.....Text Technology HD (3)
- 7035 TUTORIAL WRITER.....Authoring system (1)
- 7038 SHARESPELL.....Stand Alone Checker (1)
- 8001 CASHTRAC.....Personal finance (HD2)
- 8002 HOME BUDGET.....Home finance (1)
- 8003 FAST BUCKS.....Personal finance (2)
- 8004 TIME & MONEY.....Personal and small business accounts (1)
- 8006 LEDGER MASTER.....Latest accounts pkge (HD4)
- 8007 MR BILL.....Professional billing system (2)
- 8008 CHECKMATE GL.....A full accounts business package (2)
- 8014 TRINITY.....Personal Finance (1)
- 8020 RETIRE.....Plan for the future (1)
- 8023 ULTIMATE SALES PROG.....Sales + invoicing + stock etc (HD2)
- 8026 PAYROLL.....Full UK Prog (3)
- 8028 PAGE FINANCIAL CTRL.....Accounts clone HD (2)
- 8029 CASH ACCOUNTANT.....Small Business Start Up (1)
- 9004 WILDCAT.....Bulletin Board system (HD2)
- 9005 KERMIT.....Classic comms program (1)
- 9013 RBBS.....Bulletin board HD (4)
- 9014 WEAK LINK.....File Download Prog (1)
- 9015 EAZILINK.....For View data/BBS (2)
- 9016 QVT.....DEC Terminal Emulator (1)
- A003 PC-STOCK.....Analysis of stocks and shares graphically (1)
- A004 SURVEYSOFT.....Calculation program for surveyors (1)
- A005 ESTI-BID.....Professional estimating & job costing (6)
- A006 MAKE MY DAY.....Time scheduling, expenses etc (2)
- A007 PDS*QUOTE.....Project quotation system (1)
- A008 PORTFOLIO.....Return on investments and shares (1)
- A011 DESK TEAM.....Memory resident desktop (1)
- A014 IN CONTROL.....Business scheduling and reporting aid (2)
- A015 BUSINESS LETTERS.....Modify to requirements (650 letters) (2)
- A017 EMPLOYEE MANAGEMENT.....Controls this important area (1)
- A018 UNIVEST.....For unit trust Portfolios (B1)
- A023 GANNT.....Project Manager (2)
- A036 SUPERBEAM/PC.....Steel and Timber Beam calc. (1)
- A031 STOCK.....Inventory control (1)
- A040 INVENTORY MASTER.....Stock Control Prog (1)
- A051 PERSONAL PORTFOLIO MANAGER.....for tracking graphing etc (1)
- A052 LEGAL FORMS.....(1)
- A053 STARBURST MAINTENANCE (1)
- A054 UK COMPANY FORMATION (1)
- A057 STOCKTAKER.....For pubs, hotels etc. (HD1)
- B002 EGA UTILS.....Many E.G.A. utilities and programs (2)
- B004 ENCRYPTOR.....Protect your files from prying eyes (1)
- B007 MULTI TASKING.....Two multi-tasking programs (1)
- B029 PROFESSIONAL MASTERKEY.....Menu driven utils (1)
- B040 POWER MENU.....Econ-Ram (1)
- B048 PK-ZIP.....Standard file archiver (1)
- B049 4 DOS.....Dos shell w/plus 35 commands (1)
- B052 LAN MENU.....For network users (1)
- B053 ON SIDE.....Versatile side print (1)
- B060 BLANK IT.....Prevents screen damage (1)
- B061 WORLD CLOCK EGA/VGA.....(1)

D/BASES

- 4001 TREES.....Genealogy program (HD1)
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GAMES & MUSIC

WPS

ACCOUNTS

COMMS

BUSINESS

UTILS

PCW11 (HD) = HARD DISC; (TD) = TWIN DISC; (B) = GW-BASIC OR COMPATIBLE; FIGURE { } DENOTES NUMBER OF DISCS IN SET

SHAREWARE PROGRAMS REQUIRE
SEPARATE PAYMENTS TO AUTHORS
IF FOUND USEFUL

5.25" DISC = 10 FOR £35. 5 FOR £20,
SINGLES £4.50 EACH
VAT & POST INCLUDED. FOR 3.5" DISCS ADD 50%

Send £1 in stamps for comprehensive overviews. State disc size 3.5" or 5.25"

and floppy disk controllers and the serial, parallel and game ports are all on a multifunction board in a single 16-bit expansion slot. A Diamond Flower SuperVGA board, based on the Tseng Labs ET4000 chip with 1Mb of video RAM, occupies a second slot, leaving four 16-bit and two 8-bit slots free. One of these eight-bit slots cannot be used, however, since its blanking plate is used for sockets connected to the multifunction board by video cable.

Unusually, the VGA board has two sockets for both analogue and TTL monochrome monitors, although the vast majority of monitors now are analogue-only for obvious reasons. With this board the maximum resolution is 1024 x 768 in 256 colours, and drivers are supplied for Windows 3.0 and the usual set of Tseng-supported CAD and other applications. However, the 14in Capetronic SuperVGA monitor supplied with the review machine could only handle the highest resolution in interlaced mode.

There are eight SIMM slots on the motherboard, providing RAM expansion up to a maximum 8Mb, and there is also a 32K RAM cache as standard to boost CPU speed.

Apart from the maze of drive, port and power cables snaking around the system, it is neatly put together; the only major problem is that installing an 80387SX maths co-processor would involve completely dismantling the machine and removing the disk drive cage, to get at the empty socket. It would be a good idea for customers to specify this option when the machine is first assembled.

The review system came with both 5.25in and 3.5in floppy drives, and although the packing sheet showed that a 52Mb Quantum IDE hard disk was installed it actually turned out to be a 105Mb drive from the same maker. This is an excellent drive, with 64K of cache on its built-in controller.

Fuzzy text

In use, with the card and Windows set to 1024 x 768 256-colour resolution, the combination of the 14in screen size and the interlacing made the small text fuzzy and hard to read. At 800 x 600 the display was fine, and again the controls to adjust the display size and position were easily accessible at the side of the monitor.

The keyboard was a pleasant surprise, a hefty metal-based unit from Nan Tan with an excellent tactile feel that was a relief after some of the other keyboards used in these reviews. However, the Longshine mouse was exactly like all the others, a Microsoft/Mouse

Systems clone that looked rather tacky. But it worked well, and its adjustable resolutions up to 800dpi could come in handy for CAD applications.

Good contender

This machine is typical of the breed, with a set of components put together to a price and working pretty well despite the disparate sources of the parts. The standard RAM cache — on the 20MHz machine only — provides good CPU performance, and the Quantum hard disk is also a good performer. The interlaced monitor lets things down rather, but the keyboard is excellent and there is nothing else to complain about. A good contender, but only one among many.

Peter Jackson

Paragon Haval PC386S-20CD



This is rather a smart machine, solidly built and sleekly designed. The review sample is known as the compact desktop model, and while the term 'compact' isn't entirely convincing, this PC shouldn't swallow up too much of your desk space.

Indeed, the system box strikes a good compromise between compactness and expandability. The review machine came with 5.25in and 3.5in floppy disk drives and there is room for two more 5.25in devices, both accessible from outside the machine. The 3.5in disk drive is mounted vertically and there's a blanking plate next to it, suggesting room for one more. Taking the case off, however, reveals that the hard disk is using this bay.

The front panel is impressively endowed. You get a row of three LEDs indicating power on, hard disk activity and turbo mode. Below that are turbo and reset buttons and a keyboard lock.

The main power switch, however, is at the back.

Counting slots

The back also boasts eight openings for expansion slots. However, looking inside the machine reveals only seven actual slots (the extra opening could be useful though as some cards, like multifunction I/O devices, need more than one). The slots are all 16-bit and only one is occupied in the standard configuration, by the VGA adaptor. Six free slots is well above average for this type of machine. The company-supplied specification sheet boasted only five free slots but I counted them several times. The machine is available in mini-tower and slimline varieties, though in the latter you get only four free expansion slots (according to the spec sheet).

The two serial ports (one 9- and one 25-pin) and the printer port are provided direct from the motherboard. The sockets themselves aren't mounted on the board, but are provided via special holes in the casing. There's an additional hole available for a 9-pin D-socket. The standard AT-style keyboard socket is mounted directly on the motherboard.

Accessible sockets

The motherboard is a neat and simple affair. The 387SX maths co-processor socket is easy to reach unless you have expansion cards in slots four or five, in which case you'll have to temporarily remove them to fit the chip. Similarly, the SIMM sockets are very accessible unless you insist on using full-length expansion cards on that side of the machine. Using 4Mb DRAMs you can plug in as much as 32Mb if you really think that's a good idea.

There's plenty of space inside the box, so maintenance and upgrading should pose few problems. The power supply is a switchable 200W unit, well shielded but with a louder than average fan. It's not too disturbing, however, and shouldn't cause any irritation in normal office environments.

The 14in SuperVGA monitor, capable of supporting resolutions up to 1024 x 768, is crisp and stable enough though not particularly outstanding for its type. VGA mono and Hercules mono options are available. Power output for the monitor is provided by the system box. The display adaptor is the Orchid ProDesigner II and comes with support disks and manual. You also get a manual for the motherboard and Microsoft's standard DOS 5 pack.

The keyboard was the same item found on the TriGem, so look there (page 258) for comments. Like the

Paragon Haval PC386S-20CD

Processor

20MHz 386SX

RAM

4Mb expandable to 32Mb

ROM

AMI BIOS

Mass storage

89Mb 16ms hard disk,
3.5in, 5.25in floppies

Storage

Five drive bays (two free)

Expansion

Seven 16-bit slots (six free)

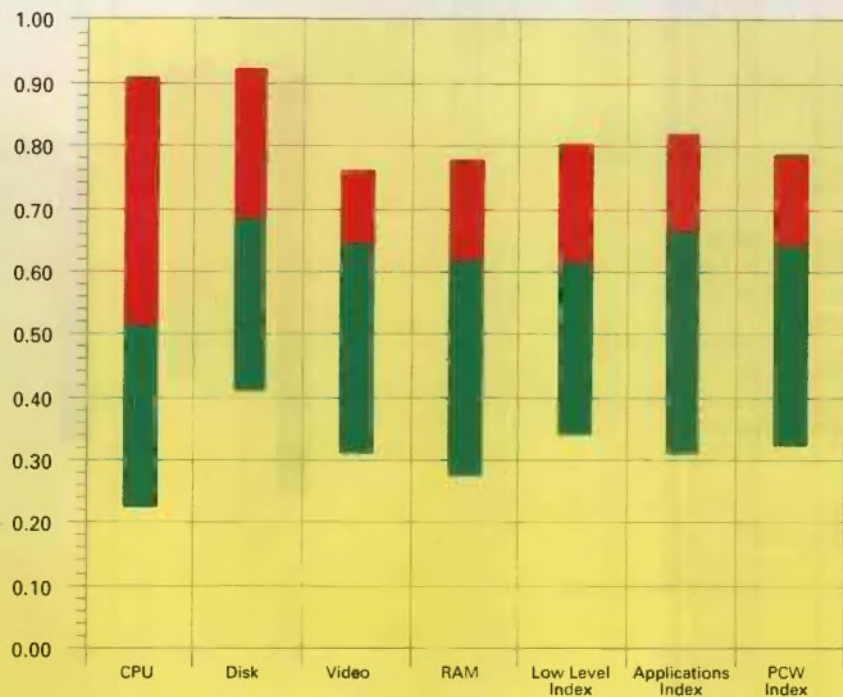
Manufacturer

Paragon 021-359 1807

Good Points Neat-looking.

Bad Points Unpleasant keyboard.

Conclusion Budget machine with quality graphics card.



TriGem, it is the weakest point of the machine.

Average performance

When put through the benchmarks, the Haval turned in a pretty average performance. Its worst feature was the CPU speed, though slightly better than average disk and video speeds helped it catch up a little to achieve overall average results. The hard disk tested was the 89Mb 16ms device. You can opt for 40Mb, 129Mb, 210Mb or 320Mb devices, all using the system's on-board IDE controller.

The machine is supplied with DOS 5 and a three-button mouse. The one-year parts and labour warranty is of the return-to-base type. If you want a year's on-site maintenance it's going to cost you another £50. You get a three-year labour warranty as standard.

You can get a colour VGA machine for as little as £850, with 2Mb of RAM and a 42Mb hard disk. The review machine, with two floppy drives, the 89Mb hard disk and 4Mb of memory will set you back £1064. Other options include a VGA upgrade to 1Mb for £20 and an extra floppy drive for £44. These are undeniably competitive prices and in spite of the machine's average performance begin to make it look very attractive.

Steve Mansfield

to acknowledge the 386sSX's role in life as a cheap, cut-down entry-level machine — in all but price. The front panel is fairly busy for a machine of this sort. There are slots for three 5.25in and one 3.5in devices (the review machine had one of each size of floppy disk drive though normally you get just the one floppy drive on the base machine). The hard disk uses another, internal drive bay.

On the left side of the panel is a large and bright LED window showing the CPU speed — 20MHz in Turbo mode and 10MHz when switched to slow speed. Next to that is the keyboard lock and then turbo and power buttons (each with confirming LEDs), a hard-disk activity light and a reset switch. It's good to have both power and reset switches on the front where you can get to them easily.



Built to order

The standard package includes MSDOS 5 which is already installed on the machine when you get it. If you want a different operating system, QCS should be able to supply it. Like an increasing number of clone suppliers, QCS doesn't keep stocks of machines but builds them to order — and to specification.

The main point of interest inside the QCS is the row of eight expansion slots — more than you get on many 386SX PCs where everything seems to be cut down. Two of the slots are already occupied: there's a VGA card in one and in the other a multi-function I/O card. The latter provides printer and games ports direct from the card and two serial ports (one 9-pin, one 25-pin) via special slots in the machine's casing (there are holes for two more such ports). That leaves four 16-bit and two 8-bit slots free.

The SIMM sockets are easy enough to get at, though life might get a bit trickier if you have any full-length expansion cards installed towards that side of the machine. The 387SX maths co-processor socket is a different story, being well hidden under the drive bays. Installing such a chip is a one-off operation usually, but on the QCS it's an operation that's going to leave you swearing.

The keyboard is a Cherry product, reasonably light in action but with a very positive and loud click. It had a slightly cheap feel but in the end I liked it quite a lot.

The monitor is slightly larger than

QCS 386/SX-20

This is a fairly chunky PC that refuses

QCS 386/SX-20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

88Mb 19ms Seagate hard disk,
3.5in, 5.25in floppies

Storage

Four drive bays (one free)

Expansion

Eight 16-bit slots (six free)

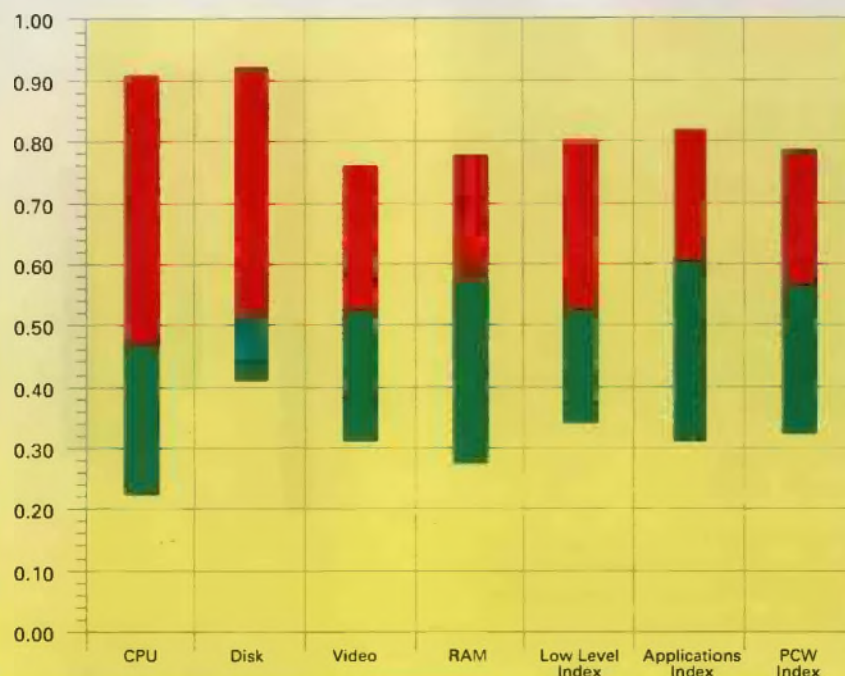
Manufacturer

QCS (0245) 495904

Good Points Picture quality and expandability.

Bad Points Slow.

Conclusion Nothing special.



average, an angular beast similar in style to Apple's products. The display is excellent, being sharp, fairly square and without flicker. It also has large contrast and brightness wheels on the front where they're easily reached. There is a power output for the monitor on the system box.

The least appealing aspect of the QCS is its performance in the benchmarks. All the times were below average with the exception of the WordPerfect test that managed to hit the mean level.

Expensive and expandable

The machine as supplied for the review costs £1224: that's with the 88Mb hard disk, 4Mb of RAM and the additional floppy disk drive. If you're content to have just 2Mb of memory, a 42Mb hard disk and one floppy drive, you can get a colour VGA machine for under a grand — £969 to be precise — which is pretty good value. Windows 3.0 and a mouse adds £90.

Other options include: a mini-tower version for an extra £20; a slim-case version for an extra £15; and a full-tower version with a 230W power supply for another £80. QCS also offers 125Mb, 180Mb and 210Mb hard drives. The QCS isn't speedy but it is inexpensive and is very expandable.

Steve Mansfield

SMC 386SX/20

My first impression of the SMC wasn't a good one. On taking the machine out

of the rather inadequate packaging I discovered that it rattled. I tracked the source down to three of the plastic card-retaining slots which had come adrift from the main chassis, and to the loudspeaker which was simply hanging loose on its wires — there didn't seem to be any bracket provided for it.

Second impressions weren't much better. The mini-tower case is functional without being particularly attractive, with the usual complement of reset, power and turbo buttons and a keylock on the front panel.

Feels nasty

Unfortunately, the keyboard supplied with this machine has one of the nastiest feels of any I've used, almost as bad as a Compaq. Like Compaq keyboards, this one is spongy with very little tactile feedback: there's no click to let you know the keypress has happened. If anything the monitor was even worse, exhibiting poor convergence — some-

thing I had thought to be a thing of the past with modern monitor designs. A Logitech serial mouse with two serial ports was provided, so using an external modem would not involve unplugging the mouse.

Internally the machine was a fairly standard collection of components. The motherboard had a Chips & Technologies chipset and a BIOS from American Megatrends Inc (AMI). The AMI BIOS is particularly flexible, offering a whole range of options.

The motherboard has eight slots, two 8-bit and six 16-bit. Two were occupied by the hard-disk controller and the VGA card. In common with a number of other clone motherboards, this one had the last three slots in line with the memory SIMMs so that it would be difficult to fit full-length cards into the slots without fouling the SIMMs.

Problem socket

More of a problem was the location of the socket for the 387 maths co-processor. This was located under the framework that held the disk drives, so you would need to remove either all the disks and the mounting hardware or the motherboard to install the co-processor. While this isn't difficult, it is a step that shouldn't be necessary: a sensible motherboard design would put the co-processor near to the expansion bus where it's likely to be accessible.

The review machine came fitted with 4Mb of 70ns SIMMs, filling one of the two banks of SIMM sockets. Since no motherboard manual was supplied with



the review machine, it is not clear whether the motherboard can use the larger 4Mb SIMMs to expand the memory beyond 8Mb.

This system was supplied with both sizes of floppy drive and a 100Mb Plus hard disk. This choice of hard disk came as something of a surprise, since while Plus is one of the most respected hard-disk manufacturers with a very good reputation for reliability, it isn't exactly the cheapest on the market. There is just one half-height 5.25in bay free — plenty of room for a tape drive to back up those hundred megabytes.

The VGA card on the review machine used the Ahead chipset and BIOS, not one I'm familiar with. It was fitted with 256K of display memory, meaning it was capable of up to 1024 x 768 pixel resolution with 16 colours, but the monitor could only show this resolution with an interlaced display. For the purposes of this review I ran Windows at the next lower resolution of 800 x 600 pixels, where the card can display 256 colours.

Unfortunately, unlike many VGA cards, this one was not expandable — at least, it didn't have any extra sockets for more display memory. It might be possible to upgrade it by removing the 256K chips and putting in larger ones, but without any documentation we shall never know.

With the exception of the Plus hard disk, this is a machine that has been built with too much attention to price and not enough attention to quality.

David Morton

Sprite



The Sprite was the fastest system tested, even beating Compaq's offering by a small margin on the weighted average of all the benchmark tests. This nippy performance is rather a surprise: outwardly the Sprite is a neat, unremarkable mini-tower.

The case is better designed than most, with well-labelled buttons for power, reset and turbo mode, though I can't remember the last time I actually switched any desktop PC to its lower speed. Thankfully the days of copy protection schemes that only worked correctly if the CPU was clocked at 4.77MHz are over, and I presume that one day soon such switches will go the way of all flesh.

The monitor supplied with the review machine was a Samsung, and very nice it is too, with a sharp, well-

converged display and no sign of any geometry problems. The keyboard is a Cherry, with the pleasant, slightly clicky feel that they're well known for. Cherry makes some of the nicest keyboards around, and it's good to see another clone manufacturer supplying them as standard.

The review machine came with DOS 5, Windows 3.0 and a Microsoft mouse, as well as a reasonably comprehensive manual.

Common kit

Inside the machine is fairly unremarkable, being the usual kit of standard parts which are common to a number of clone manufacturers — or, more accurately, assemblers. The motherboard is by Orchid and uses an Opti chipset, the BIOS is by AMI and offers a wide range of extras: you can set a password and tell the machine to boot without a keyboard, useful if the PC is being used as a dedicated server.

It's also possible to turn off the memory check when the machine boots, and to skip the floppy access and boot straight from the hard disk. These two features are particularly useful if you're developing code and keep crashing the machine, but if you make a mistake with Config.sys and include a command which locks up the computer, you won't be able to boot from a floppy and you could be in trouble.

The review machine was supplied with four 1Mb SIMMs and there are sockets for another four. These SIMM sockets will take the larger 4Mb SIMMs,

SMC 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

100Mb 8ms Plus hard disk,
3.5in, 5.25in floppies

Storage

Four drive bays (one free)

Expansion

Six 16-bit slots (three free), two free
8-bit slots

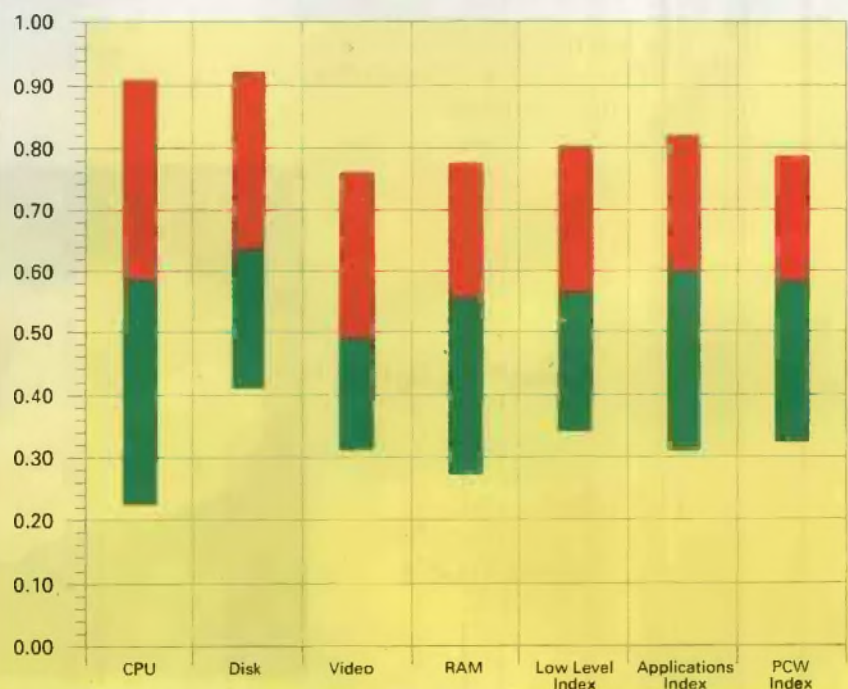
Manufacturer

SMC (0753) 550333

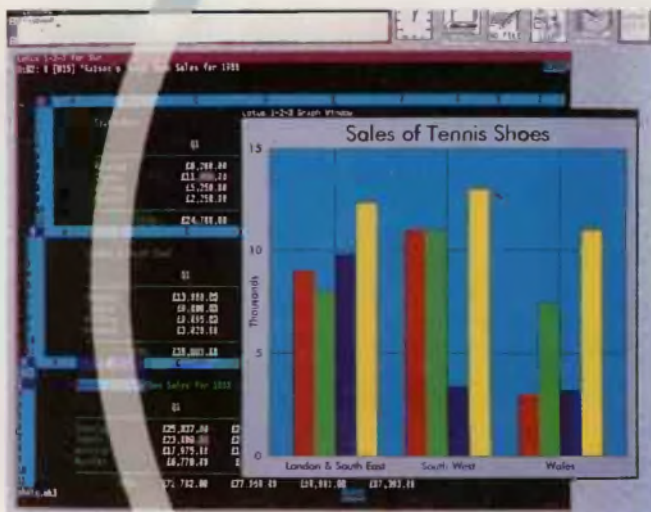
Good Points Nice disk.

Bad Points Lots.

Conclusion Look elsewhere.

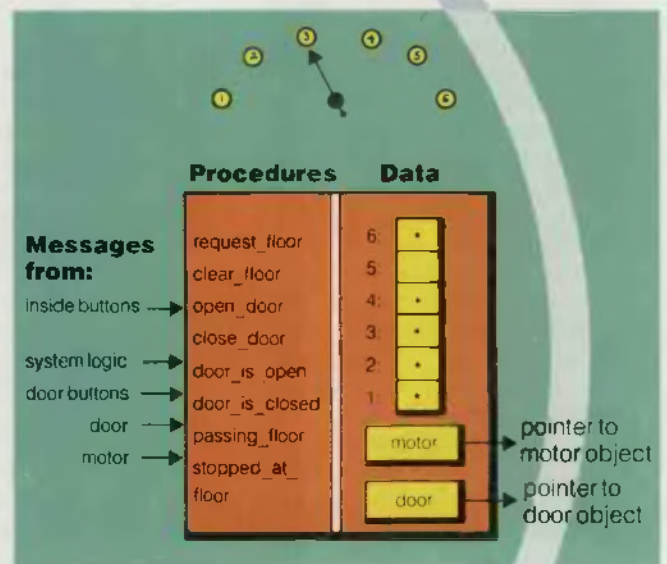


pc lan



Lotus notes 24

Can you trust the company which hit the big time with 1-2-3 to provide fully networkable applications?



No object 29

Object technology explained. What it can offer the network manager and when.

Shedding light 41

PC LAN products illuminated. Users join the reviewers and award Lanmarks to the latest PC LAN products.



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so the maximum memory expansion on the motherboard is 32Mb. However, since the maximum memory the SX processor can address is 16Mb, there is no point filling more than one bank with 4Mb SIMMs.

Not a pretty sight

Seven 16-bit slots are provided, two of which are used for the hard-disk controller card and the graphics adaptor. Unfortunately, two of the slots are directly in line with the memory sockets and it would be difficult to use a full-length card in them. Indeed, on the review machine the graphics adaptor was a full-length card and had been installed in one of these slots. As a result the card was quite noticeably twisted — not a pretty sight, and not something I'd be very happy with if this machine were mine.

Shuffling the cards around so that short cards were in the end slots would solve that problem for most users, of course, but what was less satisfactory was the positioning of the power supply. This is a large 200W unit which completely obscures one of the expansion slots at the other end of the bus, and access to the second one would be very tight.

The VGA card was another surprise: while most clone companies use VGA cards from a wide range of suppliers, many of whom use the Tseng Labs VGA chipset, this is a genuine Orchid Prodesigner II — widely regarded as the best of its kind. Fully expanded the Prodesigner has 1Mb of memory and it can display up to 1024 x 768 pixels in graphics mode.

The Samsung monitor will also run

at 1024 x 768 but only with an interlaced display. If interlaced displays rather tiring to use, and so for the review I used the machine in its highest non-interlaced mode which displays graphics applications (including Windows) at 800 x 600 pixels.

The review machine was supplied with both sizes of floppy disk drive and a 100Mb Fujitsu hard disk, leaving one free half-height 5.25in drive bay. The hard disk was quite quick and reasonably quiet in operation, which lead to a little confusion since the hard-disk access light on the front of the machine didn't work. One parallel printer port and two serial ports were provided: essential if, like this one, the machine is supplied with a serial mouse.

If you don't need a machine with a familiar name on the front, and you don't need too many expansion slots (and are prepared to be careful which ones you use) the Sprite offers a lot of performance for your money.

David Morton

Strand 386

The Strand 386 arrived with an assortment of bits and pieces. Stowed away in the cardboard box were various spare parts including blanking plates, plastic clips and screws. I still haven't figured out why, but they might be useful one day.

The system box is ugly: it is very large and has a stark, flat front. The front facia has a row of three push-buttons for Power, Turbo and Hard Reset. The buttons are labelled but there is a chance of accidentally pressing the Reset button. Also present is a key-

board lock and LED indicators. The Turbo button toggles the processor speed between 10MHz and 20MHz.

The monitor gave a good, steady picture and the colours were bright and clear, but a finer dot-pitch tube would have improved the clarity. A slow Trident VGA card was also fitted, but this can easily be replaced if necessary. The Taiwanese keyboard was most unusual, with a built-in set of flip-over key templates for dBase III, WordPerfect 5.0 and Lotus 1-2-3 users.

Annoying quirk

An annoying quirk of the Strand is the choice of DRDOS 5 (old version again) as the supplied operating system, which came complete with the View-Max (GEM) environment. Also supplied was the last disk of a set of four containing GEM Paint. I would have preferred MSDOS 5, or at least DRDOS 6.

The machine sports 5Mb of RAM and an AMI BIOS. The hard disk supplied was a very generous 324Mb Seagate model. It was connected to the



Sprite

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

105Mb 18ms Fujitsu hard disk,

3.5in, 5.25in floppies

Storage

Four drive bays (one free)

Expansion

Five 16-bit slots (four free)

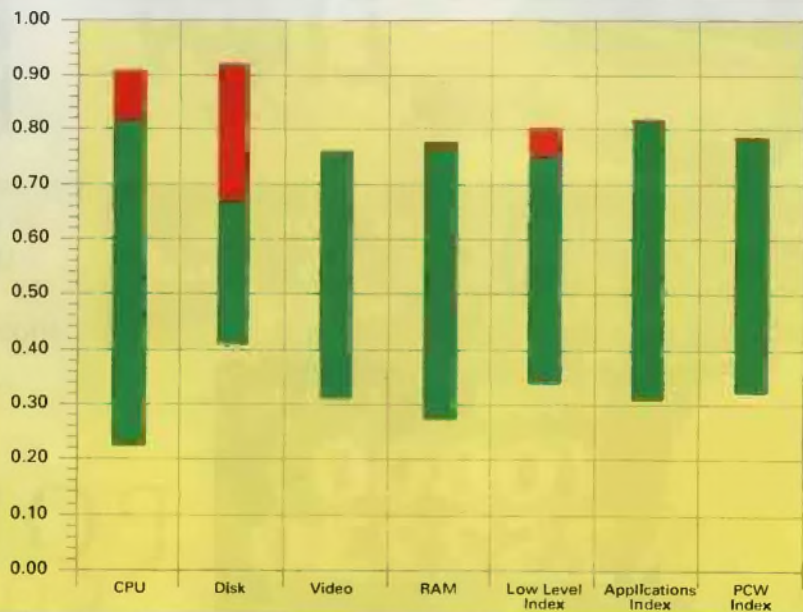
Manufacturer

Sprite 081-813 5533

Good Points Fastest in the Group Test.

Bad Points Has a problem with full-length cards.

Conclusion Lots of bangs per buck.



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	386/SX25	£395	44Mb-25MS (IDE) £ 165	EXTRA PER 1MB £ 50
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			DISPLAY	Extra Floppy Drive £ 50
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			14" VGA Colour £ 295	DR-DOS 6.0/MS-DOS 5 £ 70
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ubiquitous IDE controller and managed a respectable throughput. Two floppy drives, one 3.5in and one 5.25in, were fitted. On two occasions the machine hung completely when copying files from the 3.5in disk to the hard disk — running the controller card at too high a bus speed might be to blame.

The machine was very noisy. The fan intermittently made an awful grating noise, suggesting that it was not screwed in securely. The hard disk generally operated quietly, but when used heavily it sounded like a Kenwood Chef.

Light and flimsy

Internally the machine is built on a light and somewhat flimsy steel casing, and the general standard of construction is somewhat poor. The motherboard was badly seated and flexed nearly to breaking point when I inserted a card in one of the slots. The board itself is of reasonable quality and is quite densely populated with well-known makes of components, but using mostly rather dated technologies — the memory consisted of four Intel 1Mb SIPPs, for instance. Extra memory would be added by plugging in memory chips rather than SIPPs. The power supply is a standard Far Eastern 200W unit.

The hard drive was connected by a long cable which trailed over the motherboard, and a broken IDC plug. This plug gave such a poor connection that more than once I got a Hard Disk Controller error, so I reconnected the drive to the spare connector intended for adding an extra drive, which cured

the problem.

A number of the screws for holding the drives in their bays were missing, which might account for the horrible noise that the hard disk made. Cables for the front-panel indicator lights were all roughly a metre too long and were tied up and left trailing on top of the motherboard. All the cables were in danger of catching in the case when I opened the machine, which might be why the hard-disk interface cable was broken.

There is plenty of room for expansion, with three 8-bit and five 16-bit slots, two of which were already occupied. The co-processor socket is located inaccessibly beneath the drive bay sub-chassis, so fitting one would entail complete disassembly of the machine. There are also two free half-height drive bays.

This machine would be a very good buy on a price/performance basis, but it is severely let down by the appalling standard of construction. It is of a rather old-fashioned design both internally and aesthetically, but it does the job surprisingly well.

Jon Silver

Tandon MCS 386SX/20c



There's a certain shade of blue, common to European airport signs, old Vauxhall Chevettes and some hospital toilet walls,

which puts my teeth on edge. A strip of this blue colour adorns the top edge of the front of the Tandon MCS, fitted with a 386SX/20 processor card and thus worthy of review here.

Being different

Tandon is one of the long-standing names in the PC clone market, notable for having been around before the advent of the seriously cheap clone and much given to doing things 'differently': the Datapak ruggedised removable hard disk units were an interesting response to a particular problem arising not from first-principles analysis of likely use of computers, but from a view of the current market and an opportunity defined by the current conditions.

The Tandon's modular components are all accessible from the front of the machine: push some catches underneath and off comes the front panel to reveal three storage bays and a CPU module bay.

The default storage setup is a single



Why the machines run at different speeds



Although all the machines tested here contain a 386SX processor running at 20MHz, this does not imply they are all going to run at the same speed. The 20MHz refers to the raw clock supplied to the input of the processor and should be treated as a theoretical performance ceiling rather than an absolute measure of speed.

In order to operate, a processor is constantly reading from and writing to its main memory — the RAM. Although electricity travels down wires very quickly and transistors switch on and off at great speed, they still take a finite amount of time.

Dynamic memory, of the type used in all the machines tested, is not particularly fast, requiring typically 70ns (= 70/1,000,000,000 of a second). With a 20MHz processor requiring cycling at 5×10^{-8} and the DRAM only able to provide data at 7×10^{-8} , never mind the time it takes to transfer the data over the bus, it should be obvious that a bottleneck has arisen.

In theory, a 20MHz 386SX could be supplied with data from 60ns DRAM without being held back, due to the way the processor input clock is not directly translated into machine cycles. In practice, 60ns DRAM is not the cheapest available so alternative strategies have been used.

The simple way to synchronise the processor and its RAM involves wait states. Put simply, the memory receives a request and tells the processor to wait around for a while until its data is ready. This obviously slows the processor down each time it

accesses the RAM.

An improvement scheme divides the RAM into pairs of banks. While data is read from one bank of a pair, the other has a chance to settle down and prepare to be read next. This is often referred to as 'interleaving'. There is no guarantee that the processor will read from banks alternately, but each time it does it is saving a wait state.

The last trick up the designer's sleeve is a memory cache. This consists of a relatively small amount of high-speed RAM (normally static) positioned close to the processor itself so the data has less distance to travel. All accesses to and from main memory are buffered through the cache RAM. If the processor is working on one particular part of the RAM its contents can be quickly accessed because some clever circuitry will have arranged for it to be in the cache.

Another factor affecting speed is, as always, the performance of the hard-disk systems. Some were faster than others, as can be seen from the benchmark graphs. Manufacturers decide what sort of drive mechanism you are getting for your money. Most machines tested could have their BIOS ROMs shadowed into RAM. RAM is faster to access than ROM, the latter requiring several wait states when run at 20MHz. If the system copies its ROMs into an area of memory at boot time then all BIOS operations — such as reading the disk and writing to the screen — will be greatly accelerated.

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Strand 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 8Mb

ROM

AMI BIOS

Mass storage

338Mb 16ms Seagate hard disk,

5.25in floppy

Storage

Four drive bays (two free)

Expansion

Four free 16-bit slots, three free 8-bit slots

Supplier

Greyhound Marketing (0532) 621111

Good Points Lots for your money.

Bad Points Unpleasant construction, a bit dated.

Conclusion A dog.

3.5in drive at the top, with a 100Mb IDE drive mounted on a metal carrier in the drive bay beneath. The last storage bay is over the top of the CPU slot, and doesn't show signs of the same carrier rails and clip attachments as the other bay. So, while it would be easy to walk from machine to machine carrying your unclipped hard disk with you, extra volumes would have to be managed by traditional, Philips screwdriver methods of portability.

The CPU module carries both a heavy perforated metal jacket and dire warnings about static damage. A neat plastic lever unlatches the edge of the module from the connector at the back of the bay, and helps to pull the tight-fitting item out.

Having proved that it's easy to get into the front section of the system, I tried to get inside the main chassis. This requires the removal of some screws from the front of the machine, and quite a lot of wrestling with the immaculately tight, smoothly manufactured top case. Someone's put a lot of money into some very advanced manufacturing in metal: the bottom of the chassis, with embedded engineering quality hex nutheads (no self-tapping machine gun holes in sheet steel here) looks like nothing so much as a bit of armour plating.

The motherboard is very much smaller than is the norm, since it carries just the memory, all the I/O ports and various bits of support circuitry. The hard and floppy disk controller ribbon cables come straight off the board, and a rather complicated-looking right-angled adaptor-cum-daughterboard connects with the CPU module.

The expansion card connectors are mounted on a vertical bus board, poking up from the centre of the motherboard, with 16-bit AT standard connectors on both sides. Cards are installed lying on their sides, with room for four full-length cards on one side and three half-length on the other.

It's a very neat and well-engineered solution to the 'monster case' problem, with the bus board neatly braced against the innermost corner of the drive/module cage, and the motherboard SIMM sockets being of the 'lean over gently' type.

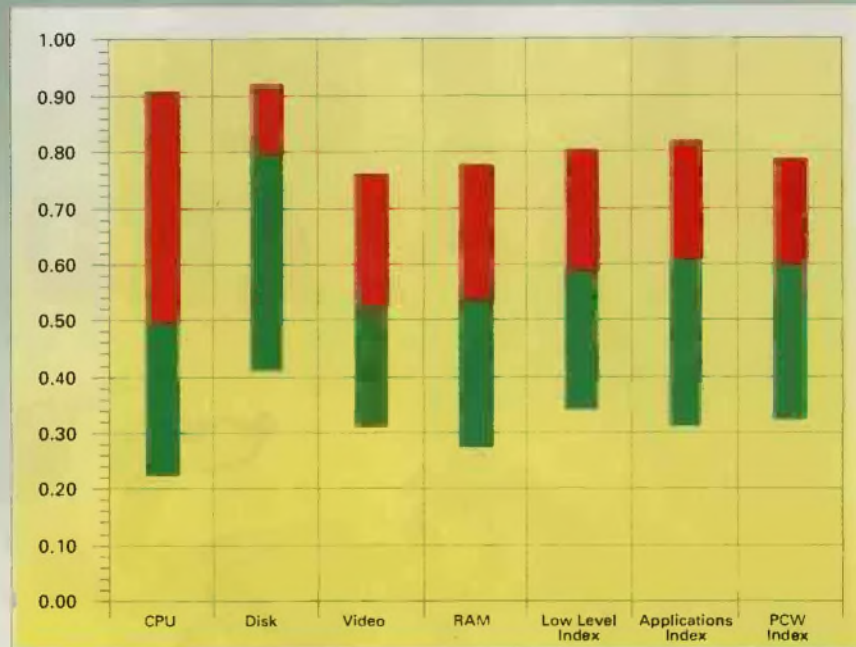
Extra utilities

The system comes bundled with DOS 5, Windows 3.0 and a rebadged Logitech mouse. There's a whole slew of extra utilities for configuring and controlling the built-in SVGA adaptor, with the usual depressingly awkward reconfiguration to allow 'non standard' resolutions for your Windows Desktop: large amounts of recognition awaits the programmer who makes this whole subject as easy on the PC as it is on, say, the Archimedes. Having said that, the performance of the onboard video adaptor seems much faster than the machine specification would suggest.

Steve Cassidy

Trader 386SX/20

My initial reaction on unpacking the Trader was that it wouldn't win any design awards. The system unit is a large box of the standard beige colour. The front of the case contains the standard LEDs for power, turbo mode and



hard disk activity. A keyboard lock is also provided. There are also push-buttons to toggle the turbo mode, reset the machine and switch it on and off. It is good to see these switches on the front of a computer rather than round the back.

The keyboard provided is an enhanced type. The feel is light and the keys produce a hollow click as they are depressed. The review machine also arrived with a Windows-compatible three-button mouse.

There is plenty of space inside. The large footprint means there is plenty of space for adding additional drives. There are five drive bays, two of which were filled on the review machine. It was also provided with 5.25in and 3.5in NEC floppy drives and a 100Mb NEC hard disk drive.

Below the disk drives is the motherboard. For reasons which I'll explain later I used two machines, each of which had a different motherboard. The first was larger and provided eight expansion slots, the second only six. If



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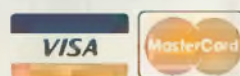
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Microprocessor	80286	80386SX	80386SX	80386DX	80386DX	80486DX	80486DX
Processor Speed	16MHz	16MHz	20MHz	25MHz	40MHz	33MHz	33MHz
Landmark Speed	21MHz	21MHz	29MHz	31MHz	65MHz	117MHz	145MHz
User Memory	1Mb - 4Mb	2Mb - 8Mb	2Mb - 8Mb	4Mb - 16Mb	4Mb - 16Mb	4Mb - 16Mb	4Mb - 16Mb
Cache Memory			32Kb		128Kb		256Kb
Hard Disk Drive	40Mb	40Mb	40Mb	40Mb	40Mb	40Mb	40Mb
Hard Disk Options	90/135/180	90/135/180	90/135/180	Wide variety of Hard Disk options up to 1.2Gb			
Floppy Disk Drive	1.2Mb/1.44Mb	1.2Mb/1.44Mb	1.2Mb/1.44Mb	1.2Mb/1.44Mb	1.2Mb/1.44Mb	1.2Mb/1.44Mb	1.2Mb/1.44Mb
Enclosure Type	Mini-Tower	Mini-Tower	Mini-Tower	Midi-Tower	Midi-Tower	Midi-Tower	Midi-Tower
Mono Hercules Graphics	£640	£749	£935	£1,050	£1,275	£1,525	£1,950
VGA Colour 800x600 256Kb	£815	£925	£1,115	£1,235	£1,425	£1,695	£2,135
Super VGA 1024x768 8Mb	£915	£1,025	£1,215	£1,335	£1,525	£1,795	£2,235



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Tandon MCS 386SX/20c

Processor

20MHz 386SX

RAM

4Mb expandable to 32Mb

ROM

Tandon BIOS

Mass storage

110Mb 19ms Seagate hard disk, 3.5in floppy

Storage

Four drive bays (two free)

Expansion

Six free 16-bit slots, one 8-bit slot

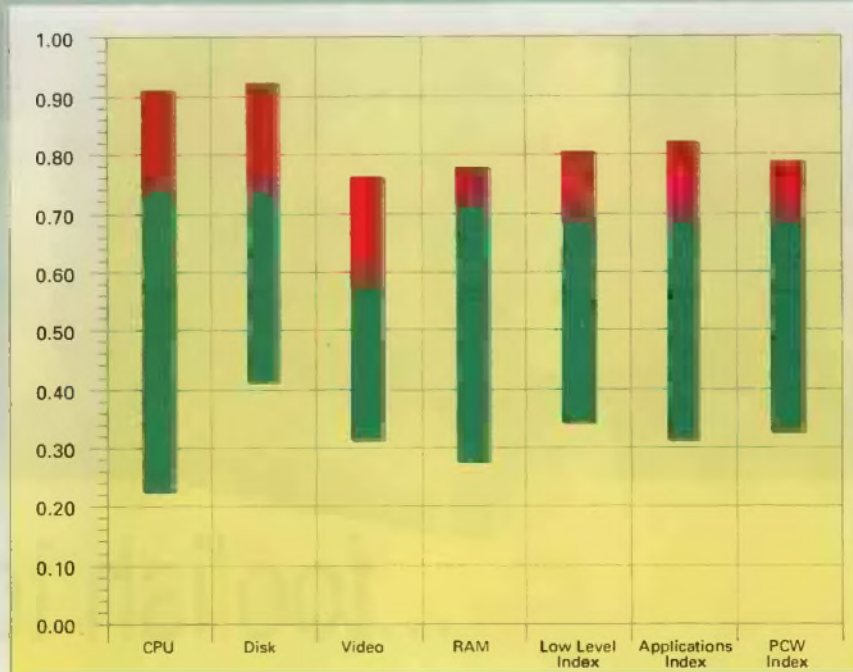
Manufacturer

Tandon (0527) 550550

Good Points Neat design.

Bad Points Noisy fan.

Conclusion Welcome breath of fresh air in PC design with above-average performance.



the number of slots is vital then check with Trader before purchase.

Two of the slots will be filled with cards regardless of which board you get. The first contains the video card, a Trident VGA card. The review machine had the full chip count of 1Mb enabling it to display 256 colours at a resolution of 1024 x 768.

The other card is a 'super I/O card' (Trader's terminology, not mine) which provides two serial ports (one of each size), a parallel port, and a game port. It also acts as the disk drive controller for the hard and floppy disk drives. No

mouse socket is provided, you are expected to use one of the serial ports.

The monitor is the only part of the system with a badge on it. It is a Trystar 14in colour unit with a .28mm dot pitch that is capable of displaying the maximum resolution of the video card. It has the usual knurled wheels on the front that enable you to adjust the brightness, contrast, vertical size and horizontal position of the on-screen text.

There's a pleasant surprise in store when you switch the machine on: the Trader range comes bundled with Digital Research's DOS 6. The DOS disks

and a Quick Reference Guide are provided free of charge but you will have to pay extra if you want a proper manual.

At the time of this review Trader was having problems getting some of its machines to run Windows. I phoned, and the response was excellent. Someone came all the way down to Kent with a new machine on a wet Saturday afternoon — good service, in my view. However, the replacement machine also developed faults running Windows. I would check that Trader has solved the problem before you buy.

Ian Morris

Trader 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

100Mb 17ms NEC hard disk, 3.5in, 5.25in floppies

Storage

Five drive bays (two free)

Expansion

Six 16-bit slots (four free), two free 8-bit slots

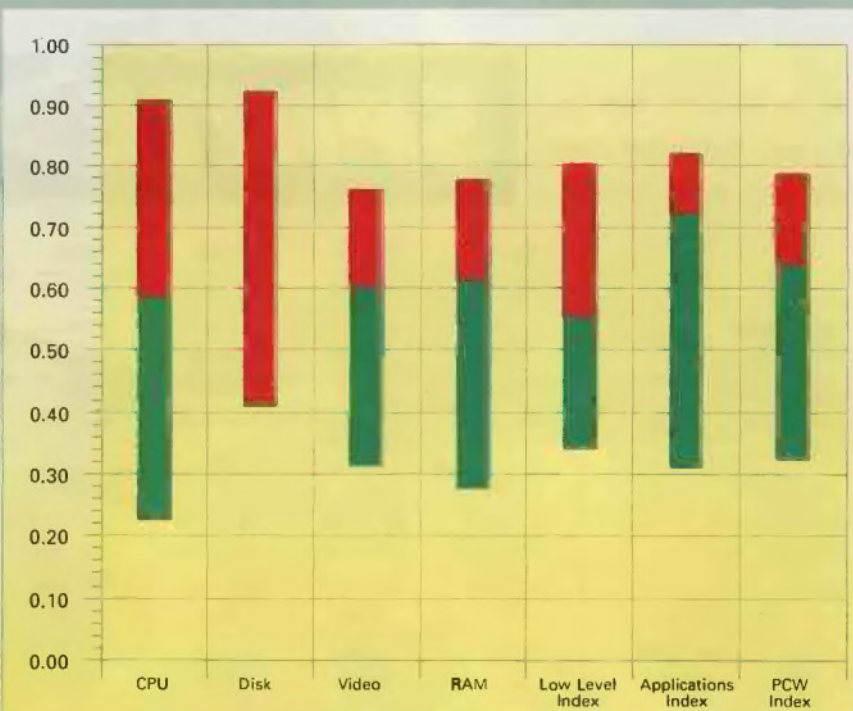
Manufacturer

Trader Systems (0527) 579120

Good Points Large footprint allows disk expansion, DRDOS 6.

Bad Points Rather non-descript appearance, problems running Windows.

Conclusion Check that it will run Windows before purchasing.



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Position _____

Company _____

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	ALR Powerflex 20CSX	Amstrad PC 4386SX	Apricot LS Lan- station	Aria 386SX	AST Premium II	Atom- style 386SX/20	Brother BC3386 SF	Chipset 386SX/20	Comet- data 386SX/20	Compaq 386S/20	Compu- Add 320SC	Dan 386SX/20	Dart 386SX/20	DEC- station 320	Dell 320SX
RAM															
Supplied	5Mb	4Mb	8Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb
Maximum	5Mb	16Mb	8Mb	5Mb	16Mb	8Mb	8Mb	16Mb	16Mb	32Mb	32Mb	20Mb	16Mb	12Mb	8Mb
Memory Cache	32K	64K	None	32K	16K	None	None	None	None	4K	32K	None	None	None	None
Hard Disk Drive															
Size	40Mb	80Mb	100Mb	120Mb	40Mb	105Mb	105Mb	88Mb	80Mb	60Mb	120Mb	88Mb	104Mb	120Mb	80Mb
Access Time	18ms	15ms	17ms	17ms	18ms	18ms	16ms	19ms	18ms	19ms	18ms	19ms	22ms	19ms	17ms
Manufacturer	Western Digital	Sony	Quantum	Conner	Conner	Fujitsu	Quantum	Seagate	Western Digital	Conner	Western Digital	Seagate	NEC	Conner	Quantum
Disk Cache	None	None	64K	None	None	64K	64K	None	32K	Yes	32K	4Mb	16K	None	64K
Floppy Disk Drives															
3.5in	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5.25in	No	No	No	No	No	No	No	Yes	No	No	No	No	Yes	No	No
ROM BIOS	Phoenix	Amstrad	Phoenix	Award	AST	AMI	Quadtel	AMI	Microid Research	Compaq	Phoenix	AMI	AMI	Olivetti	Dell/Phoe- nix
Video BIOS	Paradise/ WD	Cirrus	C & T	Diamond	Western Digital	AMI	Trident	Trident	Microid Research	Compaq	Tseng Labs	Tseng Labs	Oak	WD	WD
Video Memory	256K	256K	512K	1Mb	256K	512K	512K	1Mb	512K	256K	512K	1Mb	512K	256K	256K
Display Modes															
800 x 600 x 16	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
800 x 600 x 256	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No
1024 x 768 x 16	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No
1024 x 768 x 256	No	No	No	Yes	No	No	No	Yes	Yes	No	No	Yes	No	No	No
Expansion															
No. of Slots	5x16-bit 1x8-bit	2x16-bit	None	5x16-bit	3x32-bit 2x16-bit 1x8-bit	3x16-bit	2x16-bit	6x16-bit 2x8-bit	4x16-bit 2x8-bit	4x16-bit	3x16-bit 3x8-bit	5x16-bit	5x16-bit	4x16-bit	3x16-bit
Free	4x16-bit 1x8-bit	2x16-bit	None	3x16-bit	2x32-bit 2x16-bit 1x8-bit	3x16-bit	2x16-bit	4x16-bit 2x8-bit	2x16-bit 2x8-bit	4x16-bit	3x16-bit 2x8-bit	3x16-bit	5x16-bit	4x16-bit	3x16-bit
Drive Bays	Four	Two	Two	Four	Four	Three	Two	Four	Five	Five	Three	Two	Three	Three	Three
Free	Two	None	None	Two	Two	One	None	One	Three	Three	One	None	None	One	One
Standard Interfaces	1 x S 1 x P	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P 1 x M	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P 1 x JS	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P 1 x JS	1 x S 1 x P 1 x M	2 x S 1 x P 1 x M
Operating System	MSDOS 5.0	MSDOS 3.3	MSDOS 5.0	MSDOS 5.0	MSDOS 3.3	MSDOS 5.0	MSDOS 4.01	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 3.3	MSDOS 5.0
Bundled Software	None	Windows 3.0	Windows 3.0	Pipe Mania	None	None	Windows 3.0	None	Windows 3.0	None	Windows 3.0	None	None	None	None
Mouse	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	No
Size	6x15x17 in	264x250x 70mm	350x323x 57mm	430x425x 100mm	420x400x 180mm	360x350x 70mm	360x290x 90mm	16.5x15x7 in	409x345x 178mm	401x350x 149mm	16.5x16x4 in		413x390x 102mm		16x16x6 in
Warranty	1 year r.t. base	1 year r.t. base	1 year on-site	1 year r.t. base	1 year r.t. base	1 year on-site	1 year on-site	1 year on-site	18 mths on-site	1 year on-site	1 year on-site	1 year on-site	1 year r.t. base	1 year on-site	1 year on-site
Price	£1149	£1105	£1815	£1680	£1095	£1000	£2208	£1209	£1100	£1845	£1509	£1546	£1079	£2655	£1399
Manufacturer	ALR	Amstrad	Apricot	Aria	AST	Atomstyle	Brother	Chipset	Comet- data	Compaq	Compu- Add	Dan Tech- nology	Dart	DEC	Dell C.C.
Phone Number	(0635) 521922	(0277) 262376	021-717 7171	081-993 1475	081-568 4350	(0532) 442767	061-330 6531	(0483) 797959	081-452 6006	081-332 3000	(0800) 373535	081-961 6959	(0794) 511505	(0800) 393200	(0800) 414535

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	Digitask Axiom 386SX- 20	DS DSi 386SX/ 20	Elonex PC-320X	Gold- star GS318	Paragon Haval PC386S- 20CD	Hewlett- Packard Vectra 386- 20N	HM Minstrel Work- station	IBM PS/2 Model 57	Kamco KC320C	Kyocera Multi- light IIISx	Leo CL/LEO	Locland 386SX/ 20	MBC 386	Mesh 386SX/ 20	Multi- plex 386 SX/20
RAM															
Supplied	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	8Mb	4Mb	4Mb	4Mb	4Mb
Maximum	5Mb	16Mb	16Mb	10Mb	32Mb	16Mb	16Mb	16Mb	16Mb	16Mb	8Mb	8Mb	8Mb	16Mb	16Mb
Memory Cache	None	None	16K	None	None	16K	None	None	32K	None	None	None	None	8K	None
Hard Disk Drive															
Size	80Mb	105Mb	100Mb	124Mb	89Mb	52Mb	105Mb	80Mb	112Mb	100Mb	100Mb	85Mb	87Mb	90Mb	115Mb
Access Time	19ms	25ms	19ms	24ms	16ms	16ms	15ms	17ms	18ms	16ms	19ms	19ms	17ms	19ms	12ms
Manufacturer	Conner	Toshiba	Q'ntum	Toshiba		Q'ntum	Q'ntum	IBM	Rodime	Q'ntum	Fujitsu	Seagate	Seagate	Fujitsu	Rodime
Disk Cache	None	None	None	None	None	None	None	None	64K	None	512K	None	32K	None	None
Floppy Disk Drives															
3.5in	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes 2.88Mb	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5.25in	Yes	Yes	No	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes
ROM BIOS	AMI	AMI	MR	Phoenix	AMI	Phoenix	Quadtel	IBM	AMI	Phoenix	Phoenix	Award	AMI	AMI	AMI
Video BIOS	Trident	Tseng Labs	Oak	W.D.	Orchid	HP	Everex	IBM	Trident	Phoenix	Tseng Labs	Trident	Trident	Trident	Oak
Video Memory	1Mb	1Mb	1Mb	256K	512K	256K	256K	256K	1Mb	512K	256K	1Mb	1Mb	1Mb	1Mb
Display Modes															
800 x 600 x 16	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
800 x 600 x 256	Yes	Yes	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
1024 x 768 x 16	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
1024 x 768 x 256	Yes	Yes	Yes	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Expansion															
No. of Slots	5x16-bit 1x8-bit	5x16-bit 1x8-bit	3x16-bit	4x16-bit 1x8-bit	7x16-bit	3x16-bit	5x16-bit	5x16-bit	6x16-bit 2x8-bit	2x16-bit	5x16-bit	6x16-bit 2x8-bit	6x16-bit 2x8-bit	8x16-bit	7x16-bit
Free	3x16-bit 1x8-bit	3x16-bit 1x8-bit	3x16-bit	4x16-bit 1x8-bit	6x16-bit	1x16-bit	3x16-bit	5x16-bit	4x16-bit 2x8-bit	2x16-bit	2x16-bit	4x16-bit 2x8-bit	4x16-bit 1x8-bit	5x16-bit	6x16-bit
Drive Bays	Five	Six	Four	Three	Five	Two	Two	Four	Five	Two	Three	Three	Five	Four	five
Free	Two	Three	One	None	Two	None	None	Two	Two	None	One	One	Two	One	two
Standard Interfaces	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P 1 x M	1 x S 1 x P 1 x M	2 x S 1 x P 1 x JS	2 x S 1 x P	2 x S 1 x P 1 x M	1 x S 1 x P 1 x M	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P 1 x JS	2 x S 1 x P 1 x JS	2 x S 1 x P 1 x JS
Operating System	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 4.01	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 4.01	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0
Bundled Software	None	W'dows 3.0	W'dows 3.0	W'dows 3.0	W'dows 3.0	None	None	None	W'dows 3.0	None	None	W'dows 3.0	W'dows 3.0	W'dows 3.0	W'dows 3.0
Mouse	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Size	16x 13.25x 7in	400x 380x 170mm	380x 343x 110mm	470x 306x 156mm	16x 15.5x 6in	15.6x 15x 4in	396x 290x 100mm		420x 330x 200mm	320x 317x 67mm	435x 420x 148mm	400x 400 150mm	430x 400x 160mm	17x 15x 6in	420x 330x 200mm
Warranty	1 year on-site	1 year r.t. base	1 year on-site	1 year on-site	1 year parts & lab	1 year on-site	3 year r.t. base	1 year either	2 years on-site	1 year on-site	1 year r.t. base	1 year r.t. base	3 year r.t. base	2 year on-site	1 year on-site
Price	£1337	£1044	£1090	£1484	£940	£1919	£1425	£2473	£1075	£2315	£2195	£1295	£1080	£1289	£1274
Manufacturer	Digitask	DS C'mptrs	Elonex	Gold- star UK	Paragon	Hewlett- Packard	HM Systems	IBM	Kamco	Kyocera	Center- prise Int	Locland	MBC	Mesh	Multi- plex
Phone Number	(0293) 776688	071-281 5096	081-452 4444	081-309 1111	021-359 1807	Dealer Only	081-209 0911	(0800) 181182	081-963 1031	(0734) 311500	(0256) 463754	(03552) 28808	081-963 0715	081-452 1111	071-498 1088

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															RAM
4Mb	3Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	4Mb	Supplied
16Mb	17Mb	16Mb	16Mb	16Mb	16Mb	8Mb	32Mb	16Mb	32Mb	18Mb	16Mb	32Mb	16Mb	8Mb	Maximum
None	32K	32K	None	None	32K	None	Yes		None	None	None	None	None	32K	Memory Cache
															Hard Disk Drive
80Mb	120Mb	105Mb	88Mb	100Mb	105Mb	338Mb	110Mb	100Mb	85Mb	100Mb	130Mb	80Mb	40Mb	40Mb	Size
18ms	19ms	17ms	19ms	8ms	18ms	16ms	19ms	17ms	15ms	23ms	17ms	17ms	15ms	25ms	Access Time
Conner	Conner	Q'ntum	Seagate	Plus	Fujitsu	Seagate	Seagate	NEC	Seagate	Q'ntum	Seagate	Western Digital	Q'ntum	Conner	Manufacturer
None	64K	64K	None	64K	Yes	None	None	1Mb	None	None	None	Yes	None	Yes	Disk Cache
															Floppy Disk Drives
Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	3.5in
No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No	No	No	5.25in
AMI	Olivetti	Zenith	AMI	AMI	AMI	AMI	Tandon	AMI	AMI	Phoenix	AMI	Quadtel	Phoenix	Zenith	ROM BIOS
Trident	P'dise/ WD	Tseng Labs	AMI	Ahead	Orchid Pro II	Oak	Tandon	Trident	Tseng Labs	Tulip/ WD	Orchid Pro II	Paradise	?SVGA	Zenith	Video BIOS
1Mb	256K	1Mb	512K	256K	1Mb	512K	256K	1Mb	512K	512K	1Mb	512K	?	256K	Video Memory
															Display Modes
Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	800 x 600 x 16
Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	800 x 600 x 256
Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	1024 x 768 x 16
Yes	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	?	No	1024 x 768 x 256
															Expansion
6x16-bit	3x16-bit	6x16-bit 2x8-bit	8x16-bit	6x16-bit 2x8-bit	5x16-bit	4x16-bit 3x8-bit	6x16-bit 1x8-bit	6x16-bit 2x8-bit	4x16-bit	3x16-bit	6x16-bit 2x8-bit	5x16-bit 1x8-bit	6x16-bit 2x8-bit	5x16-bit	No. of Slots
4x16-bit	3x16-bit	5x16-bit 2x8-bit	6x16-bit	3x16-bit 2x8-bit	4x16-bit	4x16-bit 3x8-bit	6x16-bit	4x16-bit 2x8-bit	4x16-bit	3x16-bit	4x16-bit 2x8-bit	4x16-bit 1x8-bit	3x16-bit 2x8-bit	4x16-bit	Free
Five	Three	Five	Four	Four	Four	Four	Four	Five	Three	Two	Five	Two	Four	Four	Drive Bays
Three	One	Two	One	One	One	Two	Two	Two	One	None	Two	None	Two	Two	Free
2 x S 1 x P 1 x JS	1 x S 1 x P 1 x M	2 x S 1 x P 1 x JS	2 x S 1 x P 1 x JS	2 x S 1 x P 1 x JS	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P 1 x JS	1 x S 1 x P 1 x M	2 x S 1 x P	2 x S 1 x P 1 x JS	2 x S 1 x P	2 x S 1 x P	2 x S 1 x P	Standard Interfaces
MSDOS 4.01	MSDOS 5.0	MSDOS	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	DRDOS 5.0	MSDOS 5.0	DRDOS 6.0	MSDOS 4.01	MSDOS 5.0	MSDOS 5.0	MSDOS 5.0	MSDOS 4.01	MSDOS 5.0	Operating System
None	None	None	None	W'dows 3.0	W'dows 3.0	MS- Works 2.0	W'dows 3.0	None	None	W'dows 3.0	None	W'dows 3.0	None	W'dows 3.0	Bundled Software
Yes	No	Yes	No	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Mouse
430x390 x160mm	374x356 x98mm	16x15x7 in	410x380 x180mm	470x455 x215mm	415x300 x200mm	16.5x15 x7in	468x412 x127mm	18x16x6 in	16.2x14x 4.5in	364x320 x91mm	420x330 x200mm	410x370 x170mm	440x420 x160mm	381x356 x152mm	Size
1 year on-site	1 year on-site	1 year on-site	1 year r.t. base	1 year r.t. base	1 year on-site	1 year on-site	1 year r.t. base	1 year r.t. base	1 year r.t. base	1 year on-site	1 year r.t. base	1 year r.t. base	1 year r.t. base	1 year r.t. base	Warranty
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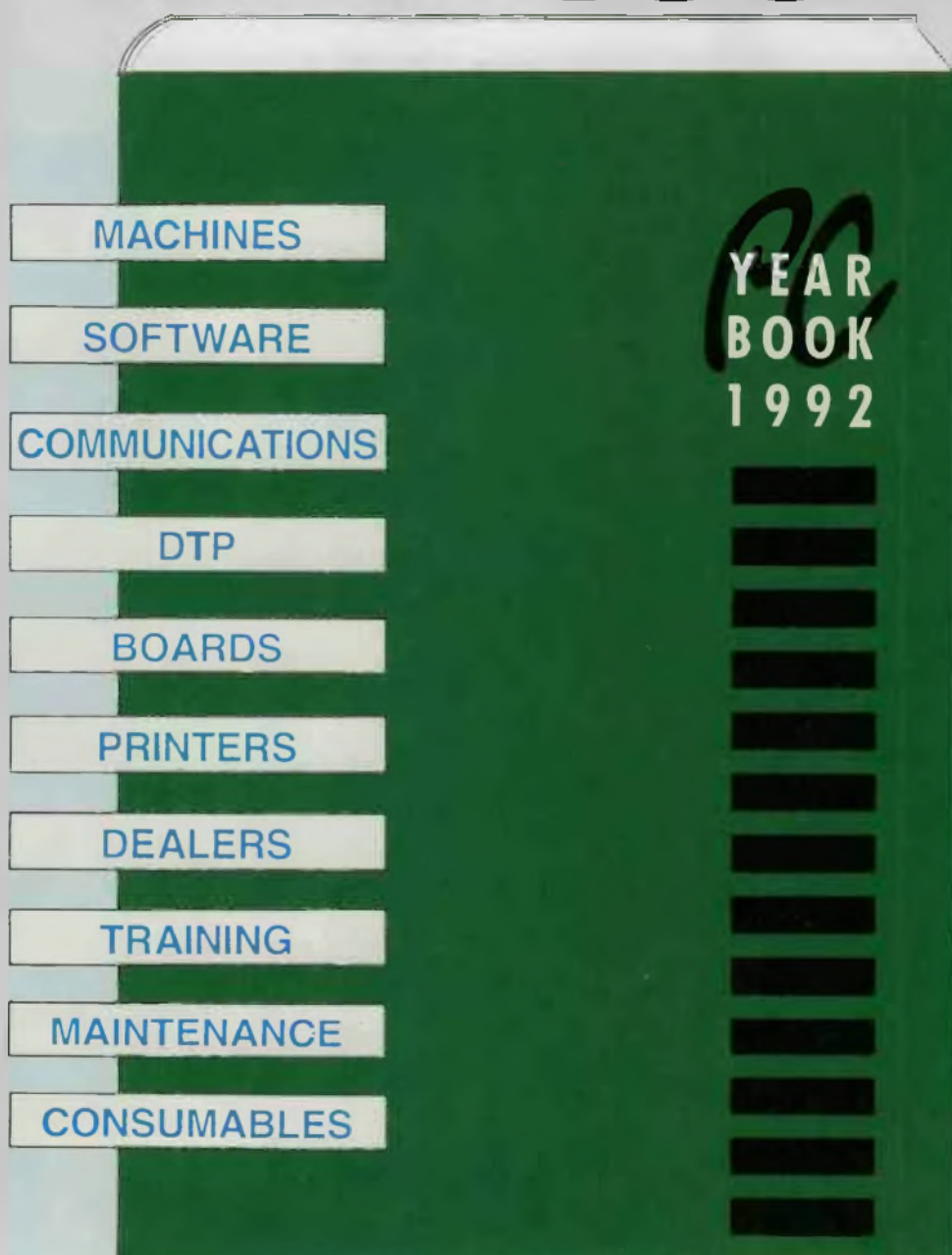
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TriGem SX386E



One's first impression of the TriGem is of a small, neat but somewhat bland machine. You're confronted with a system box that has little in the way of bells and whistles: there are small hard-disk activity and CPU speed lights, the floppy disk drive and the mains power switch on the front panel. But there's no reset switch, turbo switch or keyboard lock, here or anywhere else.

The main system box is compact which saves desk space but limits the number of storage devices you can fit—the review machine had a single 3.5in disk drive, albeit in a 5.25in device mount, which didn't leave much room. You can squeeze two devices into the front panel—say, a 5.25in floppy drive and a slimline 3.5in unit—with the hard disk using an internal drive bay,

but that's your lot. The controller does support two hard disks should you want to do things that way.

The specification sheet boasts of two serial ports. In fact, one of these is configured as a mouse port, using a PS/2-type socket (though the keyboard socket is of the older PC/AT style). The other serial port uses a 9-pin socket. The serial, printer and VGA ports are all provided direct from the motherboard, so the four 16-bit expansion slots are all free.

In opting for a slimline case, TriGem has had to arrange these slots horizontally, which for the most part shouldn't cause any problems. However, if you have a full-size card running the full depth of the machine it can easily restrict access to the SIMM sockets, and any such cards may have to be removed while you add extra memory.

Empty space

There's little to look at inside. The motherboard is small and neat, making extensive use of surface-mounted components. Apart from the aforementioned snag, the SIMMs and 387SX maths coprocessor sockets are easy to get to, and there's a lot of empty space that should make maintenance and upgrading a simple job.

The main on/off switch on the front panel is a remote (via a long metal bar) device giving a clunky feel and a certain amount of 'play', while the power supply appears to be an auto-sensing device and its fan is fairly noisy, as was

the hard disk on the review machine.

The SuperVGA monitor is a Philips Pro 7CM3209 and badged as such, though it also sports a stick-on TriGem badge. That's no bad thing, of course. The Philips monitor is a fine product with a sharp and stable display. There is no power output from the system box for the monitor so you're going to need two mains sockets.

The overall quality of the system is excellent, with the sole exception of the keyboard. It is quite possibly my least favourite of any keyboard I've ever used, lacking any positive feel whatsoever. The keytops are also quite narrow. If I were going to do any amount of typing on this computer I'd soon find myself buying another keyboard.

Looking around

The TriGem's performance is about average. In absolute terms you won't be unhappy about the way it runs software, given that 386SX PCs aren't known for their breathtaking performance. However, having chosen that processor you can do better when it comes to speed, and if your software is demanding you might want to look at one of the other machines.

The entry-level price is £1130 and for that you get 1Mb of memory, a 20Mb hard disk and mono VGA. It's worth spending a bit more, though: an extra £370 brings the machine up to the review system specification of 4Mb of memory, 85Mb hard disk and colour VGA. That's a small difference in price

TriGem SX386E

Processor

20MHz 386SX

RAM

4Mb expandable to 32Mb

ROM

AMI BIOS

Mass storage

85Mb 15ms Seagate hard disk,

3.5in floppy

Storage

Three drive bays (one free)

Expansion

Four free 16-bit slots

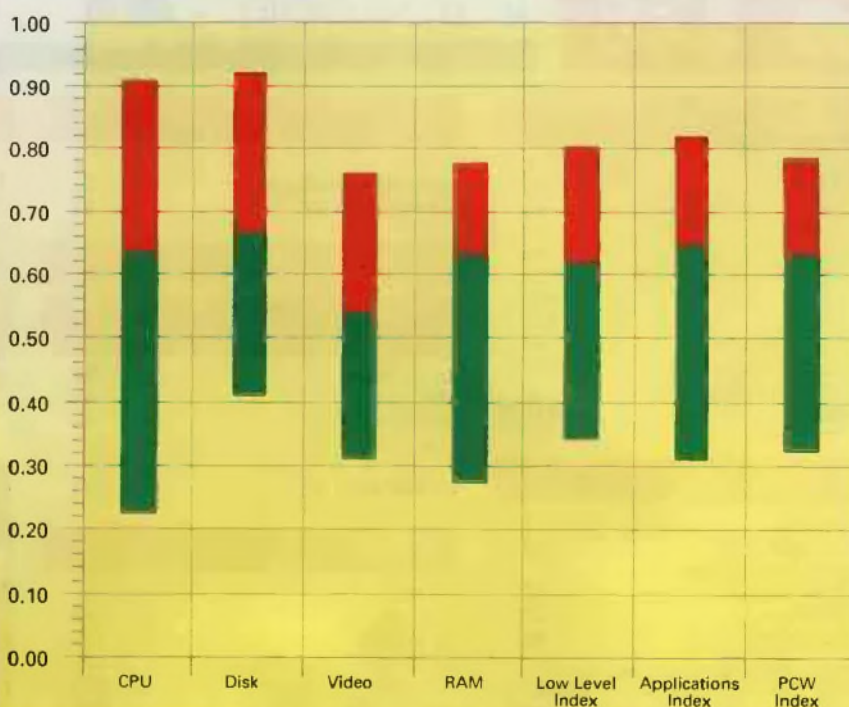
Manufacturer

TriGem (0753) 810808

Good Points Compact design.

Bad Points Noisy.

Conclusion Doesn't stand out from the crowd.



for a big difference in ability. While it's not the cheapest machine in this Group Test, those prices still make it attractive as a network machine or a standalone PC for undemanding tasks.

Steve Mansfield

Tulip Vision Line 386SX/20



The Dutch-based computer manufacturer Tulip is situated in the middle of the PC market alongside such players as Olivetti. In February this year, it launched into the small-footprint market with its Vision Line range, including this 20MHz DC 386SX model.

The machine itself is supplied with a standard IBM-compatible keyboard, Tulip DOS 5, and Tulip Windows 3.0.

It is surprisingly small, making a change from some of the giant hunks of metal that sit on a desktop invading a user's workspace. Measuring 91mm x 364mm x 320mm it has a solid, cream chassis and one 3.5in floppy situated at the front right with its own red light. Next to this is a clever feature in the form of a single light which indicates power, hard-disk access and network access all in one — when accessing the hard disk the light turns red, and stays green when inactive. The Tulip Vision Line logo is stylishly displayed in beige along the front left, making the machine something of a designer model.

Along the back are two serial ports and a parallel port in addition to a VGA port and the 5-pin keyboard connector. The power socket is also here, plus loosely connected panels for three 16-bit expansion slots. It is here that the screws for the casing are situated.

Lots of space

When the chassis is removed, there is a surprising amount of space given the overall size of the machine. The shielded power supply is at the rear right while the Canon-made floppy is stacked on top of the 100Mb 3.5in IDE hard drive. The three full-length expansion cards sit at the rear centre and the chips, which are all Intel-based, lie along the left-hand side. There is also a 387SX slot at the front left, and tucked away just behind the front panel are the Duracell batteries used for the CMOS RAM which holds the date, time and

configuration.

There was 4Mb of memory on the review model, although generally there are only two, and the RAM can be expanded to 18Mb using the SIMM sockets to the left of the drives. These were plastic and hard to handle. Metal ones would have been better: if the Simms were removed and replaced too often, they could easily be broken — as indeed happened with our model.

Internal fan

When running the machine is very quiet, as unlike many computers the fan is not at the back of the chassis but rather inside, totally contained within the unit. The screen, measuring just over 12 inches diagonally, has the power control on the right-hand side, while the contrast, brightness and two hold dials are located on the left, leaving the front face clear. The brightness and contrast give a reasonable range, while the hold controls merely move the screen image around, enabling the user to centre it. I was disappointed that the image could not be lengthened or expanded, as can be done on some other monitors.

The keyboard, meanwhile, had the Tulip logo on it. It is a normal full-travel keyboard with a solid response, making it ideal for word processing.

At £2145 for the 2Mb SVGA colour model, the Vision Line is slightly overpriced — I've seen 386DX/33's for less. The slimline build does justify this, however. Ultimately, this is a compu-

Tulip Vision Line 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 18Mb

ROM

Phoenix BIOS

Mass storage

100Mb 23ms Quantum hard disk,
3.5in floppy

Storage

Two drive bays (none free)

Expansion

Three free 16-bit slots

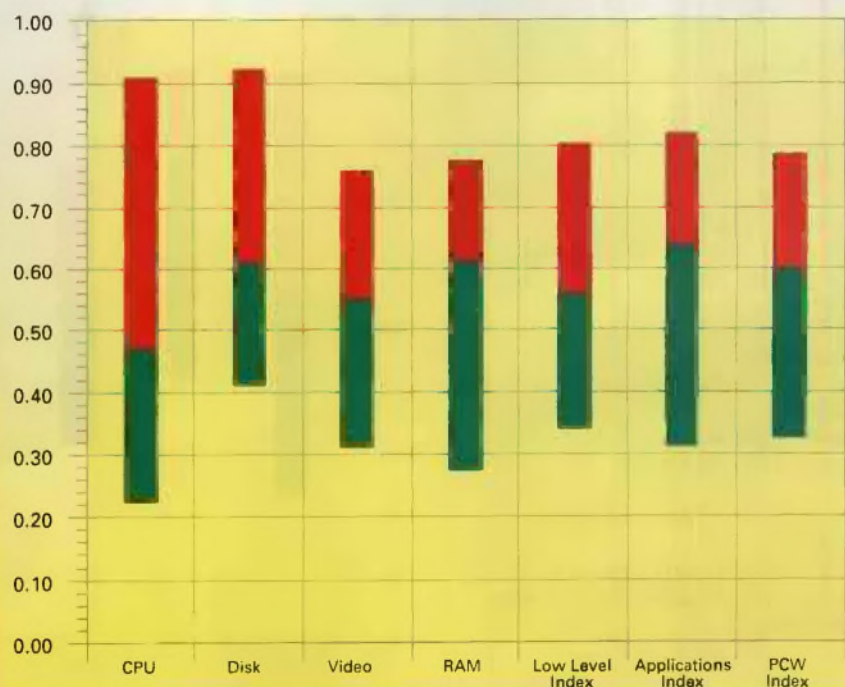
Manufacturer

Tulip (0293) 562323

Good Points Good-looking design, slim, stylish.

Bad Points Expensive, display controls could be better, poor-quality SIMM slots.

Conclusion Pretty but expensive.



ter for the image-conscious user who wants some style on his/her desk, and is prepared to pay a little more for the privilege.

Danny Bradbury

Unimart 386SX/20



Unimart will build you a system to order, that's the way the company works. You want a 386SX/20 with 4Mb of RAM and a 100Mb hard disk? Certainly sir, no problem. Started about three years ago and slowly growing from its computer maintenance roots, Unimart now sells about 3-400 machines a year. There's no glossy brochure marketing its range, just a shop in Twickenham, a modest advertising

campaign and a 60/40 customer split between business and Joe Public, and they're doing very nicely, thank you.

In common with many of the smaller system builders, Unimart has chosen the Moretec Taiwanese mini-tower case as a base. I must admit to liking the mini-tower format and the Moretec box is well proportioned and good looking, even with the daft MHz-displaying LEDs and even dafter-named 'Turbo' button. More useful, and still on the front panel, are a power switch (a real one, not just the usual end of long metal pole from the power supply), a reset button, hard disk and power lights and a key-operated keyboard security lock.

Naked on the front

The test machine came configured with both 3.5in and 5.25in floppy drives and the front panel has two push-out sections to take more drives. Unimart hasn't quite got round to producing its own badge yet so the machine is naked on the front with a computer-printed address label stuck on the back. This low-budget theme is continued with Dymo-tape labels identifying the selection of back-panel ports, though it's worth pointing out that a lot of suppliers don't even do this.

The ports, from the top, are monitor, 9-pin serial, 25-pin parallel, games port and 25-pin serial along with power in/out sockets and a standard keyboard port. Underneath the weighty system unit are four good-quality rubber feet — this I like. No more scratched desks and

sliding computers: more suppliers should do the same.

The monitor is a Tystar with a dark grey screen surround and controls to position the picture on the screen as well as the usual brightness and contrast knobs located at the front, while the keyboard is, again, from Moretec.

Untidy but under control

The system cover comes off reasonably easily by undoing three threaded screws which are one quality-step higher than the usual budget (yuk) self-tappers. Inside it's all rather untidy but things are kept reasonably under control with numerous cable ties. A Seagate 130Mb HDD lives above the floppies, backing on to a 200W fan-cooled power supply which should provide enough oomph for any expansion.

The total number of expansion slots are six 16-bit and two 8-bit. Even though the length and carriers are available to accommodate full-length cards, the cards have to slot between the RAM on the motherboard, and it appeared to me (I didn't have a full-length card to try it) to be a very close thing whether they'd fit at all. Half-length cards would present no problem.

Two of the slots were already occupied, one with a card supplying the four serial/parallel ports and one by the video board. The video board is the respected Orchid ProDesigner II item complete with 1Mb of RAM — very satisfactory, though Unimart did say it may be changing this for a Tseng com-

Unimart 386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

AMI BIOS

Mass storage

130Mb 17ms Seagate hard disk, 3.5in, 5.25in floppies

Storage

Five drive bays (two free)

Expansion

Six 16-bit slots (four free), two free 8-bit slots

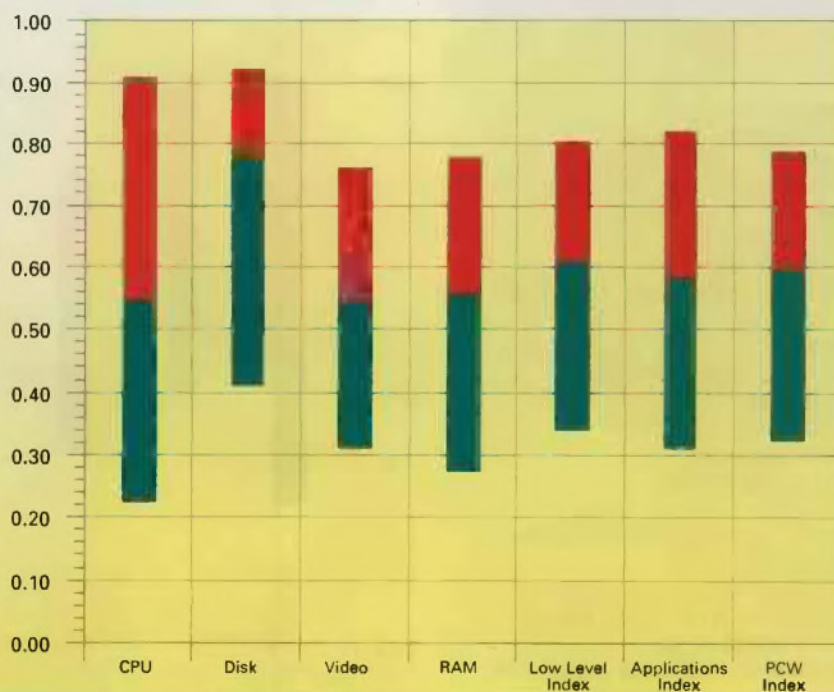
Manufacturer

Unimart 081-893 8161

Good Points Neat box, good graphics.

Bad Points Untidy internals.

Conclusion Budget West London possibility.



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ponent in the future.

The machine will take up to 16Mb of RAM on the motherboard using 4Mb SIMMS and there is ample working space to fit these. You won't be so lucky when fitting the co-processor as its socket is squeezed beside the spare disk bay, requiring some screwdriver work to remove the vertical motherboard to gain access.

Fourth division leader

Using the Unimart presents no problems. The screen, driven by the Orchid card, was firm and crisp with acceptably fast graphics. The keyboard was OK though not to everybody's taste, but it's a lot better than some of the real cheapies. The Unimart was only top of the performance fourth division in our benchtests, though it ran everything without hiccups including Windows 3.0 and various applications.

The Unimart could be for you if you want to mix and match. The company will build it how you like and our model, at least, worked fine. You don't get the reassuring name of Dell or Compaq but there you're paying partly for the label, and with the Unimart you're not. After all, you don't even get one.

Nick Edmunds

Viglen Genie 3sx

Surprisingly, Viglen must be one of the older companies represented in this

Group Test. Founded in 1975 it certainly is older than some of the more established names like Dell and Compaq. It was the only company, of the ones I dealt with, that was organised enough to send information about its products with the review machine.

Looks familiar

Having got the system unit out of the large amount of packaging that the Genie comes in, the case looks superficially like some of the other machines in this Group Test. On the front is the Turbo button and LED, the hard-disk activity LED, the on/off switch and the power LED. There is also a reset switch on the front of the case — to stop you pressing it by accident, it needs a thin pointed object to press it. The other items on the front of the case are the keyboard lock and the 3.5in floppy disk drive.



Around the back everything looks neat and tidy. One of the things that makes the Viglen unusual is that every port and orifice is labelled. I'm not talking obscure hieroglyphics that enable Viglen to sell the same product to many countries: the Viglen labels are all in English.

To get inside the machine you simply undo two screws each side and lift the lid off. However, I should mention here that the Viglen very nearly didn't get reviewed. Each company was asked to provide a 386SX-based machine running at 20MHz. By implication we thought this would mean that all machines would contain the Intel processor, as the AMD chip runs at 25MHz. Inside the Viglen is an AMD 386SX-25MHz but the people at Viglen explained that the chip is actually being run at 20MHz.

Reduced performance

This begs the question: why should a company wish to reduce the performance of one of its PCs? Viglen offers two reasons: running the chip at this speed enables Viglen to continue to ship the 20MHz Intel maths co-processor to customers; and this is the speed at which the motherboard was designed to run.

It is inside where the Viglen begins to differ from the competition. Each part is of a very high quality — the motherboard is particularly nicely made. Viglen has opted to place the add-in slots horizontally (five 16-bit slots and one 8-bit slot are provided);

Viglen Genie 3sx

Processor

20MHz 386SX

RAM

4Mb expandable to 32Mb

ROM

Quadtel BIOS

Mass storage

80Mb 17ms Western Digital hard

disk, 3.5in floppy

Storage

Two drive bays (none free)

Expansion

Five 16-bit slots (four free), one free 8-bit slot

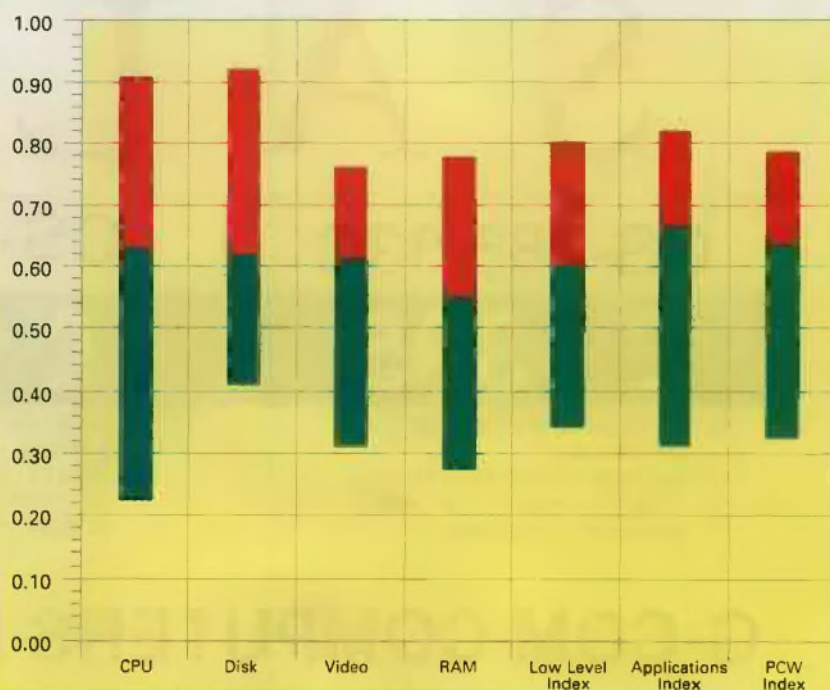
Manufacturer

Viglen 081-997 3000

Good Points Everything you need is provided.

Bad Points Average performance.

Conclusion Ideal for beginners.



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three slots are placed either side of a central spine. One of these slots is filled with the Viglen combined video and I/O card which, as well as acting as a SuperVGA card, provides two serial ports (both 9-pin), one parallel port and acts as a disk controller.

The video card in the review machine contained the maximum 512K of memory and provided 16 colours at a resolution of 1024 x 768. Two of the remaining slots would be particularly difficult to fill as they require the removal of the power supply. Four 1Mb SIMMs were fitted, giving a total memory of 4Mb; the maximum amount possible is 32Mb.

Keyboard mix

The keyboard provided with the Viglen is a bit of a mixed bag. Although it is an enhanced keyboard the size of the unit has been reduced by removing the blank areas between the different clusters of keys. The feel is great, but I did have some problems caused by the lack of space around the keys and the changes to the layout. Throughout the review I constantly pressed the Insert key instead of Backspace, and I also kept missing the \ key which is down between the Control and Alt keys on the bottom row.

A Microsoft-compatible mouse was provided. A mouse cage and quality mouse pad are included in the price.

Microsoft DOS 5 and Windows 3.0

are both bundled with this system, and each comes with a complete set of manuals. There is also a complete set of hardware documentation in a ring-binder. The Viglen had no problems with any of the software I tried to run on it. The performance was adequate without being blindingly fast. The video card in particular took a while to redraw some screens under Windows.

Complete system

One of Viglen's advertising claims is that it provides complete systems, and this was certainly the case with the review system. Anybody considering purchasing a 20MHz 386SX would only need to budget for the Viglen and their chosen applications.

Ian Morris

Wyse Decision 386/SX20

Wyse has been around for quite some time, not as a PC clone maker in huge volumes but as a specialist in serial terminals. This screen-and-keyboard interest led the company to enter the PC market first by way of some high-quality displays and add-ons, most notably a very high-resolution paper-white monitor targeted at the then infant PC desktop publishing sector (oddly, given this history, there are no

Wyse-branded products in the Macintosh market).

Anyway: here we find ourselves looking at an off-white box. It's certainly not compact, by any definition, and the design of the plastic front panel, with its upper third bulging out and a smallish badge bottom left, seems to emphasise just how much room the thing takes up. Someone in the marketing department has decided to brazen things out with an old joke, by calling this the 'WYSE Decision', a description so cringingly awful as to beggar understanding.

Curious decoration

The system comes with a Wyse-badged monitor, complete with tilt & swivel stand, and a compact and curiously decorated keyboard. The typing feel is



Forty-five 386SX's stand up to be counted

At the end of reviewing 45 386SX/20's on behalf of our readers (one of the biggest tests ever) we were exhausted but we'd had great fun. We had pored over each machine and had amassed thousands of words and figures of objective views and performance data. But we had also, just as importantly, listened to our reviewers' subjective opinions and how they assessed that difficult-to-quantify 'look and feel' of each machine. So, our conclusions are based not just on raw performance or numbers of slots or even price but all of these, combined with our experienced overall view of whether we thought a machine was good or bad.

So what, I hear you chorus, did we think? Let's look at the embarrassments first. The first **MBC** just wasn't a happy computer, as a quick glance at our graphs will show. Sending out a faulty machine for review is a public relations nightmare but **MBC** certainly gets full marks for moving quickly to rectify the situation — unfortunately too late for our benchmarks.

Another lemon, the **Strand**, gave the impression of being thrown together in a hurry and was one of the worst-assembled machines we have reviewed for some time — not many Brownie points there. The **Trader** didn't even manage to run Windows — a fairly serious problem if that's what you want to do. Again, like **MBC**, **Trader** responded well but the end result was a non-Windows machine.

In between the worst and the best machines were a huge number of perfectly satisfactory systems that were just, well, nothing special. Yes, they were 386SX/20's and worked as such, but they all had aspects we were unhappy with and none managed to rise above the ever-growing and highly competitive

throne that this market sector has become.

The machines that did stand out from the crowd were the **Amstrad**, **Apricot**, **CompuAdd**, **Dan**, **Elonex**, **Goldstar**, **HM**, **Kamco**, **Sprite** and **Tandon**. The two big boys, **DEC** and **IBM**, couldn't really show off at this party, arriving with the dearest and second-dearest machines respectively. Let's face it, they don't normally move in these circles; but buy 20 or 50 or 200 PCs, as corporations will, and watch those prices fall.

Amstrad's midget was nice but too tiny for most. The reviewer fell in love with the **Apricot** but this is a true local area network machine and not a real desktop PC. The **CompuAdd** looked good, being quick and not too pricey. We thought the compact **Dan** was OK and the **Elonex**, though cheap and well built, had failings.

Goldstar has produced a well-built computer but not the fastest. **HM's** **Minstrel** had few faults though only average performance, and the **Kamco**, though just another clone, was cheap and fifth fastest overall. The **Sprite** surprised us all with its turn of speed and the **Tandon** we thought well designed. All these machines you'd be happy with as your Windows platform, but we had to come off the fence and name a winner.

We particularly liked the **CompuAdd**, the **HM** and the **Tandon**. They all had their own niggling problems — speed and expansion on the **HM**, expansion again on the **CompuAdd**, and noise on the **Tandon** — but were all good and all cost around £1500 fully configured.

When we weighed it all up, we found the **Tandon** well designed, well built, quite speedy, expandable and it gets our **Seal of Approval**, with the **HM** and the **CompuAdd** sensible choices for anyone's Shortlist.

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Wyse Decision 386/SX20

Processor

20MHz 386SX

RAM

4Mb expandable to 16Mb

ROM

Phoenix BIOS

Mass storage

40Mb 15ms Quantum hard disk,

3.5in floppy

Storage options

Four drive bays (two free)

Expansion

Six 16-bit slots (three free), two free

8-bit slots

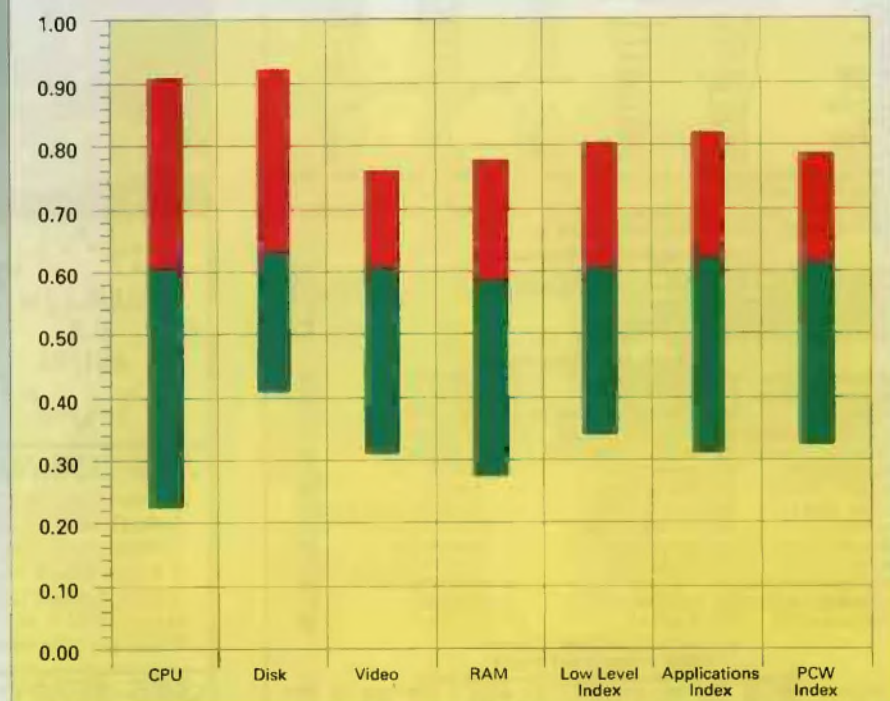
Manufacturer

Wyse (0734) 342200

Good Points Crisp monitor.

Bad Points Naff keyboard.

Conclusion Big, for what it does.



solid but click-free, the lead long enough — just — to allow the CPU barn to be tucked under your desk. Num Lock, Caps Lock and Scroll Lock each get an LED, mounted in an odd 'dummy key'; one person coming to the machine for the first time, from long exposure to the original PC/XT 84-key, decided the LED mount was in fact the Num Lock key while hunting for the cursor, and happily bruised the end of their finger on the protruding LED window. Another simply summed it up as 'naff'. Good for typing on, but a weird design. The connector to the CPU, as with all the other machines I reviewed this month, is the old XT/AT standard rather than the new PS/2 mini DIN.

Five big screws hold the cover on the machine, out of a collection of about 25 on the back panel. The entire front comes away with the top and sides, with the turbo and reset button tops coming away from the guts of their respective switches which are mounted on the chassis itself (gets round having trailing leads to undo, I suppose).

Throwback

Inside, the available space is dominated by the drive cage and the power supply. The reason for the case's unusual height can be found here: the PSU is much the tallest object within the case, shouldering above the tops of the cards in the expansion chassis. It's a bit of a throwback to the days of the original PC/XT, featuring a Big Red Switch and a pass-through connector, to power

the monitor without needing another wall socket.

Back to the interior. There are three half-height drive bays at the front, the top one of which holds the system's single 3.5in floppy disk drive. The two bays beneath that, bizarrely enough, are empty: the hard disk, a 40Mb IDE Maxtor unit, is screwed to the outside of the drive cage, overhanging the edge of the system board like a jerry can on the back of a land-rover.

The motherboard provides six 16-bit and two 8-bit slots: in the review machine, three were occupied by an SVGA display card, a multifunction card for serial and parallel ports, hard and floppy controllers, and lastly an Ethernet card — though there was no indication as to whether this is standard equipment.

The bundled software set is minimal: a copy of DOS 4.01, and a pair of setup disks which are used to set the usual startup options found on a Phoenix BIOS-equipped machine. The various compatibility tests (Flight Simulator, Fractint, and so on) were passed with flying colours, despite the aforementioned naive pilot acquiring an LED imprint on his finger. What was then left to stand out were the quirks.

Wise decision?

The big, bold, industrial-history power supply comes with a big, bold fan — bigger than any fitted to the 486/33 systems reviewed in the November issue. This makes quite a racket. One

becomes even less impressed with the power arrangements when it comes to the monitor, since the pass-through connector on the main box is not switched on and off by the main box switch.

It's asking for trouble to call a machine the Wyse Decision and then commit design gaffes like these. Or perhaps the name is just another gaffe...

Steve Cassidy

Zenith Z-386SX/20



Zenith has always been an odd company. It is still best known for TVs in the US and Heathkit over here, although it is now owned by Groupe Bull of

Zenith Z-386SX/20

Processor

20MHz 386SX

RAM

4Mb expandable to 8Mb

ROM

Zenith BIOS

Mass storage

40Mb 25ms Conner hard disk,

3.5in floppy

Storage

Four drive bays (two free)

Expansion

Five 16-bit slots (four free)

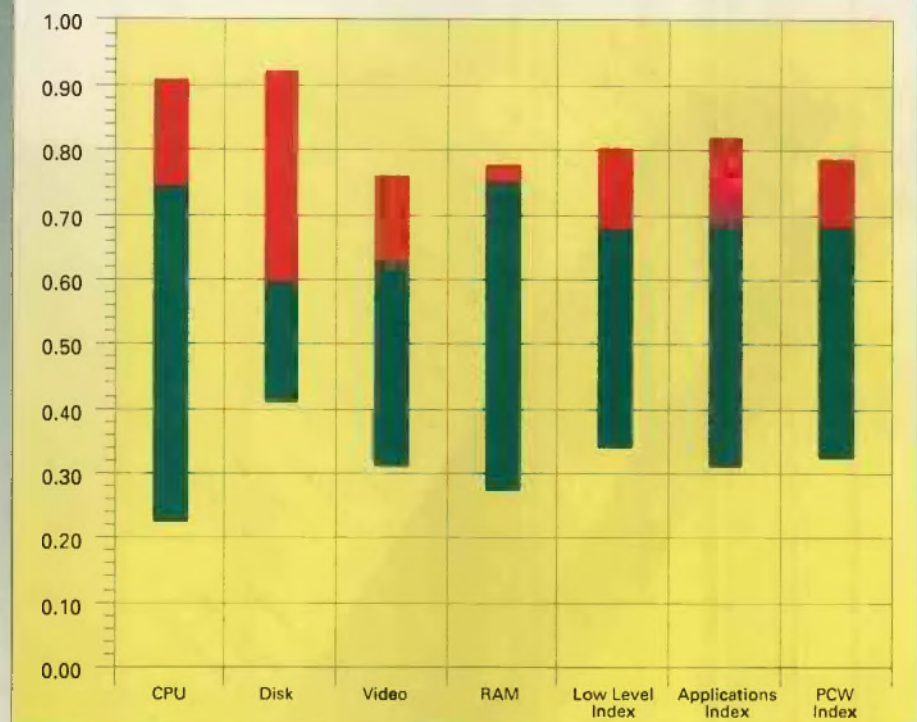
Manufacturer

Zenith (0628) 668588

Good Points Excellent monitor, good design and construction.

Bad Points No SuperVGA, poor keyboard, limited disk space.

Conclusion Not as high-end as it should be.



France — a change which cost the US company some lucrative US Government deals. But in the commodity market that the SXPC business has become, it is still in there slugging. And after a series of machines put together from disparate parts, it is rather refreshing to see a system that has obviously been put together as a whole.

The case is small-footprint but tall, to leave room for the maximum number of horizontally-mounted expansion boards, and the front panel is plain apart from the power switch, the hard disk light, and the blanking plates for the storage bays.

There are three bays altogether: one third-height 3.5in, one half-height 3.5in, and one that can take a half-height 3.5in or 5.25in device according to choice. All these bays are accessible from the outside world.

At the back are the blanking plates for the five slots, two 9-pin serial ports, a parallel port, a keyboard socket, and a keylock. The power supply, oddly, does not have a second socket to drive a monitor, but this is probably because Zenith's standard FTM colour screens are unusually power-hungry. Even more unusually, the rear panel has a metal loop fixed to it, designed to take a security cable to fix the machine to a desk or water pipe.

Conventional layout

Inside the case, the layout is conventional. The motherboard at the bottom holds the Intel processor, eight SIMM

sockets for RAM, floppy disk and IDE hard-disk controllers, and all the interface ports. So, only one of the five 16-bit slots is occupied in the standard configuration, taken up by Zenith's own VGA board. This uses Headland's VGA hardware (previously known as Video Seven) but has only 256K of video RAM.

The display resolution is therefore limited to 640 x 480 in 16 colours, and Zenith provides no additional drivers to provide 640 x 400 in 256 colours, say. Video RAM can be upgraded to 512K, supporting 256 colours at 640 x 480 using a Windows 3.0 Video Seven driver.

Standard RAM cache

Like the Mesh machine the Z-386SX/20 has a RAM cache fitted, although this is actually standard rather than an extra-cost option. It is built onto a small board that plugs into a dedicated motherboard slot and gave the system its good CPU rating in the benchmark tests. Different cache boards can be used to upgrade the cache to a maximum of 128K.

Zenith seems keen to limit the machine's expandability, and only offers RAM expansion up to 8Mb and a choice of 40Mb or 80Mb hard disks from Conner and Quantum. But of course, users can add drives of their own to increase storage capacity if required. The standard floppy drive is a Sony 3.5in unit, although a 5.25in drive is an option.

The monitor with the review system was the renowned Zenith ZCM-1492, a flat-screen monitor with quite remarkable depths of black and colour. The review screen was as good as ever, once a mental adjustment had been made to beat the optical illusion of pincushioning caused by the flat screen. However, the ZCM-1492 only handles VGA resolutions rather than SuperVGA, with a maximum graphics resolution of 640 x 480. This is presumably why Zenith does not bother to offer any special drivers for extended modes on its VGA board, since the monitor could not display them.

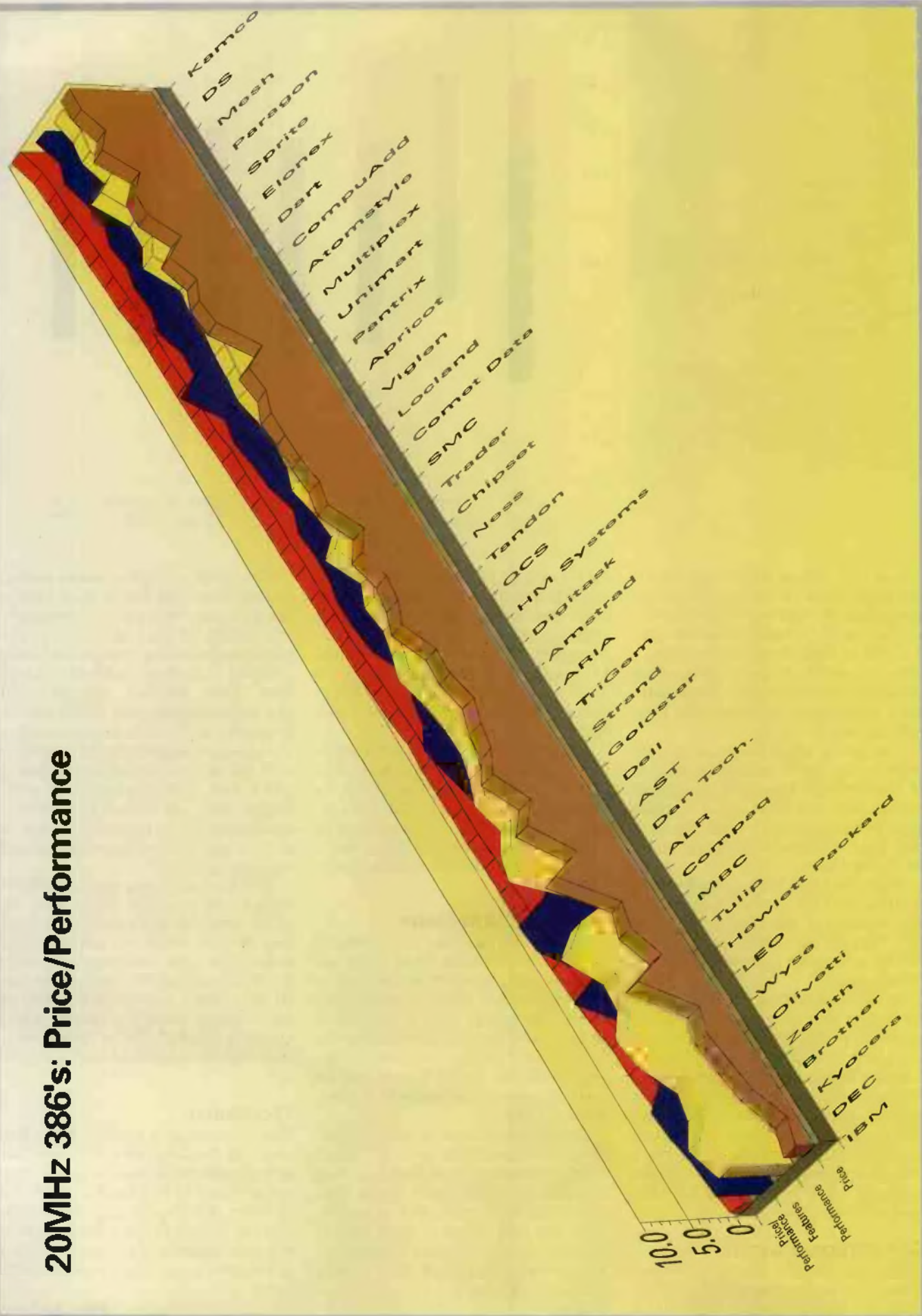
The keyboard was another Zenith design, but was very poor. Light, no tactile feedback, and a completely dead feel like the worst of Compaqs. The mouse was some compensation, since it was the genuine Microsoft model that all the cloners are now attempting to copy without actually managing it, and naturally worked fine with the bundled copies of MSDOS 5 and Windows 3.0.

Workhorse

The Z-386SX/20 is a solidly-built, fast, and neat machine, with the usual Zenith advantages of built-in system control software in ROM and a wonderful monitor. But Zenith-imposed limitations on memory expansion, hard disk sizes and video resolutions make this a workhorse rather than a pedigree racehorse.

Peter Jackson

20MHz 386's: Price/Performance



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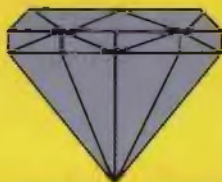
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The PCW Awards 1991

One year and one issue after our first-ever industry awards, this month sees the announcement of the PCW Awards for 1991. Many categories have changed to reflect changes in personal computing, but we believe our winners still represent the best products available. Over the next ten pages, you'll find our judging panel's recommendations for everything from Best Entry Level System to Best Power Portable. New awards

include Best Gadget, Best Entertainment Product, Best Groupware Application, and Best Language Implementation.

The PCW team also names its favourite of the year, the product that has had the most impact on the Editorial Department. As we see so much good hardware and software this was a difficult task, but one product did claim the title. Who have we given awards to? What has won the PCW team award? Read on...

Hardware section

Best Entry Level System

Macintosh Classic



△ The Mac Classic fits the Entry Level bill perfectly

With its built-in screen, compact size and oh-so-cute appearance, Apple's Macintosh Classic takes this award for the second time. Our judges decided that even though this machine is now over a year old, it still represents the best way to enter the world of personal computing.

Our definition of 'Entry Level' is primarily based around word processing, with the option of expanding into other areas at a later date. The Classic seems to have been designed almost specifically to fit the bill, and it's cheap and easy to use.

The basic unit boasts an 8MHz Motorola 68000, a 9in 512 x 342 pixel black-and-white display, a SuperDrive 1.44Mb floppy and 2Mb of RAM. We recommend a minimum memory size of 4Mb, plus System 7, the latest version of the Macintosh Operating System. A hard disk is a must for any kind of serious work and a good size is around 40Mb, as it allows for future expansion.

If want a computer for a beginner or for general office work, you should look no further than the Macintosh Classic.

Best All Round Business System

Dell 333P with 80387

Picking one desktop machine from the masses available is a tall order and perhaps a little unfair. To fight shy and refuse to choose is cowardly so we chose the machine we would be happiest about buying. The Macintosh IIsx was a strong contender, but in the end we went for the Dell.

Not long ago, such a decision would be motivated by price: Dell used to be significantly cheaper than the herd. Today, this is no longer the case; vicious price cutting has led to the wide availability of the £1500 386/33.

So why pay more? The answer is service: normally this involves the manufacturer signing an insurance deal with one of the national service organisations which promises to fix your machine when it goes wrong. With a Dell you get a rapid response from a trained Dell engineer who turns out when promised, and who will normally have all the parts required to get your system up and running. Dell telephone support is excellent: the company does return telephone calls and often a



manager will call to make sure you are happy with the response.

The decision to include a 387 co-processor was made on the basis of price/performance. Of course, the full 486 includes a co-processor but the equivalent 486 machine from Dell (albeit with a bigger hard disk and an EISA bus) costs over 50% more. Adding a 387 costs just £195 (a 10% increase on the price of the machine). The benefit when using those maths-intensive packages which utilise the co-processor is stunning, and with the increasing number of 486 systems being sold there are more and more programs which take advantage of the chip.

Best Power User System

Dell 433SE

What should an ideal power users system provide? An enormous amount of power. There are many machines on the market, especially in the 33MHz 486 range, that fit the bill, but we were looking for the best. It was a close-fought battle between the



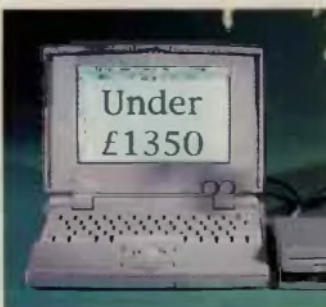
Solidisk 486-33E and the eventual victor, the Dell 433SE (awarded the PCW Seal of Approval, Hardware Group Test, November 1991), but the Dell just managed to out-power its opponents. It offers massive expansion capabilities: up to 64Mb of 60ns RAM, seven free EISA slots and the option to upgrade to the same specification as Dell's 450SE. Couple this with a very fast VGA card, an excellent Trinitron monitor, a 128K memory cache, a 16ms 200Mb hard disk drive and Dell's great keyboard, and you've got a winner.

All this kit doesn't fit into a small box, and at 600 x 580 x 200mm, it's far from portable. There is, however, an LED that doubles as a handle so the unit can be dragged around on castors, which makes moving it slightly less strenuous. This amount of kit doesn't come cheap, but on a price/performance basis, it's worth the £6234 you'll need to drive one away.

Best Personal Portable

PowerBook 100

Finding a product that deserved to take the title



Best Personal Portable was a lot easier than we expected, as all our judges had a good idea as to what they wanted from a portable machine. High on the list were a quality screen to provide clear text and graph-

ics, a decent keyboard, and some form of mouse or trackball input device. The latter is especially important if you're going to be using software that takes a WIMP approach to everything, such as Windows 3.0.

From that last statement you'd think that an MSDOS machine would be the victor, but you'd be wrong. The award for Best Personal Portable goes to Apple, for its brand new PowerBook 100 notebook. Reviewed in the November 1991 issue of PCW, it turned out to be everybody's idea of the perfect low-cost portable. As Peter Jackson pointed out, everything about it is just so right, from the quality and size of the screen to the weight and overall size of the casing. And you get 2Mb of RAM, a 20Mb hard disk, an external floppy and an AC adaptor all for less than £1350.

Best Power Portable

Dolch PAC 486-50E

On sheer processing power, there is now little to distinguish between the portable and the desktop. So, with several 486-based portables launched this year, the winning machine had to have something to make it worthy of the Best Power Portable award.

What the Dolch PAC 486-50E has is multimedia potential, including a display supporting full-motion video. The optional video screen is colour flat-panel, with 640 x 480 resolution and Thin Film Transistor technology to achieve a palette of 24,389 colours. The picture can be input from any PAL, SECAM or NTSC-compatible analogue source and can be used within the Multimedia Extensions of Microsoft Windows.

The standard PAC 486-50E is based on Intel's 50MHz 486 microprocessor, rated at some 21.5 MIPS. In its basic configuration, it includes a 200Mb SCSI hard drive, 8Mb RAM expandable to 32Mb, a 3.5in floppy drive and three full length/height 32-bit EISA/ISA internal expansion slots.

At a time when industry analysts are predicting portable computing and multimedia as the growth areas of computing for the next few years, the Dolch PAC 486-50E is in a good position for the future.



▲ Its multimedia potential sets the Dolch PAC 486-50E apart from the Power Portable crowd

▽ Simplicity spells success for the Radius Pivot monitor

Best Peripheral — Video Output

Radius Pivot

Simplicity is what differentiates the very best products from the merely good, and it was this quality that earned the Radius Colour Pivot the Best Peripheral — Video Output award for 1991. The monitor has a full A4-sized display, with a resolution of 1024 x 768 and support for 256 colours. But the real beauty of the Ra-



dius lies in its ability to turn through 90%. It takes so little effort that with one hand you can change the orientation from portrait to landscape and back again. Whatever application is running is adjusted to suit the new orientation, keeping documents and files upright so they can be read as before.

This is a product that will appeal to everyone. For intense word processing and page layout, the Pivot provides a full-page view in portrait orientation or allows two documents, side by side, in landscape. Spreadsheet users will appreciate being able to fit more columns on the wider screen, and with drawing packages there is more scope for imagination. With the expertise of a respected monitor manufacturer behind it, the Colour Pivot is not only a fun way to work, it's a trustworthy product.

Best Peripheral — Video Input Canon Ion



△ Where the world of photography meets the world of computing: the Canon Ion still-video camera

Earlier this year, *PCW* described the Canon Ion as 'a glimpse of the mass-market future for still-video and PC image capture' (Short Reviews, September 1991). Once Canon had made an add-in card for the PC, the Ion still-video camera became a valid device for the computer user. Photographic images could be input

directly to the PC, as well as the video recorder or TV. For bringing the world of photography to computing, the Canon Ion has earned the award of Best Peripheral — Video Input.

Pictures are taken as if the Ion were an ordinary camera, but are then stored on a hard-sectored, erasable 2in disk. The images are produced at a resolution of 786 x 295, with 16.8 million colours. It may not match the quality of 35mm film, but the pictures are reasonable and don't require developing. Then, with the Canon PC add-in card, those pictures can be transferred to the PC.

The technology is still in its youth, but the Canon Ion is already showing great potential. The new level of flexibility it offers for the application of pictures will not only be appreciated in the office, but will also find a market in the home before long.

Best Peripheral — Printed Output (Mono) HP LaserJet IIIsi

For this award, the *PCW* judges were looking for more than just quality print. Now that it is commonplace for laser or LED printers to have a 300 x 300 resolution and some form of resolution enhancement for smoothing curves, the winner had to offer much more.

The Hewlett-Packard IIIsi did. At 16ppm, it was faster than any other printer nominated; its print capacity, at 50,000 pages per month, was higher than the others; and with two 500-sheet paper trays,

it held more paper than any other printer. The maximum 18Mb of RAM was more than the others could provide, and it was the only one with a duplex printing option.

Networking, or resource sharing, is now normal office practice, but few printers are designed to cope with the networked environment as well as the Hewlett-Packard IIIsi. It runs unattended, switching automatically between the two paper trays as they become empty, and has the memory and printing capacity to serve an entire department.

Not only does it manage high volumes, it has sacrificed none of the quality that made the LaserJet famous but has improved resolution to 300x600. There can be no better printer for the networking environment.



Best Peripheral — Printed Output (Colour) Kodak XL 7700



It has been an interesting year for colour printing. Still a relatively new market, 1991 has seen several professional printers launched at the sector that wants quality at any price, and, at the same time, the burgeoning low-end market.

Using inkjet technology, full-colour printers can now be produced for less than £10,000. All the major printer manufacturers, including Olivetti, Mannesmann Tally, Canon, Fujitsu and Kodak have this year released colour printers aimed at the lower end of the market, and it looks as though there will be even more in 1992. But although the quality from these printers is fine for everyday office printing, it is still far from the professional finish of thermal printers.

It was the untouchable quality of the print that convinced our judges that the Kodak XL 7700 Digital Continuous Tone printer deserved the Best Peripheral — Printed Output (Colour) award. It uses advanced thermal dye transfer technology to give prints of near-photographic quality and is supplied with either an IEEE 488 or SCSI interface to take the digital information of the computer environment. Prints are stable, do not curl and are scratch-resistant.

"The Dolch is a screamingly fast, high-powered machine. You can add as much power to it as you can afford..."

PC Magazine

"The Dolch is by far the fastest portable computer that BYTE has ever tested."

BYTE

"The Dolch was the fastest machine tested ... and offers the best display."

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"Of the dozen machines tested, the Dolch comes closest to the portable desktop ideal."

PC Magazine

Specification

386sx-20, 386-33, 486-33, 486-50 EISA, 486-50 EISA models

64Kb or 256Kb fast CPU cache

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<input type="checkbox"/> Please send me further information on the Dolch portables			Size of company <input type="checkbox"/> Not a business <input type="checkbox"/> 1-9 staff <input type="checkbox"/> 10-99 staff <input type="checkbox"/> 100-999 staff <input type="checkbox"/> Over 999 staff

PJ1

Best Peripheral — Local Area Communications

NetWare Lite

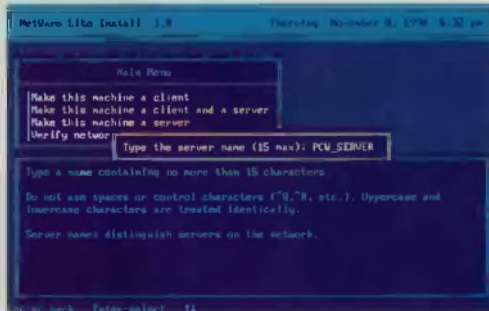
Local Area Networks are rapidly catching on in the general computing environment. Even the most non-technical users are beginning to see the sense in sharing resources and establishing direct communications with other terminals.

The corporate LAN market has generally been well served, but life has not been easy for smaller workgroups wanting to set up a simple network around a few PCs. NetWare Lite has been outstanding in providing groups of fewer than 25 with a viable way to set up a network, and easily deserves the award of Best Peripheral — Local Area Communications.

▽ NetWare Lite: PC networking for the under-25's

A £70 kit per PC is all you need to set up the network. No file server is needed and any PC on the network can be configured as a 'client' or a 'server'.

For small groups, the cost of using NetWare can be half to a third of the price of setting up a network in the traditional way, and as Novell will be offering an upgrade path to versions 2.2 and 3.11 of its server-based network operating systems, it's a good investment for the future.



Best Peripheral — Wide Area Communications

Motorola/Codex 3265

The Motorola/Codex 3265 is an outstanding modem. It is outstanding because it implements the V.32bis/V.42bis standards to their full, giving an effective transfer rate of around 36Kbps over normal phone lines. It achieves this using a pair of Motorola's own high-performance communications processors, while other manufacturers, in their rush to get V.32bis onto the market, have attempted simply to update existing products which are generally not up to the job.

The 3265 also distinguishes itself by being easy to use, solidly constructed and replete with just about every imaginable feature. All commands can be accessed from a front panel with an alphanumeric LCD. It implements most common control standards and can be controlled over a network. But the most important feature of any modem is reliability, and the 3265 does not disappoint.

Future modems will no doubt do the same job faster and/or better, but Motorola/Codex got there first and set the standard.



△ The Motorola/Codex 3265 modem has gone where others will surely follow



Best Entertainment Product — Hardware

Sega MegaDrive

The hardware section of our new Best Entertainment Product award goes to a rather large Japanese company. Video games have always been big business in the land of the rising sun and the amount of money people like Nintendo spend on development is incredible. After much debate and severe testing, our first award goes to Sega for its popular and highly praised MegaDrive, currently the only decent games console officially available in Japan, the USA, Europe and the UK.

At the heart of its sleek, black casing is the popular Motorola 68000, backed up by a Zilog Z80A and a couple of custom audio/video chips. The unit incorporates a snazzy hand controller, has a palette of 512 colours, boasts multi-channel FM stereo sound and can generate a maximum graphics resolution of 320 x 224 pixels.

Cartridges available include arcade classics such as the PCW office favourite, Super Hang On, Space Harrier, and a great platform game called Sonic the Hedgehog. Prices range from £29 to £59 and an optional adaptor lets you use older Master System software too.

The Sega MegaDrive is available from all good video-game stockists such as the Virgin Megastore, Oxford Street, London W1 and has an RRP of £129.99.

Software section

Best Text Processing Software

Word for Windows 2.0

In December 1991, Simon Rockman described Word for Windows 2.0 as '...the best Windows word processor around — for now'. Quite a prestigious title (even if it wasn't official). Nothing has since appeared on the market that can match it, so Word 2.0 has been awarded PCW's Best Text Process-

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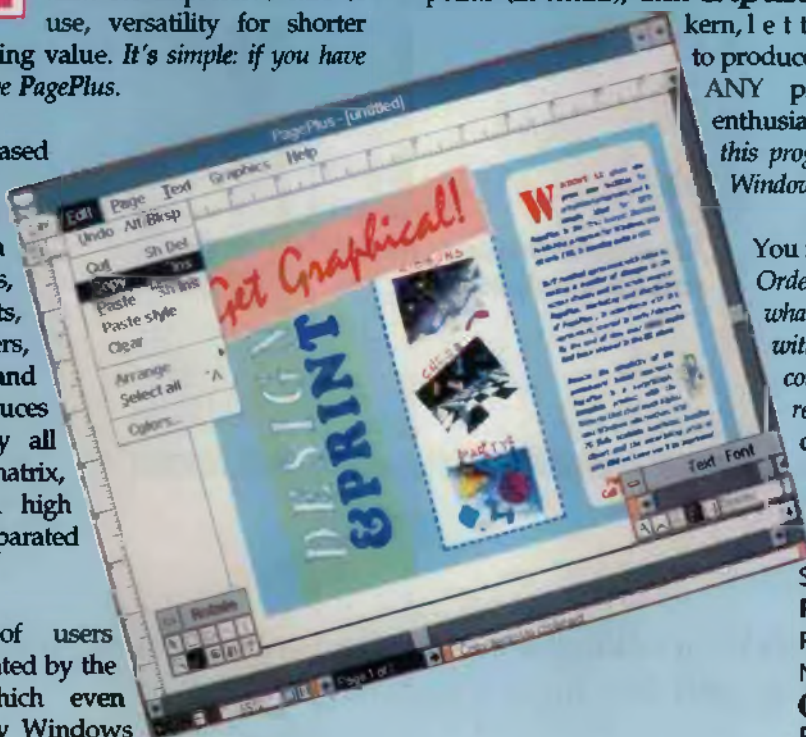
PagePlus for Windows, the great Windows 3 desktop publisher from Serif, is winning universal praise from users and reviewers alike for impressive ease of use, versatility for shorter publications, and astonishing value. It's simple: if you have Windows 3.0 you should have PagePlus.

PagePlus is pasteboard based and allows full rotation of text and images, making it ideal for producing high impact materials: flyers, invites, adverts, hand-outs, brochures, short newsletters, business stationery, forms, and the like. PagePlus produces great output on virtually all printers including dot-matrix, ink-jet, and lasers. Even high resolution colour separated PostScript like this advert!

Already thousands of users worldwide are delighted by the power of PagePlus which even exceeds much more costly Windows alternatives. It's easy to see why PC Plus concluded: "At the price, there is currently no DTP under Windows to touch it."

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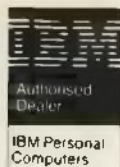
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ing Software award. The old version of Word for Windows had a firm grip on the Windows word processor market, selling more than a million copies. With the improvements in Word for Windows 2.0, that grip can only tighten.

Existing Word users will have no problems converting to the new version. In fact, they will probably find it easier to use. Twenty-two icons in a screen-top 'toolbar' perform routine tasks at the click of a mouse button. The functions launched by these icons can be changed to the most common tasks performed by the user. An icon can even be assigned to a macro.

The program also comes with some sub-programs, or 'applets'. These are Draw, Chart and Table, an enhanced version of the old Word table editor. The Chart applet is virtually the same as that used in Excel 3.0. Draw, a small art package, deals with object-oriented and bit-mapped images and allows them to be easily incorporated into the main text.

Whether you love Windows or hate it, this is the word processor to beat.

Best Page Layout Software

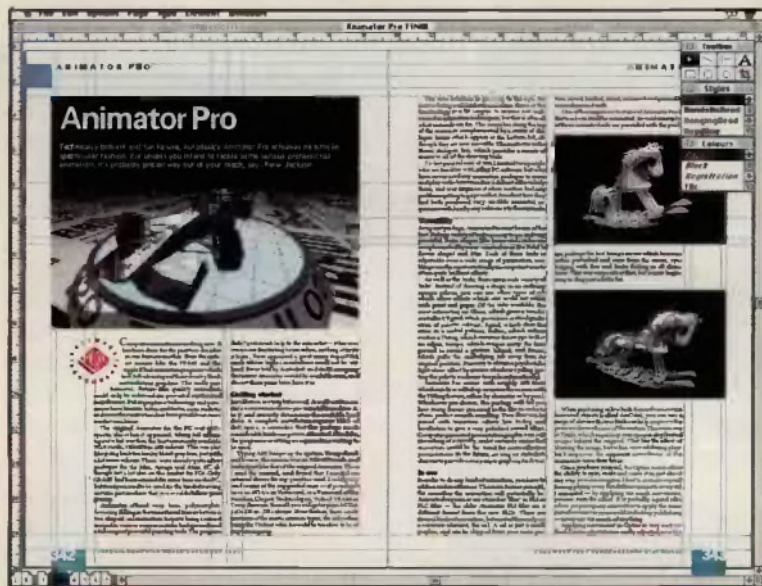
PageMaker 4

Last year, Aldus PageMaker 4.0 was narrowly beaten into second place by Quark XPress in the Best Desktop Publishing Software Award. This year, with the category changed to Best Page Layout Software, PageMaker 4 takes the first prize and takes it without much competition.

Although 1991 has seen a glut of cheap desktop publishing packages falling over themselves to be the easiest to use and dropping features in the process, the better known names have had little to offer. Only the colour release of Ventura Publisher posed a threat, but there was inadequate proof of its reliability. PageMaker 4, meanwhile, has been made available for Windows 3.0. Unlike all those budget packages, it is both simple to use and capable of everything the professional user requires.

One of the features that puts PageMaker above its rivals is the Story Editor, introduced on version 4.

▽ We make up our pages with PageMaker 4, a professional product that withstands the PCW pressure



This saves you having to go back to your word processor to run a spelling check, generate an index and table of contents, or perform other editing functions such as search and replace, or cut and paste. Version 4 also introduced a scaling option for printing, a Book feature, and support for Pantone colours, CMYK, RGB and HLS formats.

Another point in its favour is that PageMaker 4 has passed the test of time in the PCW office. It has been in use for quite some time, standing up to the pressure of 500-page issues month after month. That makes us confident enough to elect PageMaker 4 as the best page layout software on the market today.

Best Spreadsheet

Excel 3.0

Excel 3.0 is still the best-selling spreadsheet for Windows, and has been since its launch. Selling the most doesn't necessarily mean that it's the best



(look at *The Sun*) but in this case the connection seems to be true. Microsoft claims that Excel 3.0 is easier to use than 1-2-3 for Windows, and judging from converts on PCW this may well be true.

The user interface is similar to that in Ami Pro, Corel Draw and now Word for Windows 2.0. Many commonly used functions can be carried out by clicking on a toolbar icon after selecting a target worksheet area. Macros can be set up using the macro recorder, and activated by buttons which can be placed anywhere on the worksheet. The 'Sigma' icon (SUM function), unique to Excel 3.0, is used to total a selected area of the sheet. Microsoft claims 70% of all spreadsheet operations can be performed with it.

Excel's prize feature is its charting capabilities. The spreadsheet data can be graphically displayed in a virtually endless form of 2D and 3D charts, which can be incorporated into the worksheet. But a myriad of other features makes Excel 3.0 for Windows the best spreadsheet on the market.

Best Database Management Tool

Borland Paradox Engine Concept

Predictably, nominations for this award included WindowsBase, the SQL database for Windows 3.0 which, together with the Skylight flat-file database, joined SuperBase and Omnis in the Windows data-



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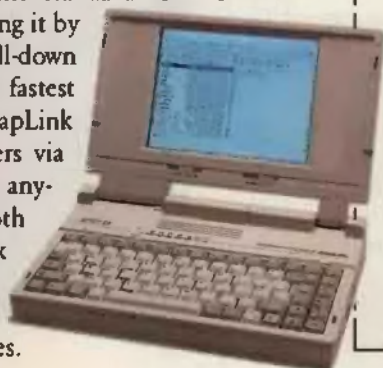
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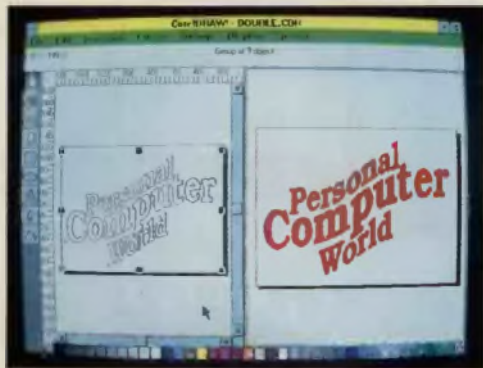
base arena. But in the field of database management in 1991, it was impossible to ignore the rise and rise of Borland. In a surprising but astute move, Borland purchased ailing Ashton-Tate, giving it control over dBase IV. At the same time Borland took its own range of database products, centred around Paradox, to new heights.

The award is not for Paradox alone (we're still waiting for the much-hyped Windows version) but for the way Borland has addressed the problem of database file compatibility across a number of its applications — what Borland refers to as 'interoperability'. While Paradox remains the company's flagship database management tool, the Paradox Engine allows access to Paradox files from programs written using Borland's language products — C++ or Turbo Pascal — running under DOS or Windows 3.0.

Programs written using the Borland languages and the Paradox Engine can offer a range of functions that complement those available in Paradox itself, while retaining the ability to exchange files. ObjectVision — Borland's elegant form design and data entry tool — completes the picture.

△ The rise and rise of Borland in 1991 centred on its expertise in database management

Best Graphics Application — Object Oriented Corel Draw!



△ If you want it doing properly, do it yourself. Corel did, and found itself at the forefront of the object-oriented graphics software market

package market. Corel didn't wait for the competition to catch up before launching version 2.0 with a host of new features and fonts. Corel Draw! is good, albeit a shade slow. It provides circles, line and boxes, zoom, cut, paste and drag. It also has features like the ability to add arrowheads to all lines, to draw lines as bezier curves and smooth them, and to treat a whole drawing as a shape by crushing, stretching or extruding it. You can perform any number of operations on a line of text and then edit the string. There is full-colour support using the Pantone Matching System, and the option to produce four-colour separations.

Most of its rivals are better at a few particular

things, none of them do the job as well all-round. This is the second year running Corel Draw! has won this award. There have been a few changes between the 2.0 and 2.01 versions but it is still the same. It is still the best.

Best Graphics Software — Bitmapped Publisher's Paintbrush



As he spent a great deal of time testing graphics packages for the Software Group Test in our October issue, choosing a winner in this category didn't pose any problems for Chris Cain. The best of the bitmapped software

then was ZSoft's Publisher's Paintbrush and nothing has been launched since that's good enough to change our minds. This product offers professional-quality image editing on the PC, without the price tag normally associated with high end art applications.

Packages such as Adobe Photoshop and Studio/32 come in at more than £1000 and £500 respectively — Publisher's Paintbrush retails for only £325. There are lots of cheaper products available, but none boasts as many useful functions.

Among the features on offer are freehand, line and geometric drawing tools, custom brushes, shading, blending, good font support and nice zoom facilities. The software can also handle numerous file formats, including PCX, TIFF and GIF, any Windows 3.0 graphics resolution, and 16.8 million colours. A decent PC equipped with this package would be ideal for pre-press picture retouching or creating your own original artwork — the program is flexible enough for both tasks.

Best Graphics Software — Animation Autodesk Animator Pro

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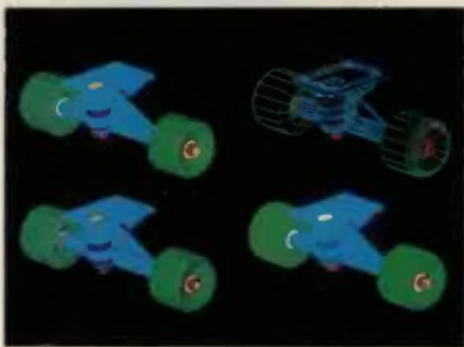
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tween clinching that all-important contract and winding up in the bankruptcy court with the receivers on your tail. On a lighter note, animation packages can help professional cartoonists make their work come to life far faster than before. Some stores also find them useful for advertising brand new products, and video and computer enthusiasts use them just for fun.

This year's winner of the *PCW* Best Graphics Software — Animation award is Animator Pro, from leading graphics specialist Autodesk. It enables amateur and professional animators to design full-colour sequences with flowing, faultless movement and high-resolution graphics. These can be created using 'Animated Cels', as with traditional methods, with graphic tweening or by simply painting with custom brushes. The entire program is controlled via mouse input and pull-down menus, so it's extremely easy to use.

Best Graphics Application — CAD

AutoCAD 11



△ Release 11 of AutoCAD breaks new ground in the PC CAD software environment

AutoCAD has long been the leading Computer Aided Design (CAD) software for the PC, with perhaps as much as 60% of the market worldwide. Release 11 doesn't sound like a package that is going to break new ground, but it has a number of new features that haven't been seen in PC CAD software before and

which mean AutoCAD can now compete with the more expensive systems running on specialist proprietary hardware.

There are new design and drafting tools, and facilities for workgroup computing and drawing recovery, and for invoking routines or off-the-shelf software through the AutoCAD Development System (ADS) and the AutoLISP compiler.

An optional Advanced Modelling Extension provides Release 11 users with a set of modelling tools for creating solid 3D objects from basic shapes, such as spheres and cones, and then performs Boolean calculations on them to determine the mass properties.

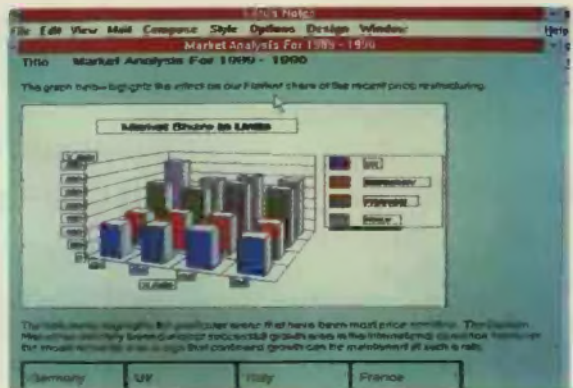
Despite being one of the more reasonably-priced CAD systems available, AutoCAD is a well-respected package and a wise investment.

Best Groupware Application

Lotus Notes

With networks becoming more and more popular in today's offices, the term 'groupware' has evolved to cover software used by groups of people. This is normally used for communication purposes, to keep everyone up to date on the latest developments in the workplace.

By far the best groupware product we've seen is



Lotus Notes, which handles data distribution with speed and style. It supports documents containing text and graphics, and will import and export data to and from Lotus 1-2-3, Microsoft Word, WordPerfect and even DisplayWrite. A context-sensitive hypertext help feature is also provided, as are comprehensive security measures that provide selective restricted access to data.

Notes is available for both Windows and OS/2 Presentation Manager and works with all major PC networking hardware and software including Novell NetWare, 3Com 3Plus Open, IBM OS/2 LAN Server, Banyan Vines and Microsoft LAN Manager. A minimum system configuration of a 286 with a hard disk and 3.5Mb of RAM (Windows) or 4Mb (Presentation Manager) is required.

Best Programming Environment

Visual Basic

Visual Basic is aimed at a broad cross-section of computer users. It applies one of the best-known programming languages (Basic) to one of the most popular software operating environments, Windows 3.0. Visual Basic has abandoned the Multiple Document Interface protocol and now uses multiple windows, making management of the elements of a program far easier than it was with Basic. Visual Basic also includes three events for communicating with other Windows packages by using Dynamic Data Exchange (DDE).

Although many of the techniques are unfamiliar to Basic programmers, they were picked up quickly by our reviewer (*PCW* July 1991) and could then be applied to working in the more complicated C or assembler environments. Visual Basic provides an easy way for enthusiasts to get into programming, as well as enabling professional programmers to produce prototypes quickly and to build cheap applications for Windows. That all-round appeal and its ability to achieve results quickly made Visual Basic a favourite with the judges.

Best Language Implementation

Turbo Pascal for Windows

At first sight it may seem strange to choose a version of Turbo Pascal as the best language implementation, since the language it implements is hardly standard Pascal. Borland has never been



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▲ Turbo Pascal for Windows — Borland's award-winning language implementation

apologetic about this. Indeed, on one occasion when an earlier version of its compiler was shown to fail a significant proportion of the tests for ISO compliance, a company spokesman commented: 'We don't need to be standard. On PCs we are the standard.'

Borland's C++ was the first Windows compiler to function without Microsoft's Windows Software Development Kit. C++ was good, but its Integrated Development Environment ran in DOS text mode. Turbo Pascal for Win-

dows was launched a month after C++, and was the first language compiler to run under Windows and produce Windows code.

Borland's speed in converting its leading development environment to Windows has had an appreciable effect on the popularity of Windows itself: when a port to Windows from Turbo Pascal involved translation from Pascal to C, few developers could afford the time to make the switch. Turbo Pascal for Windows makes that step one worth taking: it's not painless — there's still the task of learning the Windows API, but it's certainly cost effective.

Best Utility

LapLink Pro

For the second year running, Traveling Software takes the award for Best Utility. LapLink Pro wins it for the company this year. The package is more than just an update to the market-leading file transfer utility; LapLink Pro provides comprehensive communications support and greatly improved file management, that make the category 'utility' somewhat restricting.

LapLink Pro offers support for ISDN adaptors and cellular radio modems, as well as Hayes compatible modems — and, conveniently for notebooks without built-in floppy drives, it can even install itself over a modem link. As well as transferring files from one PC to another, it can now transfer files from one drive to another. Pro has also added a text editor, enabling users to patch files together without leaving LapLink, and a Clone New Disk facility for duplicating the entire hard disk.

The presentation of the package has been brought up to date with the addition of mouse control, and an icon and a .PIF file allow it to be used within Windows. But it is still a DOS program. Despite all these changes, LapLink is as easy as to use as ever.

Best Entertainment Product

Lemmings

All kinds of games products were evaluated, from complex adventures to arcade affairs, but in the end one title clearly stood out from all the rest. The winner of the first PCW Best Entertainment Soft-



ware award is Liverpool-based Psygnosis, for the utterly addictive Lemmings.

Available across a range of formats, including PC and CDTV, it will probably go down as one of best video games of all time. The concept behind it is staggeringly simple, but then the best ones always are. The player takes control of a band of totally loopy lemmings and has to guide a set percentage of them across various perilous landscapes, using parachutes, pickaxes, dynamite and other fun everyday items. The resulting gameplay is hilarious and so addictive that you can easily find yourself playing well into the wee hours.

Best Gadget

Psion Series 3



The first product to take our brand new Gadget award, the Series 3 is the latest entry in the field of pocket computers. It is very portable, weighing 265 grams, yet it has a qwerty keyboard, an eight-line 40-character screen, and it can store up to 8Mb of data on removable, solid-state flash memory disks. It connects well to PCs (though less well to Macs), and has an excellent set of built-in applications including a Word-compatible word processor, a fast database and one of the best calendars we've ever seen.

You can even write programs for it using a built-in extended version of OPL, Psion's Organiser Programming Language.

The machine is a bit costly — it starts from £199, but a usable set-up (with 256K of system memory and a 512K Flash EPROM card) really costs more than £350. However, for this price you get the most elegant pocket computing solution we've seen yet — and it's pretty, too.

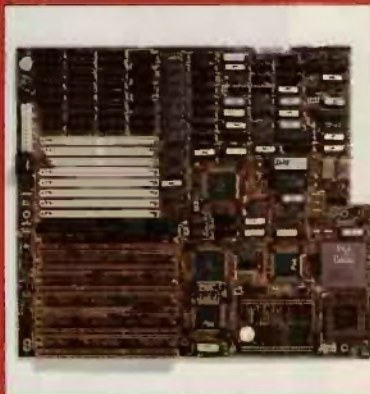
The bus is the bottleneck in high performance PC systems, so what price to double the speed? EISA prices start from £999+VAT for a 486/33 mainboard, £1,719 for a complete tower VGA system with 40MB disc and 4MB RAM. An EISA Ethernet card costs £250 and an SCSI

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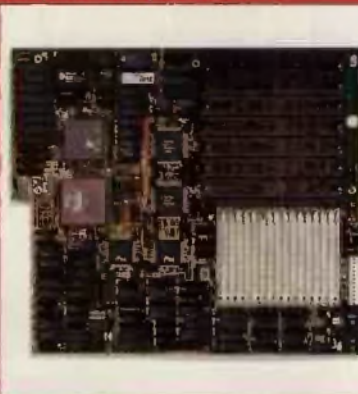


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Most Influential or Innovative Product

Go! PenPoint

▽ It got there first and set the standard for others to follow: Go! Corp's PenPoint



After several years of speculation about pen-based computing, Go! Corporation has come up with the PenPoint computer and operating system. It's a device with the power of a computer, but which can read markings made by a pen. Technophobes and computing enthusiasts alike have heralded it as a new age in computing, and the PCW panel was in no doubt it deserved the award for The Most Influential or Innovative Product of 1991.

Go! Corp has produced the prototype computer and screen, the pen or digitiser that 'writes' on the screen, and, most importantly, the PenPoint operating system that enables the computer to understand the pen markings. The machine released earlier this year was based on an 80286 processor with 8Mb of memory. A SCSI port and a modem slot were built in, as was a new method of file storage complete with instructions for downloading when the system is in transit.

Not only was Go! Corp the first to bring out a fully-functional pen-based computer, the company has also designed a system far superior to any of its rivals.

Editorial Team — Product of the Year

Word for Windows 2.0

Word for Windows 2.0 takes this award because it was the one product that all the judges had a good word for. PCW has both beginner and experienced Word users, and at both ends of the scale it has proved popular. Each person can use Word in a

different way; we all have our own favourite features and even the way the display is set up varies from user to user. At PCW we get to see a lot of different word processing packages, but Word for Windows is still the one we choose for day-to-day writing. It also wins the Best Text Processing award and

a resumé of the product can be found in that category.

PCW Personality of the Year

Philippe Kahn

Yes, it's an old cliché, but there really is very little you can say about Philippe Kahn that hasn't been

said already.

Some people told us there was little point in attempting to choose a Personality of the Year. They argued, with some justification, that there just aren't any personalities left in the computer industry. Well, like him or loathe him (and few people's opinions are less extreme), Borland's enigmatic leader certainly has a personality.

Who else would have sent friends a CD of the great man himself playing clarinet with some of America's top jazz musicians? Who else would have turned a press conference at a European Software Festival, with a panel that included Marvin Minsky, Niklaus Wirth and Bjarne Stroustrup, into a dissertation of his own rather bizarre theory that had Mozart been born in America in the Thirties he would have been a jazz musician?

Who else could have totally lost his native French accent in the years since he moved to California? Who else would delight in causing a trail of embarrassment and confusion among his employees by demonstrating unannounced software products? Who else would stave off a possible law-suit with a competitor by simply buying that competitor?

Flamboyant, arrogant, charming — few people can be all these things in the space of a few minutes. Except Philippe Kahn.



Vapourware — Software

WordPerfect for Windows



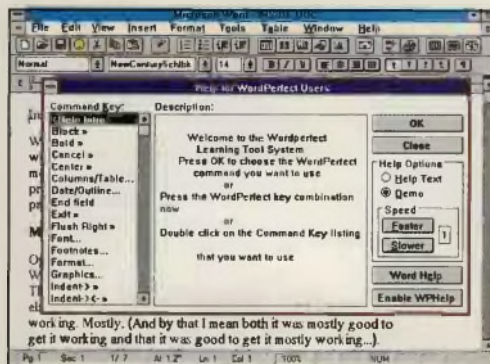
The advent of Windows has badly affected those companies which were either not lucky enough to be on the bandwagon or not flexible enough to react to the market. Previous market leaders like Ashton-Tate, WordStar

and, most importantly, WordPerfect have had a tough time getting to grips with Windows.

WordStar took the novel approach of re-packaging (in the broader sense of the word) NBI's Legacy and offering it as a substitute to WordStar for Windows, with the final package somewhere in between WordStar and Legacy. This formed something of a stepping stone. Around the same time as WordStar announced WordStar Legacy, WordPerfect announced WordPerfect for Windows.

With the market slipping rapidly towards Windows, WordPerfect had to act fast. The marketing machine swung into action and early alpha test copies were skilfully demonstrated at the *Which? Computer Show*. The skill was to negotiate the package without crashing it.

After the show, WordPerfect made a big play of the software's move to beta testing. Reviewers who saw this software claim that it was very shaky,



△ The last word in word processing: Word for Windows 2.0

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despite WordPerfect's claim that it would ship very shortly. As 1991 slipped by, the software went backwards from beta test to alpha test and the 'real soon now' promises started to ring hollow. The delivery date slipped to 'the end of the year' and finally to 'end of November'. This article is being written before then. Time will tell if the program makes it in time for Christmas.

Vapourware — Hardware

Active Book

Herman Hauser's Active Book is a sad product. Not because it isn't very good — those who have seen it say it is. What is sad is that you can't buy one yet.

Sages in the computer industry predict that pen-based computing is going to be bigger than the existing PC industry, and the Active Book was destined to be at the forefront. Using the Acorn-designed ARM (Advanced RISC Machines) central processor, it has a lot of raw processing power for a device with relatively low power consumption at a very low component price.

When Acorn spun off the ARM processor as a company owned by itself, Apple and VLSI (the manufacturer of the chip), the Active Book Company was cited as a 'major' customer. We wanted to review the machine in the April 1991 issue of PCW, and Guy Kewney went to visit the company with a view to previewing the prototype.

For several months we were told to wait a month, until rumours began to surface of a deal with some American backers. One backer is rumoured to be AT&T, which in turn owns NCR, maker of one of the first pen-based machines to go on sale.

Initially we were told that the Active Book had been delayed while a floppy disk was incorporated into the design. Then that the Americans were only interested in the second-generation machine, and that the original design would not be affected. Finally that the Americans wanted to re-design before anything was launched. The machine now looks further away from launch than it did six months ago.

Hardware Dog of the Year

Intel 486SX

The Intel 486SX has not enjoyed the welcome given to the 386SX, which was greeted generally as a superb and innovative product. Technically, the 386SX was identical to a standard 386, except that the external bus reduced from 32-bit to 16-bit. All the features of the 386 were available, most importantly including the memory management facilities to free DOS users from the 640K limit imposed 10 years ago by IBM engineers at Boca Raton.

There is no parallel with the 486 and the 486SX.

Whereas the 386SX offers something new, the 486SX is simply a 486 with the maths co-processor removed. Considering that the 486 is itself little more than a 386 and its 387 co-processor on the same chip, you might think the 486SX is a 386 by another name. What clinched a general antipathy to the 486SX was the discovery that its complementary 487SX co-processor is a full 486 with the main processor disabled.

In fact, a 486 of any ilk has advantages over a 386. One is that a 486 or 486SX uses the clock speed of its timing crystal directly (the 386 divides it by two), enabling the use of cheaper, slower components with no sacrifice in performance.

If the 486SX had been better presented, people might have taken to it more than they have. Perhaps Marketing Dog of the Year would have been a more appropriate award.

Software Dog of the Year

Wang UpWord

Every now and again there comes a piece of software that changes the way you think about computers. It challenges the way you work, even the way you think. Such milestones are eventually recognised, although there may be years of struggle before the world accepts the genius of creation.

Being a pioneer isn't easy. Others will wait for you to innovate, then tuck in behind and exploit your great idea, supplying the insatiable market you created. So what happened to Wang? Wang UpWord isn't a milestone product. It is, if anything, the opposite. The world is moving towards WYSIWYG word processing in a Windows environment, with standard menu structures and rich feature sets. UpWord is WP in a window, but it is most definitely not Windows WP.

If Wang had taken a successful DOS product and wrapped it in a shiny new Windows shell, it would have been a move universally condemned for its cynicism. Words fail when the product hidden inside the shell is crude, slow and lacking in features.

There is a new version of Wang UpWord on the way. We can hardly wait.

PCW Awards 1991: Panel of Judges

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Senior Staff Writer, *Personal Computer World*

Rupert Goodwins

Freelance writer and PCW columnist

Peter Jackson

Freelance writer and former Editor, *Personal Computer World*

Guy Kewney

David Morton

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386/33c 64K Cache	4mb	£1090	£1150	£1280
386/40c 64K Cache	4mb	£1145	£1205	£1335
486/25c 64K Cache	4mb	£1409	£1469	£1599
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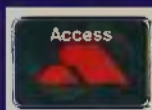
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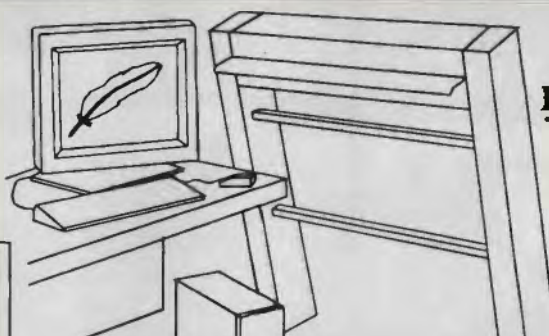
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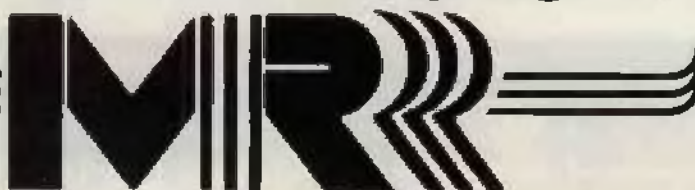
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Backpack vs HP DAT

There's no real contest between these two tape drives. Both provide reliable data backups but they are otherwise aimed at different markets. Still, Hewlett-Packard shouldn't boast so loudly about trouble-free starting, says Frank Leonhardt.



Backing up files is one of those tasks which everyone agrees is a good idea but hardly anyone ever bothers with. Ask why and you discover that most people are so confident of this wonderful technology that they don't believe a catastrophic failure can ever occur — at least not to them. A string of past false alarms tends to result only in a false sense of security.

But data faces many threats, not least from you, the user. Operator errors are more likely to lose data from a hard disk than mechanical failure. You might type 'DEL *.*' (or its Windows equivalent) to

wipe a floppy and accidentally zap the Winchester instead. Another easy mistake is to delete a lot of text in a word processor and save the rest into the only disk file, before realising that you have deleted hours of work. The office trainee can cause untold havoc by posting a stack of invoices to the wrong accounts.

In all these cases, a safe copy of the files would quickly save the day and reduce the risk of violence against the culprit.

Software, which on an MSDOS machine has the hardware by the throat, can be a killer too. If you are particularly unlucky, a piece of rogue code could wipe out everything on your hard disk in milliseconds. More likely, a slight coding error can trash the operating system, taking any open files into never-never land.

Then there is sabotage. A disgruntled employee perhaps? You might even be unlucky enough to encounter a virus. These are far less common than some sections of the press would have you believe. However, the novelty value of finding a genuine virus has destroyed your disk will be of little consolation.

The last danger is hardware failure. How long do you trust your hard disk to continue working? Forever? Ten years? Try three to four years, on average for a good one. Some models break down sooner than this because of a hidden design flaw — there is no way of telling. Some drives will go on and on, others may die sooner than average. When you consider that the drive heads are passing the surface of the disk at a height too small to see at a speed greater than 50mph, you may wonder how Winchesters can be expected to work at all.

Personally, I retire drives after three years because I value my data. But just in case I've inadvert-

ently fitted one of the 'sooner' models I also take regular backups.

Tape versus floppies

When the IBM XT first showed up with its massive 10Mb Winchester, nearly 30 floppy disks were needed to make a full backup. This was not fun. Backing up a 120Mb PS/2 requires more than 80 of the newer 1.44Mb diskettes, and although they have four times the capacity they can only accept data at twice the speed of the old 360K floppy. The MSDOS floppy-based backup system can be used, but it is hardly practical.

Enter the tape drive. Unlike available floppy disk standards, tape systems have been able to match the increased hard-disk capacity with improved recording technology of their own. A modern DAT drive can stash 2Gb on a single 90metre cassette (see box below) of about the same bulk as a 3.5in floppy, and back up all the files on a 120Mb Winchester in about 15 minutes... a far more attractive proposition than sitting up all night feeding a hungry diskette drive from a leaning tower of floppies.

Getting to the point (at last), this is actually a review of two radically different tape backup systems. In the cheap and cheerful corner sits the Backpack tape drive, produced by MicroSolutions. From the high end comes Hewlett-Packard's HP DAT PC Backup Solution (crumbs!). If you plan to skip to the conclusion of this review to find out which I thought was best, I'm afraid you are going to be disappointed. These are two very different backup products which are sure to appeal to different people for different applications.

The Backpack drive

The Backpack tape drive is available in two versions, the larger model 141080 being tested here. It uses standard DC2000 mini cartridges which are available in 205ft and 307ft lengths giving capacities of 83Mb and 125Mb respectively. By using a software compression method these capacities are effectively doubled, at the expense of backup speed on slower PCs. The other model, the 141040, uses the same cartridges but only stores half the data.

The tape drive forms part of a range of MicroSolutions products, all of which are designed to connect to an IBM PC parallel (printer) port. This means it can be connected to practically any PC, including laptops, with no need to use up an expansion slot nor even to open the case. However, the parallel port was not designed to operate at particularly high speeds so this may not be a high performance option.

The Backpack tape drive comes packed in a small well-padded cardboard box with all the necessary cables and bits. Only the tape is missing. The single 72-page manual is simple to understand and fairly well typeset, with plenty of screenshots. It does lack an index, but as it's so short you can probably find your way around using the comprehensive contents section at the front.

Installing the hardware is easy. You just plug the power lead into the drive, plug the drive into the PC printer port, and plug any displaced printer into the drive's through socket. The external power supply is packed into an outside 13amp plug — so over-



sized, in fact, that it might cause problems in some sockets.

The backup software installation was just as simple. Insert the disk into drive A: (or B: if you prefer and run the install program. This copies the software (one 60K .EXE file) into a directory on your hard disk. You can copy the program using DOS if you prefer. But market forces being what they are, people expect to have a program called INSTALL, even if it is a bit pointless in cases like this.

Operation

Backpack's software is a piece of cake to use. It has the feel of having been written by someone who knew what he was trying to achieve rather than by a committee bent on pleasing everyone. And once started, the system just went away and did what it was asked to do.

The results of each backup are stored on the tape

△Micro-
Solutions'
Backpack

DAT and your data

DAT — or digital audio tape — was designed mainly by Sony for recording sound digitally on cassette. The technology has been adapted for storing computer data on DAT cassettes, taking advantage of their high capacity and cheap volume production.

In normal audio systems, the tape is passed across a stationary head for reading and writing. But DAT employs a spinning head like that on a video recorder. The tape is guided around a drum containing the head (or heads in the case of the HP DAT drive) which are mounted at an angle so that as they spin, they traverse the tape in a series of diagonal stripes.

This technique has the advantage of utilising a far greater proportion of the tape for storage than a full-length continuous track and means that the tape itself does not have to move particularly fast as the effective tape speed is governed by the spinning head.

In general, the faster a head moves across the media, the higher the possible data rate and the higher the capacity — assuming the tape doesn't melt. A 90metre DAT cassette can hold as much as 2Gb, the 60m version 1.3Gb.



▲ A DAT DDS cassette which can store 2Gb of data

as a file set. One tape can have any number of sets stored on it, capacity allowing, and when you wish to restore a file you simply select the set you want from a menu.

Selecting files for backup is easy. Presented with a directory of your chosen source disk you can tag individual files or directories on or off, or include and exclude a whole group using wildcards or a range of dates. You restore files in exactly the same

way, picking which you require from an identical directory display. For repetitive operations there is a macro recording facility, and a menu of utilities allows you to format and maintain tapes.

This was an early version of the software and I did find a couple of bugs, which are apparently known about and are being fixed. Talking to the UK distributor Timatic, I got the impression that it knew the product really well, having helped with its development.

Incremental backups (only storing the changes to the hard disk) are quite possible, as is spreading file sets over more than one tape. The only limitation appears to be an inability to back up from more than one hard disk into the same file set. Backpack can back up network files and restore them just as if the network were a local hard disk.

Backing up took place at the rate of approximately 1Mb per minute. This rate is limited by the rate at which data can be passed down the printer port, and will vary from machine to machine. Each operation was bracketed by a couple of minutes of winding and groaning as the tape was repositioned,

sadly an inevitable irritation.

Data can be optionally compressed to double the effective tape capacity. On a 386SX, reduced transmission time made up for time spent compressing. On a 386DX-25 there was actually a 25% overall speed improvement with compression enabled. You would need a 286 machine, or worse, before there would be any reason to disable it.

The HP DAT drive

Hewlett-Packard is one of the original computer companies, guarding a reputation for reliability and corporate hand-holding. A few months ago it decided to promote its products as giving 'trouble free personal computing'. The company boasts that its kit will work first time, plugged in straight from the box, in the same way people expect a typewriter to work first time. This is fine if HP can pull it off, but as a marketing cry it seems about as sensible as painting your tank in dayglow colours and sticking a flashing light on top before going into battle.

Certainly the cry rang in my ears as I unpacked the HP DAT drive, a neat standalone unit connected to the host computer via a SCSI-2 interface (SCSI, a fast standard popular with small high-performance computers, requires an interface card to be installed in most PCs).

The 'solution' comes in three boxes: one containing the drive and cable, one with the Sytos Plus backup software, and the third with your chosen 'Host Bus Adaptor kit' consisting of an interface card and several software drivers.

There are separate manuals for the SCSI interface card, the SCSI software, and the tape drive itself. You also get two Getting Started booklets, a User's Guide for the Sytos software, and a separate pack for the Novell drivers. This came to about 2.5in of manual in total. I love a good read, so I cancelled all my appointments, had my phone diverted, and settled down in a comfy chair.

Actually that's a lie. I flipped open my PC, bunged in the SCSI card, plugged in the drive and turned on the power. The machine booted, but after some time screened a message from the SCSI card saying it could not find device zero. A switch on the back of the drive told me that it was set up to be device 3, so I set it to zero and tried again. Still no luck.

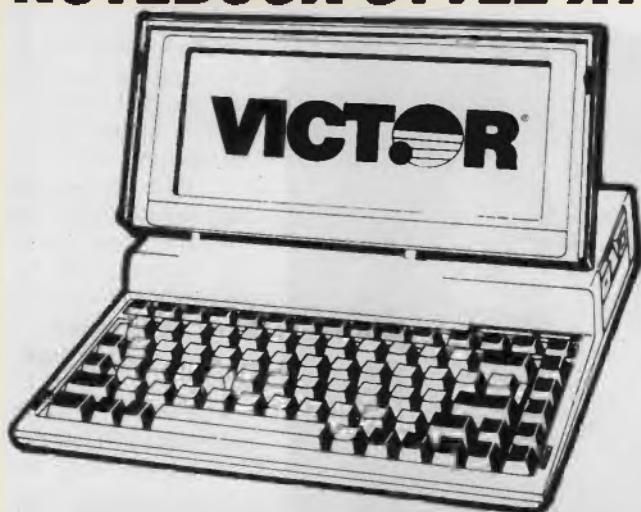
Perhaps installing the software might explain things, I thought. It came on four high-capacity diskettes, three of which were drivers for various things and the fourth was the Sytos software. None of the driver disks had an Install program that I could find, only strangely named files ending in '.SYS'.

There was nothing for it but to tackle the manuals. In the event I managed to find the half dozen pages of useful information I needed quite quickly. The manuals are well presented and very explicit, illustrating, for example, how the drive can be



▽ The HP DAT from behind. Extra devices can be connected using the through SCSI connector. A small fan keeps it cool

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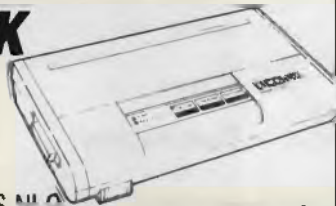
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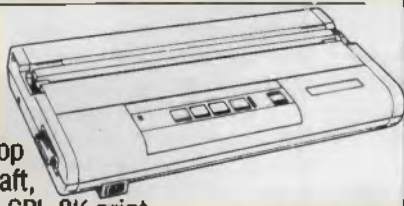
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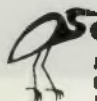
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positioned next to a desktop CPU, or placed on the table next to the monitor if you have a tower machine.

The section on installing my particular SCSI card (an AT-bus general purpose Adaptec) showed very clearly how I had to change the jumpers from their factory-set default positions. The driver software had to be installed manually, editing the CONFIG.SYS file by hand and so on. This is what HP calls trouble free?

Sytos did come with its own Install program, which promptly commandeered 1.5Mb of hard disk, creating seven directories and 56 files. At least it did it automatically.

Operation

Once the HP DAT had been installed correctly it did its job very well. Sytos is a powerful piece of software — and should be considering its size. It did everything that it might be called on to do (that I could think of) but took some persuading for the functions. Selection of items for processing is handled consistently, regardless of the direction of the transfer. A scrolling directory tree can be used for tagging directories; pressing F5 brought up a list of files within the directory for individual tagging.

Sytos keeps a record of each tape's contents on the hard disk. This can be used to find archived files quickly, assuming that the hard disk contains records for the volume you are trying to use. An unrecognised tape will be examined and a volume record file created if necessary.

Backup and restore to the DAT drive was very fast, at around 10Mb per minute. The enormous capacity of the tapes means that most users will be able to leave the backup running overnight anyway, making the exact speed irrelevant.

The drive has no less than four heads — two each for reading and writing. When the drive is writing, it immediately re-reads the diagonal stripe



△ The Backpack's DC 2000. Warning: it is inadvisable to unwind your own tapes

(frame) to error-check. If the data is not correct, the drive will re-write it further down the tape. A built-in error-correction system can recover all data even if a 2cm run of tape is completely destroyed after writing, the company claims. I have no reason to doubt this.

The drive is clever in its own right. It keeps a log of each tape's usage, updated each time you press the eject button. It handles all the error correction and drop-out avoidance. It even recognises a head-cleaning cassette (supplied) and cleans itself whenever one is inserted.

Data is recorded using the DDS (Digital Data Storage) standard developed jointly by Hewlett-Packard and Sony, accepted by ISO and the European Computer Manufacturers' Association, and being considered by the ANSI. This may mean that in the future, DAT tapes will be interchangeable.

I was not so impressed with Sytos Plus. At one point it failed to read some files I thought I had backed up. This might be due to an error on my part or it might be a bug. Even if I did accidentally select the backup simulation rather than the real thing, or I was fooled into removing the cassette before it had finished completely, the fact that I was confused as to what I was doing does not bode well.

Sytos Plus never repeated this early incident and settled down to working perfectly well, even if some of its warning messages were alarming ('Bad file header').

Conclusion

The HP DAT is a complex, reliable, high-end unit capable of quickly backing up 2Gb of data unattended. It will appeal to people with large file servers working in a fixed configuration. The Sytos Plus operating software, though powerful, does not inspire operator confidence and it is difficult to be sure you are doing what you think you are. Once set up and running, it should be simple to operate.

A range of optional configurations allows the HP DAT to connect with AT, EISA and MCA buses. Drivers are available for MSDOS (3.3 or above), OS/2 v1.1, SCO Unix, OS/2 with LAN manager or LAN server, and Novell Netware 286 V 2.15 or 386 v 3.1.

The Backpack tape drive is simple, powerful and easy to install and operate. Although limited to the MS-DOS environment, it is still able to backup small networks. The ability to connect it to the printer port, coupled with the un-cluttered driver software, means you can easily share one drive between several machines.

Both products are reasonably priced for their intended markets, and despite a few slight rough edges they should solve the problem of backing up for a great many applications.

Specifications

Backpack 141080

UK distributor

Timatic (0329) 239953

Capacity

83Mb to 250Mb
(with compression)

Backup rate

1Mb per minute (typical)

Dimensions

60x105x240mm

Interface

IBM PC parallel port

Price

£539 for 80Mb model, £459 for 40Mb version. Tapes £20 for 205ft, £25 307ft

HP DAT

Manufacturer

Hewlett Packard, Cain Road,
Bracknell, Berks RG12 1HN
Tel: (0344) 369369

Capacity

1.3Gb to 2Gb

Backup rate

10Mb per minute
(approximately)

Dimensions

100x115x240mm (allow 140mm
extra at rear for the SCSI cable)

Interface

SCSI using MCA, ISA or EISA
adaptor kits

Price

£2195 for drive alone; Sytos Plus
costs £153. Interface cards: ISA
£354; EISA £975; MCA £450.
Tapes: £48 for box of five 60m
tapes and £61 for five 90m tapes

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ClarisWorks

The integrated-package route is littered with disintegrated hopes. ClarisWorks could change all that. It's less than the sum of the equivalent standalones but has advantages for users of the new, cheap Mac portables, reports Jack Weber.

▼ A ClarisWorks graphics document combining colour graphics with text frames and a spreadsheet frame. All frames are objects, and can be given a border and colour fill with the graphics tools

The history of integrated software is littered with notable failures. Lotus Jazz (Jazz = let's all jam together = integrated software. Geddit?) was the first really important program to appear for the Mac, and the first big clunker to hit the trash can. The lavishly promoted upgrade Modern Jazz never even made it to the dealers' shelves before Lotus gave up and went home to DOS, where it produced Symphony — on the apparent assumption that DOS folk are less hip than we Mac types. Symphony never made the big time either and the lesson to other software companies was clear: avoid integrated software. Which, on the whole, they did.

Only Microsoft bucked the trend successfully: MS Works has been consistently, if not spectacularly, popular among Mac users for years. No one would have ever challenged it, perhaps, had Apple not changed course last year and started making cheaper Macs. Now a frenzy of fresh integrated products has appeared, presumably on the as-

sumption that there's a vast new market of people considered too poor or too confused to be power users. BeagleWorks, GreatWorks, ClarisWorks and MS Works are all stomping on each other in a bid to be all you'll ever need on a Mac.

Apple's very own software company, Claris, wasn't the first to launch (Symantec's GreatWorks came out about a month earlier), but its marketing clout and its solid reputation will mean that ClarisWorks is bound to attract a lot of attention. Like all the other products, it combines the familiar suite of word processor, spreadsheet, charts, database, graphics, macro recorder and communications software that every business person is assumed to need. And, like all those others, it comes at a price that you might expect to pay for a dedicated product in just one of those categories.

Installing ClarisWorks is a doddle because it's all handled by the Apple Installer software supplied with System 7. This installs the application, as well as the various dictionaries and file format translators which have to go into a special Claris folder inside the System folder. As with System 7, more knowledgeable users can decide which files they want to install, while beginners are offered a painless Easy Install option. Five minutes later, you're ready to go.

Opening up

Claris made much in its advance publicity of the notion that its Works would do away with the 'outdated modules' found in everyone else's Works, providing a truly 'seamless environment'. So I was surprised when ClarisWorks opened with a dialogue box asking me what type of new document I wanted — word processor, graphics, database, spreadsheet or communications. This is an exact equivalent of the dialogue box you get in MS Works. Gradually though, the differences became clear and I was impressed.

THE PALM

Except for coconut, the consumption of tropical oils is declining.

The palm tree, for most people, conjures up an image of a tall canopyed, tropical tree. The palm family—genus *palmae*—is actually comprised of more than 2,600 different kinds of vegetation.

The palm family is also not

	FTW	FTS	FTW	average
Palm Oil	283.4	300.8	243.6	275.9
Coconut Oil	663.4	650.5	882.4	732.1
Doam Oil	473.6	423.7	358.4	418.6
Palmyra Oil	183.5	172.3	158.9	171.6

ClarisWorks doesn't eliminate the need for separate modules, but it does do a very neat job of allowing you to use them in a single document. Say you have a word processor document open and want to include a table of figures. You can follow the conventional route of opening a spreadsheet document, creating the table, then pasting it into the word processor. Which works fine, but takes time and gives you a static set of figures. Or, you could select the spreadsheet cursor from the toolbox and drag it across the page to create a frame, which immediately becomes an active and fully functional spreadsheet. Try to add a chart and the difference becomes even more obvious, because if you paste it in from a separate spreadsheet document, it's just a picture. But if you create it from the spreadsheet frame, it responds to any changes in the numbers.

'Hang on a minute,' you may say. As I did, at this point. 'I could do that with System 7's Publish & Subscribe.' But no, you can't. Because ClarisWorks doesn't support Publish & Subscribe. In the new Apple jargon, it's System 7-compatible, but not System 7-savvy. Which is rather surprising at first, this being a brand new post-System 7 product and Claris being very close and cozy with Apple. But the logic's not so daft: Publish & Subscribe is a way of making ordinary applications behave more like integrated applications, so what's the point when you've already got the real thing?

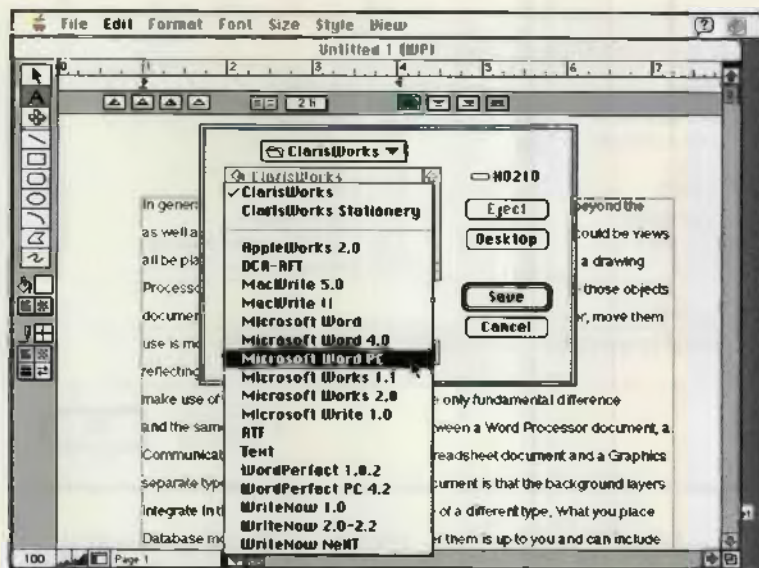
Text, graphics, spreadsheets, as well as their associated charts, can in general all be placed freely within any word processor, graphics or spreadsheet document. Which you choose is mostly a matter of convenience, reflecting the dominant content — all make use of exactly the same toolbox and the same ability to include frames. Communications is obviously a separate type of activity, so it doesn't integrate in the same way, while the database module links in via mailmerge or conventional cut-and-paste. You can, in fact, put text and spreadsheet frames into a database layout, but they're treated, reasonably enough, as background objects which will appear the same on every record.

This concept of frames is so fundamental to ClarisWorks that it's worth looking at more deeply. Essentially, most ClarisWorks documents contain an arrangement of objects — just as in any Macintosh drawing program. Those objects could be simple graphical elements, like lines or ovals, they could be text areas or — and this is where it goes beyond the MacDraw analogy — they could be views onto a spreadsheet. As in a drawing program, you can arrange those objects above or below each other, move them about and format them.

The only fundamental difference between a word processor, spreadsheet or graphics document is that the background layers are of a different type. What you place over them is up to you. It can include spreadsheets within spreadsheets; text within spreadsheet within text — or whatever else you dream up. In each case you can switch at any time between a simple graphics ruler, or a text ruler very similar to that in MacWrite.

Words and pictures

The common toolbox provides a selection pointer, text tool and spreadsheet tool. On a graphics or



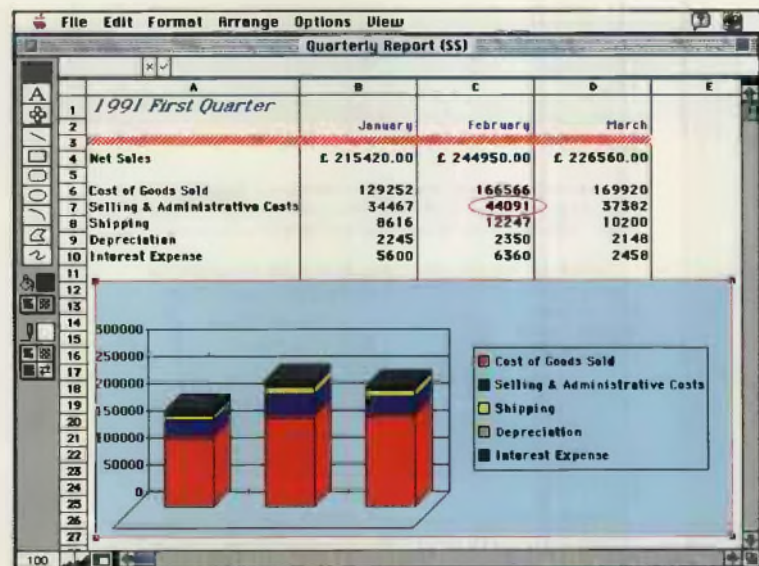
spreadsheet background, dragging the text tool creates a text frame. Within an existing text frame, it acts as the usual I-bar for positioning the insertion point or highlighting a selection. But if you hold down the option key while you drag, it lets you create one text frame in front of another. What you can't do, unfortunately, is flow the background text around this new frame. But perhaps DTP is a bit much to expect at a price like this.

Word processing features include headers, footers, footnotes and multiple columns. There is also a decent Find/Change command with the ability to track down invisible characters like tabs, returns and column breaks. Character-level formatting covers the usual range plus superscripts, subscripts and coloured text. As in MacWrite, the ruler reflects margin, tab and line settings for the current paragraph, and you can copy rulers to other sections of a document. Line spacing can be set in one-point or half-line increments, but there is no control over paragraph spacing — which is a pity, because that's useful even for basic letter writing.

The display is fully WYSIWYG, showing all margins and text correctly, and letting you zoom the window anywhere between 3.125% and 3200%. One of the nicest features is the way text frames can

△ ClarisWorks can read and write file formats for a wide range of Mac and PC word processors. This could be especially useful in a laptop that has to deal with more specialised software back at the office

▽ Spreadsheet documents can produce a variety of charts, but formatting options are rather limited



Enter Match Records Condition

Fields	Operators	Function
Invoice Date	+	ABS(number)
Salesperson	-	ACOS(number)
Title	*	AND(logical1;logical2;...)
Author	/	ASIN(number)
Category	=	ATAN(number)
Qty Sold	>	ATAN2(x-number;y-number)
Price	<	AVERAGE(number1;number2;...)

Formula

DAYOFYEAR(NOW())-DAYOFYEAR('Invoice Date')>20

Cancel OK

△ ClarisWorks provides a common list of database functions. Here, they are used to find records that match a specific formula

▽ Mailmerge is one task where integrated software really shines. Instead of having to export data to a special document, you simply pick field names from a list and insert them into a letter

be linked by clicking a run-on indicator at the bottom of one frame before dragging to create another. Obviously you don't get the precise typographical alignment that you'd expect from PageMaker or XPress, but, it certainly lets you produce much more than just plain letters and reports.

ClarisWorks supports the standard Claris spell checker and thesaurus as well as the XTND file translators, which means that you can open and save documents in the native formats of all the common Macintosh word processors. Compared to the previous offerings from Claris, these word processing facilities lie somewhere between MacWrite and MacWrite II. Better in some respects, because the ruler is actually based on that in the forthcoming MacWrite Pro. And, of course, you get built-in graphics which MacWrite doesn't provide.

Using the graphics part of the toolbox, you can draw straight or freehand lines, rectangles, rounded rectangles, ovals, arcs and polygons. The familiar Claris bucket and pen tools are used to select colours and patterns for all fills and lines; and you can also define lines as single or double-ended arrows. Objects can be scaled, flipped, rotated through 90°, locked or grouped. Freehand lines can also be smoothed, un-smoothed and reshaped. As with word processing, the facilities are a bit basic

by modern standards but not nearly as basic as they might have been. Certainly they are perfectly adequate for the sort of work likely to be done with an integrated program like this.

Numbers

One of the more novel aspects of ClarisWorks is the way that it handles spreadsheets. Although spreadsheet frames behave in some respects just like any other objects, they are really more like embedded windows. You create a frame by selecting the spreadsheet tool and dragging it within a document. Immediately, it fills with a grid of default-size rows and columns, the menu bar changes to reflect the fact that you are working on a spreadsheet, an entry bar appears, and you can begin to type in formulae and data.

This mini-spreadsheet may be all that's required. If you need more, just select the frame and go to Open Frame in the View menu: it will zoom out to a full window where you can spread out up to the maximum 256x256 cells. Although this now appears like a separate spreadsheet document, it isn't. It's simply an extension of the frame, and forms part of the original document in which that frame belongs. If you want a self-contained spreadsheet which can be opened directly, you have to create a Spreadsheet document. Either way, the facilities are the same.

Based loosely but recognisably on Claris Resolve, the ClarisWorks spreadsheet provides resizeable rows and columns, text formatting for individual cells and the ability to attach graphics, text and charts. You can also add cell borders, but they are virtually useless because any change to a cell's contents clears them all. All the usual commands are there to let you Insert, Delete and Fill rows and columns; Paste Special allows you to decide whether just values, or formulae and values, are pasted; and a Move command lets you bypass Cut and Paste altogether by selecting a block and entering a cell reference for it to be moved to.

One limitation is that numerical formats are restricted to just five basic types, plus several date and time formats. There is no way of customising them beyond setting the number of decimal places. But, on the plus side, ClarisWorks provides a hundred functions, including statistical, trigonometric and financial ones, and also allows those functions to call macros. So you could, for example, set it up to run a macro which switches to the Communications module, dials up another computer and downloads new data whenever a particular cell reaches some preset value. That's quite a decent level of sophistication for a low-cost package.

Charts are an essential feature of any spreadsheet — sometimes the only reason for using one. ClarisWorks doesn't offer the 3D plots that Resolve or Excel users can expect, but it does provide plenty of options including multiple scaled pie charts, exploded pies, logarithmic axes, X-Y plots and a pseudo-3D option that adds depth to bar and column charts.

Creating a chart simply involves selecting a block of cells, pressing Command-M and picking the format. Axis and legend labels will be copied from the spreadsheet and appear in whatever font and style they had there. If you don't then need to

File Edit Format Font Size Style View

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100 Page 1

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see the corresponding spreadsheet, it's an easy matter to hide its frame behind the chart and bring it forward only when it has to be updated.

Data

While word processing, graphics and spreadsheet documents are all more or less interchangeable, incorporating a database is not so easy. The reason, of course, is that a database doesn't take up a fixed amount of space in the same way as a graphic or a group of cells, but is made up of numerous individual records. The ClarisWorks database, therefore, has to exist in a separate document and window, and cannot be viewed through a frame.

As you might expect, this module shows some family resemblance to the highly successful Claris FileMaker Pro database, but it also contains significant differences. Essentially, there are two modes for working with data — Browse and Find; and a third — Layout, which is used for designing screens and printed reports.

When you create a new database document, ClarisWorks opens up the Define Fields dialogue

a lot of calculating muscle for analysing your data.

As an added power boost, those same functions can also be used to define search criteria for finding specific records in a file. Unfortunately the interface is rather poorly thought out, with a Find command that performs search by example, and a Match command, tucked away in a different menu, to do the formula search. Various other less-than-intuitive menu arrangements make ClarisWorks' database its least polished module. But, in practical terms, these are not major quibbles and are probably outweighed by the advantages of integration. Mailmerge, for example, is beautifully simple because you don't need to export any data: just open the text and data documents you need, and insert fields straight into the text via a dialogue box.

Communications

Communications software tends to be the misfit in any integrated package. I doubt, actually, that anyone would include it if everyone else didn't do so. Since they do, it becomes a marketing feature. This marginal status is reflected by the fact that Comms doesn't appear in the main manual but is consigned to its own slim volume, making it easier to put aside and ignore.

Most users will probably do just that, but it's there if you need it and provides a perfectly decent no-frills level of service that will cover any likely requirement for communicating with on-line services or directly to other computers. There is no built-in phone directory or log-on automation but you can use macros and preformatted stationery documents to provide similar facilities. However, the Communications module does get the prize for having the neatest interface in ClarisWorks.

Conclusion

Integrated software is seen as the low-cost compromise for anyone restricted by timidity or lack of cash. But being impoverished or computer-shy is not the only reason for wanting integration. There's also convenience. And the place where that's most likely to count is inside a PowerBook.

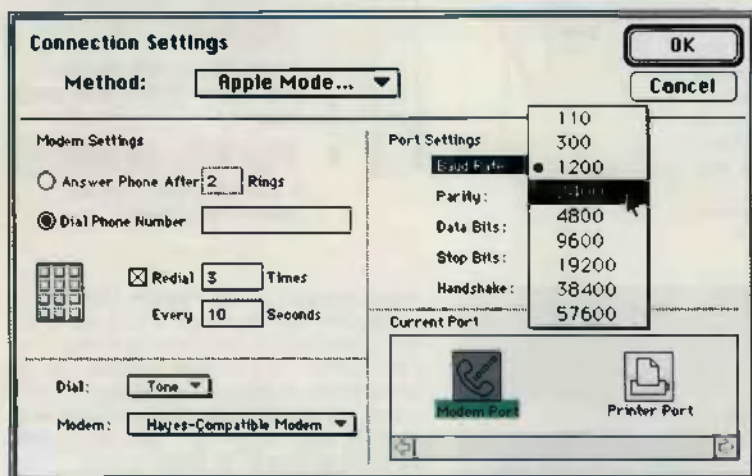
Drop ClarisWorks, or its alias, into the Startup Items folder, and you have all the facilities of five applications whenever you switch on the machine. No fussing with the Finder, no running out of memory (that pseudo-static RAM won't be cheap for some time to come) and you even get the comms software for when you're on the road.

ClarisWorks needs just 900K of RAM. Which, as it happens, is pretty much what you're left with after System 7 has loaded into a 2Mb PowerBook 100 or a Mac Classic. Any comparable set of dedicated programs would need a 4Mb machine at least.

The package has without doubt an effective and innovative approach to integration, allowing you to combine or de-couple the different modules as needed. The interface design doesn't quite come up to Claris's usual standard, but I found it easy enough to pick up, and the manuals are very good.

During my relatively short but intense acquaintance with it, ClarisWorks appeared perfectly solid and well behaved. At £195, it is, at least by Macintosh standards, a bargain.

Claris is on 081-756 0101.

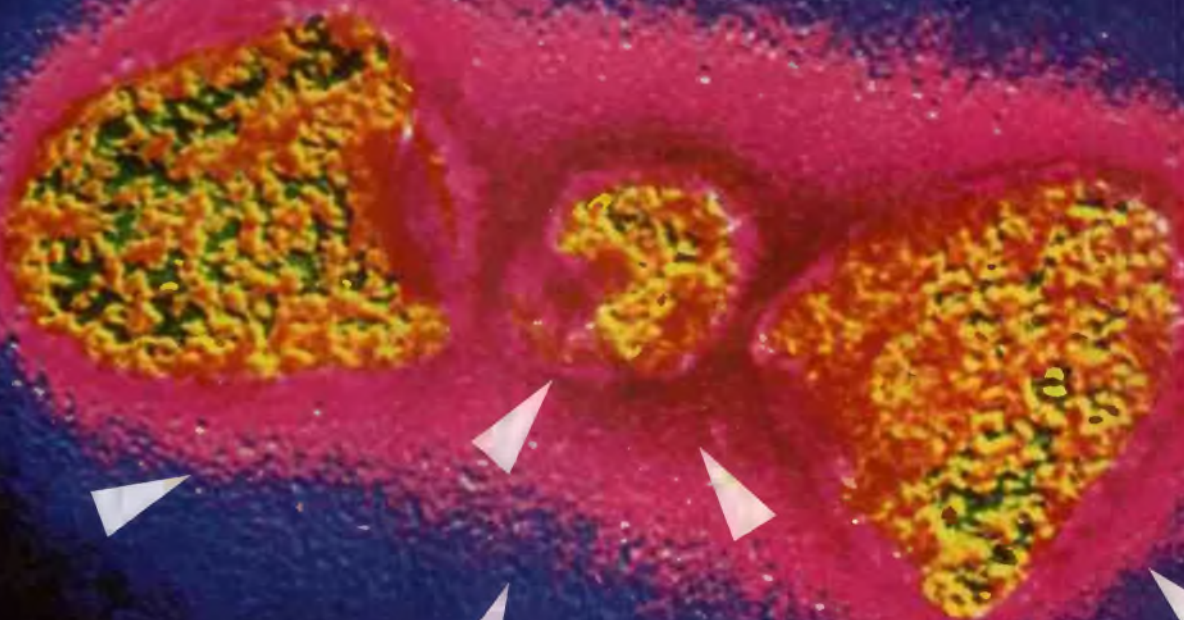


△ The Communications module supports Hayes-compatible modems and several specific models including Apple's Portable modem. The macro recorder provides some automation for logging into on-line services

box in which you name the fields that you'll need and allocate each one its type — Text, Number, Date, Time, Calculation or Summary. Fields can be added, removed or redefined at any time, though.

Having completed the field definitions, ClarisWorks goes straight to Browse mode and displays a default layout of vertically arranged fields and labels. If you're happy with that, you can begin entering data straight away. If not, there are templates for columnar reports and address labels, as well as a Blank option that gives you the freedom to create your own custom layouts.

These can contain any arrangement of fields, text, graphics and frames, with full access to the toolbox and to text formatting. In keeping with the integrated mood, the database shares many features with its associated spreadsheet. This has a downside: Number, Date and Time fields are limited to the same few data formats. It also has an upside: Calculation and Summary fields have access to nearly all the one hundred functions, except for a few spreadsheet-specific ones. Since layouts can include Summary and Sub-summary regions which display calculations based on all the records in a file or on sorted sub-sections of it, this provides



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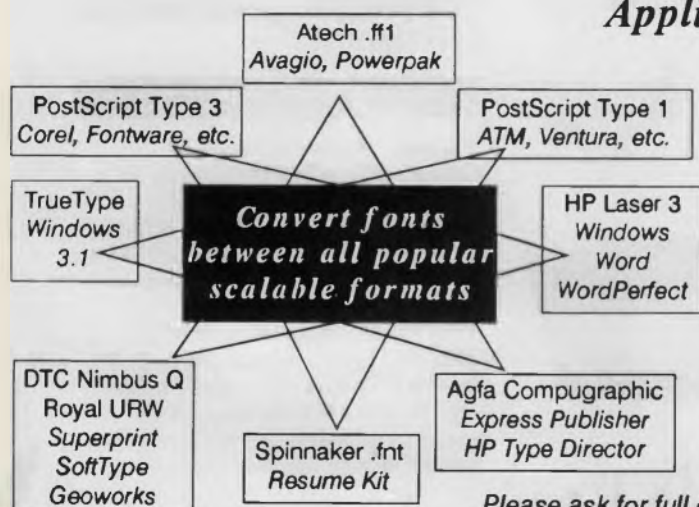
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Cache transactions

Writing data directly to RAM or disks, or reading it directly back, takes far too long for your average processor. Peter Jackson outlines the various ways of beating the consequent bottlenecks by using fast cache memory.

In the real world, a cache is a hoard of gold and precious stones, normally with a dragon sleeping on top of it. But in the fantasy world of computers, a cache is a way to get at precious data faster than is theoretically possible for the storage medium. And for those who want to squeeze maximum performance out of their machines, the second type of cache has the most immediate value.

A cache can be thought of as a fast buffer between any form of data storage and a faster form, so that the fast device reads data from the fast cache rather than directly from the slow storage. This cuts the time the fast device has to wait for the slow one, removing bottlenecks from data transfers and so improving throughput.

This general statement needs to be made first because it is quite possible for a typical PC today to have five different types of cache, each addressing a different bottleneck. Each deserves to be considered separately, but all work on the same basic buffering principle: the rest is technique, but the technique has become more and more sophisticated.

Inherent problems

The sophistication has been necessary because there are inherent problems. First, the cache is always smaller than the storage it is buffering, and so the cache software must have some means of deciding which data should be in the cache. Obviously, having a cache the size of the slower device would not only be expensive but would also make the original device redundant.

Second, there is the problem of making sure that the contents of the cache buffer matches the data being buffered. If the data on the slower device changes without the cache knowing about it, then the cache will get out of step with inaccurate and unpredictable results. A related problem is protection from power failure and other memory glitches. If the cache contents are out of step with the

contents of the buffered storage — particularly if write operations are cached as well as reads — then a glitch that wipes the cache will leave the stored data in an indeterminate or outdated form.

All caches have these problems, and it is worth looking at the ways they are addressed at different points in the computer system.

The oldest form of PC cache is the disk cache, in which an area of RAM is set aside to buffer data extracted from a disk drive. The cache software in its most primitive form simply monitors each request for a sector of disk data. It then looks in the

cache to see if the data is there already; if not it copies the entire track containing the new sector into the cache. The advantage is that sectors are frequently accessed sequentially, and so a single cache 'miss' — a request for data not in the cache — is turned into a 'hit' when the next request is for the next sector in the same track.

Early disk-cache programs did little more than combine this mechanism with a simple algorithm to determine which cached tracks to discard when the cache is full. The two most popular algorithms were 'least recently used' and 'least frequently used'; the first discarded the track that hadn't been accessed for longest, while the second discarded the track that was accessed least often.

Other features of early disk caches included

posted writes, in which disk write operations were cached and written to disk in blocks rather than single sectors, and the ability to cache floppy and network drives as well as local hard disks. But these techniques were dodgy because of the potential for lost coherency. A mains failure could leave posted disk writes in the cache rather than safely on the disk, and network drives and floppy disks could be removed from the network or the drive before the cache and disk data could be reconciled. And of course, these early programs stole precious con-

"A cache can be thought of as a fast buffer between any form of data storage and a faster form, so that the fast device reads data from the fast cache rather than directly from the slow storage"

ventional memory from the 640K maximum, making a large cache rather self-defeating.

The SmartDrive disk cache supplied with Windows and MSDOS 5.0 is one of these primitive models, apart from its ability to use expanded and extended RAM for a buffer, and to share memory back and forth with Windows 3.0. More sophisticated software like Multisoft's Super PC-Kwik has more options. For example, caching complete tracks of data for each sector that is not in the cache is inefficient if most disk accesses are random rather than sequential; in this case Multisoft has added an option to cache sectors rather than tracks. It also allows you to give read operations priority over write operations, allowing a quick return to the operating system prompt while cache transfers are still under way. And you can protect removable-media disks from being removed when write operations are pending. For users with memory to spare, a good disk cache package is a safe investment that can make a dramatic difference to the performance of disk-intensive operations.

Head movements

But software-only disk caches can only do so much. They have no effect on the way the disk controller and the drive hardware go about their business. This obviously represented an opportunity for hard disk and controller makers to improve the perceived performance of their drives. If they could build a disk cache into disk controllers, complete with the software, RAM, and processing power required to manage it, then users could gain speed without sacrificing RAM. With the trend towards 'embedded' controllers, where the controller hardware is built into the drive and plugs directly into a computer's motherboard, drive makers have enough control over the hardware to make their caching controllers as efficient as possible. Similarly, controller manufacturers like DPT and Perstor could use caching techniques to boost performance with a conventional hard disk.

All these new controllers work by minimising movement of the disk-drive head, which has become the main bottleneck in getting data from the disk. There are various approaches. The simplest is the sort of track buffering used by primitive software caches: the controller reads a whole track of data into its own RAM at a time.

But there are now *intelligent prefetch* routines that retrieve likely data from the hard disk even before the computer requests it, and *elevator seek* routines that sort data requests into an order that minimises in-and-out head movement (successive requests for data on tracks 129, 832, and 64 would be arranged so that the head could read the tracks in numerical order on a single sweep). A frill is to base the elevator seek order on the current position of the disk head.

Posted writes can also be implemented in controller-based hardware caches, and new security techniques are being applied to settle users' nerves about data loss during a power failure. For example, earlier write-caching techniques could leave data in the controller's RAM buffer for minutes before writing a batch to disk, but modern controllers reduce that delay to something like tens of milliseconds. An alternative nightmare scenario,

in which the data flagged as stored on disk by the controller cannot actually be written to disk because of a disk fault, can be handled by defect mapping software that can turn the posted-write feature off if data integrity might be compromised.

Prefetch routines have been improved, too. Previously, they would abort a prefetch operation to handle immediately any new data request. But because the new request is likely to be for sequential data that the prefetch would have written into the controller RAM, this is not the most efficient algorithm. Some new controllers check a new request arriving during a prefetch to see if it is sequential. If so, the prefetch continues; if not, the prefetch is aborted as before.

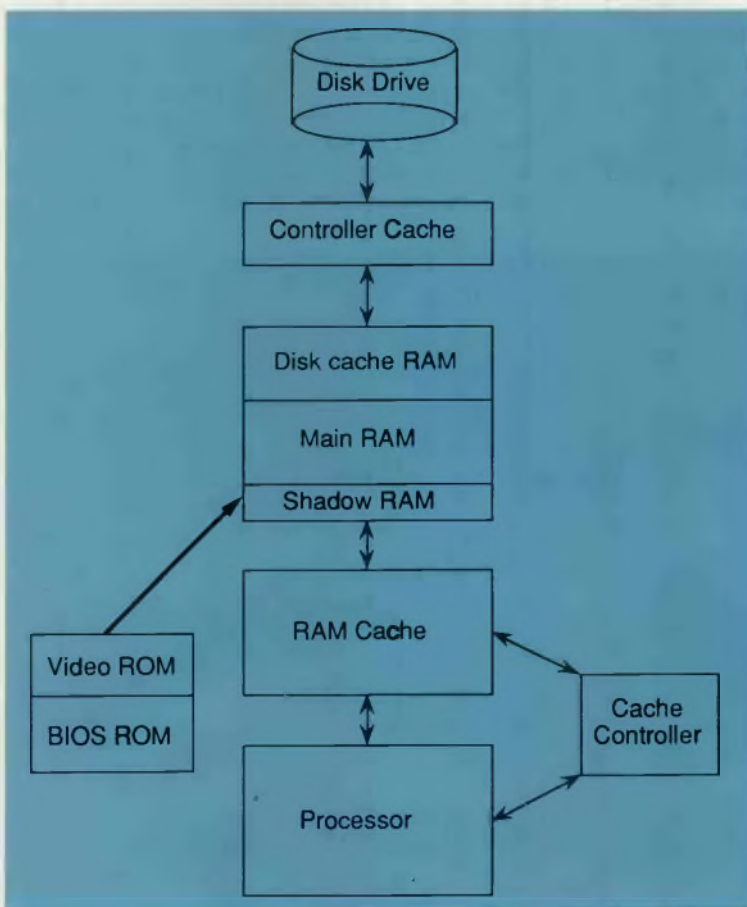
An even more sophisticated caching method, only possible with an embedded controller, is to read and write multiple sectors per hardware interrupt. In most disk systems at high data transfer rates, a significant fraction of transfer time is used to handle the interrupts generated by the PC BIOS for each 512-byte sector requested.

Of course, there is no reason why a caching disk controller should not be used in conjunction with a software cache. Indeed, in high-speed systems where data transfer rates are governed by bus transfer rates, this combination can improve performance more than using either technique alone.

RAM caching

All this technology is used merely to move data as quickly as possible between disk and RAM. But increasing processor speeds have pointed up another candidate for caching: the interface between the processor and its main RAM banks.

▽ Fig 1 PCs can have several levels of caching, including BIOS shadowing and the CPU's internal cache



RAM cacheing became an issue with the first 80386-based PCs, which not only dealt with data from RAM in 32-bit lumps but also had a clock rate of 16MHz — twice that of the standard 8MHz 80286-based IBM AT. The memory chips then available had an access time of 120ns, 150ns, or

supports, and allows slower memory to be used for main RAM so long as the cacheing algorithms are efficient enough to avoid too many slow cache misses.

At these speeds, the organisation of the cache is as important as its size and speed. At every memory access the cache circuitry needs to check whether the data requested is in the cache, and slow checking will reduce the benefit of the cache. The simplest design is called *fully associative*: the cache RAM holds the contents of the last N memory locations accessed, where N is the cache size, and any cache location can be associated with any main memory location depending on when it was last read. The cache controller has to search every cache location for a particular item before signalling a hit or miss. That this must be done very fast, in 10ns or less, limits the size of the cache.

In a *direct-mapped* cache, every main memory location is associated with a cache RAM location. To see how this works, say the cache RAM has 16K locations. Each location can then be described by a 14-bit number, which can be associated with all main-memory addresses whose first 14 bits match that number. When a RAM request is made, the first 14 bits of the address send the cache controller to a single location in cache RAM. To establish a cache hit or miss, the controller needs only to compare the rest of the address with the upper bits of the source address of the data at that cache location. Direct-mapped caches are cheap to build and fast, and are very common in low-end PC clones.

A third type is the *set associative* RAM cache. This works like the fully-associative cache, but cuts down the cache searching time by dividing up the cache locations into two or four sections. Each of these is associated with a particular set of main memory locations, so given a main memory address only a fraction of the cache needs to be searched for a match. The Intel 82385 cache controller chip that is used in most early 80386-based machines implements a two-way set associative cache.

Intel has produced some figures showing the efficiency of various cache designs, expressed in terms of size, percentage hit rate, and performance improvement factor over non-cached dynamic RAM. These figures, from the 80386 Hardware Reference Manual, are shown in Table 1.

So far, all these cache designs have been concerned with speeding up RAM reads. Some of the same techniques are also applied to speed up RAM writes while ensuring that cache contents and main RAM contents do not get out of step.

With a *write-through* cache, all write operations are direct to main memory but the data is also cached in case it is needed again immediately. A *posted-write* RAM cache works like a posted-write disk cache: data is cached for writing to main memory later, without main processor involvement. With a *write-back* cache, all RAM writes go to the cache and main RAM is only updated when the data in a cache location is due to be flushed by the least-recently-used algorithm. A 'dirty bit' is set for each location that has been written to cache but

Cache Type	Cache Size	Location Size(bytes)	Hit Rate	Performance Factor
Direct-mapped	1K	4	41%	0.91
Direct-mapped	8K	4	73%	1.25
Direct-mapped	16K	4	81%	1.35
Direct-mapped	32K	4	86%	1.38
Direct-mapped	32K	8	91%	1.41
Direct-mapped	64K	4	88%	1.39
Direct-mapped	64K	8	92%	1.42
Direct-mapped	128K	4	89%	1.39
Direct-mapped	128K	8	93%	1.42
Two-way set	32K	4	87%	1.39
Two-way set	64K	4	89%	1.40
Two-way set	64K	8	93%	1.42
Two-way set	128K	4	89%	1.40

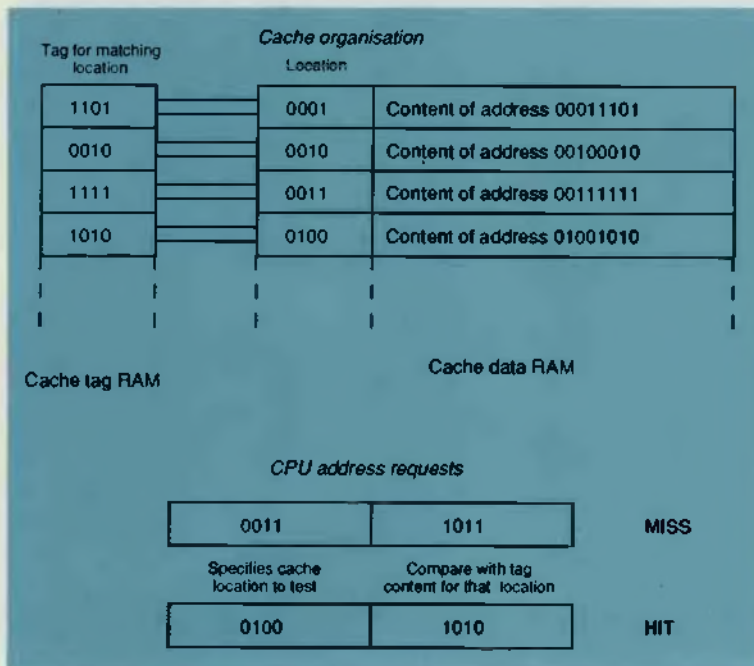
Table 1 Intel figures on the efficiency of different cache types and sizes

▼ Fig 2 Eight-bit example of direct mapping. The first four bits of the CPU address point to a cache location, which itself points to a four-bit 'tag' giving the source address of the cached data

slower, and could not keep up with the processor's demands. Conventional memory designs would have forced the processor to wait for one or more clock cycles at each memory access — in a 'wait state' — while the memory chips prepared themselves to make data available.

There are various ways round this, using different memory architectures like 'page-mode' or 'static-column' RAM chips, or interleaved RAM banks on which sequential memory accesses can come from different banks. The most efficient answer, delivering zero-wait-state operation, is a RAM cache.

This is an area of fast storage that sits between the processor and the main RAM banks, hopefully storing the data that the processor needs most often. The cache RAM has access times in the 25ns to 45ns region, depending on the speed of the processor it





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not to main RAM, so that the cache controller knows that main RAM must be updated when the contents of that location are discarded.

The 82385 cache controller chip implements the write-through cache, while Everex' AMMA technology implements the faster write-back cache.

The posted-write and write-back techniques are not as dangerous here as they are in disk caches, since any glitch that wipes the the cache is almost certain to wipe the main memory too. However, cache coherence is equally important in RAM caches. The main threat comes from DMA transfers, where data is moved into RAM without intervention by the central processor. The cache controller must know when the contents of main memory locations change, so that it can flag the cache copies of those locations as invalid before the processor reads them. Similarly, in a machine with a write-back cache, a DMA transfer from RAM to another device will get out-of-date information from main RAM unless the delayed writes are made from the cache before it starts.

Snoopers

To get round these problems, cache controllers use 'bus snooping' hardware running concurrently with normal cache operation. This detects the start of DMA transfers, and the design of the cache controller determines what happens next. In a write-through cache the only problem is a DMA transfer into main RAM, which is solved by marking cache copies of the affected locations as invalid. In a write-back cache the same technique can be used for DMA transfers to main RAM, but for transfers in the other direction the cache controller needs to delay the DMA request while it performs all the delayed write operations.

Clever RAM cache designs can do even better than this, by cacheing the data transferred by DMA in the same way as it caches main memory. But most PC RAM caches are not so sophisticated.

"Until there is a revolution in disk drive mechanics or dynamic RAM chip access speeds, increasing processor speeds mean that caches of all kinds are here to stay"

So, we now have data being transferred between main RAM and the processor as fast as possible using a RAM cache. But even here, some speed improvement can be gained. The 80386, 80486, and 68030 processors have built-in parallelism, so that their internal circuits can run several operations side by side. But they can only do this if they can queue up program instructions and data on the chips themselves, since this 'pipelined' execution needs data much faster than any external cache can supply it.

The 80386 has a simple instruction prefetch structure, but both the 80486 and 68030 have fully-fledged internal caches. The 80486 has one 8K cache for instructions and another the same size for data, while the 68030 has 256 bytes of cache for both. These internal caches have allowed some manufacturers to build systems without any external cache at all, although the Intel data in Table 1 shows that cache efficiency increases with cache size and the size of each cache location. For example, early 68030-based Macs and early 25MHz 80486-based PCs tended to rely on internal caches to speed up RAM access. Now though, the Macintosh IIfx and the 68040-based Quadras combine internal and external RAM caches — with

an optional cache board for the IIfx — while 33MHz 80486-based PCs have an external cache as a matter of course.

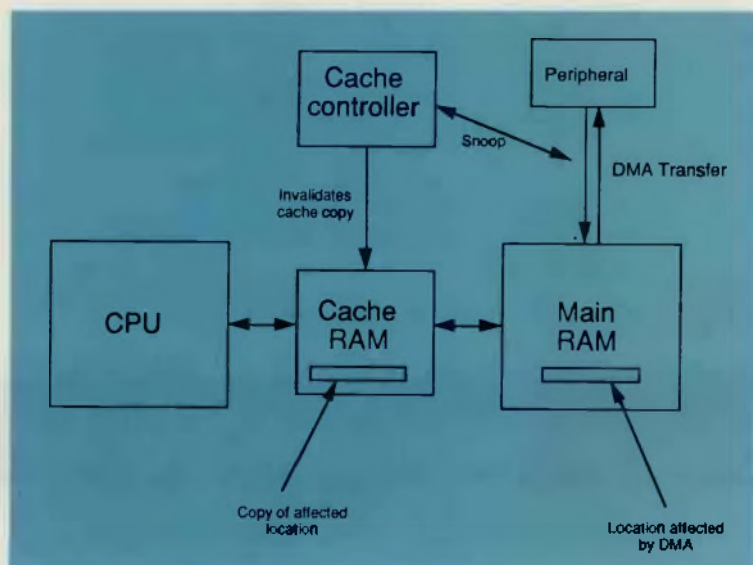
So it is quite possible for a high-end PC to have four different levels of cacheing, comprising hardware and software disk cacheing and internal and external caches between processor and RAM. Add to this a form of cacheing that is often forgotten — the 'shadowing' of BIOS and video BIOS ROMs into fast RAM — and it is easy to see that the performance of 32-bit PCs can be governed as much by the quality of their cacheing hardware and algorithms as by their raw clock speed.

Best and worst

Of course, cacheing is not perfect. It works best when disk data is accessed sequentially, or where processing loops are small enough to fit into an internal or external RAM cache in their entirety. It works worst when data on disk or in RAM is accessed randomly, or in multi-tasking environments where two or more applications use memory locations mapped to the same cache location, and 'thrashing' ensues. Intensive DMA input and output operation can also slow things down, as RAM cache contents are invalidated or flushed frequently rather than sitting there waiting for the processor to access at high speed.

Nonetheless, without RAM caches at least we would not get anything like maximum performance from any PC using the 80386 or 80486. And until there is a revolution in disk drive mechanics or dynamic RAM chip access speeds, increasing processor speeds mean that caches of all kinds are here to stay.

▽ Fig 3
The cache controller 'snoops' on DMA transfers to keep track of RAM updates





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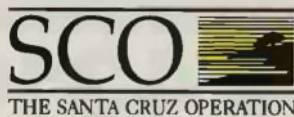


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ObjectVision 2.0

This new version of Borland's database application for Windows is powerful, easy to use, and as an expert system has the edge over Microsoft's Visual Basic. But it lacks the impact of its predecessor and left Simon Rockman feeling a little disappointed.

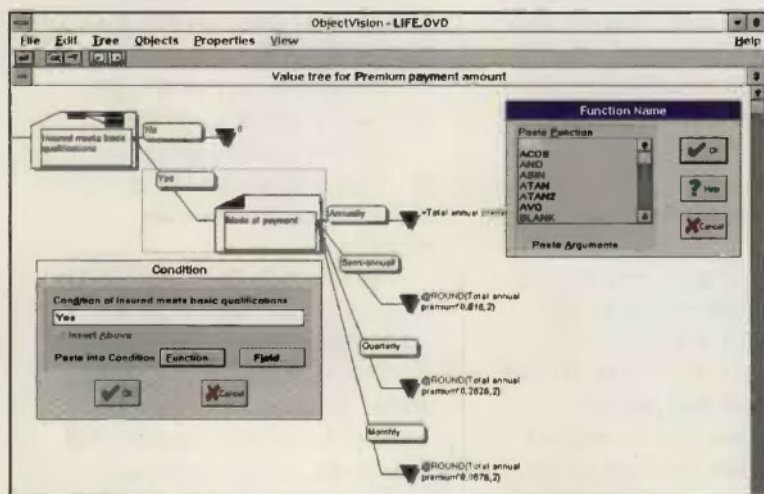
▼ ObjectVision uses Decision Trees to perform operations. Its power lies in the operations which can be performed using a tree, something which has been strengthened in the new release

When I reviewed the original version of ObjectVision I came to the conclusion that it was very nearly brilliant and all that held it back was the omission of sophisticated searching and printing. It was then Borland's first Windows application. In the intervening year a lot has happened in the operating systems market. The company has joined with IBM to watch OS/2 play will it, won't it, with a load of associated Microsoft/IBM politics thrown in, and Borland has bought Ashton-Tate to become the dominant producer of PC database software.

A year on Borland is a very different company and the second version of ObjectVision has been launched with enough brouhaha to convince any onlooker that it is radically different. It isn't. My

cation development tool, form filler and database front-end. Since an expert system is a type of database and a form filler is a necessary front-end to a database, and all three are a type of application, the difference isn't quite as clear cut as Borland would have one believe. But ObjectVision is a very different type of database to most in that it is almost as flexible as anything with a database language without your having to write any code.

ObjectVision isn't unique in this respect; there is the DOS application, Magic, from the Israeli company MSE, but ObjectVision does a better job and is a Windows package. It is different enough from the mainstream for Microsoft to have taken to using it as the standard application for demonstrating the snappily-named Windows for Pen Computing.



main complaints have only partially been addressed.

Borland argues that I am a blind man, and cites the old joke of four blind men examining an elephant, the man holding the tail getting a different impression to the one holding the ear who forms a radically different opinion to the one holding the trunk who in turn contradicts the man touching the side of the animal.

The four elements Borland has identified as views of ObjectVision are an expert system, appli-

How ObjectVision works

The traditional way to produce a database is to decide upon the file formats you wish to use and work back to the logic needed to provide those files. An example would be a routine to decide if one customer can be eligible for two discount schemes, say educational and quantity discounts. Having built the logic the system designer then decides upon the fields which must be filled and produces an input screen which asks the relevant questions.

ObjectVision works the other way around. The user designs the input screen (the form) and attaches the logic to each field in the form before the data is written to a file. It is possible to have multiple forms and the whole gamut of Windows gadgets, such as drop-down menus, tick boxes and radio buttons, in a form.

So far this sounds rather like Microsoft's Visual Basic, but here's the clever bit: while Visual Basic allows you to design forms, the logic behind them is controlled by BASIC code. Under ObjectVision the 'code' is in the form of a decision tree. Like an old-fashioned flowchart this lets you represent graphically the operations to be performed on the data. Unlike a flowchart it does the job for you. I studied computing at school and we once discussed the possibility of computers being able to produce programs from flowcharts. Then it seemed

like a pipedream. Funny things, computers.

The flexibility of ObjectVision is governed by the number of symbols which can be inserted into the flowchart, the number of options in a decision tree. In this way ObjectVision isn't as malleable as Visual Basic but then it requires less skill — and far less typing. From the venom with which Borland belittles Visual Basic the company appears to see the Microsoft product as the major rival, an analysis I'd describe as accurate. There are plenty of database-type applications for which the choice between the two products is borderline.

Borland claims that ObjectVision has no rivals since most other packages require some coding. The company cites the special advantages of its data linking. As part of the company's view of the future the software links seamlessly to the Paradox engine, Borland's database-driving software. ObjectVision is not tied to Paradox: it supports Btrieve, dBase, ASCII and DDE links, and does so easily. While some products which offer access to database files require a script to be written, ObjectVision linking requires only that you select the database you want and then point and click on the relevant fields to establish a relationship. Advanced features such as virtual fields, filters, one-to-many and the creation of data structures are all possible.

But if ObjectVision has no rivals, Borland then goes on to explain why the program is so much better than Visual Basic, Perform Pro Forms, InfoAlliance and Asymetrix Toolbook, by belittling Toolbook as an historical curio, interesting only for being the first Visual product but failing in that it is slow (a valid criticism), its dependence on scripts and its high memory requirements. Forms, Borland claims, are little more than an expensive replacement for paperwork, with weak database links. One program I'd add to the list of rivals, if only for its graphical nature, is Thinx.

ObjectVision 2.0

One aspect of computer applications which has grown up over time is the toolbar. ObjectVision 2.0 has one, not that Borland calls it that (it's a Microsoft name); more precisely, it's an Object Bar. Borland's tools hang around in different bars because they are context-sensitive. Different bars appear when you select the Tools Form or the new Tools Stack menu or when you access the new tree editor.

The Form tool object bar has eight tools: field, button, table, text, filled rectangle, rounded rectangle, line and graphics. There are three additional tools for getting to other parts of the program: close tool, and direct jumps to the stack and link tools. They form the fundamental ethos which gives the Windows operating system its look and feel.

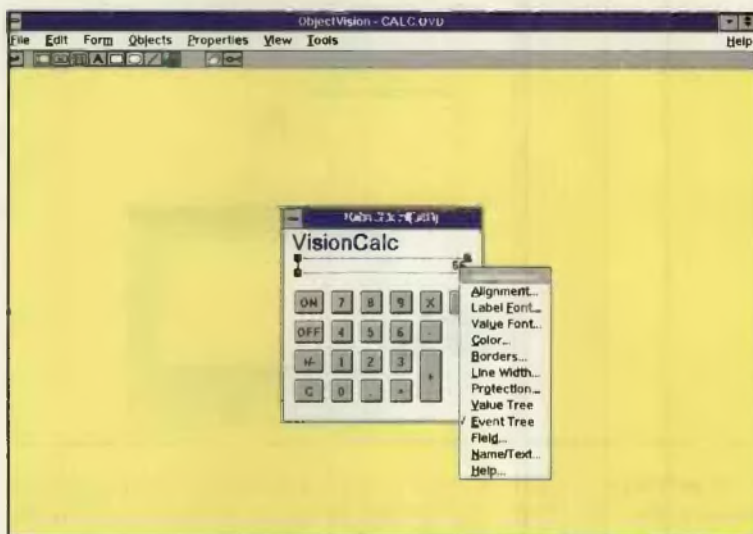
Any development tool should have the full range of Windows controls. ObjectVision 2.0 has added true radio buttons and combo boxes. The new CUA controls are added to fields by right-clicking the mouse button when pointing at a particular field and then selecting field type and the appropriate selection method.

The ease of form design has been improved by the introduction of rulers and adjustable grids. Ruler increments can be inches, centimeters or characters. Grid settings do not appear on the

screen but determine how accurately objects can be sized and positioned on a form. Here there are three choices: coarse (one character by one line), medium (half coarse) and fine (one quarter coarse).

The stack tool looks after multiple forms. These branch off the central (or goal) form and so there isn't much to do with the stack other than close the tool or insert a new form. One of the clever things about ObjectVision is that a decision tree can access fields which have not yet been created and the software will automatically prompt for the data when you run the application. I would have liked to have seen the stack tool provide a way of searching for such occurrences and creating a new form.

The tree editor is similarly lacking in tools, sporting only a branch object, a conclusion object, and expand and reduce view. The ability to see as



much of the tree as possible is a real boon. When I reviewed ObjectVision 1.0 I used a machine with a 640 x 480 display. Since then I've moved up to a 1024 x 768 display, and the extra screen space is hugely useful in this application.

Property Inspector

Just as Borland has adopted toolbars, so it has 'invented' a new system. Called 'menus on demand' it is a context-sensitive way of accessing data. In the case of the Property Inspector this uses the right mouse button to produce a menu of options which reflects the properties of the object the pointer is on. By necessity this produces a Sun-type menu in the middle of the screen which at first feels odd under Windows but is so useful you soon grow to like it.

The item selected determines the applicable characteristics, such as object name, display formats and font characteristics. After clicking on the right button and displaying the Properties list you move to the desired property and select it. You can also change properties by selecting the Properties Menu item from the menu bar, selecting Object, Form or Stack and choosing the property desired.

Event Trees

One of the nicer aspects of Visual Basic is that the run-time program can monitor the user's actions

▲ The Property Inspector pops up when you select an area of the screen and click on the right button

and respond appropriately — actions such as clicking in unexpected places, or just changing the focus. ObjectVision has gone some way to providing this level of control with the introduction of 'event trees'. These cause actions to occur based on an event other than a change in the value of an item of data. Actions can include opening or updating a database, printing a form, moving to another form or field, adding or deleting menu items, modifying database filters, causing a DDE event, or invoking a custom DLL. Borland gives an example of how to do this on a sample order form.

To create a simple event tree on the customer form that reminds you to check your work before

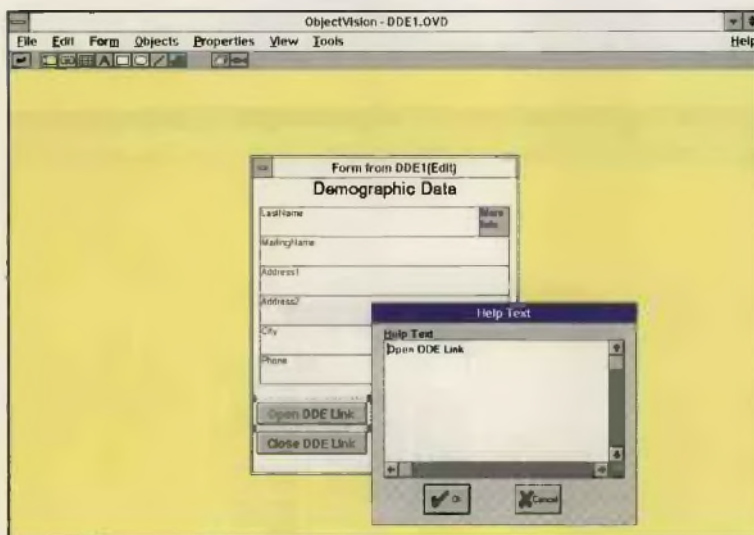
in the program thanks to the form designer, this didn't seem too much to ask.

The solution Borland has implemented is not quite as elegant. ObjectVision 2.0 has a PrintLink feature, using both a Link option from the Print menu and an @printlink function. This feature prints out as many forms as necessary to print each record in a link. Using a restricted range or filter you can narrow the number of records you are interested in before printing.

Borland has also added the File Print Form and File Print All menu options. The first prints the currently selected form. If the form contains a table which needs more space than is available, the software will print multiple forms. In this way I can create a screen form which is not used for input, but which does work with output. With just one type of form there is less for the user to worry about in terms of fonts and sizing, but unless you have a very hi-res screen you waste space on the printed form.

My second major complaint, the lack of searching, has been better addressed with a Locate field type. When the Locate field value changes, the locate function goes to the database table and attempts to position on the new record. ObjectVision then retrieves records from the database, assuming that the field is indexed.

The system is fast. There are three levels of Locate — auto locate, inexact and restricted range. If you select auto locate ObjectVision will automatically attempt to find the record which matches the new value; inexact will cause ObjectVision to find the record which matches, or is closest to matching, the content of the field; and restricted range will limit the search area.



△ ObjectVision is one of the first non-Microsoft applications to support both DDE and OLE. Help text is easy to find

entering a new customer database, select Customer from the Features menu to select the customer form, Select Form from the Tools menu to enter the design mode, and call up the Properties menu using the right mouse button while the pointer is on the customer's form title bar.

One of the options in the Property Inspector will be Event Tree; select it, then select conclusion from the tool (object) bar. A combo box will give you a choice of options. Choose Select from the combo box for the event name. The select event occurs whenever a form, field or button is clicked by the mouse or called by the @select function of another event tree. In this case, though, it is calling up the form which triggers the event tree.

To generate the warning message you click the function button from a Paste Into Conclusion heading and type a warning message. The event tree will take care of displaying the message on screen. Whenever the form is selected the message will appear (and annoy you).

Printing & searching

One of my major gripes about ObjectVision 1.0 was its poor printing support. It seemed to me that here was an excellent way of getting data into a system with no method of extracting the information at a later date: a write-only database. What I really wanted was the screen form design to be supplemented by a printer form design tool which allowed the system builder to design a form on-screen and send it to the printer using the extra width available on paper. With most of the code already

Conclusion

There is certainly a year's work in the changes between ObjectVision 1.0 and this latest version but the update isn't as stunning as the original. Instead of wearing a coat of many colours, ObjectVision is best seen as an easy-to-use front-end to query a database. It is powerful in this respect, certainly powerful enough to be an expert system, and for this kind of work it is very much better than Visual Basic. Unlike the Microsoft product it is not a language (indeed, that is one of ObjectVision's assets) and Borland is wrong to target it quite so strongly.

ObjectVision 2.0 is ideal for large companies who need to provide staff with strictly targeted applications and who have a limited time scale in which to produce a polished application. It is also suitable for the person who enjoys tinkering with software and has some use for the end result. At £149 it is exceptional value for a development tool.

Specifications

ObjectVision 2.0

Manufacturer

Borland UK (0734) 320022

Price

£149 + VAT

Minimum hardware required

Intel 80286 or better; Windows 3.0 or later (works with Windows 3.1 Beta 2); DOS 3.1 or later; 1Mb RAM min will use up to 16Mb; 2.5Mb hard disk space; mouse strongly recommended

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CK Modeller 4.0

Represent and communicate your ideas as shapes, text and colours with Creativity Software's CK Modeller, a 'graphical thinking sketchpad'. They must be sound ideas though: there's no room for muddled thinking here, as Rupert Goodwins learned.

▼ CK Modeller starts up in Design mode, showing the basic set of model categorisation provided. You can add others, if you wish

It can be difficult, in the commodity-driven, strategically-planned market of today's computer industry, to recall the exuberance of the early days. Computers were going to be 'thought amplifiers' that gave people the chance to play with ideas like so much Meccano; with a micro in every home, a golden age of intellectual exploration would dawn. Today's computer, though, is more yuppie than hippy — a damn fine typewriter, a superb filing cabinet and a financial adviser that you can actually switch off. Not much evidence survives of those early ideals.

Yet people are still thinking those thoughts, and

of 4.0 — previous versions were developed for clients such as Shell International Petroleum.

Creativity Software's link with those early days is one of the program's progenitors, Tony Hodgeson. He's a business consultant who developed a whiteboard and magnetic shapes ideas communications tool called Communikit, intended to help people communicate and record their ideas during meetings. This was in 1976: by 1979, it was clear that it would transfer very well to personal computers when they had developed reasonable graphics and processing speed. This had happened by 1985, when Shell saw a prototype of the software and fiscally expressed an interest. So, even though it's a new product, it's got a few years' development behind it.

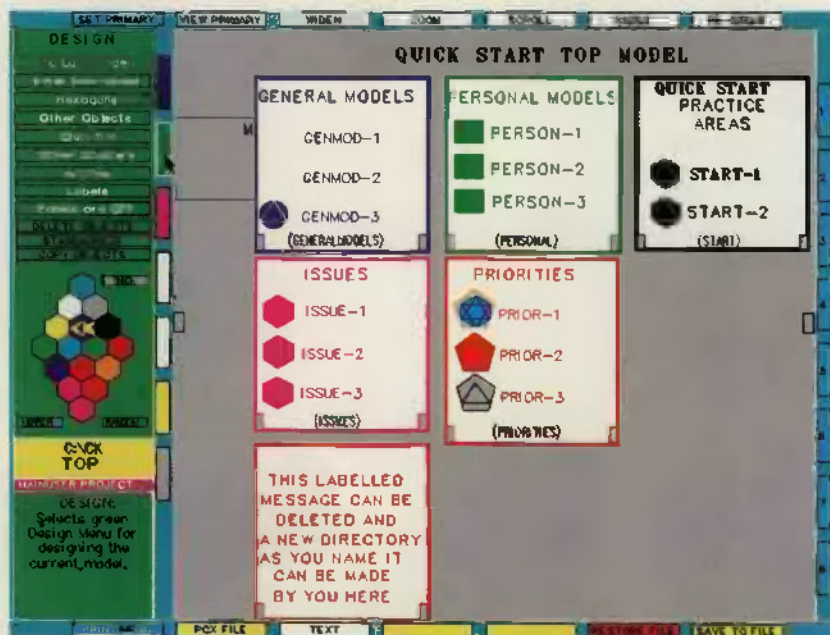
Graphical thinking

Creativity Software describes CK Modeller as a 'graphical thinking sketchpad', which is as good a starting point as any. At its most basic, it provides a blank worksheet on screen. Then, it lets you select a shape (normally a hexagon) and give it a name, text and colour appropriate to the idea you want it to represent. This shape lives in the worksheet: you can then add more shapes, and then start to group them according to how you perceive their relationships with each other.

This might sound a bit like an outliner, such as GrandView, and there are similarities, but whereas an outliner imposes a hierarchical structure on your ideas there are no such restrictions with CK Modeller. An outliner also does very little with your idea apart from place it in context; CK Modeller uses colour and shape to provide a visual tag for each idea. This is called an 'idon', a

mixture of an idea and an icon; this might seem a bit West Coast, but Creativity Software is so taken with the name that it's going to become Idon Software in early 1992.

There is a strange charm in giving an idea a colour, which is a trick learned from subatomic physics. This sort of physics has very odd objects



one company, Creativity Software, has got as far as releasing software, CK Modeller 4.0, that explores some of these concepts. Furthermore, it is claimed, the advantages gained from using this software are valuable enough for major businesses to be incorporating versions in their decision-making structure. That's why the software has a version number

called quarks which have been given false colours. A red quark isn't the same colour as a pillar-box; red is just a label used to denote a certain indescribable property about that particular particle.

That's how CK Modeller works; the idea is that you'll learn to associate certain classes of ideas with particular colours and thus to be able to infer information about the ideas in a model. Creativity Software suggests that you use its colour scheme — red for action, black for problem areas, white for learning, green for creativity and so on — but you don't have to. Consistency is the important thing; providing that you (and everyone who sees your models) always link the same colours to the same class of ideas, everything'll be just dandy.

There are a couple of reasons behind the choice of a hexagon as the basic shape. Firstly, and obviously, it allows a dense packing of idons onto the screen. Secondly, it's a widely-known quirk of the mind that it can consciously work on up to seven or so ideas simultaneously. A hexagon lets you arrange a central idon with six related idons around it — *voilà*, the magic number.

You can link groups of idons together with arrows, and throw labels in just about anywhere. The arrows themselves have text capabilities; once you've got your model to the point at which all your major areas of interest are defined as groups of idons, you may find yourself working mostly with their interaction and relationship, and this is where the attached text for the arrows comes in most useful.

User interface

The CK Modeller user interface is all its own, having neither pull-down menus nor icons itself. The program uses the metaWindows display software, also found with the AutoRoute route planning package, to implement a graphical interface which makes extensive use of colour.

The main workspace is surrounded on all four sides by control areas. To the right is a row of buttons with numbers in — these are effectively bookmarks that let you hop between areas in a model. Along the bottom are buttons to do the mundane tasks of printing, text addition and filing. The top holds the screen controls; instead of scroll bars, you have to move around a model that's larger than the screen by selecting the Scroll mode.

Likewise, Widen, Whole and Re-Draw do fairly obvious things to the display. Re-Draw is necessary, alas, because quite a lot of screen operations result in bits missing from the display. If you have overlapping hexagons, for example, and move the one on top away, the newly-revealed part of the one underneath stays blank until a re-draw happens or that hexagon is selected.

The meat of the interface lies down the left-hand side. There are seven colour-coded modes for this area, the most important of which is the green Design. This is where you choose your shapes, drop them into the model, link them together and so on. You can also start a brand new model here.

Colours can be chosen from a palette of 18 (one colour, rather worryingly, is called Deep Purple

and is for Authorities, Powers, Motivations and Agendas). You can also randomly recolour a group of idons if you feel the need for a little cognitive shake-up.

Some slightly more powerful concepts reside in the purple Network menu. This doesn't refer to multi-user facilities — there is no network support in this program — but to the ability to make a hexagon a gateway into another model. This adds a third dimension to models, since a single idon can link into different screens. NETWORK also holds a few viewing commands to help you design and see related groups ('networks') of models.

The yellow Activator menu gives idons a way of calling up external MSDOS programs by attaching batch jobs (OK then, Activators) to them. Given that there's no easy way to import or export data to most examples of whatever it is you might so invoke, this



has a rather limited value.

There are three export formats supported, in fact: plain text (which produces the script file that underlies the whole model), a .PCX picture of the screen, and a .AGE file for Lotus Agenda. This last has each idon as an entry in a list with a text description of its colour, shape and so on.

The blue Survey mode lets you examine models, and the grey Process mode controls the overall environment. You can, for example, go into a Brainstorming mode which takes most of the structure away from the model, creates a new model with the resultant mess and finally creates a gateway to this new model from the old one.

There are also controls for screen type, working directories and so on — since CK Modeller isn't a Windows program, it has to have its own drivers for each different graphics mode it wants to support. I used it in 800x600 mode on my Pro Designer II, and very nice it was too. It'll work with anything from EGA upwards.

Two other modes, the red Conferencing and brown Support, didn't do anything. The book says that these are used in other sorts of modelling software, but since Creativity Software doesn't sell

△ Zoomed in on some brainstorming input: note text is being input to the black hexagon. Some text has already been input to the purple hexagon

any other sort of modelling software to the general public, I guess that these are either hangovers from versions that haven't seen the light of day or are still in development. Either way, it's clumsy to leave the stumps waving around.

When in design mode, text can be entered both onto the hexagons themselves, where it forms a label, or by clicking on the bottom of the hexagons. This brings up a rudimentary text editor that lets you bash in quite a lot of words. It's not suitable for writing a novel in, though, or really much use beyond a couple of pages of notes.

ment of a novel I'm trying (unsuccessfully) to write and the other the marketing plans for a fictitious company selling a fictitious product (but, nevertheless, based on real-life examples I've encountered).

The book is science fiction, and set on Earth a few years hence. Being a meticulous sort of chap, I wanted to develop the ideas behind the technological and social changes I was guessing would happen. Bashing in the ideas was simple enough; grouping them in a useful way was more difficult. I soon found out that CK Modeller encourages a certain way of thinking, of categorising problems, and that if you followed that way you could use the program to very good effect. It has to be said that it's far less restrictive than traditional outliners in this respect, but it's still up to the user to think through the relationships between ideas.

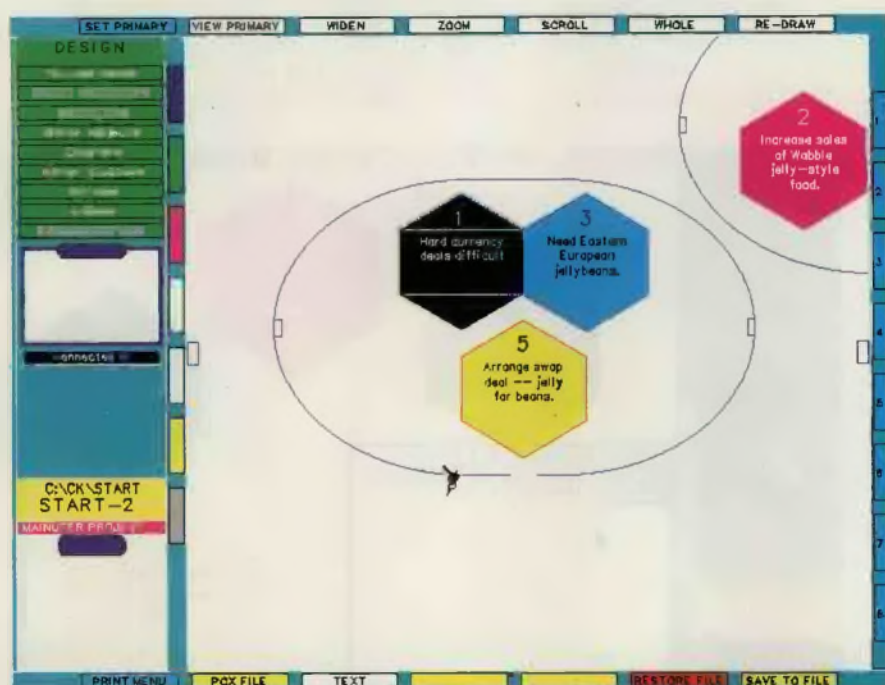
The business example worked a lot better. Perhaps it's because the problems of producing some new item for sale are better defined than the malarkey of producing a novel background for a book, or perhaps it's because I'd already learned the 'correct' business way of thinking about a proposal. Whatever, the model I built clearly showed the areas where I hadn't thought through the problems that would be involved.

In one way, it's tempting to see CK Modeller as not so much something that produces answers through its own innate cleverness, but more as software that encourages you to ask yourself (or, because it produces models of your ideas that others can understand) or that encourages others to ask you about the areas in your ideas that you haven't properly sorted out.

Several things come across strongly when using CK Modeller. Firstly, it's whiteboard ancestry is plain — this is a very good tool for brainstorming, alone or in a group. For those who've never been in that situation, I should say that sitting in an office with a whiteboard and a set of appropriate pens at the beginning or design stage of a project is one of the best ways of getting people to understand the problems involved. You can dash down ideas, change them in seconds, group them, draw diagrams: the problems are that the next people into a room tend to erase the brilliant schemes that have been designed, and that once people leave and go back to their offices, they start to forget exactly what it was that was agreed. CK Modeller solves both of these problems; you can save a brainstorming session or the subsequent developments, and you can print out as many copies of a model as you want.

Printing

Printing deserves a special mention. CK Modeller is the first program I've come across, bar art software, that makes a good case for a colour printer. The use of colour is essential when model-making, and this carries across to the hard copy. Unfortunately, I couldn't get hold of a colour printer for this review, but the software can drive monochrome printers including the Epson FX series and HP



▲ An idea is generated by considering two associated ideas and trying to find a common factor

Peculiarities

There are plenty of peculiarities in the CK Modeller interface. Some of them are unsettling — during certain editing operations, the mouse pointer switches position on the screen from the icon you're operating on to the text window in the bottom left-hand corner of the screen. When you've done that, the pointer returns from whence it came, but this seems to break one of the rules of GUI design — the user, and only the user, moves the mouse pointer. Also, the pointer design changes shape at the click of the button, a wasp with stinger poised when you choose delete, a bee when you're about to perform some specific action and so on.

The thing that took the most getting used to (and I still get confused) is the way the software uses both mouse buttons. I should admit to being firmly in the 'one mouse, one button' camp of interface design, and it's true that since all PC mice have two buttons it's not exactly a sin to want to use both. It's just that almost nobody else in the MSDOS world does this, and having to remember which button to push is something a lot of us have forgotten how to do.

In use

Such nit-picking aside, the big question is clearly whether the software comes up with the goods. I used it for a couple of projects, one the develop-

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LaserJet 2s. It knows about colour printers compatible with the HP PaintJet and the Sharp JX series.

As correlation to this, it's not advisable to use CK Modeller on a monochrome display, be it CRT based or the ubiquitous VGA resolution LCD found on most laptops. Sharp used CK Modeller when it launched its first series of colour laptops — it's nice to see something that uses all this high technology to do something that really can't be done with anything else.

Back at the printing, CK Modeller can produce

unlike anything else but might lack the refinements for survival in the wider world. It works, and works well, but you'll have to budget more time for learning it than you will for the next Windows word processor you come across.

Documentation

The documentation is an interesting collection. You get quite a lot for your 400 quid: a ring-bound program manual, a spiral-bound *Thinking with Hexagons* book to help you grasp the underlying concepts, and a portable Kommunikit. This has an A4 whiteboard, pens, magnetic hexagons and little pouches for water bottles and wiping cloths. It's very twee, and an irresistible reminder of the product's management consultant origins.

The manuals themselves are wordy and prone to the occasional discourse about the rationale behind the program. Given that it's so different from most PC programs, this is quite a good idea; unless you have some idea about lateral thinking, conceptualisation and the way that thoughts can be organised, you're unlikely to get the best out of CK Modeller.

However, you have to be receptive. I've always had a jaundiced view of the wilder ideas peddled by management consultants, and hitting articles about 'cognitive kinetics' and the like triggered all sorts of adverse reactions.

On taking a deep breath and working through the software, though, it becomes clear that there are good ideas here. What's missing — and what's promised for the

very near future — is a 'getting going' walkthrough to help the new user get from the first encounter with the program through to useful results without hitting the deeper philosophy about lateral thinking et cetera. Such things are useful, but at the right time.

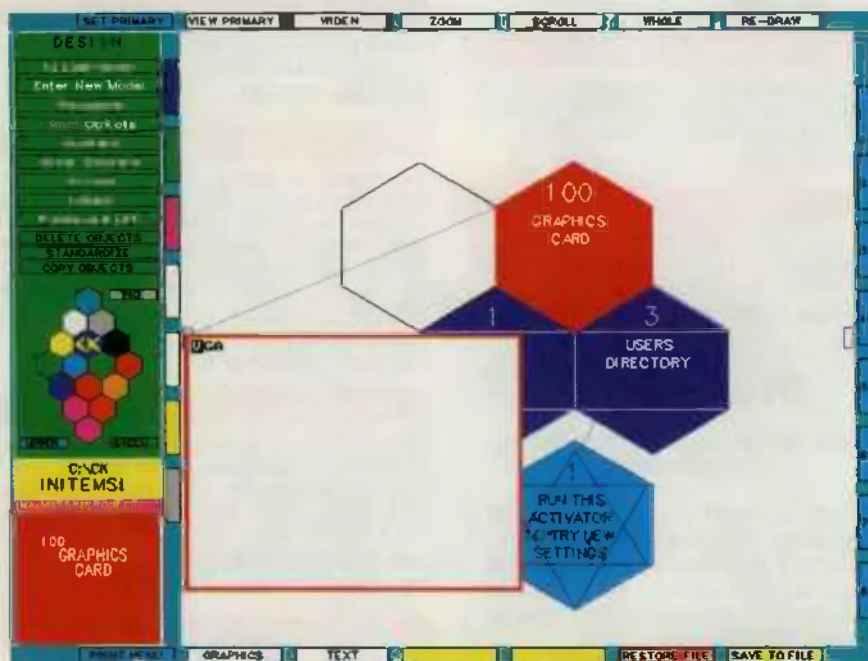
Conclusion

What CK Modeller is good at is producing a model of your idea of a problem, providing you've learned how to use the software. If other people have learned about the program, then it's an excellent way to communicate ideas; in fact, I'd be hard pushed to find better. In a corporate environment, where you can sensibly train teams of people in the same skills, CK Modeller makes a lot of sense.

As a 'thought amplifier' for the single user, its utility is more variable. If the problems you deal in are mappable to the CK Modeller paradigm (and I had hoped to avoid using that word), then it'll be useful. Many business problems can be fitted into that way of thinking, and once you've learned how to express them to the computer (far simpler than expressing them to someone else, as it happens) you'll be able to get good results from this package.

It's no panacea for muddled thinking, though; in the final analysis, it can only build on your breakdown of a problem. Used thoughtfully, it can both show up flaws in that breakdown and suggest better ways to approach the problem.

Creativity Software is on (0796) 3880.



△ As you widen the view on the model, the labels in the boxes are replaced by numbers as the resolution becomes inadequate to show the letters

not only single sheets with bits of the model on but has a Poster Print option that splits the entire model into page-sized chunks and prints them out, one by one. It can also do a 'stamp set', printing out miniatures of given models, and a Model Print that produces a sequence of pages with all the clusters of idons in a sort of catalogue format. Clearly, a lot of thought has gone into this side of things.

In fact, it's clear that a lot of thought has gone into the entire program. It's sad, in one way, that it's so divorced from the GUI/Windows 3.0 way of thinking that has come to dominate most PC software; it will lose a lot of brownie points in corporate environments for its nonconformity (and there are plans to launch in the States where such individuality may be even more difficult to sell). In another way, it's quite exhilarating to see a program that is so different and yet still works. It's always worth remembering that, just because everyone's doing something a certain way, this isn't necessarily the only or best way to do it.

Two years ago, the CK Modeller interface would have aroused no comment whatsoever. Now it seems idiosyncratic almost to the point of eccentricity. It's also not faultless: I managed to crash it a couple of times with a Runtime Error report when trying to use the View Model Set option from the blue Survey mode.

It's clear that this is a program that has developed in isolation from the major events in the software world; like the animals of the Galapagos islands, what has resulted is a program that's completely

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Raise you half a billion!



Helen Johnstone talks to Ray Sangster, the man behind a comeback by laptop pioneer Zenith Data Systems. Groupe Bull, which bought Zenith in 1989, has challenged him to build a \$½ billion turnover by 1993 — and he's working on it.



We're back,' says Ray Sangster, boss of Zenith Data Systems, and he undoubtedly believes it. Turnover is back to the level of 1989, when Zenith was acquired by France's Groupe Bull. But regaining the reputation the company had when US parent Zenith Electronics decided to sell will be a tougher job. The UK subsidiary ranked second only to Toshiba in the portables market, and was also known for producing competent, reliable desktop machines.

The two years since have seen frenetic growth in the portables field, and tougher competition than ever in the desktop market. But Ray Sangster has a determination that makes Zenith's comeback one to be taken seriously. Any attempt to digress from the company's business is met with a slight impatience. This single-mindedness has made Sangster

an important factor in Zenith's recovery. That's not to deny the impact of its first post-takeover suite of products, announced in May 1991, which included an SL laptop — the first to be built around the Intel 386SL chipset. The power-saving MastersPort 386SL attracted the level of attention that the old Zenith had been used to.

With up to eight hours of battery life, the SL laptop could be taken on the road without the usual baggage of power supplies and adaptors, and stand up to a full day's work. The launch was an impressive move after 18 months of silence, and it gave Zenith a much needed boost. 'We're back with the big boys,' Sangster announces. 'There was a pause after the takeover, but we're back with a bang.'

Back with the big boys is where Sangster belongs. After a spell in the leisure industry, he joined the audio division of Philips in 1975. Computing was beginning to stir up considerable excitement and he began to develop an interest in the industry. So, as computing reached its springtime in 1980, he moved to Tandy as a senior European controller. After four years, he went on to Apricot to expand its export market. Two years later he was running the company's operations in the Middle East. He moved on to Zenith in early 1988, to head up the European

OEM division and manage what was Zenith's largest contract of the time, with British Telecom.

Zenith Data Systems, as part of Zenith Electronics, can lay claim to an impressive string of technological firsts. It was responsible for the first multi-processor microcomputer, the Z-100 series, released in 1982. The following year it brought out PCs enabling modular upgrades, and a system that supported both MSDOS and CP/M on the same hard disk.

Then, well ahead of the general trend, Zenith began working on the portable PC. By 1986, it had released a full-function portable weighing less than 6.5kg. Over the next three years, the company built up its reputation by being the first to introduce fluorescent backlighting to battery-powered machines, the first to put SIMM memory on a portable, and the first to incorporate extended supertwist LCD technology.

Opportunity

The UK division was set up six years ago as the US giant Zenith Electronics' first European base, but was restricted to sourcing products from overseas. It was also obliged to follow a strategy based on decisions made in the US. 'We were 4000 miles away. We were fundamentally a sales and marketing division, and we were working to 30-day targets. Our influence was limited,' Sangster recalls. Not surprisingly, he saw the Groupe Bull takeover as an opportunity for Zenith UK to develop as a company. When the purchase was publicly announced, Sangster was already involved in drawing up a set of proposals for Groupe Bull, covering how Zenith UK wanted to reorganise. 'Bull accepted our plan.'

Sangster's soft Aberdonian accent gains a note of triumph as he talks about the changes that ensued. 'We're now an IT operation in our own right.' He seems to be more a man of the new Zenith than of the old. Promoted to Northern European vice-president last year, he has been behind many of the recent changes. Only when he mentions HDTV does he show any disappointment at the US company's decision to sell Zenith UK. In the US, Zenith was 'a name as well known as Marks and Spencer', a fame built on the success of its TVs and other home electronics products. So, when the question arose as to how to finance an investment in HDTV, Zenith Data Systems was the sacrifice.

The new strategy under Groupe Bull meant a reorganisation of product lines to make Zenith Data Systems wholly responsible for the PC division, with Bull covering what is loosely defined as 'integrated systems and solutions'. Previously, Bull marketed some PCs from NEC (which holds a 15% stake in Bull) and is rumoured to have re-badged some Zenith laptops.

But the bulk of Bull's business rested on the mini and mainframe sectors. No doubt also, Groupe Bull noticed that Zenith had invested heavily in EISA technology — Bull itself had taken on the alternative MCA architecture. EISA was beginning to look

more popular, and so Zenith provided an EISA option as well as supplying the expertise of a major player in the portables market.

Sangster recognises how important the acquisition was. 'Bull were having to move very quickly towards open architecture and they couldn't do that without Zenith.' No incompatibility between the two partners is acknowledged by Sangster. He gestures as if to brush aside the MCA-EISA debate. 'Now we have the best of both worlds.'

European focus

For such a perfect marriage, Zenith has been very quiet since the takeover. Losing the backing of an American company cost several important contracts with the US government, and has meant a greater focus on European sales. Europe accounted for 15% of Zenith Data Systems' worldwide sales before the takeover; now it amounts to 50%. A major change in marketing operations has also been

necessary. Bull is committed to selling through indirect channels and Zenith has had to work hard to build up its network of dealers.

Ironically, Sangster's primary responsibility before the takeover was to manage the UK subsidiary's largest contract. By the end of his first year, he had secured an extension that took the contract up to 1991 — and Zenith still has it. Several old contracts have been lost, however, as Zenith has redirected business toward dealers. This doesn't seem to have left

Sangster with any feelings of resentment. He lives so firmly in the future that at one point he admits of his products: 'The moment I launch them is the beginning of the end.' Now his energy is focused on implementing a 'just-in-time' distribution method across Europe.

Groupe Bull has given Zenith a manufacturing plant in Villeneuve D'Ascq, near Lille, so the company can ship direct to dealers in France and Belgium. The service will soon be extended to Scandinavia and most of mainland Europe. The plant uses computer-integrated manufacture methods to cut down on the product lead times.

The plant has enabled Zenith to evolve from being essentially a sales and marketing operation into a manufacturer in less than two years. As part of the change, it has had to invest heavily in research — and again, Bull has provided the practical support. R&D expenditure rose by 25% in 1991, to maintain teams in Europe, the USA and the Far East. 'Groupe Bull are giving us the financial resources to do that.'

So a different Zenith Data Systems is emerging, from obscurity, but the market has changed too. Figures for the UK laptop market for July 1991 from Romtec show that Toshiba has fallen from what seemed an unassailable lead of around 30% in 1989 to a share of just 11%. Amstrad is now at the top of the table with 25%, with all other vendors taking less than 20%. Zenith is fifth, with an 8% share, and claims an even greater share in Europe.

"Sangster lives so firmly in the future that he admits of his products: 'The moment I launch them is the beginning of the end'. Now his energy is focused on European distribution"

'Zenith has been back with a big, big bang with the SL,' says Sangster. 'We had to be impressive and the SL was exactly what was needed.' The machine has all the hallmarks of the product developments that made a name for Zenith in the 1980s. While other manufacturers looked at putting greater processing power into the laptop, Zenith stuck to the principle that the machine should be battery powered. The SL is claimed to be the first laptop with a battery life longer than three to four hours. In what are termed 'rest-resume' conditions, when the machine is used in short bursts, the 386SL can run on battery power for as long as eight hours.



The chip can switch to a rest mode that shuts down the computer when it is idle, 'freezing' any applications that are running. At the touch of a button, the MastersPort can resume the applications without needing to reboot and configure. To cope with the freeze, the BIOS had to be re-written and a new hard disk drive was developed with Conner Peripherals.

Zenith always had a close relationship with chip manufacturer Intel, but Intel hotly denied accusations that Zenith negotiated a deal that initially excluded other manufacturers from use of the SL chipset. Sangster, too, denies Zenith's deal with

Intel used any prohibitive practices. He accounts for the partnership as a natural consequence of Zenith's position in the market at the time. 'We were a leading player and Intel were too. We got together with two other leading players to address how battery life could be extended. We gave them a commitment, but I believe several manufac-

turers will show their SL machine soon. Just as important was the relationship with Conner.'

Desktop range

Six months after the launch, the SL is still an important machine, but for Sangster it seems to have reached the 'beginning of the end'. His interest is now on Zenith's new range of desktop PCs, launched in November. The company seems to have written a list of the features that will be 'in' for the 90s and made them the specification for the range: 486-based processing, modularity, multimedia capabilities, high-quality graphics displays, a small footprint, and even ergonomic styling. 'We believe it will make as big an impact as the SL has,' Sangster says.

Groupe Bull has given Zenith the target of reaching a turnover of half a billion dollars by 1993. That means a 50% increase over the next year. But Zenith has bucked the recession over the last two

years to regain its market position and has every confidence of continuing that success.

It hasn't been quite such a good year for Groupe Bull. There have been many redundancies and first-half results for 1991 showed consolidated revenue down by \$349 million on 1990, a 4% decline. Bull is still estimated to be the seventh largest IT supplier in the world and it aims to restore the financial balance by the end of the year.

The approach, given impetus by the Zenith acquisition, is to develop 'total solutions'. In addition to Bull's strengths in systems, the group can offer an expertise in networking and communications that complements Zenith's new desktop range perfectly. The Japanese have had a similar approach for some time. Fujitsu, for example, acquired ICL last year to cover the systems sector and recently entered the PC market after years building its reputation on printers and copiers.

Scaremongering

Despite, or maybe because of, the scaremongering of the French Prime Minister's attempts to impose trade restrictions on Japanese businesses, Sangster doesn't feel threatened. 'What the Japanese have is money and technology associated with hardware. What they don't seem to have is distribution — they have not cracked distribution.'

Of more concern to him is the fact that there will never be a return to the heady days of the 80s for the computer industry. 'It will continue to slow down — we're becoming a mature industry. We have to look carefully at what to put in the market and how.' The philosophy at Zenith is to aim for the quality end of the market, providing integrated computer systems and a comprehensive support service.

Sangster talks about the growth of computer literacy leading to more demanding customers, a greater insistence on reliability, and higher expectations of how the supplier should behave.

The flip side of a computer-educated public is a growing demand for cheap, off-the-shelf solutions. Britain's first US-style computer supermarket, PC World, opened in October promising prices lower than those of the dealers, if not the mail order companies. There are still sceptics who say it won't catch on in Britain. Sangster disagrees. 'I do think it will take time, but I do think it will be successful.'

Amstrad, IBM, Olivetti, Toshiba and Tandon are all expected to have products at PC World. Does Sangster consider Zenith above the supermarket sell, or will he be looking for shelf space as well? 'If I have a product in the range, provided I make money...', he pauses. 'But if the question is "Am I going to become an Amstrad?"... No, definitely not.'

Sangster is doing all he can to make Zenith a name in its own right again. It isn't easy to measure his role in the success; he is inclined to skirt around his personal achievements in bringing Zenith back to a position of strength in the PC market in difficult times. But there is no denying his determination. If the last 18 months to two years have seemed quiet, that was only on the surface. Zenith Data Systems has experienced something of a metamorphosis since the takeover, but in its new form, the company looks at least as strong as it ever was.

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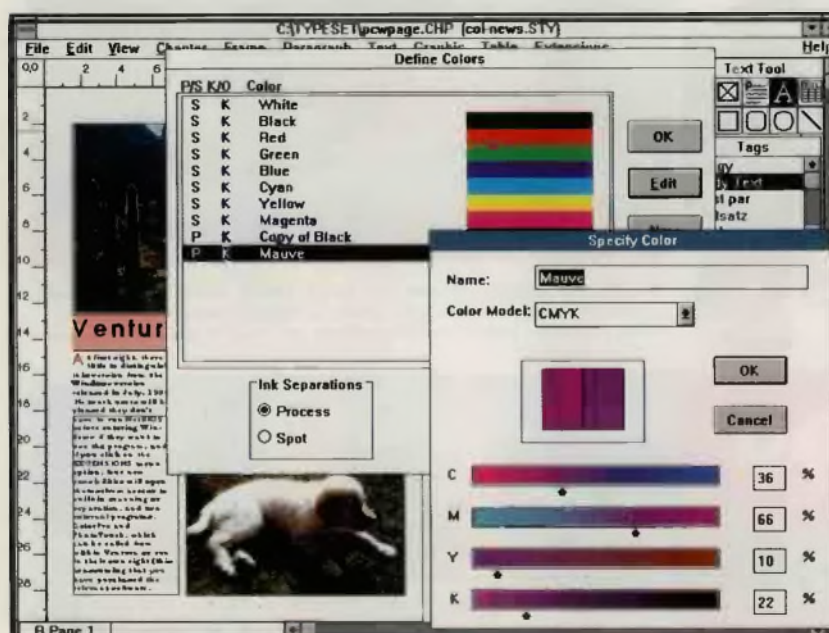
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Ventura 4 for Windows

The imminent release of Ventura 4 allows DOS machines to challenge the Macintosh in the world of high-quality, professional colour publishing. Karl Dallas tried a preview version and was very impressed... apart from some spaced-out text displays.



△ The Define Colors menu allows very delicate new shades to be created, using either CMYK, RGB, or HLS

The DOS world takes a great leap forward into the world of professional colour publishing, with the imminent release of Ventura Publisher 4. Hitherto only Mac products have had the facility to prepare full-colour process separations. For instance, Aldus PrePrint does this rather neatly with PageMaker on the Mac, but there is no equivalent utility for Windows PageMaker: files have to be transferred from the DOS machine to a Mac for prepress work.

Similarly, Quark XPress has separations extensions in its Macintosh version, but these are unlikely to be available for the release of the Windows version in Spring. Anyway, Quark can only separate EPS images. Ventura can also handle TIFF or PCX.

The availability of very sophisticated prepress extensions to Ventura on the comparatively inexpensive DOS platform means many DTP professionals will have to learn a whole new set of skills, exponentially more complex than anything they've had to work with so far.

Inexpensive, of course, is a comparative term. With all its extensions, this latest version of Ventura will cost you just over £5000 (plus nearly £1000 VAT), and it won't run on just any old hardware. In fact, you could spend more on your computer and display.

We ran the software on an HM Minstrel 486/33 with 8Mb of memory and a 105Mb hard disk (in all, £1645 without a monitor). We viewed the result on an Etap Fresco Quattro 24-bit monitor, with a 1600x1200 resolution (£6685 from Active Computer Systems), and scanned images with a JX300 colour scanner (£1347 from Sharp Electronics). Total cost £9704, not including a Hitachi colour printer which did not arrive in time for the review. Even so, this set-up is cheaper than the sort of graphics workstation that has monopolised prepress work until now.

Upgrade features

The basic Ventura 4 is a fairly standard upgrade, addressing some of the inconsistencies and irritations of VP3. You no longer need to run NetBIOS before entering Windows if you want to run the program across a network. The text editor now includes undo/redo, search and replace and spell checking. You also get automatic scrolling, direct import of Word for Windows documents, and support for DDE and OLE, plus VP3 features like support for documents of up to 9999 pages. When Windows 3.1 and the OLE-compliant versions of Paintbrush become available, you will be able to edit a PCX image from within Ventura simply by double-clicking on the frame.

In general, the new Windows version runs much faster than the old one, so you no longer have to stay with the GEM version to get anything like decent performance. (There will be a GEM upgrade, minus some of the new features.) Also, you usually had to run the old version with Windows in standard mode — losing virtual memory, which is only supported in 386 enhanced mode. This was still the case with an earlier beta version of VP4; the late beta preview version provided much better speed.

I would expect even better performance from the shipped product, because code optimisation is usually the last thing to be done after the final bug fixes.

Facilities out of step

Some of the facilities, like File Open list boxes, have not caught up with the way Windows now does things — and they are certainly going to be even more out of step when the user-friendlier Windows 3.1 comes along. Also, the standard of the WYSIWYG display is not up to what we have come to expect: type is displayed in a very gappy manner, even with kerning set to 'tight'. Displaying the same type specimens side-by-side in Ventura and Win-

dows Write, it's a little disturbing to achieve better display with the freebie word processor.

Of course, this was a beta copy, so perhaps this problem will be addressed by the time Ventura 4 ships. If it isn't, you would have to consider carefully whether the standard was acceptable: the accuracy of Ventura's width tables has always been one of its main attractions to professionals. However, printed output did not suffer from similar problems.

The colour capabilities of Ventura 4 are going to be the main talking point. Not all were available at preview time: the PhotoTouch image editor is still to come, but the scanning, separating and ColorPro extensions really justified Ventura's claim to be

Mixing and matching colours

The inclusion of professional prepress extensions for the first time in a DOS DTP package will introduce non-specialists to a whole new dictionary of terminology, and to areas of expertise which have hitherto been the exclusive preserve of colour professionals.

In many ways, this is a more revolutionary — and potentially much more traumatic — development than the invention of desktop publishing itself. Most people migrating to electronic publishing were at least familiar with basic type terms, such as points, picas, fonts, and so on. But how many users, led to believe that desktop prepress can cut out the processing middleman, know anything about such arcane matters as knockouts, trapping, GCR, or UCR? And if I tell you that the latter acronyms stand for grey component replacement and under-colour removal, are you any the wiser?

The first thing you have to realise is that the printed image is never going to look exactly like what you see on the screen, simply because the image is created in a different way.

The VDU screen is an *additive* device: red, green and yellow light is added in various proportions to make up what you see: 100% of the three colours produces white. Printing is a *subtractive* process, usually employing cyan, magenta and yellow inks: 100% of each makes black, and you get different colours by taking away percentages of one or more of the three. Black ink (which, of course, is not truly black) is added to the equation to make better solid shadows, because using the three coloured inks together in practice produces rather muddy blacks.

The colour screen on your VDU probably uses an RGB (Red-Green-Blue) system, while most printers use a CMYK (Cyan-Magenta-Yellow-black — no, I don't know why it isn't CMYB) system. However, a new CIE system (devised by the Commission Internationale d'Eclairage) has been specifically endorsed by Adobe for PostScript Level 2. Two alternative monitor systems, HSV (Hue-Saturation-Value) and HSL (Hue-Saturation-Lightness) claim to represent colour in a manner more analogous to that of the human eye. Theoretically, the CIE specifications should make it easier to transfer monitor colour specifications to print, and vice versa, but as things are today, we'll still be transferring an RGB colour model into a CMYK environment.

Paper and printing

A further complication comes from two other variables: the type of press on which printing will take place, and the type of paper to be used. Think of newspapers and glossy magazines. The former use a more absorbent type of paper, the latter less so: different ink constituents will be required for one, compared with the other, and different colour inks have different levels of absorbency.

Also, you can't just print black ink in the places where you want black ink, because the muddy greys produced by the underlying Cyan-Magenta-Yellow mix will show through. You have to remove the grey. Hence the complementary processes of under-colour removal and grey component replacement.

Excessive ink is not merely expensive: it slows down drying and increases the likelihood of smudging and set-off ('blotting' of the image on one sheet on to the back of the next sheet as it comes off the press).

In theory you can print with 100% of each of the four colours, with a 400% result; in practice the maximum is around 300%, though specific percentages will be learned by experience with specific presses, papers and inks. The percentage can range from as high as almost 350% for coated paper, printed offset, down to 240% for open web newsprint.

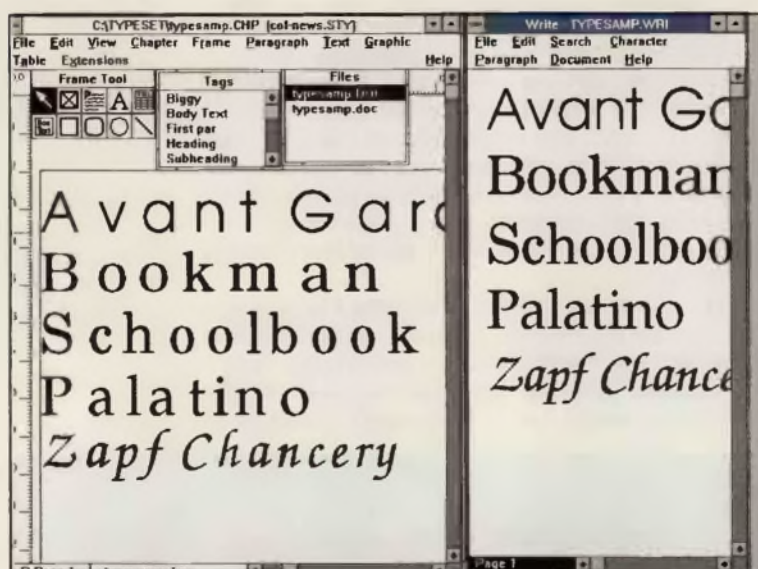
Spot colour

So far, we've been looking at full-colour halftone printing, but similar principles apply to spot colours, where special colours can be premixed. The most widely used system for achieving consistent results here is Pantone, but because of the different colour models used for screen and print, only an approximation of printed Pantone can be achieved on screen.

The great virtue of the Pantone system is that you can pick a colour from a printed colour specifier and if you tell the printer to use that number recipe, you should get fairly close results. Some DTP programs allow you to mix Pantone approximations on screen, but they don't usually allow you merely to type in the Pantone number and see something like you will get.

When printing one spot colour on top of another, it is usual to 'knock out' (or reverse white-on-black) the shape of the superimposed image from within the underprinted image. This may not be necessary if black text is being printed on a yellow panel, but black on red looks muddy if the letters underneath are not actually whited out. However, since spot colour is often used on less accurate presses where colour registration is not so precise, it is usually advisable to make the white under-image slightly smaller than the superimposed printing. This overlap is known as *trapping*.

So, you see, doing desktop prepress is not a matter of simply running a separation program or extension and telling it to get on with it. You're going to have to make some pretty critical decisions on questions like trapping and knockouts (at the page design stage) and UCR and GCR (when creating separations). Get used to the idea you'll get it wrong the first few times, and learn by experience. Remember, the person who never made a mistake never made anything.



▲ Gappy type display on Ventura compared with the superior character spacing of Windows Write (right)

placing high-level colour prepress on to the electronic desktop. Colour capabilities of the base product include: support for 24-bit colour and colour TIFF and PCX files; Pantone spot and process colour specification; process or spot colours; support for 65,000 colour definitions, 255 of which can be treated as spot colours for printing; and true 24-bit colour display of images and defined colours.

You can choose a Pantone colour by number from a menu of several thousand, and display it on screen. Access to the menu is via the Define Colors option, as before, with the difference that you can specify a spot colour with some certainty that it will match the display you have just shown your client — or the printed proof you have output on a desktop colour printer.

The chosen colour appears on all menus after it has been defined, identified either by its Pantone number or by a name of your choice, such as olive green or slate blue.

Before you start using desktop colour, you have to ensure that all your devices are calibrated to work as well as possible with each other. This is not a once-for-all operation, because devices may be sensitive to small changes in the environment.

It is worth taking some time to scan in a set of

specimen colours and compare the image on screen with the original. If you have a colour printer, print out the result so you can compare all three. Obviously, the existence of different presses and papers will complicate matters further, but time taken at this stage will avert a lot of hassle with angry clients later, especially if you are working in colour-critical areas like fashion or textiles.

Preview marquee

Ventura provides an easy way to do all this. The scanner extension allows an image to be scanned into a document in a similar way to importing a graphic: first create and select a frame, then go to the Extensions menu and select Ventura Scan. It is possible to select (or change) your scanner from this menu, to preview the image, and to select only a part of the total image to be scanned from the preview display.

The shape and size of the selected frame can be superimposed as a marquee upon the preview image, to help in scanning the relevant portion. This marquee can be enlarged or reduced to indicate the area to be scanned. It is also possible to crop or resize the image either as it is scanned, or afterwards, in the normal Ventura manner. It can also be moved around under the frame 'window'.

Among the scanners supported in the preview version were the Sharp JX300 and JX400, the Howtek Scanmaster and Scanmaster II, and the Nikon LS3500 slide scanner. More are promised.

Colour scanning produces huge files: a full-page A4 full-colour image at 300dpi scans in at about 25.5Mb. Quite apart from finding the disk space, there is also the question of whether you'll have enough memory to load the image into your DTP file, even with virtual memory enabled. Helpfully, Ventura calculates the file size prior to scanning.

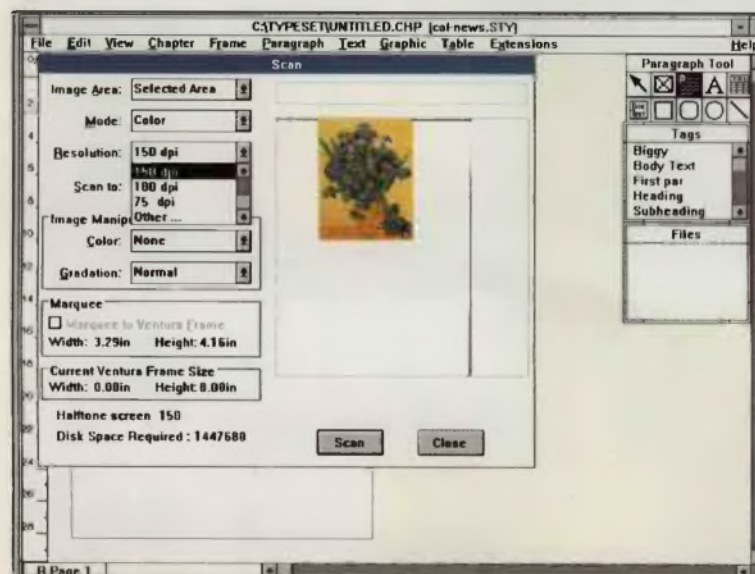
The scanning module sets a standard for ease-of-use for the other modules: clearly Ventura realised when creating it that most users will be venturing out into fairly uncharted waters.

The separations extension, for instance, is impressive in the way it guides you through what is pretty arcane stuff. Eleven scrolling list boxes take you through factors like:

- Press and paper to be used.
- Press gain. This accommodates for the fact that half-tone dots tend to spread, especially on uncoated papers.
- Grey balance (which actually offers only one option at present).
- Separation of continuous tone images (off or on).
- The tonal range of an image or the entire document.
- Gradation, with options like 'open shadows' or 'darken highlights'.
- Sharpness.
- An option which compensates for scanner tendencies to heighten dark greens and blues.
- Screening model.
- Line screen frequency.

This list may seem alarming but in practice the prompts are fairly easy to handle. Instead of asking you to type in figures for parameters you're probably not yet relaxed with, the module uses understandable if slightly imprecise descriptions like 'darken' or 'lighten'.

▽ Ventura Scan's Preview mode allows a 'marquee' to be drawn around the area to be scanned



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△ The Separator Settings menu provides 11 scrolling list boxes, with options listed in simple language

However, the more advanced ColorPro module offers more precise numerical parameters. As the price (four times that of base Ventura) suggests, this is a real high-end tool. Unlike the scanner and separator extensions, it can be run as a standalone, as well as from within Ventura (which swaps out the base program so you can't get back into it until you close down ColorPro). Once colour correction settings have been defined within ColorPro (say, for a specific input or output device or printing press), you can save them and import them into Ventura Separator. You can then use them for other scanned images or documents produced using the same hardware.

Finely tuned

On-screen features include a densitometer and manipulation of gradation and range for the four process colours. These can be manipulated either by selecting and dragging a point on a graph for any of the colours, or by clicking on a list box and typing in new values.

Under-colour addition and removal is very finely-tuned, allowing the removal start and maximum density to be defined. And GCR and UCR can be applied to any of the four plates, not merely black.

It is possible to retain a pre-corrected image on screen alongside the corrected version, allowing continual comparison to ensure that the produced result is the sought-after improvement on the original. However, the only way to abandon the corrected version is to go back to the File menu and reload the original file: there is no Cancel button, or even Revert, which seems an astonishing omission.

Another feature — soft plate proofing — allows on-screen preview of any combination of printing plates: the electronic equivalent of proofing out separation progressives.

Conclusion

This is not a program I would recommend for beginners. While Separator is as easy as you can

expect from such a complex subject, ColorPro really presumes some prior knowledge, which you can't expect just to pick up in the reference section of the local library. It takes the product beyond the scope of straight DTP, which assumes a lay user prepared to learn by doing, and requires true colour-process professionals to design to use it.

I must confess myself a sceptic on this point. Colour process is a craft almost as closely guarded as the secrets of the medieval guilds, one of the last surviving outposts of the old print exclusivism that has been dealt a body blow by DTP and direct input. I cannot imagine many of the old hands descending to a desktop package. Still less can I see them helping a beginner through the difficulties, because they'd be helping themselves out of their jobs. But there are going to be some very rich pickings for the training bureaux, if they can show people how to use this new product.

For the less skilled majority — and I include myself — VP 4 with the scanning and separation extensions will be enough to be going along with.

Plus, of course, PhotoTouch. The specification for this is very impressive, as it needs to be to go up against products like PhotoStyler, Picture Publisher, and Publishers's Paintbrush. It supports full 24-bit colour (like all the other new Ventura products), with greyscale and colour correction; retouching and masking of scanned or imported images; working on images of any size at any resolution, and on more than one simultaneously; batch-processing for any number of images, each with its own set of operations; personalised colour mixing and selection; import and export of colour palettes; localised colour correction and retouching using 8-bit masking channel; utilising up to 256 layers of masking; and integral paintbrush tools: air brush, paint brush, pencil and editable charcoal brush.

But the jury must be considered to be out on PhotoTouch until the product is actually available for evaluation.

Until then, though, the new product really sets a new benchmark of excellence, which the others are going to have a difficult job keeping up with, still less surpassing.

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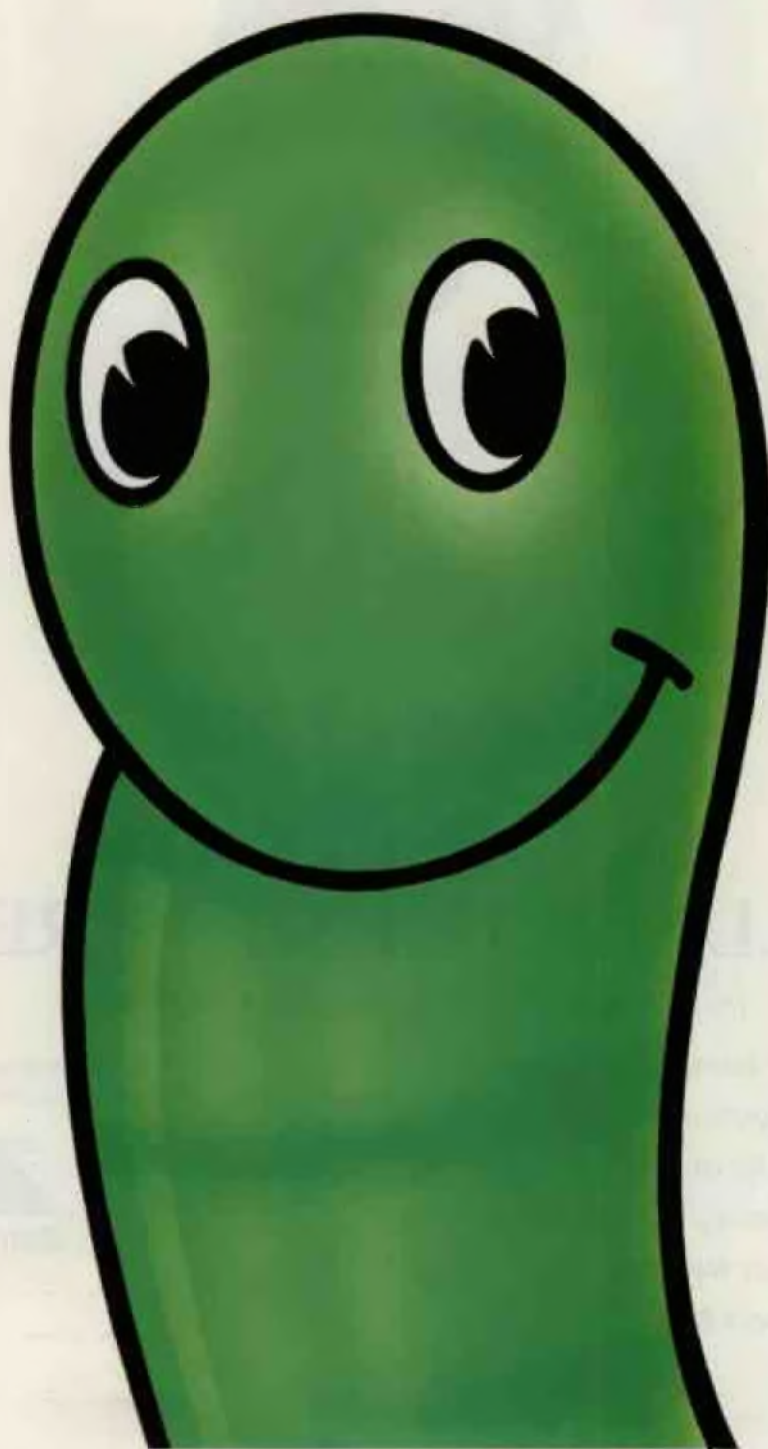
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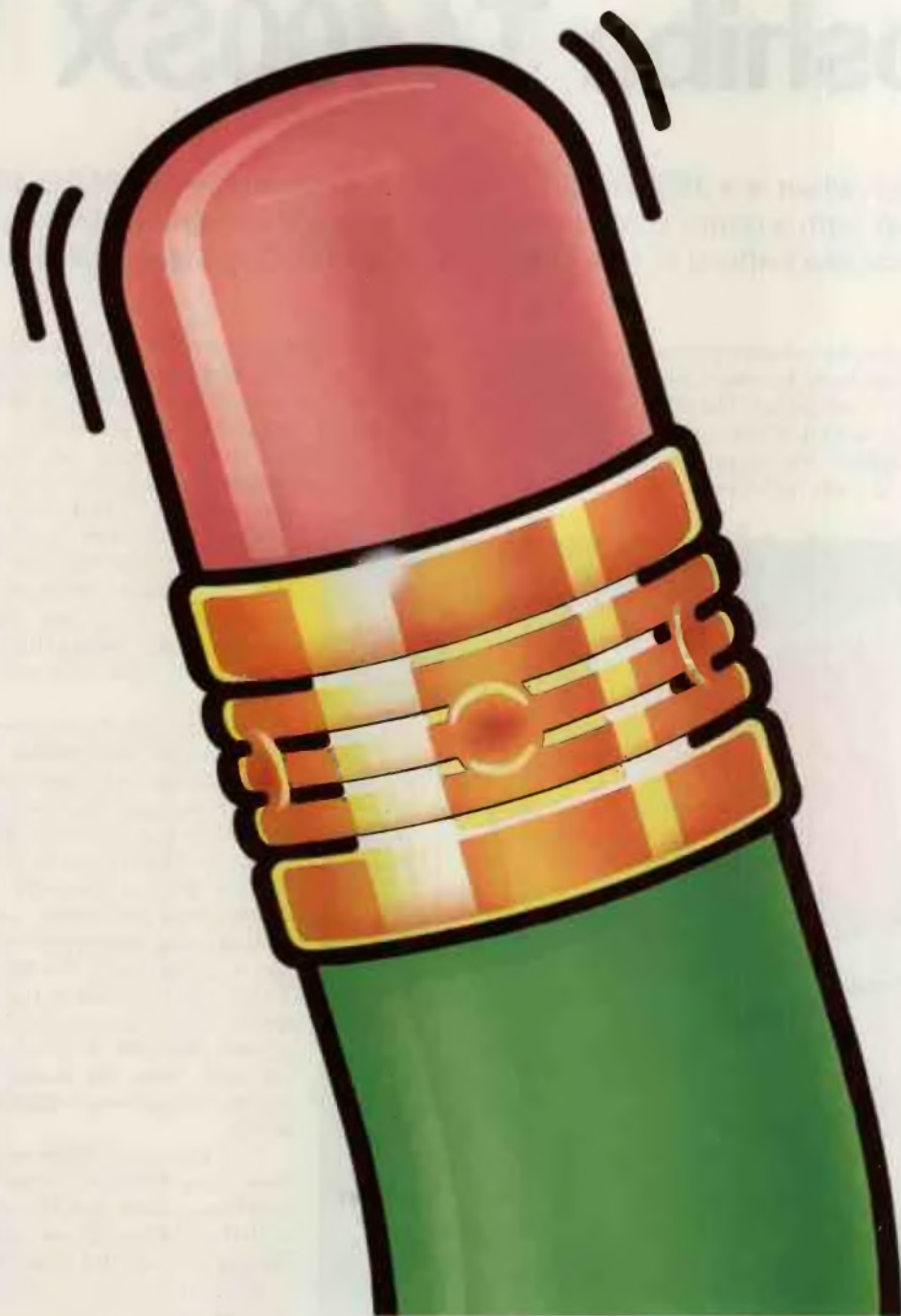
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Toshiba T4400SX



Question: when is a 25MHz 386SX notebook preferable to a 25MHz 486SX notebook with a better screen and weighing much the same? *Answer:* only when you can't afford to fork out the extra £1000. Guy Swarbrick reports.

Compaq may have been a pioneer in portable PCs, but the Texan lunchbox was always going to appeal only to a limited market. The company that started the real revolution, the revolution that led to today's 6lb 386SX notebooks, was Toshiba.

The early Tosh portables were, with hindsight,

pretty horrible. Powered (if that's the right word) by an 8MHz 80286, and fitted with what must have been the slowest hard disk available at the time, the T3200 had only one virtue: portability.

It wasn't that portable, mind you. It weighed a ton and was tied to the mains, but you could, just about, pick it up and carry it from the office to the boot of the car. And at a time when the average LCD was virtually unreadable under any lighting condition, from any angle, the Toshiba's gas plasma display meant there really was only one sensible choice.

Toshiba rapidly became number one in the portable market. The more it sold, the more it spent on development. It was one of the first companies to introduce a 6lb 8086-powered notebook, the T1000 (with an LCD, the gas plasma devices allegedly using too much power for battery operation, as well as being too expensive for such a low-end machine). The 286-powered T3100 was replaced by the T3100SX, which had a similar but much improved case and the freedom to operate away from the mains, for short periods at least, even with a gas plasma screen.

The next revolution was what is now being described as the Windows notebook. Sharp and TI got there first with their 286 machines, with Toshiba lagging behind. But when the 386SX notebooks started to arrive, spear-headed again by TI and Sharp, Toshiba was back at the front. Now Toshiba has moved the goalposts again, with the introduction of the T4400SX.

The rest of the industry seems to be beaver away to produce a 386SL-based notebook with a long battery life and, in some cases, colour displays. Toshiba has produced a 486SX note-



S. AST Premium Exec 386SX/25

book, with a long battery life and the legendary gas plasma screen.

AST's potted portable history isn't nearly so extensive, but the company has been producing portable machines for some time now and its entry into the lucrative SX notebook market was by no means an embarrassment.

The company's latest product, the AMD-powered Premium Exec 386SX/25, is a far more conventional machine than the Toshiba, with LCD screen and 386 processor. But it too offers low weight and a long battery life, and reasonably high power. And unlike the Toshiba, its price is reasonably low.

Toshiba T440SX

Sadly, one of the nicest things about the T4400SX we reviewed is almost certain to change before the machine is produced in bulk. The familiar grey case has pastel green catches to hold the screen in place and a matching power switch. They aren't big enough to be garish, but they are big enough to make the case look attractively different. Ah well.

A quick tour around the case reveals nothing unexpected in terms of additions or omissions. From front left clockwise, there's a modem port, keypad connector, power switch, expansion connector, DC power-in socket, recessed reset button, a single 9-pin serial port, a parallel port, VGA out, mouse connector, battery compartment and 3.5in disk drive.

Two compartments are visible only from below, one for credit-card style RAM expansion up to 10Mb, and one where other notebooks have a 387 socket. You might expect this to allow easy upgrading to a real 486... Sorry, I mean to allow the addition of a 487SX. Actually, you have to open the case to

do that. The opening is to allow access to the BIOS chip.

Opening the case is fairly simple but almost unnecessary. To get at most of the components you can leave in place the three short screws at the rear of the base: you unscrew instead the three long ones at the front, and lever out the keyboard.



Carefully. Given that the review T4400SX was the only one in the country at the time we did this, it was just as well the keyboard unit didn't snap. Perhaps it wouldn't, no matter how violently you removed it, but I'm not convinced. I was really gentle and the keyboard still bent and twisted enough to get me thinking of ways to apologise.

Inside, you may be surprised to find even more open space than in the first 386SX notebooks. The power supply is at the rear left, behind the 2in Conner disk drive; to the right of this is the 486SX in a natty lever-operated zero-force socket to allow easy upgrade to the 487SX; to the right of this, occupying the front-right corner, is the floppy drive.



And that's about all there is. In the front-left corner is a bay to hold the optional modem, and the rear-right corner has a slot for the massive 16.8V, 2400mAh NiCad battery.

Back to the processor. I have to say I didn't notice anything unusual about it at first, and Toshiba didn't draw my attention to the fact that it was rated at 25MHz. Perhaps the company thought that a 486SX notebook is interesting enough in itself, so there was no need to boast that it used a 25MHz 486SX chip which at the time had yet to be announced. This is definitely a machine with hidden talents.

Flip up the clamshell lid and apart from the deep-orange screen, there are few surprises. The clamshell has a friction hinge that allows it to fold back past 180 degrees, which might be useful in the short term but could cause problems if the hinge loosens with age.

The keyboard is much as you would expect. Well-damped, short-travel keys give a feeling of quality, and although the layout has obviously been compromised because of the space available, there are real Page Up and Page Down keys and the cursor keys are in the familiar T-shaped layout, which is sensible. The British keyboard even has the '\ ' in a sensible place.

In use

Manufacturers rarely send out virgin PCs for review these days. The hard disks are inevitably crammed with software designed to make the product look good. The T4400SX was no exception — but the software itself was a little out of the ordinary.

We are used to being supplied with notebooks set up to run Windows 3.0. In fact, a basic specification for our 386SX notebook Group Test in September was that the machine be capable of running Windows. But it's unusual for a notebook to arrive with PageMaker 4.0 installed.

Why? You obviously haven't used PageMaker. Superb page layout tool it may be, but quick it isn't. Except, that is, on the T4400SX. Not only is the machine quick enough, but its superb display capable of displaying 16 distinct shades of red/orange makes light work of displaying even the most complex graphic.

Also surprising was the machine's use of DOS 4.01. Since not long after its launch, DOS 5.0 has become as near ubiquitous as makes no practical difference. Every now and again you come across a machine still being shipped with version 3.3, but unwieldy, unreliable version 4.0 is about as rare as the proverbial hen's teeth. And deservedly so.

Still, should you feel you don't want the advantages that DOS 5.0 gives you (vastly more memory for your DOS applications, reliability, that sort of thing), don't buy the retail upgrade version and stick with version 4.0.

If you haven't used gas plasma, it's difficult to appreciate how much better it is than LCD. The Windows pointer is always visible; it won't strain your eyes (in fact, it's very close to the theoretical ergonomic ideal of amber on black); the viewing angle is wide; and subtle images are handled as well as many monochrome CRT displays.

Let's not get carried away. There's a little bit of flicker (although after a while I only saw it when I

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looked for it) and many people find the colour scheme hard to work with, no matter what the ergonomics experts may think. As a long-term general solution for portable screens, gas plasma has some serious defects, not least of which is that colour versions are out of the question. But the future might well see TFT (Thin Film Transistor) LCDs take the colour market while gas plasma dominates the monochrome.

The Toshiba will drive a colour VGA monitor. But, when you try driving the internal screen and a monitor simultaneously — a feat some of its predecessors managed happily — the T4400SX is a disappointment, with very poor quality VGA and unreadable text on the gas plasma.



AST Premium Exec 386SX/25

So much for the Toshiba. How does the AST compare? The first obvious difference is the size. The Californian portable, pale grey save for a darker logo panel on the lid, is marginally bigger than its Japanese rival. The 3.5in floppy drive, mounted along the front edge, is visible with the lid shut. Unlike with some front-facing designs, this doesn't mean you are liable to knock the disk out of the drive: the release button is well protected.

A spring-loaded door on the right-hand side covers the battery compartment, housing a small Mexican NiCad pack. At the rear, under an unusually well constructed flap (much sturdier than that on the Toshiba) are connectors for the power supply/charger, a keypad, and a VGA display plus one parallel and one serial port. That's right — one serial port. No mouse port. True, there is a facility for an internal modem, but there is room on the back panel for a second serial port and no excuse for not providing one.

Open the lid by pulling on the rather odd catch at the front, and everything's more or less as you'd expect. The keyboard, like the Toshiba's, is well laid out with a proper T-shaped cursor pad. The review machine had a US layout but was otherwise fine. Or at least, it was until I tried typing on it. The keys have minimal travel and feel completely dead. As with any keyboard you may get used to it, but you may not want to.

A power switch, half a dozen LEDs (power, hard disk, battery level, and the three key locks), ineffectual brightness and contrast controls, and a small lump on the screen surround are the only other distinguishing features visible from the outside.

The screen itself is excellent when properly adjusted, with good contrast, adequate backlighting, and minimal bleeding. Unfortunately proper adjustment takes several minutes, thanks to the coarseness of the controls, and even then it seems to drift from its original settings. Half an hour with this reminds you why you like gas plasma.

I don't want to admit to enjoying opening up laptops for fear of being awarded PCW's ceremonial anorak. Besides, it's putting them back together that's fun — or rather, it used to be. It's just too easy these days. Three screws hold the keyboard in place, and above and to the left of it, a cover simply slides off. This is where the modem and SIMMS go — there are two SIMM sockets, one of which was filled on the review machine with 2Mb of RAM.

The AMD Am386 SX/SXL-25 (to give the processor its full title) sits on a daughterboard above the motherboard, which is relatively densely populated by today's standards. Cirrus Logic, Actel and, ironically, Toshiba provide most of the support chips. The 2in 80Mb hard disk is from Conner (to whom thanks for the sticker indicating the drive capacity, which helps reviewers and support staff alike).

Everything we threw at the AST worked with no problems, even the new PCW compatibility test, Windows 3.1 Beta 2.

Side by side

So, the T4400SX screen is good and the benchmarks confirm that it certainly has the edge in

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performance. Many portables throw those two advantages away by being over-heavy and over-reliant on a mains supply.

The Toshiba does surprisingly well, considering its internal make-up. Remember, it isn't the big things that save weight, it's a combination of dozens of little things. The NiCads aside, one factor the Tosh has to contend with is that its ceramic-clad 486SX chip is two or three times heavier than a plastic-packaged 386SX, and the zero-force socket packs about 50% of the mass of the chip. The T4400SX's Conner drive is lighter than the 3.5in units which are still the most common even among notebooks. But the floppy drive is no better or worse than most. Overall, then, you would expect the T4400SX to be a heavy-weight laptop, at best.

Power consumption of the non-CMOS 486SX processor compounds the problem, requiring a hunkier battery than its less powerful cousins. Battery weight is not often considered, never mind quoted—but the Toshiba's NiCads weigh in at just over 1kg, and take it from me, that's not good. The AST's pack weighs 600g, just over half the weight. And to prove there's

nothing unusual about the AST, the PCW Seal of Approval-winning Tandon NB/386SX has a 640g NiCad.

Fortunately, despite these disadvantages, Toshiba did a wonderful job with the engineering of the rest of the T4400SX, which weighs just 2.3kg as against just under 2.7kg for the AST. The Tandon,

incidentally, weighs 2.6kg and has a 40Mb hard disk, as against the 80Mb units in the AST and the Tosh (though the review Tosh had only 60Mb). So for the Toshiba, all that adds up to 3.3kg, and the AST is just about the same. Include the PSU's (and who travels without them?) and the AST (and its 386SX powered rivals) moves a little ahead: at 700g, the Toshiba's weighs 200g more than the AST's.

So, with only 200g (1/2lb if you're still resisting the march of progress) between machines, what else separates them?

Not battery life. Just under two hours for the T4400SX, just over two for the Premium Exec 386SX/25. That only leaves price. Now here, there's a real difference. The Toshiba lists at £3799, the AST at £2745. Clouds the issue a bit, doesn't it?

Conclusion

At £3799, the T4400SX isn't going to find a mass audience just yet. The other arguments you might have expected to deter the purchase of a notebook powered by a crippled 486 over one powered by a crippled 386 just don't apply.

Don't kid yourself. A 486SX notebook isn't heavier than a 386SX and it doesn't have worse battery consumption. If you need the best notebook around, with no compromises, this, currently, is it.

If you have wanted a notebook but haven't seen one you think will be up to your class of job, then the T4400SX may provide the answer (Gene Wang, Language Business Unit chief at Borland, was lusting after one simply because it would allow him to store the full Borland C++ setup and a Quattro Pro presentation on the same hard disk and run them respectably quickly). There are complications, of course. I can't imagine anyone actually laying out pages on the train on the way to the art room. But it doesn't take much imagination to see how a powerful, portable PC might be useful.

The 486SX was seen by many as a cynical marketing ploy, but the lower clock speed and cheaper, less power-hungry components needed to support the 486 may mean that the notebook skips the 386DX altogether. Perhaps, in the notebook, Intel's phoney innovation has finally found a home.

If the money just isn't there, the 386SX notebook offers many of the same facilities at a much lower price. The Premium Exec 386SX/25 may not have the power of the Toshiba, but it's certainly no slouch. You certainly won't feel ashamed to get it out in the rush hour, but you may wish you had a second serial port when you're in a hotel room in Singapore with an external modem and a Windows comms package.

Specifications

Toshiba T4400SX

Manufacturer

Toshiba (0932) 753029

RAM

2Mb expandable to 10Mb with memory cards

Mass storage

3.5in floppy and 80Mb hard drive

Screen

Choice of 16 greyscale gas plasma or 64 greyscale LCD; 256-colour VGA output

Weight

3.3kg including batteries. 700g power supply unit

Interfaces

One parallel, one serial, VGA out, proprietary expansion port, mouse, modem port

Price

£3799 with either screen

AST Premium Exec 386SX/25

Manufacturer

AST 081-568 4350

RAM

4Mb as standard

Mass storage

3.5in floppy and choice of 80Mb and 60Mb Conner hard drives

Screen

32 greyscale VGA

Weight

3.3kg including batteries. 500g power supply unit

Interfaces

One parallel, one serial, internal modem

Price

£2495 ex VAT for 60Mb model; £2745 with 80Mb disk

"A 486SX notebook isn't heavier than a 386SX and it doesn't have worse battery consumption. If you need the best notebook around, with no compromises, this [the Toshiba] currently is it"

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NetWare Lite

If you have less than 25 PCs and would like the benefits of networking but without the investment in a dedicated file server, Novell's NetWare Lite is a quality peer-to-peer product. Some advanced functionality is missing, but Stuart Berman was impressed.

Adding the word Lite to the name of a product usually means it either has no alcohol or no calories, and on that basis I don't normally give it a second look. NetWare Lite has neither of these two characteristics, so maybe it's worth a look after all.

NetWare Lite is the latest in a long line of quality network operating systems from Novell. The company's server-based networks have come to domi-

support the others on the network, without being able to use it for 'real' work, is a psychological problem that should not be underestimated.

If a user had five PCs and simply wanted to share a laser printer and a few files and to operate a common database, he would, if he wanted to use Novell software, have to buy a dedicated machine to use just as a file server, which rather negates the cost-saving benefits of sharing the printer.

If you add together the cost of the networking hardware, the extra machine and the cost of NetWare itself, the unfortunate user must have a very strong business need which can't be catered for in any other way, in order to justify the cost. There are far cheaper solutions, from serial port networks to low-cost Ethernet, that can provide some of the answers, but they tend to be either too limiting or too unreliable.

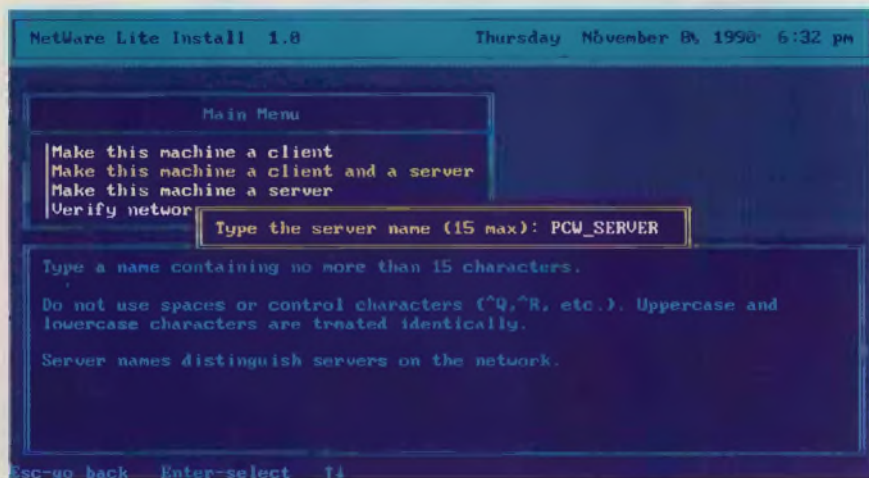
Time for change

NetWare Lite is clearly aimed at changing this scenario. Instead of a dedicated file server it allows any machine to be configured on the network as a 'client' or a 'server'. In this case, a server is an

ordinary machine with no special formatting (a conventional Novell file server does not use DOS-format hard disks and has to be set up before it can be used). The server can still be used as a normal PC, even while it is acting as a server (a non-dedicated server, to use the term Novell adopted in its previous dabblings with such a system). The only real difference is that its hard disk or printers can be accessed by other users of the network.

The beauty of this system is that the network can have as many servers as it needs, with the number of clients and servers changing from day to day as the needs of the workgroup change.

The other scenario in which this product could prove extremely useful is peer-to-peer linking over existing networks. If organisations have a Novell network, this product will work alongside it (or rather, on top of it) to allow the sharing of local



△ The peer-to-peer nature of NetWare Lite does not remove the need for one machine to be nominated as a server

nate the LAN market over the last few years. The purpose of the new product is to attack the potentially huge market of very small PC networks, a market which has only recently begun to take off as customers see the benefits which the increasingly large number of network users are getting from their traditional systems and decide they want a piece of the action.

In recent years the price of relatively fast networking hardware has come down significantly, but for many potential users, the investment required is still too high. NetWare Lite is designed to appeal to people with less than 25 PCs who would like to obtain some of the benefits that networks offer without investing in a dedicated file server.

It's the need for a dedicated server to act as the centre of all communications that has put many people off. The idea of buying a machine solely to

drives or peripherals. It would prove particularly useful for a manager wanting continuous access to his secretary's files or to a network manager wanting to back up a remote machine to a local tape drive.

Installation

The software certainly lives up to its name in terms of weight. It is packaged in an A5-size half-inch thick box with the software fitting on one 3.5in disk.

Installation is via a very friendly install program. You must know precisely what networking hardware you are using, but otherwise things are fairly straightforward. The program does, however, ask one or two technical questions; one in particular concerning interrupt levels is likely to unnecessarily blow the head off any nervous user.

The result of the installation is a directory containing all necessary files and a batch file to load up all the relevant networking software (startnet.bat). The installation program also has a test module to verify that network connections are working.

Functionality

The Net program provides all the basic network configuration functionality. It allows servers and remote printers to be mapped into the local machine's configuration, and permits control over servers, print jobs and print queues. It also provides logs of errors and statistical information.

One rather nice touch is the ability to configure a particular directory (and its subdirectories) as a network drive while leaving the rest of the server unavailable to clients.

Security is adequate, but the default is to grant all users supervisor privileges and to give all users access to all printers. Network management will have to be strict and, occasionally, heavy handed. Password protection is provided and there is an interesting feature that can force the user to change password every *n* days.

The message-sending facility allows for 35 character messages to be sent to other users. Unfortunately, if the recipient has switched off his message facility and so does not receive the message, the sender is unaware of it.

There are a few extra commands which can be accessed only from outside the menu program, but the only significant ones are for logging in and out of the network.

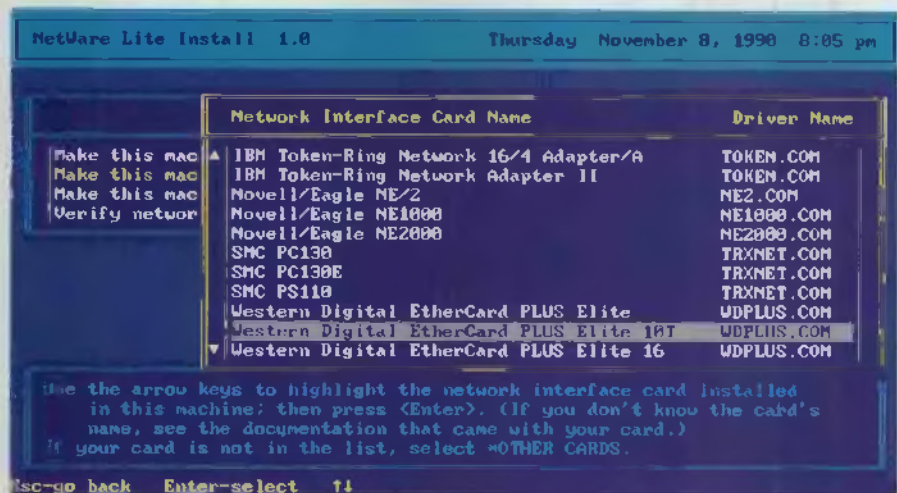
Those used to the full NetWare functionality will be aware that much of the more advanced functionality is missing from this product, but in my view Novell has drawn the line in exactly the right place. Much original functionality has been simplified but all the essentials are present.

Theoretically there is no reason why two independent networks shouldn't run over the same networking hardware. However, it was good to see that a single machine was able to access a dedicated file server using a version of NetWare and to concurrently access a 'Lite' server. This would enable

a 'client' to, say, print a file from a remote dedicated server on a printer connected to a Lite server. We only tested this with version 2.15 of NetWare 286 but we were assured by Novell that it would work with any version.

Peer-to-peer problems

There are a number of inherent problems with peer-to-peer networking, most of which Novell has failed to solve (though to be fair, most may well be insoluble). The first is performance. If a manager decides to run disk-intensive software on a remote



server machine then the application running on that machine will suffer a fairly dramatic slowdown. It is hard to see how a software solution could have overcome this, but it's a very real issue that potential users should consider before deciding to use this or any other peer-to-peer product.

The second problem concerns the erosion of valuable memory. Many users of this product will probably be running with 640K of memory. On such a machine configured as a client, only the available memory went down to below 500K. Configured as a client and server it went below 450K. Such a low quantity of usable memory is likely to cause trouble for many people.

It is possible to alleviate this by purchasing more memory and a memory manager such as QEMM to load at least some of the software in high memory. This is not an easy operation for the non-technical user (probably NetWare Lite's major customer) and besides, it isn't too clear how much it would help. Novell technical support advised me that neither the client nor the server programs could be loaded high, but the lower-level drivers could. The user manual offered no advice, which is a shame because it's this that will swing the balance in favour of the program for many prospective users.

Network stability

Then there's the issue of network robustness. If this product is aimed at the small organisation, how are network crashes to be handled? The system installed in the PCW office passed the standard tests (rebooting individual client and server machines in the middle of critical operations) with reasonable ease, something which can't be said of many low-cost networks.

▲ Novell's market-leading experience means that it can support all the major network cards

No network is immune from terminators being kicked off or wires coming adrift, so how is the small not-so-expert user going to deal with this? I hope the dealers installing these systems are putting in extra phone lines in preparation for the problems, because as everyone knows, as soon as a network has been installed, for a while it becomes indispensable.

Stable though NetWare Lite appears to be, the user of the client machine is highly vulnerable to operations carried out on the server. If the server

the dedicated machine necessary for a non-Lite solution, the price difference is considerable.

Novell provides a reasonable upgrade path to versions 2.2 or 3.11 of the fully-featured server-based network operating systems, should you decide you need more performance than NetWare Lite can provide.

Documentation

Documentation comes in the form of a characteristically red booklet, with clear and lucid instructions. It is written with the non-expert in mind, with 'an analogy for new users' for each function. While this will be good for novices, the documentation was more than a little short on more heavyweight technical details: for example, only one page served as an appendix to using NetWare Lite in conjunction with an existing Novell network.

Users with more technical abilities will want to know more about using their IPX drivers instead of the IPXODI driver, but they won't be able to find the information here. The troubleshooting section is fairly

thin but does have a comprehensive description of all the NetWare Lite status reports.

Conclusion

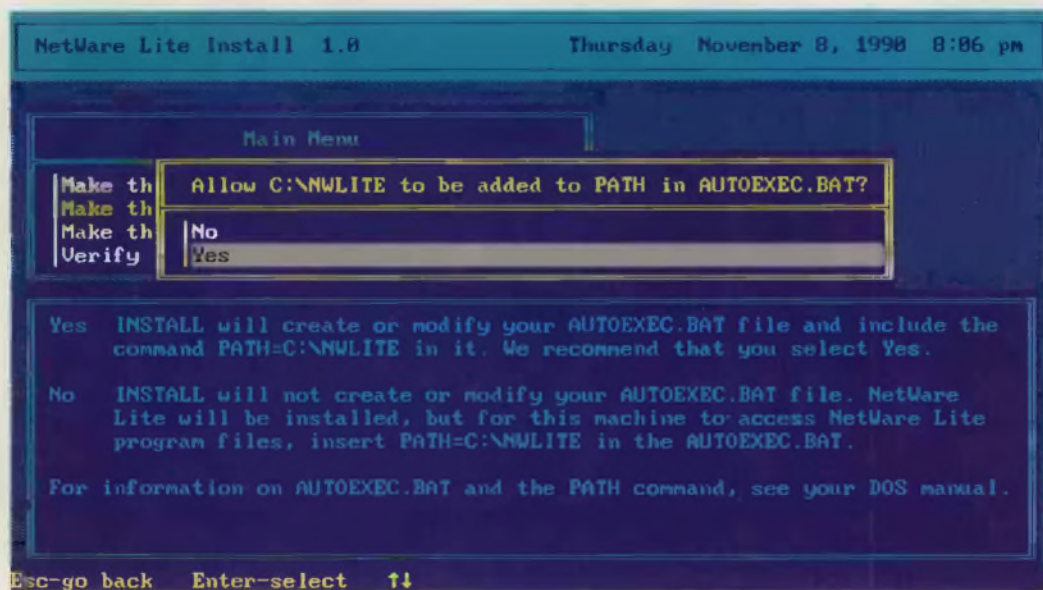
Peer-to-peer networking is getting more attention these days and who better to produce a product in this arena than Novell. It is such an obvious concept that it is hard to understand why it has taken so long for the idea to be realised in a useful product.

It remains to be seen whether NetWare Lite will enable much use to be made of the server machine, as memory and performance issues will limit its use. While that may cause fewer problems for network clients, it does mean that you effectively have a server-based network. It will certainly reduce the cost of high-speed networking for low numbers of machines.

Novell has been one of the premier vendors of PC network software for a good few years and this offering is just what we would expect in terms of functionality, quality and ease of use. It is an extremely well designed, professional product with no serious competition as yet.

Small operations with inexperienced users and no internal support should be cautious because there will be problems, but the backup Novell and its dealers can provide will be at least equal to that of any other supplier at this end of the market. Even larger operations with an existing Novell network may find NetWare Lite a very useful supplement to their existing set-up.

Novell is on (0344) 860400.



△ The install routine is polite enough to ask before altering your Autoexec file

user decides to reset the machine or switch it off there is no telling what potential damage could be done to the client application. In our necessarily limited testing, crashes were recovered gracefully and, to the company's credit, Novell has interrupted the soft boot to remind the user of this potential hazard.

Look-and-feel

The idea of a network is that it should look and feel to the user just like a standalone machine except with more resources available, and when the user has logged in to NetWare Lite, this is very much the case. When network drives have been mapped in they can be used and accessed just as local drives. The net program itself looks and feels very familiar, having an almost identical user interface to its older brothers and sisters.

The program is completely menu driven and easy to use, and most commands can be executed from the DOS prompt too. The commands are similar to those in full versions except that the word 'net' is inserted before each keyword so 'capture' becomes 'net capture'.

Prices

NetWare Lite costs £70 per user so the minimum cost to link two machines is £140. A copy of the program is required for each user. A five-user network will cost £350, which should be compared to the price of a non-NetWare Lite solution that would cost in the region of £650 for the cheapest alternative. When you take into account the cost of



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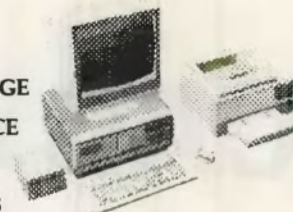
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CAD of the track

Formula One racing pushes Computer Aided Design as well as cars to the limit, with machines undergoing an almost continuous process of redesign with hi-tech precision techniques. Simon Rockman visited the Tyrrell Racing Organisation to find out more.

Imagine a business costing millions each year in research and development, with a product that changes in design to the extent of 60% a year — even though a single design mistake can kill. A product, moreover, that will be so much scrap by the end of the year.

That's the racing-car business, and the snags have not stopped the hard-nosed Japanese getting involved in a big way. The official-supplier list for the Tyrrell Racing Organisation includes several Japanese companies: Angle, a clothing manufacturer; Nippon Shinpan, a bank; PIAA automotive accessories; Calbee, which makes crisps and snacks; and NGK spark plugs.

Tyrrell's engines are supplied by Honda, and Japan's Satoru Nakajima is number two driver.

Tyrrell cars also blazon the name of Epson on their sides, giving publicity (the *real* product of motor racing) in exchange for cash sponsorship. But Epson's involvement seems to begin and end there: Tyrrell doesn't actually use Epson computers.

But US AutoCAD publisher Autodesk is very much involved,

and Tyrrell's need for a CAD system is clear. A racing car has 2500 parts, each of which is computer-designed to be as light and as strong as possible. Colin Chapman of Lotus worked to the rule of thumb that 1lb weight equals 1/100th a second per lap. Chapman's first law of engineering states: 'If it breaks it's too light, if it doesn't break it's too heavy.' This rule was formulated a long time ago, and despite the radical changes in car and circuit design it still holds true.

There is also a good logistical reason for saving weight: Tyrrell has to take around 30 people and 30,000kg of cars and spare parts to each race (the

Formula One Constructor's association charters two 747s to take all the British teams to long-haul destinations).

Everything has to be incredibly strong: a racing car will accelerate from a standing start to 100mph and back in under 6 seconds, which generates forces of up to 3G under braking. In the hands of a genius, like Jean Alesi who made his name in the number 4 Tyrrell by taking on Ayton Senna at Phoenix, the car will dance. The side forces are so severe that drivers do special exercises in order to build up their neck muscles. The necks of Formula One drivers are second in size only to those of American footballers.

Tyrrell employs 100 people, all focused on getting the very best performance out of a car which will race 16 times in a season. While CAD is important, there is little computer-aided manufacture. The output of AutoCAD is given to the fabrication department as hard copy. The manufacture is a mix of traditional craftsmanship and the latest hi-tech. A part such as the upright which holds the wheel to the suspension, which would be cast in a mould for your Fiat or Ford, is built from rod and tube and sheet for a racing car.

A Tyrrell engineer with the skill of a master jeweller takes a week, working with titanium and tungsten, to produce the part an operator in a car factory would make in seconds. The difference is quality and, of course, weight. A number of racing car manufacturers have projects to build road cars which will sell for sums around £500,000. If they are built to these standards they really are worth ten times as much as a top-notch sports car.

Machine tools

The machine shop is the one area where computer technology does stand alongside the craftsmen. Here CNC (Computer Numerically Controlled) machine tools are used to turn solid aluminium alloy and even titanium into precision parts. Currently the tools are programmed by hand, but the possibility of driving them directly from AutoCAD is being explored. Even wheelnuts are made in-house, from an alloy so soft that the thread of a



△ George Ryton had used conventional paper and mainframe systems for racing-car design but he ultimately decided that a PC-based system was the best solution

cross-threaded nut will simply strip off, leaving the bolt thread intact for a new nut.

Alongside the traditional craftsmanship is the latest in hi-tech precision manufacturing techniques. The undertray of the car is made from sticky-backed carbon-fibre sheets which are laid down in layers like a hi-tech papier mâché. The result is put into a plastic bag, from which the air is evacuated, and the whole thing is cooked at 40°C. Behind the undertray is the (smaller) carbon fibre exhaust diffuser.

An undertray costs about £7000 to build and the company expects to destroy two or three in each race and during pre-race testing. Small circular titanium skid plates are fitted at vulnerable points on the undertray to reduce wear (it is these that produce the sparks you see on television). The world's racing circuits are not as billiard table smooth as they appear and the undertray is riding only a few centimetres above the track. On street circuits the potential for wear would be enormous without the skid plates.

Attached to the main section of the chassis, the monocoque, is the engine (with rear suspension, gearbox and rear wing attached) plus the nose and side pods which house the oil and water radiators, provide driver protection, and help generate aerodynamic downforce.

The Tyrrell team has continued to develop the aerodynamic efficiency, introducing the high nose and hidden splitter which led to the distinctive anhedral wing (now copied by many other teams).

The integral design of the nose, undertray, diffuser and rear wing has been refined to increase the down force when negotiating low and medium speed corners while maintaining positive handling characteristics. The design has to allow for the side-entry fully-ducted internal radiators. This means that changing a component like the front wing can have reverberations through the rest of the design, so a CAD system is a must.

"Ninety per cent of the work Tyrrell does with AutoCAD is 2D: it replaces the designer's pen and drafting board but the result is much the same"

Survival pod

But it is not only the aerodynamics that AutoCAD has to contend with. The car has to meet the requirements of the FIA international racing organisation, which insists that drivers must sit in an extra-strong 'pod' to maximise their chances of surviving a crash. A rule introduced in 1990 stipulates that a driver's feet must not extend

beyond the front axle. This, combined with the need for a relatively short wheelbase, means that racing drivers are either short or uncomfortable. Most are both.

Ninety per cent of the work Tyrrell does with AutoCAD is 2D: the software replaces the designer's pen and drafting board but the result is much the same. But sometimes it is useful to view a component in 3D, and one of the most interesting examples is the design for the fuel tank.

This is not the simple matter it might seem at first sight. Strict size and safety regulations tend to breed conformity of appearance, but the design is crucial to the car's performance: weight is every-

▽ The 1991 Tyrrell 020 was the first racing car to be exclusively designed using AutoCAD



thing, and the fuel tank weighs 350kg at the start of the race and almost nothing at the end. This, in a 500kg car carrying a 700kg engine, represents a weight loss of nearly 25% — and designers have to establish how the changing load can best be distributed. Tyrrell used an optional solid modelling package called Advanced Modelling Extension (AME), which creates 'solid' models that can be represented in AutoCAD as a mesh or wire-frame model. This enabled Tyrrell to model a fuel tank and investigate its centre of gravity; the results will govern the 1992 design.

The engine is one area in which Tyrrell has little control. In 1991 the company used the V10 Honda RA101E but it has lost this superlative Japanese power plant for next season. In most racing cars the engine block is part of the car's structure, providing a rigid mounting point for the rear suspension and wing. The size, shape and weight affect the chassis and airflow. Development on the car continues through the off season, but major elements of the design will be affected by the new engine. (As an aside: Tyrrell is not allowed to start its own Honda engines. When a car is being tested, Honda sends mechanics from its base just outside London. There are always Japanese engineers in attendance at races.)

The application of CAD is clearly sensible but the choice of a PC-based solution is less obvious. The industry is in many ways more advanced than aerospace (Tyrrell was using an aluminum-lithium

alloy a year before aircraft manufacturers) and cost is not of paramount importance. Winning is.

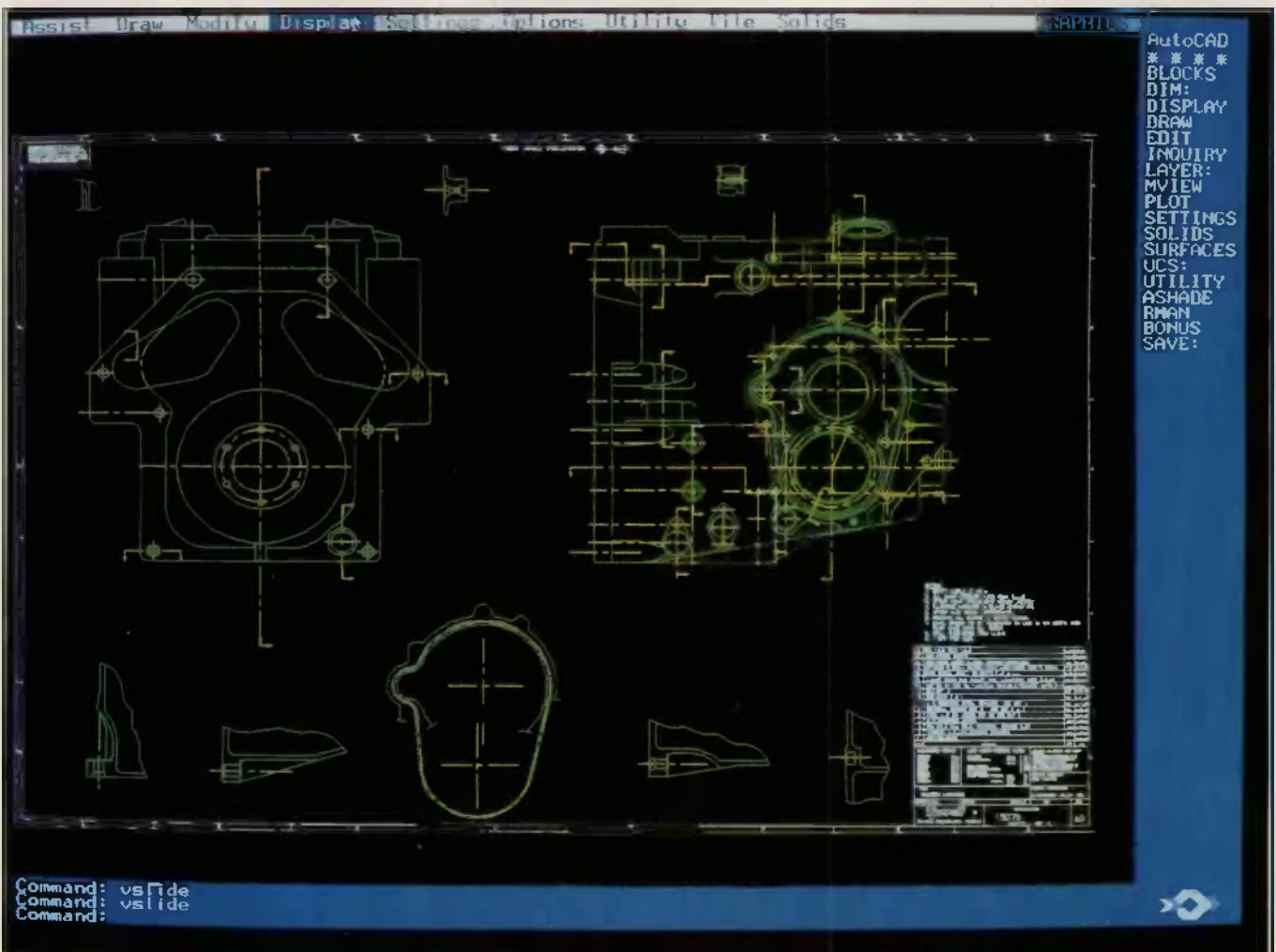
The decision to go for AutoCAD was made by George Ryton, Tyrrell's likeable chief designer. George previously worked at Ferrari, where he gave luscious curves to the 1989 Ferrari 640, probably the prettiest racing car of modern times. To do this he used a pencil; Fiat (owner of Ferrari) used a powerful mainframe system. George wasn't happy with that system, and when he joined Tyrrell he wanted a system the eight designers could use immediately. Starting slowly, using AutoCAD release 10, the drawing office expanded its computerisation into a 12-station Ethernet network based on RM Nimbus machines with large screens.

Each part of the car is given a number which is used as the DOS filename and referenced in all the paperwork. The jigsaw puzzle takes a while to assemble and all the parts have to be built to a schedule. So Tyrrell installed a customised project management system which includes the details of which parts use which resources, how long each takes to make, and how they interact.

Religious fervour

Races are a fortnight apart on average, a time in which major changes may have to be designed and put into effect. Even given the religious fervour with which those in motor sport work 24 hours a day to get a car ready, there may not be enough time. The software will determine what is possible. Designers

▽ Around 90% of the work Tyrrell does with AutoCAD is 2D, with only occasional need for 3D modelling





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have to establish which parts will be affected by a change and access them under AutoCAD to make the necessary adjustments. George Ryton reckons that the CAD software makes his team 50% more efficient, so that a lot more is now possible between races. 'We write a job sheet at the end of each race, noting down the design elements. Some require drawing changes, new parts and modifications. If we were drawing longhand we would simply not have the reactive rate. We'd probably only be able to do 30% of what we actually do now.'

Of the eight people using the design software now, only two started with CAD experience. Some picked up the system in a couple of days, rapidly reaching the proficiency they had attained with conventional drafting methods. The first design Tyrrell tried was a wheel, which conventionally doesn't need re-inventing. Normally the initial design would take two or three days, after which the profile intersections had to be produced. The job took a day with AutoCAD, and the intersections a few hours.

The first major task was Tyrrell's six-speed, twin-shaft transverse gearbox. This is the most complicated assembly built by the company, with a vast number of interchangeable parts (the choice of gears is made at each circuit to suit the track and conditions). Managing director Bob Tyrrell says that it is the lightest gearbox in the industry. Mating it to the Honda engine is no mean feat, because oil cooling is shared in the dry sump system. The engine's enormous power and torque is handled by a three-plate carbon clutch — first gear is regarded as disposable and will not last much more than a couple of re-starts to a race.

AutoDesk's involvement has progressed beyond

that of supplier — the company now actively embraces feedback from Tyrrell. The relationship is symbiotic: AutoDesk gets a better product, tested in the hot-house environment of Formula One racing; and Tyrrell gets a chance to shape the software to its own requirements, with early access to improved versions.

When showing PCW around the factory Bob Tyrrell frequently referred to the cars as 'scrap'. Amazingly, the company will spend £3m to £4m on materials each year to build nine or ten cars which are then unwanted at the end of the season. But retired Formula One cars are raced by enthusiasts and are valuable — and it is not unusual for teams to give cars to drivers as a reward. Nigel Mansell has a Ferrari he drove during his spell with that team and Jackie Stewart, perhaps Tyrrell's most successful driver, has a Tyrrell which his son Paul (also a successful driver) takes out at special events.

"Tyrrell has a program which emulates the effect of driving around the world's major circuits. This saves about 60% of the time necessary for track testing"

▽ Building a racing car's suspension is a complicated balance between weight and strength, a problem compounded by the competitive nature and short deadlines enforced by the sport

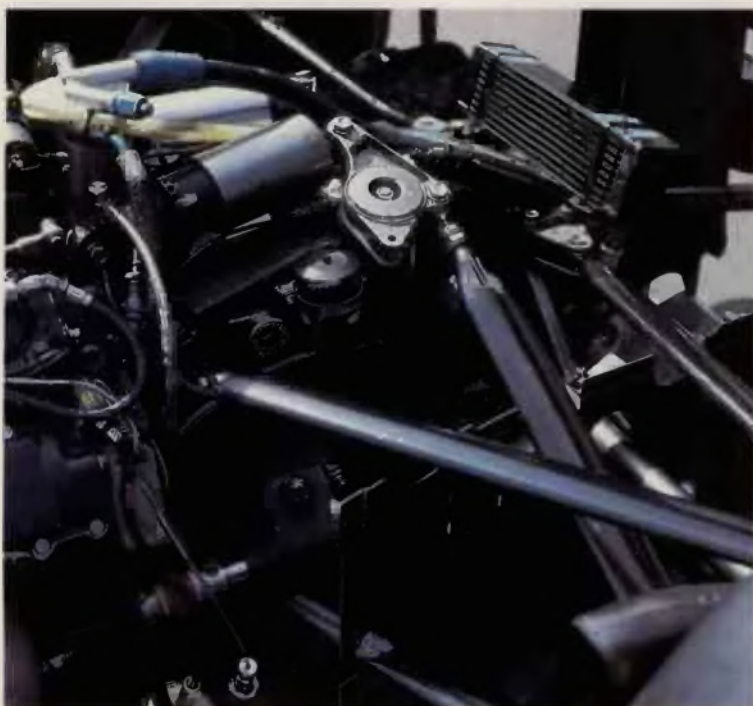
Wind flow

AutoCAD is also used to help build scale models of car designs for wind tunnel work. These 'real' models are much more effective than computer simulations for modelling the effects of the wind because airflow constitutes a chaotic system in which minor changes can make huge and unpredictable differences. Observing the effects in a wind tunnel cuts down testing time at a circuit by 40%. Still, a good bit of simulation goes on. Tyrrell has a program (still pretty much under wraps) which emulates the effect of driving around the major circuits of the world. This saves about 60% of the time necessary for track testing.

Tyrrell currently employs only one programmer, who is responsible for the data logging system. This uses a smart card to record non-engine aspects of how a car performs. The card is read after a session to find out what went on while the car was whizzing about. With a project to introduce Active Suspension, and an increasing number of computer projects, the team looks a little under-resourced.

Tyrrell has recently started using some of AutoDesk's other products. The mesh from AutoCAD is fed into AutoShade, which transforms it as a 100% accurate 3D image of the design. Sponsor logos can be digitised and surface-mapped onto the car, and the results can be visualised using Animator Pro (see last month's PCW).

Tyrrell often uses these 're-sprays' to show potential sponsors how a car will look bearing their logos. A sponsor can be sent a VGA presentation or a video tape with no need for anyone to cut stencils or pick up an airbrush. Lighting and camera angles can be chosen to accentuate the area of the car surface Tyrrell is trying to sell. (Painting the cars is currently sub-contracted, but Bob Tyrrell plans to bring this in-house because the paint represents a noticeable weight on the car. Either way it is expensive: around £10,000 a car). For my part I think the Tyrrell cars look great as they are.



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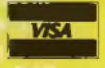
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Practical neurocomputing

Neural networks are made up of highly parallel webs of computationally simple units that act in unison, often to striking effect. Nick Beard assesses their value as an alternative to the rigid and complex digital computing.

Neural networks are now an established and important part of the computer scientist's toolkit, especially for those specialising in artificial intelligence and pattern recognition. Although neural networks have a biological flavour (they are 'in-

spired' by real brains) implying parallelism, much valuable neurocomputing can be achieved on a standard PC.

Here we will look at the background to neurocomputing, such as differences between expert systems and neural networks, focusing on getting useful work from a neural network. We will also look at a number of packages that turn your PC into a neurocomputing system. These are the latest release of the extremely potent NeuralWorks; Autonet, a combined neural net and expert system that does almost *everything* for you; Genesis, a Canadian package, and Braincel, an Excel add-on that brings neural nets to your spreadsheet.

Training trouble

The majority of commercial neurocomputing applications are based on the back propagation of errors training algorithm — back-prop — or one of its variants. This is a powerful technique, and in general, if a relationship can be learnt by a neural net, back-prop will do so (for further details of the back-prop method, see 'Having a brainwave', PCW February 1990).

In essence, the algorithm is a gradient descent method. It works like this: the correctly trained state of the network is defined by a particular set of weights for the interconnections between nodes in the network. As the weights are changed, the network output error changes. The goal of training is to minimise this error, which can be viewed as searching the error surface (see below). At any point on the surface, the best bet is usually to move down the error slope: descending the error gradient. Unfortunately, in certain problems, this can result in becoming stuck in a false minimum.

The underlying maths is gradually becoming better understood, and techniques for ensuring that networks learn quickly and effectively are being developed. There is, however, still a 'black art' feel to maximising their performance. Training is complicated by the fact that it is possible to overtrain a network, where it learns the exact nuances of each and every case in the training set. In this situation the output error after training would be zero for the training data, but higher for the test data that the network has never seen before. This might not matter when learning Boolean relationships, but for classification of noisy or fuzzy data, it can seriously diminish network performance. Trial and error is as yet the only realistic solution.



An alternative approach

It is difficult to find ways of describing the enormity of digital computing's impact without resorting to clichés. Not just the raw processing power for crunching more numbers than ever previously imaginable, but also the increasingly smart applications, the progress of artificial intelligence. However, the *limits* of computing have appeared in unexpected places. An alternative to digital computing, *neurocomputing*, could provide solutions where conventional digital, *Von Neumann* (after computer scientist John von Neumann) approaches have failed.

Neural networks are systems that *learn* — how to recognise shapes, patterns, data series, and how to classify them or predict their future behaviour. Connectionism, neural networks and parallel distributed processing are more or less synonymous with neurocomputing, and represent a novel and important approach to computing. Rather than the complex central processor and separate memory of a digital computer, artificial neural nets are made up of highly parallel webs of computationally simple units that act in concert. Their effects can be striking.

Brain roots

There are fundamental differences between computer and brain *architectures*. Computers are usually based on the Von Neumann architecture, rapidly carrying out instructions, one at a time. Brains, however, are densely interconnected networks of neurons, operating in parallel. Brains are not fast clock-speed machines, operating instead at 'speeds' in the millisecond range. Compared with the 4.2 nanosecond instruction time of a Cray 3, there is a million-fold difference. Comparisons between brains and computers might offer clues as to how people manage such impressive computational feats. However, irrespective of what neurocomputing can teach us about brains, it is proving to be a valuable technology.

Neural networks that are used commercially or researched in computing laboratories, are very small compared with real brains usually by a factor of millions. Nevertheless, they have been applied to many problems, including text-to-speech conversion, image data compression, handwriting recognition, signal processing and financial modelling.

Expert systems and neural nets are very different. Expert systems are much like any other program in that they require detailed step-by-step instructions on how to solve problems. Neural nets are different — they are taught by example. Neural networks are systems that are deliberately constructed to make use of some of the organisational principles of the human brain.

Neural networks are often simulated on standard serial machines, which can make them slow, especially during training. Simulating a densely interconnected web of many hundreds of neurones — simple processing elements — takes considerable computer power, therefore neural networks can become far more significant when implemented in real-time hardware.

One of the first in this field is Carver Mead, of the California Institute of Technology, who has, for example, implemented a silicon retina (see 'Frontiers', April 1991). Others have implemented a few neurons on a chip but Mead was undoubtedly the first to achieve neural implementation on any significant scale.

Intel has already released its first neurocomputing chip. However, although there are real concerns over performance on single processor machines, there are many well circumscribed problems where neurocomputing on a PC is sufficient. There is no need to spend a fortune in order to use a PC as a neurocomputing platform, though a maths co-processor makes a *big* difference. If you want to do heavy-duty neurocomputing, there is now a range of specialised add-in cards that will increase the performance of a 386 PC by orders of magnitude.

Braincel

Even if it deserved no other commendation, this product warrants a rosette for helping to rid neurocomputing of its odour of exoticism. What could be more mainstream than Excel? If you can use Excel, you can use this neural network. It is not the most powerful neurocomputing environment ever developed, but it works — not perfectly, but well enough to use. Operating within Microsoft's Win-

dows spreadsheet, Excel 3, makes neurocomputing seem as ordinary as doing your accounts. Braincel lets you simply enter your data into Excel, define a few ranges as specified in the Braincel manual, and set the thing running. It lets you know when it has finished learning. You can leave it running in the background, though it is not entirely happy about allowing other programs, such as the evil timewaster Tetris, access to the CPU.

To use Braincel, the same basic principles apply as with any neurocomputing system. First, decide what the problem is you want to solve, and gather data to provide examples to the network from which it can learn. Each example has to include the 'correct' output. Then train and test the network (these steps tend to vary between different systems!) which in the case of Braincel involves telling Excel which range holds the training data, which holds the test range, and firing up.

The *network* in a neural network is made up of simple processing units. Each one makes a 'decision' on the basis of the inputs it receives. This decision is a transformation of the sum of the input signals, and the formula used for the transformation is called the *transfer function*. This requires inputs between fixed limits, usually between 0 and 1. Most datasets for real-world problems are outside this range, so some conversion is required. This is mathematically simple, as long as you know the *minimum* and *maximum* values for each input item. Braincel has two rows of data at the bottom of the list of cases, which are the minimum and maximum values for each input item in the column above.

Braincel uses the standard back propagation of errors training method, which is the most widely used network training routine (see opposite). It also has an alternative method called *back percolation*, which can be faster in some circumstances. The thing learns for a fixed length of time or until the overall output error level reaches a preset minimum. The trained system is referred to as an *expert*, which is probably not the wisest choice. These things are quite distinct from expert systems, and calling them experts will only sow confusion.

Installation is simple, with a dearchiving routine to unpack the files from a single floppy. From Excel, loading a file Braincel.xla adds a menu item to the DATA Excel menu option. Data is entered while still in Excel, and then running Braincel prepares the system to learn. Braincel knows about the DDE, so hot-links can be established with Excel. There is a macro library listing to enable you to embed Braincel functions within Excel routines.

The general flavour of the package is still rather rickety — it stumbled and fell on a few occasions during the installation and loading process. It registers on the Excel 'recently opened files' menu, but gets into trouble if you try to run it from there. Error trapping is not ideal, and on one occasion it caused my entire system to hang *completely* (big red switch job) when trying to exit Windows. In order to access Excel ranges, Braincel jumps around all over the place and causes a disconcerting screen flashing. Input and output nodes are limited to 80 in total. These problems are said to be due for fixing in release 1.1, which will be available any time now.

Braincel could do much to popularise neural

nets by providing an environment that does not require the user to learn an entirely new interface, and does not insist on fussing around with other software to prepare data for the network.

Autonet

Neural networks can be difficult to train: there are lots of rules of thumb that help, but these are hard to come by. With Autonet you don't need them. It has considerable neurocomputing experience built into an expert system that controls the neural

network training process for you. The result is a system that is easy to use, yet powerful enough to be applied confidently to serious problems.

To use Autonet, simply present it with a batch of data that represents the problem to be solved. You do not even have to bother about the minimum and maximum values, as Autonet sorts this out for you. The illustration used in the manual is of classifying flowers: irises. From four input attributes, petal length, petal width, sepal length and sepal width, the goal is to train a network to be able to allocate

West Side Memories

Persuading a computer to play chess is far easier than having one safely drive a bulldozer — or even a bicycle. The simple skills we take for granted are often the most difficult to reproduce in computer programs. There are some things that people can do with such ease that it can be a surprise to find that they are almost irreproducible by computer. For example, we have remarkable pattern recognition capabilities, and a useful attribute called content addressable memory. Try and guess what these clues describe:

It is a navigational instrument. It is not a compass. It is used to measure the angle of the sun over the horizon. It enables you to determine your geographic position. It contains a telescope, a triangular frame, and a mirror.

You are now likely to have identified the object, or to know that you have no idea what it is, or will know that you know it — and its name will be on the 'tip of your tongue'.

Cognitive scientist Philip Johnson-Laird (*The Computer and the Mind*, Fontana 1988) uses this example to demonstrate the essential difference between human and computer memory. Such recall is very difficult to mimic with a conventional database, but a connectionist approach handles easily (the object was a sextant).

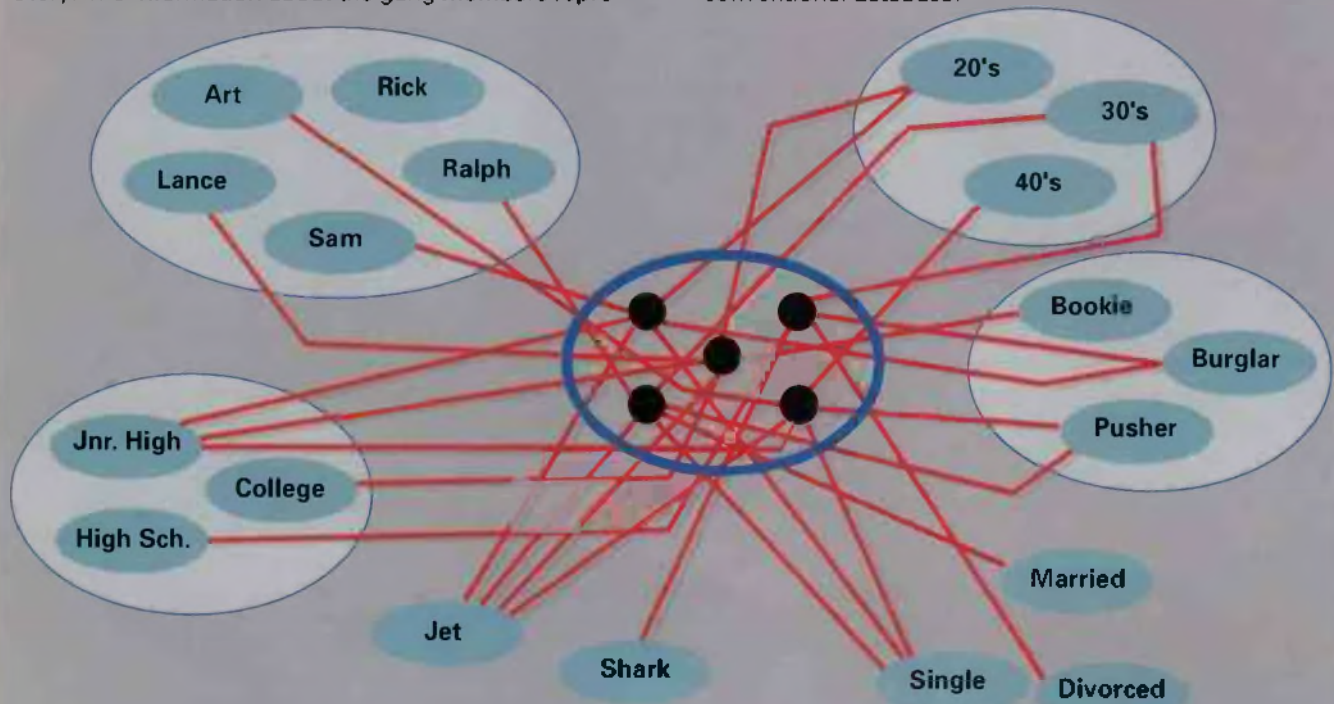
To see how human memory might work, consider the Jets and the Sharks, the two street gangs from *West Side Story*. The information about the gang members repre-

sented in conventional database style might be stored under the headings NAME, GANG, AGE, EDUCATION, MARITAL STATUS, OCCUPATION. A connectionist network would work in a very different way.

As shown below, the units (the simple computational nodes which roughly correspond to brain cells) are grouped into seven pools, each corresponding to one of the six attributes such as NAME or GANG, and a pool of instance units which contains a unit for each individual.

Altogether there are 68 units — the diagram below shows just some of them. Each unit has an inhibitory connection to every other unit in the same pool, plus two-way excitatory connections between each instance unit and the units for its attributes.

To retrieve an individual's attributes from his name, we stimulate his name unit and allow the stimulus to spread to the instance units, and from there to the units for the attributes of the instance. After a number of cycles, the network will tend to show high activation (stimulation) levels on his attributes. This is similar to recalling an entire memory from part of it — a fragrance recalls a dinner, a romance, a piece of music. In real brains, the scale of the interconnections is increased by a factor of 1010. The behaviour of this system, as we know, is quite different from that of a conventional database!



The units and connections for some of the individuals in the Jets and Sharks. Adapted from *Parallel Distributed Processing*, JL McClelland and DE Rumelhart, MIT Press

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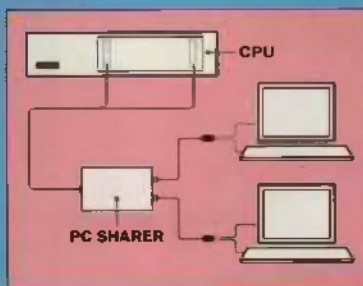
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plants to the correct species according to the values of these parameters. There are three species, *Setosa*, *Versicolour* and *Virginica*.

The system is menu driven, and the first job is to tell Autonet about the data. It needs to know where the data is (path), the training data filename, test data filename, the number of cases in each file, and the number of inputs (in this example four per case). Data files are ASCII, but Autonet makes one pass through the data to convert it into binary format to improve speed. To start the process, select method of analysis (neural network, or a traditional pattern classification method provided for comparison) and press 'learn'. The network gets round the problem of overtraining by retaining 15% of the training data and periodically testing the network's performance against it during training. It remembers the best state of the network from all the trials, and when training is finally stopped, uses the internodal weights that give the best performance on this test data. This is a novel and extremely

valuable feature that sets this product completely apart from other user products. This is not such a big deal in the case of NeuralWorks (see page 372) which is an engineer's tool, but for otherwise non-neurocomputing folk, it's a boon.

Installation is simple, though seriously marred by the presence of a copy-counting 'protection' program. These routines really are a damn nuisance — a hard disk failure is bad enough without being unable to reinstall all your software on the new disk.

The instruction manual is short, clear and simple, aimed at getting you started rather on problem solving than teaching you the background theory of neurocomputing. There is a brief overview for those who want it.

There are two implementations of Autonet, aimed at either *classification* problems, like the iris grouper above, or *prediction* problems, such as trying to predict share price movement (which neural nets *cannot* do). These are optimised differently, and so

you must load the appropriate one. There are advanced features available within the network, such as the ability to amend the 'cost matrix' to make the networks attach more significance to specific errors. For example, imagine a network set up to help read blood tests via a microscopy image processing system. It is far more important that the network errs on the side of caution, referring slides to human experts where there is *any* doubt, than that it treats all mistakes as equally bad (as it will never be perfect). In Autonet, this is helped by attaching a far greater *cost* to certain classes of error; thus passing a bad slide as good would, during the training process, create a much bigger output error than classifying a good slide as bad.

To keep accounts for a small business, you can either buy a spreadsheet and set up your own accounting system, or buy an accounting program. Your choice will depend on whether you know all the appropriate rules and procedures, and whether you can be bothered learning a spreadsheet in sufficient detail for a DIY system. Neural networks now offer a similar choice. If you really want to do serious neurocomputing, then NeuralWorks is the package of choice. If you understand what neural nets are good at, but do not want to learn about building and training them for yourself, then Autonet is for you. Networks produced by Autonet can be exported to be run by NeuralWorks II.

FlashCode-generated C code for a neural network trained to function as an Exclusive-Or logic gate

```
/* Sun May 26 09:43:40 1991 (xornet.c) Recall-Only Run-time for
<sample> */
/* Control Strategy is: <backprop> */
#ifdef __STDC__
#define ARGS(x) x
#else
#define ARGS(x) ()
#endif /* __STDC__ */
/* - External Routines - */
extern double exp ARGS((double));
/* *** MAKE SURE TO LINK IN YOUR COMPILER'S MATH LIBRARIES ***
*/
#ifdef __STDC__
int NN_Recall( void *NetPtr, float Yin[2], float Yout[1] )
#else
int NN_Recall( NetPtr, Yin, Yout )
void *NetPtr; /* Network Pointer (not used) */
float Yin[2], Yout[1]; /* Data */
#endif /* __STDC__ */
{
    float Xout[6]; /* work arrays */
    long ICmpT; /* temp for comparisons */
    /* *** WARNING: Code generated assuming Recall = 0 *** */
    /* Read and scale input into network */
    Xout[2] = Yin[0];
    Xout[3] = Yin[1];
LAB110:
    /* Generating code for PE 0 in layer 2 */
    /* Generating code for PE 1 in layer 2 */
    /* Generating code for PE 0 in layer 3 */
    Xout[4] = (float)(2.3759611) + (float)(-6.5872302) *
Xout [2] +
        (float)(-6.5899692) * Xout[3];
    Xout[4] = 1.0 / (1.0 + exp( -Xout[4] ));
    /* Generating code for PE 0 in layer 4 */
    Xout[5] = (float)(6.6503196) + (float)(-4.3457026) *
Xout [2] +
        (float)(-4.3504548) * Xout[3] + (float)(-10.089293) *
Xout [4] ;
    Xout[5] = 1.0 / (1.0 + exp( -Xout[5] ));
    /* De-scale and write output from network */
    Yout[0] = Xout[5];
    return( 0 );
}
```

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Autonet brings practical neurocomputing to a wider range of users than any other product available. It deserves to be a success, and perhaps even more so now the forthcoming Windows release is available.

NeuralWorks Professional II/Plus

There is nothing else like this on the market. It is an entirely self-contained neural network laboratory and network development suite that enables you to build almost any imaginable neural network on a range of platforms. NeuralWorks II was reviewed in PCW in February 1990 and it was good then. It is even better now. This review is based on the latest 386 Protected-Mode version, though it is also available in 286 Protected-Mode, Macintosh, Sun and various accelerator card versions. Trained networks can also be dumped as C source code for re-compilation to any other platform that has a C compiler.

This is definitely not a Windows-compatible product. The company — bravely and quite properly — would not compromise the performance of its products to conform to a standard that cripples a powerful 386. To port to Windows would have resulted in a graphics interface 3-5 times slower, disabled the co-processor access, and restricted the memory available to NeuralWorks. Instead of wasting time on a disruptive and cosmetic re-write, the

company has produced a potent protected mode product that requires 2Mb of RAM and prefers a co-processor too. So, installation can include setting up a batch routine to ignore the likes of SmartDrive and reboot to free up extended memory for NeuralWorks.

NeuralWorks is mouse and menu driven, and has a new feature called the Tool Palette. This is a column of icons, from each of which an arm of new icons unfolds when pointed at. These are tools connected to a specific task, such as dealing with a specific node (or processing element) in the network. The range of neural networks available is as wide as your knowledge — or imagination — could desire, as you have effective control over every aspect of the network's function. To speed things up, though, there is the Instant item on the opening menu, from which you can select pre-designed networks.

Having trained your network, *Flashcode* produces a C source code listing of it for inclusion into other programs. This is a new addition to NeuralWorks;

previously the *Designer Pack* was needed to do this. It is amazingly simple. The listing in Figure (**) took about 20 seconds to set up and generate. Designer Pack is still required if you want to generate C source code for *trainable* nets, but if you are happy to use a routine with weight values hard coded, Flashcode will suffice.

An oft cited problem with neural nets is the difficulty of extracting explanations from them. Expert systems are coded so as to be able to provide an audit trail of any decision they make. Neural nets are less forthcoming. However, there are techniques for getting to the heart of the network, and NeuralWorks provides one. ExplainNet gives you the relative effects of each input data item on the output.

Documentation is excellent as ever, split over four volumes. The main three — reference, tutorial, and theory — are the same across all platforms. A specific system guide is provided to go with your particular machine. Copy protection is provided through a printer-port widget.

It is difficult to fault this product, though it is expensive and primarily aimed at the serious user. There is a cheaper 'cut-down' version called Explorer, which brings much of the teaching ability of the system but not value to engineers. It must still be at the top of the league for serious, flexible, general purpose neurocomputing systems.

Genesis

Genesis was developed by Gary Josin, a Canadian academic who has also worked as a consultant to NASA. He has built neural-net based jet-fighter autopilots, using a technique called *performance functions* that tells the network about the basic laws of physics in order to give it an additional element of wisdom. Genesis implements performance functions.

Genesis is a serious package, aimed at users who want high performance back-prop systems on PCs. It has a modular structure, which includes a common 'network build' user interface, with separate modules which contain the elements for a specific network paradigm. I only had access to the back-prop module for this review. It is through the common user interface that networks are designed, trained and tested. This is character based, on the grounds that this eases porting to other platforms. You could argue that if NeuralWorks can manage a graphical interface across various platforms, so every other package should. This would be trivial, though, unless you are truly wedded to an invariant glitzy front-end. The Genesis user interface is effective.

Training a network is not entirely straightforward. It can be even more difficult when targets for the network are not known precisely. How can learning be controlled in these circumstances? Genesis uses performance functions to provide further information to the network about what the network is learning but is not contained in the training set. Response learning and reinforcement learning are also available, so that networks only when the output is not in the range defined by a suitable function. User I/O routines are available to Genesis, to ease linkage to external systems, and a template function written in C is provided to help.

Neural Network Software Details

Braincel

Available from

Keyword Software (0942) 825344

Price

£199 + £2.50 P&P + VAT

Hardware required

PC with 2Mb, Windows-compatible graphics card, DOS 3+, Windows 3+, hard disk

Autonet

Available from

Recognition Research 061-449 8628

Price

£997

Hardware required

PC 286 or above with 640K, DOS 3.2+, CGA or above

NeuralWorks II Plus

Available from

Recognition Research 061-449 8628

Scientific Computers (0444) 235101

Price

£1795; £249 support price

Hardware required

286 with 1Mb (for 286 version) or 386 plus 2Mb, EGA or above, 4Mb disk space, DOS 3.2 or above. Supports Weitek and i860

Genesis

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Neural Systems Inc (Canada) 604-263 3667

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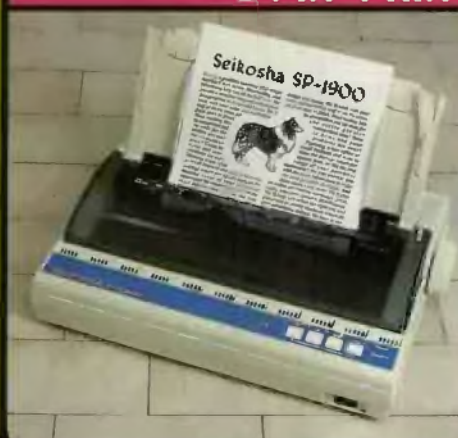
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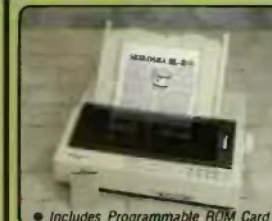
STARTER KIT: £25

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324 CPS 80 COLUMN

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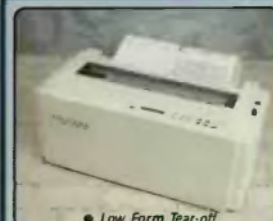
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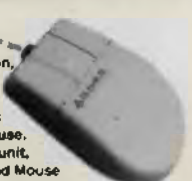
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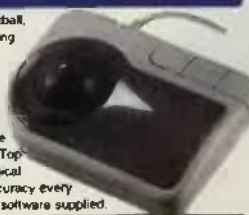
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Tandon NB/386SX

Life in the mucky confines of Guy Swarbrick's bag are sadly taking their toll on Tandon's 386SX notebook. But to its credit, after three months the machine is coping quite well with Guy, his anorak and some C++ code on the train journey home.

Winner of the PCW Seal of Approval, the Tandon NB/386SX is starting to look a little the worse for wear. It's still in one piece, but travelling day in, day out, in my bag, sandwiched between *The Independent* and the *Chatham, Rochester and Gillingham News* has left the pale grey case streaked with the tell-tale black smudges that only newsprint can make.

Picking the Tandon up leaves small amounts of print on your fingers and, consequently, the catches which secure the lid of the clamshell case, the LCD brightness and contrast controls and the power switch are also ingrained with muck (though interestingly, the keyboard is made of sterner, or at least, less porous stuff). The thing looks more than three years old, never mind three months.

That, after all, is why PCs are light grey in the first place; just in case the technology race ever slows down. Sometime in the future, a PC will be

built which, six months later, is not obsolete. You'll still want to replace it, though, because it looks and feels too old.

The only non-cosmetic sign of ageing is the battery compartment, which I suspect would rather be protected by a sturdy briefcase than slung in a bag. The hinge has deformed a little and the door has developed a rather irritating habit of opening on its own. More than once I've wondered why the thing was dead, only to discover that the battery was missing and have had to fish around among the pens, disks and bits of paper that populate the bottom of my all-purpose carrier (that's carrier as in useful device for transporting assorted objects, rather than carrier as in Sainsbury's/anorak).

That aside, everything works well. DRDOS 6, which found its way onto the hard disk shortly after the Tandon was liberated from our first Group Test, has gone to make way for the more conservative MSDOS 5.

I didn't want to do it. It made sense to have at least one machine in the office (most of the time, at least) which ran Digital Research's alternative operating systems and I hadn't had any problems with it. I even had QEMM 6 working perfectly, right down to the 'Stealth' technology the latest version of Quarterdeck's all-purpose extended/expanded memory manager uses to replace useless portions of BIOS ROMs with useful extra RAM.

Night work

Unfortunately, one night I had to do some work on the Windows 3.1 preview which appeared in the last issue and I had to do it on the train on the way home. Windows 3.1 and DRDOS 6 simply refuse to talk

to each other, so DRDOS had to go.

Ever since then things have been fine. This Long Term Test was written on my lap, in Word for Windows 2.0 under Windows 3.1 while watching Borland's *World of C++* tutorial video. Battery life is still good, with no sign of memory problems yet, although I have been quite careful about running the batteries down.

What more could you want? Well, some more RAM and a bigger hard disk would be nice. The paltry 2Mb of RAM which comes as standard is fine for most single programs under Windows, but anything more sophisticated is out of the question.

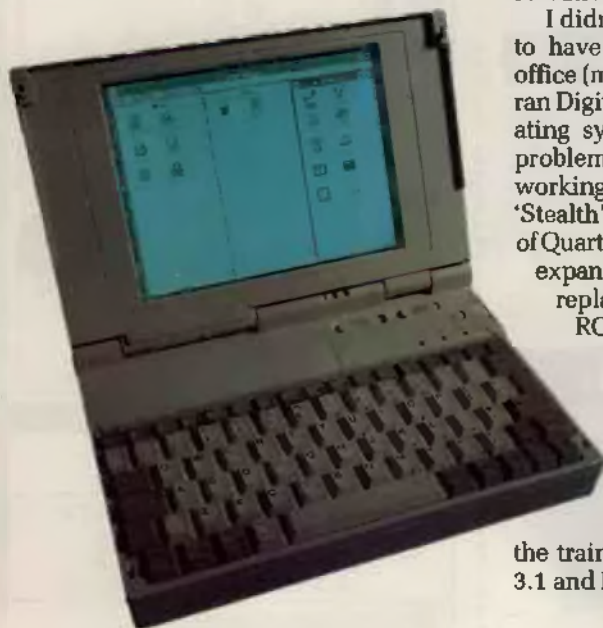
One at a time

Having said that, the 40Mb hard disk is small enough that you won't have that many Windows applications installed. I did have Corel Draw, Word 2.0 and Works all present at the same time, but the space remaining was measured in bytes and I didn't attempt to run more than one program at a time.

It isn't just applications that are limited by the hard disk space. Add more RAM and you'll want to run more applications. To do that effectively you really want to allocate a decent-sized permanent swap file. Unfortunately, a decent-sized permanent swap file takes up a significant proportion of your hard disk, removing the ability to install multiple applications and, in turn, the need for a swap file.

The latest space hog that puts a burden on the Tandon's hard disk is Borland C++ version 3, which comes on no less than 17 disks. Yes, I do want to write C++ code on the train and, yes, that is my anorak. Shame I don't have room for Word for Windows any more...

Tandon is on 081-759 0707.



MacLink Plus

MacLink Plus is an integral part of the production of this magazine, but setting it up to perform its PC-to-Mac conversions took more than a little trial and error. It works well, but those wish lists just won't go away, will they? Guy Swarbrick explains.

We've said before that the more you use a product, the more you find to criticise. Over the past few months I probably haven't used any package as much as I've used MacLink Plus and, it's fair to say, I have one or two items on my wish list.

The problem with Long Term Tests is that the programs you like best — or at least, the programs you use most — come off worst. So let's get one thing straight right now. I like MacLink Plus. I use it every day, even though there are plenty of alternatives available to me.

Now to get nasty... The original plan was to use MacLink Plus to transfer files from my PC to the Macintosh IICI that Lauraine, our Production Editor uses. The files would come to me from staff and contributors and would then be converted to the appropriate Mac format and sent down the cable which comes with the software.

There were a number of problems with this scheme. First, operation based around the cable is a little cumbersome. The Mac software is OK, but the PC end is rather crude and, in our case, since I knew which program had originated the files, it was me who really needed to be in control.

Second, what we really needed was a transparent way of converting DOS-based files into Mac files and making them available to the Production Department. Having to run conversion software on Lauraine's Mac was an unwelcome complication.

Logistical problems

More fundamentally, there were logistical problems. The cable simply wasn't long enough to reach from my PC to Lauraine's Mac. We tried one or two solutions, including littering the production desk with a PC that was used only for MacLink. A bit of a waste. OK, the side effect of the eventual solution was that I ended up with a Mac on my desk, so I have at least one good reason to prefer it, but it really works. I could have used my PC and the cable as before, but I don't have the desk space so I did away with the PC altogether.

FDHD drives in Macs will read PC disks, or at least, they will with the help

of Apple File Exchange or an INIT-like DOS Mounter which, conveniently, comes with MacLink Plus.

Pop a DOS disk in the drive and it appears on the desktop. You can access it as though it were a Mac disk. We used this for a while, but the combination of System 7, DOS Mounter and AppleShare was somewhat less than stable. Fortunately an alternative utility which comes with Soft PC, AccessPC, performs the same function reliably.

So, we finally reached the stage where we could put a disk in the Mac drive and read the files. Now for the file conversion.

It really couldn't be easier. You run MacLink, select the PC format you want to translate from and the Mac format you want to go to, choose your file and click convert. 99% of the time that's all there is to it.

Of course, having said it couldn't be easier, you were probably expecting me to point out all the things that could have been easier. For a start, there is no facility to select a batch of files that you want to perform the same translation on: you have to convert each file manually. Nor is it possible to double-click on a file in the list and have it converted. You have to select the file and then click on Convert. Crazy.

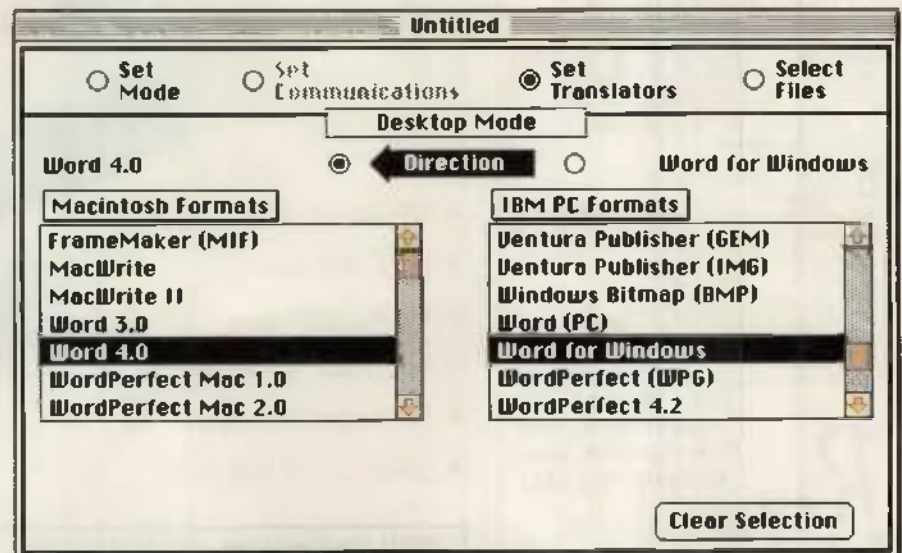
File conversion works, for the most

part, and most file formats are there. Spreadsheets, word processors and graphics formats (including things like Windows BMP files) are present, but the conversions aren't really flexible enough. For example, you can convert from PC TIFF to Mac TIFF and from BMP to PICT, but not from BMP to Mac TIFF or PC TIFF to PICT. As most of our screenshots arrive in BMP or PCX format and have to be sent to the originators as TIFFs, that's a real pain.

So is the fact that MacLink Plus can't automatically determine file types. You can put the translators into the Apple File Exchange folder and AFE will determine file formats for you, but AFE is so slow that even guessing half a dozen formats under MacLink Plus is quicker. Besides, if you have Access PC or DOS Mounter running, AFE will clunk away for ten minutes before it is ready to convert files, only to announce that, since the INIT has convinced it it is reading a Mac disk, you can't access the PC-to-Mac translators.

If only...

PCW wouldn't appear without MacLink Plus. Well, it would, but we'd have to insist that everyone provide their copy in RTF format and their screenshots as Mac TIFFs, which might put a few noses out of joint. If only the authors had tried using it...



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Confessions of a power junkie

Power is addictive, warns Guy Swarbrick after just a few jabs of a 486/33. But it hasn't gone too much to his head. He's been busy cacheing in his chips, mining XTree Gold — and finding out how dolphins take to fractal compression (it cracks them up).

They say power is intoxicating. They (whoever they are) are wrong. It's addictive, certainly, but it induces the sort of addiction you don't realise you have until the object of your addiction is removed.

486/33 towers are a case in point. Having reviewed so many of them, we got used to having all that power on tap. Most have gone (with the exception of those joining our Long Term Test fleet) and we're up to our ears in 386SXs. Some of the 486s seemed a little sluggish in the company of their peers. All of them seem desirable now.

Apple, I think, is about to realise the potency of this phenomenon. The company doesn't yet realise the implications behind the demise of the Macintosh SE/30.

Slow is bad

Like the powerful small cars Alfa Romeo and Lancia produced during the 1960s, the SE/30 is an intoxicating beast. You expect a Ferrari, or a Mac IIx, to be fast. You expect a 1300 Giulia, or an SE/30, to be a sedate, everyday companion. That it isn't is a pleasant surprise.

On the surface, replacing the Giulia with the 1.2 litre Alfasud or the SE/30 with the Classic II shouldn't be a problem. In both cases, the successor is a neater, arguably prettier package with almost as much punch.

And there's the key. Newer is good. Prettier is good. Better is good. Slower is not good enough. Apple expects to sell an awful lot of Classic IIs, despite the fact that the model is slower than the SE/30.

They will. But until they jack up the performance, at least to the same level as the old model, and preferably 10% or so higher, they aren't going to sell as many as they could. Alfa had to upgrade the Sud twice before it really



took off. Classic II Ti Quadrafoglio Verde. It's got a certain ring to it, hasn't it?

Cache crisis

Most of us have been using Fast! as a replacement for Microsoft's Smartdrive disk cache utility. Smartdrive's fine and if that's all you have it'll certainly give a big improvement over an uncached disk. But Fast! is two to three times better.

Until I discovered Windows, I was using MultiSoft's PC-Kwik, for no better reason than Dell bundled it with the 310. I'm now using the latest Windows-compatible version of Super PC-Kwik for a whole hatful of reasons.

You might expect the main reason to be that it's quicker than Fast!. It isn't quicker, though. In fact, it isn't much quicker than Smartdrive. But PC-Kwik PowerPak is more than just a disk cache.

The package is divided into four major parts: disk, video, keyboard and a print spooler. It provides accelerators for each, plus an excellent command line editor called ReDOS, and a utility allowing you to scroll back through the

last couple of screens of text. Useful for checking what happened in complex Autoexec.bat and Config.sys files, for example, where you can usually only check the last 25 lines.

They work quite well, although I found that the performance varied greatly from PC to PC. On some you'd see a 10% to 20% increase in video writes through the BIOS and a 50% reduction in BIOS scroll speed; on others, a 1% increase in write speed and a 600% increase in scroll speed.

Worst of all, though, neither MonaLisa's TIGA drivers nor Windows 3.1 get on with Power Pak. The former pairing conspired with Power Pak to lock up the Dell 433P if I tried to access its setup program.

XTree Gold

Of the programs I used regularly before I joined PCW there is only one that I still use regularly. Then I used MultiMate, DataEase, Lotus 1-2-3, Mace Utilities and XTree virtually every day. I dumped MultiMate at the earliest opportunity (as, indeed, has Borland) and replaced it, after a couple of stops along the way, with Word for Windows. DataEase hasn't gone altogether: I just do virtually no database work these days. Excel has replaced 1-2-3. PC Tools ousted Norton Utilities, which had in turn ousted Mace. XTree is all that's left.

Not that XTree Gold 2.5 is easily recognisable as the crude file manager I used four years ago. It hasn't changed much since version 2.0, though.

What I can't understand about either the old or new versions is why, if they can read different word processor formats for the View facility, they don't go the whole hog and do file conversion. If they know enough about a file format to be able to read it, you would imagine they should be able to write it.

In fact, the new version isn't very good at recognising file formats. Several complex Windows BMP files fooled it, as did some WordPerfect files, so perhaps its just as well it can't create files of its own.

It's still a good file manager and I'll carry on using the new version. But under Windows 3.1 with its improved File Manager, I'll stop using XTree under Windows.

System sleuth

It seems to be the month for new utilities. Hot on the heels of Power Pak and XTree Gold came System Sleuth Pro from Dariana Technology Group (DTG). Like CheckIt! and InfoSpotter, System Sleuth is designed to tell you everything you need to know about the machine on which it is running and, if necessary, to test certain aspects.

It does so, though, in a less attractive and less easy-to-use way than either of the others. The interface is standard CUA (in fact it looks very much as though it was written using Borland's Turbo Vision libraries for either C++ or Pascal), but there are certain anomalies (windows with nothing outside the visible area have scroll bars, for example) and the design is so unappealing visually that you don't want to explore its hidden depths.

Included in the box is the System Sleuth Utility Toolkit (the manuals were cheap photocopies and the Californian company doesn't seem to answer its phone, so I can't confirm whether this is part of Sleuth Pro or a separate package). There isn't much in the utility. A 'where is' program, called FILEFIND, which will track down lost files; a more useful FINDDUPE program, to find multiple copies of the same file on your hard disk; and CLEANUP, which clears all the .BAK and .TMP files from your hard disk (by default, although it will look for other files). Very handy under both Windows and DOS 5.

GETCMOS and PUTCMOS give a rather worrying control over the contents of your machine's CMOS RAM. Still, they proved handy when PC Kwik Power Pak locked me out of the Dell 433P's setup program.

Compression

Our Windows & OS/2 columnist, Ken Morse, rather modestly talks about IBM's new Action Media 2 board which won the Comdex Best of Show award in Las Vegas in November. I say modestly, because Ken was actually involved in the board's development. Congratulations.

Ken's speciality is data compression, and compression for real-time



△ These three images were produced from the same original compressed file. The middle image is displayed at the same resolution as the original, the others differ in area by a factor of 4. The quality is undoubtedly less than an uncompressed image, despite the 768 to 10K compression, but the relative quality of the enlarged image is impressive

video is one of the hot issues of the moment.

Techniques for still video compression are well established. Discrete cosine transforms (DCT), the conventional method around which the JPEG compression standard is based, enable compressions of 300 to 400 to 1. The first generation of commercial video compression hardware is expected to be based around MPEG, essentially a DCT system for video.

But there are some people who believe that the future of compression lies in an altogether different direction. The three images on this page started life as the same 320x200, 24-bit image. The file took up 768K. Compressed, it occupied a mere 10K, and as you can see it is possible to shrink and enlarge the image with very little loss of quality.

The image comes from a package called Fractal Format-ter from Iterated Systems. It's a demonstrator for the company's fractal compression techniques (Iterated Systems claims the package is a commercial clip-art collection for DTP, but the images, rather than the quality of the reproduction, suggest otherwise).

The package provides 350 images on three, 1.2Mb 5.25in disks. Impressive? Not as impressive as 2.5 minutes of Casablanca, sound and video, which the company squeezes on to a 1.44Mb 3.5in floppy.

OK, the quality isn't brilliant, even on the colour images in the clip-art library, but that's because Iterated Systems is trying a little too hard to impress. Compression from 768K to 10K is impressive. Had the image been compressed from, say, 1024x768 24-bit, the resulting file would have been bigger but the results would have been even more impressive.

At first I was unconvinced. Demos are usually better than 'the real thing', but the quality of Iterated Systems' sample images after fractal compression is poor. Nonetheless, the anoraks are impressed. To paraphrase Samuel Johnson, fractal compression is like a dog walking on its hind legs. It is not done well; but you are surprised to find it done at all.

The real test, though, is to compare a fractal compressed image with one compressed using DCT. Both lose in the translation but the fractal image loses less — and since the resultant file contains not the image itself but a mathematical model for simulating it, you gain a large degree of resolution independence.

I expected to be less than impressed. I wasn't. A feature on compression techniques will appear in PCW in the near future.

Haval

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The New Hacker's Dictionary

Editor: Eric Raymond
 Publisher: MIT Press
 Price: £22.50(hb), £9.95(pb)
 ISBN: 0-262-68069-6

Technobabble

Author: John Barry,
 Publisher: MIT Press
 Price: £19.95
 ISBN: 0-262-02333-4

A tendency to develop *neologisms* — newly coined words — is a sign of madness. It is also common among computer folk. Much of the language described in *The New Hacker's Dictionary*, however, is not freshly made-up by *hackers*, but instead represents an imaginative and creative use of existing words. Hackers include people who wander around other people's data, but also those who program for pleasure. (The entry in the dictionary claims the phrase originally meant one who makes furniture with an axe...).

This is not a dictionary in the traditional sense of the word — I doubt if anyone would use this to look up words for their definition. It is more of a history of a culture, and an explanation of a belief system and a working environment — in dictionary style. Much of it is hilarious. The humour of these words is in their cynicism, their deadpan understatement, their delicious contempt, or their blatant silliness. Some examples: *drool-proof paper* is documentation written so that only a complete idiot could bear to read it (an Apple manual actually advised: 'Do not expose your LaserWriter to open flame or fire.'). *Hyperspace* is a memory location that is far away from where the program counter should be pointing. An IBM discount? A price rise.

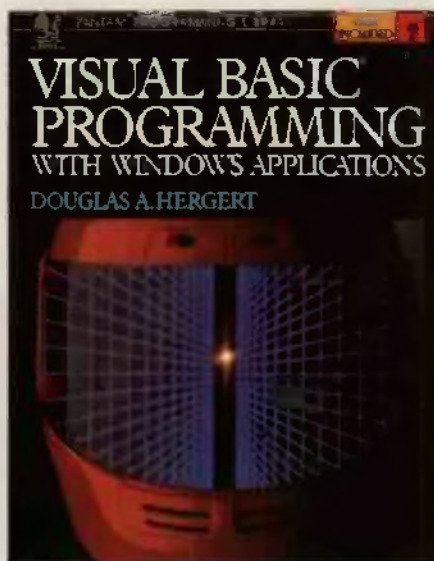
Or consider this: *Generally, a guru event must be followed by a vulcan nerve pinch*. A guru event is one which requires the attention of a possessor of arcane or complex knowledge (like someone who can tinker with the Unix core without anxiety). The vulcan nerve pinch? A CTRL-ALT-DEL reboot, required by machines in a state of *wedgitude*.

A technology overflowing with potential for things to go wrong has bred a rich language of abuse. There are many other reasons for jargon generation, however, and many of them are surveyed in *Technobabble*. Many are of a non-technical origin.

Technobabble is concerned with the bogus, the excessive, the gratuitous, the

clichéd, though some terms are included to illustrate how original meanings can be lost. *GREP*, the Unix text scanning command, looks like an acronym but has a long list of candidate origins. (The *Dictionary* cares not which is correct, and offers an extension: *VGREP*, to *visually GREP*, which is largely what you are doing to this text.)

Technobabble includes a splendid tirade against user-friendliness. What does it mean? Early in my days in this industry, I had to write a definition as part of a user specification. My suggestion of 'absence of gratuitous hieroglyphics from the screen' was discounted as facetious... a good job, too, as user-friendliness is now almost synonymous with hieroglyphics. Try these from the email community: (;-) (:o) (:!) (:/). Not obvious, until you turn the page on its side, to get The Wink,



Shock, Sorrow and Sarcasm.

Barry bemoans those awful electronic voiced switchboards, but gives no other obvious sign of disliking technology. The tone of the book would probably appeal to the hacker using the dictionary language. It is not a complaint about 'degeneration of the language' of the sort spouted by people who would not know good language if it punched them in the face. There is instead a disapproval of the *bogosity* involved in the obfuscatory, the dense, the distracting outpourings of *veeblefesters* — otherwise known as *suits* or *marketroids*. This is about attitudes. The *Dictionary* includes a good example which clarifies the difference between suits and hackers: *copy protection*. 'A class of clever methods for preventing incompetent pirates from stealing software and legitimate customers from using it. Considered silly.'

Both books present a refreshing view of the computer industry, in contrast to the image many people have of a dry and sterile world of air conditioning, fast printers and the occasional science fiction novel. They help to explain to the observer that there is more going on here than meets the eye. Both highly recommended.

Nick Beard

The Art of Human-Computer Interface Design

Editor: Brenda Laurel
 Publisher: Addison-Wesley
 Price: £25.95
 ISBN: 0-201-51797-3

Think of Apple Computer Inc and it's a safe bet that graphical user interfaces will be one association that springs to mind. This is largely due to the work of the Human Interface Group within Apple. The members, most with at least two university degrees in subjects as diverse as electrical engineering, computer science, and cognitive psychology, have been responsible for many of the Mac's user interface features.

The Art of Human-Computer Interface Design, a collection of essays, was originally intended as a training manual for use within the HIG. But as the number of contributors from outside Apple increased, the decision was taken to release the work commercially. The product has roughly a 50-50 mix of Apple and non-Apple authors.

Interface design encompasses many fields, which are reflected in the range of topics selected. Further variety is displayed in the essay types: research papers, surveys, case studies, tutorials, and opinion pieces.

Such diversity could result in a chaotic hotch-potch. Fortunately, the editor has done a fine job in grouping the 50 essays into five sections.

The first, entitled *Creativity and Design*, looks at the methods designers use to create new and more expressive interfaces. Topics include how to choose suitable metaphors for interfaces, when to change aspects of an existing interface, and how to encourage interdisciplinary co-operation, as interface design requires input from a wide range of disciplines.

Part two, *Users and Contexts*, examines the needs of different users, with case studies of children, writers, and even gorillas. Also examined are the requirements for interfaces to games software (the essay is written by Chris Crawford, author of such games as Bal-

ance of Power), and the HyperCard interface is subjected to a very frank assessment.

The third section, *Sermons*, is the most interesting. Contributions from leading visionaries such as Alan Kay (of Dynabook fame), Ted Nelson (Xanadu), and Jean-Louis Gassé (Former President, Apple Products) ensure lively, not to say controversial, essays. The piece by Donald Norman (director of the Institute for Cognitive Science, University of California) is a prime example. While much of the rest of the book is concerned with improving interfaces, Norman says they get in the way and that only when they disappear will computers become truly useful. Worth thinking about.

The fourth part, *Technique and Technology*, looks for ways of expanding the number of communication channels we have with computers.

The final section, *New Directions*, looks at the trends for long-term development. Essays explore the use of agents (intelligent macros that carry out tasks for the user), virtual reality, and the anticipated merging of computer and television technologies.

This is not a book suitable only for interface designers and Mac owners. All computer users spend much of their time interacting with user interfaces. This book provides a valuable insight into their design.

William Hern

Designing Interaction

Editor: John M Carroll

Price: £16.95

ISBN: 0-521-40921-7

John M Carroll is manager of the user interface institute at IBM's Thomas J Watson Research Center in Yorktown Heights, New York. This book is the result of a workshop held there and contains contributions from many of the participants, who included Donald Norman, author of the classic *The Psychology of Everyday Things*.

The book centres on the application of cognitive science — the theory of human thought — to interface design. Its pragmatic outlook reflects a new drawing together of human-computer interaction (HCI) theory and programming. If HCI has a failing, it's that it doesn't often produce results usable by programmers under pressure. And the computer industry is only starting to take advantage of knowledge gained in other fields, such as psychology.

This book covers the range of HCI practice, from how to use existing psy-

chological theory, to extending the scope of psychology itself. Norman, for example, proposes studying artifacts themselves to gain more knowledge of how people structure their worlds.

This book is, like most of Carroll's work, somewhat academic in style. But it's an important step towards better, more usable computer systems.

Wendy M Grossman

Visual Basic Programming: With Windows Applications

Author: Douglas A Hergert

Publisher: Bantam

Price: £42.99 (inc VAT)

ISBN: 0-553-35317-9

Visual Basic represents a fairly large step in the progress of Basic since its birth in the 1950s. It drags a traditionally procedural language into the realms of event-driven programming. This change, combined with the extra functionality of Windows, mean that Visual Basic can come as a shock to anyone used to the traditional form.

Visual Basic Programming attempts

to ease this transition. Ideally, you would already be familiar with Microsoft's QuickBasic (on which large parts of Visual Basic are built). However, most Basic programmers should be able to get to grips with it quickly, and knowledge of any high-level language will help. The book leads you through nine applications, supplied on a 5.25in disk, illustrating aspects of program construction. (You have to send to the US for a 3.5in version.)

The applications demonstrate Windows functions like menus, graphics, dynamic data exchange and drag and drop. Each chapter starts with a brief description of the subjects covered, then what the program does. The rest of the chapter goes through the program listing with boxed sections describing any particular topics. The style is generally clear and to the point, and it is easy to dip into the book.

However, there are many omissions: no mention, for example, of Dynamic Link Libraries. Finally, the chapter on DDE requires Excel; without it, it may not make much sense.

There is a desperate need for a complement to the official Visual Basic documentation (or a replacement). Sadly, this isn't it.

Matthew Bell

October's Top Ten Books

Author	Title	Publisher	Price	This	Last
Woram J	PC Configuration Handbook	Bantam	£24.95	1	—
Petzold C	Programming Windows 3	Microsoft	£27.95	2	1
Livingston B	Windows 3 Secrets	IDG Books	£36.95	3	4
Swan T	Borland Turbo Pascal for Windows Programming	Bantam	£26.99	4	—
Hergert D	Visual Basic Programming	Bantam	£43.99	5	—
Person R	Using Excel 3 for Windows	Que	£27.45	6	—
Acerson K	WordPerfect 5.1 The Complete Reference	Osborne/McGraw Hill	£24.95	7	5
Wolverton V Seigel L	Running MSDOS Mastering FoxPro 2	Microsoft Sybex	£21.95 £26.95	8 9	2 3
Baumgarten E	Using WordPerfect 5.1	Que	£25.95	10	—

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Eye of the Beholder

Computer: PC; Amiga
Supplier: US Gold/SSI
Price: £30.95

Due to a combination of deadlines, lack of space and lack of product, some interesting and entertaining games never make it to the 'Screenplay' pages. Normally, by the time we have room to spare, these titles are past their prime and a whole batch of new software is waiting to be checked out. This month sees a break with tradition to look at *Eye of the Beholder*, a challenging role-playing affair which has been on sale for around three months.

An official Advanced Dungeons and Dragons video game by SSI, *Eye of the Beholder* brings TSR's famous fantasy world to the silicon screen. This has been done before and the games have proved popular, but never in such detail and with so much style. *Dungeon Master* is often thought of as the best of its genre, but everything in *Eye of the Beholder* is bigger and better.

Taking control of a party of heroes hand-picked by yourself, the idea is to free the city of Waterdeep from an evil influence. The influence belongs to Xanathar, a particularly nasty piece of work who lives underneath the settlement and has plans to take it over. Hired by Waterdeep's troubled ruler, it's your task to enter the sewers, seek out the vile villain and destroy him if you're able.

The party comprises four fantasy characters, each with their own skills and alignments and, in true AD&D style, six races are on offer. Players can choose from elves, dwarves, halflings, half-elves, gnomes and humans in an attempt to create the best team for dealing with subterranean terrors.

Classes available include fighters,



magicians, thieves, paladins and even clerics who can heal the sick using powers bestowed on them by the gods. Each class and race has something to offer, but characters must be chosen wisely—a dwarf fighter is a mighty opponent, while a gnome fighter is more of a shandy drinker.

Once you've selected your team, the action starts at the top of the sewers with the screen split between a 3D view of the surroundings and portraits of each person. Clicking on a portrait with the mouse reveals that character's inventory, allowing you to see any objects they're carrying and their current status. During the game characters develop and this is reflected in the likes of their armour class, dexterity, wisdom and intelligence.

The sewers are explored in exactly the same way as in *Dungeon Master*—you simply use the mouse to pick up, drop and use any objects found. Doors can be opened by clicking on buttons or employing the appropriate key, though with this example, a skilled thief and some lockpicks may prove just as effective. Eventually, these doors will lead to one of Xanathar's minions and the party will have to engage in battle in order to continue.

Various weapons may be found in the game, but not all can be used by your party: once again,

everything depends on your chosen characters. Fighters can employ any type of weapon from enchanted swords to razor-sharp axes, while mages are limited to daggers, rocks, slings and magical spells. Some characters, such as rangers, can fight with two weapons at once, so they're ideal to have at the head of the party.

As you continue to wander around in search of Xanathar, you also encounter numerous puzzles which must be solved with all possible speed. These range from doors that won't open to vast rows of switches and levers which must be set in the right order to reveal a secret set of stairs. Some walls are not as they appear and your party can actually walk straight through them—nothing found in *Eye of the Beholder* should be taken at face value. Only by examining everything carefully will you succeed in your quest.

Other parts of the game include the discovery of magical weapons, potions, mystical scrolls and a war between two powerful races. This war, details of which will not be disclosed here to preserve maximum enjoyment, proves to be merely a sub-plot with yet more sub-plots stemming from it. Everything in *Eye of the Beholder* is so well thought out that you can start to get lost in its complexity.

Graphically, the game features detailed 256-colour VGA images, 3D characters and flicker-free animation. The latter is particularly impressive when it comes to humanoid creatures such as skeleton lords, skeleton warriors, dog-like dudes and Mantis men. Stopping to admire the scenery can prove fatal, however.



The audio department is just as detailed, provided your PC is equipped with an Adlib or compatible sound system. With one installed, doors creak, creatures make all sorts of noises and sequences involving teleport gates are extremely entertaining the first few times. Music does not accompany the game, but an option exists to turn it off which strikes me as rather odd: signs of a data disk-driven sequel? As you would expect, the Amiga version features exceptional sound as standard and stereo effects are constantly used to generate atmosphere.

And atmosphere is something Eye of the Beholder has plenty of, as a lot of AD&D ideas have been incorporated. The creatures you come across are true TSR characters and the spells you get to cast match the ones available in the board games. Attack rounds aren't quite the same, but battles are just as exciting and it's amazing just how much you can get drawn into the action.

Eye of the Beholder combines AD&D action with great graphics, superb sound and a complex and challenging storyline. If you want a good PC-based introduction to TSR's realms of fantasy, look no further: this has almost everything you could wish for. All that's left to say is roll on part two, which should be with us just before Christmas Day.

Chris Cain

Gunship 2000

Computer: PC & compatibles

Supplier: MicroProse

Price: £39.95

I was just about the only person not to be impressed by the first version of MicroProse's Gunship helicopter simu-

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Charts supplied by Software Circus at The Plaza, Oxford Street, London W1, 071-436 2811, and at 282 High Holborn, London WC1, 071-404 4492.

lator. And without wanting to spoil the ending, I seem to be one of a small band of people unimpressed with the latest version, Gunship 2000, if for subtly different reasons.

The first version suffered, like many MicroProse offerings in the past, from being described as a simulator and turning out to be a fairly unsophisticated game. The new version suffers from being hyped as a super-realistic simulator and turning out to be a fairly decent game.

The opening sequence, in fact every aspect of the game, is very pretty, but let's get straight to the point. There are two methods of controlling your Gunship, easy and realistic. The first is, reasonably, and the second isn't at all.

Flying a helicopter is rather like juggling. In your left hand you have a lever with a twist grip. The latter is the throttle, which controls the amount of power getting through to the rotors; the former is the collective, which alters the angle of attack of the blades, determining how much lift they generate.

In your right hand, between your legs, you have a joystick called a cyclic which tilts the rotors, determining in which direction the lift is directed, giving the helicopter its unique ma-





Select Action Area. Press Alt-Q to quit.

the collective) and the rudders. Depends how you define realistic, I suppose. Tomahawk on the Amstrad PCW five years ago was a better simulator than Gunship 2000.

Still, you get to fly Apaches, SuperCobras, Comanches (the new designation for the experimental LHX gunship), Kiowa Warriors

(militarised JetRangers), Black Hawks and Defenders (the military version of the Cayuse) in Central Europe or the Persian Gulf.

The missions are challenging, the weapons systems sophisticated and the scenery superb. It just isn't remotely like flying a helicopter. Not only are the controls unrealistic, the frame rate, even on a fast 486, is so slow that, despite warnings to the contrary in the manual, you are constantly over-correcting.

There's an auto hover mode which creeps ever upwards instead of holding you steady — an almost totally useless addition. As is the not quite totally incomprehensible simulated speech, which annoys but never really informs.

The navigation system is over-complicated and counter-intuitive, and the modelling and rendering of the vehicles and helicopters is crude compared to other state-of-the-art PC flight simulators.

It is also hideously copy protected (you have to search for one of five codes accompanying one of a dozen or so squadron patches spread over 30 pages of the manual which is, incidentally, remarkably informative but largely irrelevant to the game). More effort, in fact, seems to have gone into the keyboard templates, the copy protection scheme and the advertising campaign than into the gameplay. Sadly, that's not unusual these days.

If a game is all you want, Electronic Arts' LHX, which makes no pretence at being anything other than a game, has better graphics, is better put together and more fun to play. At least LHX's non-realistic flight controls actually make the helicopter easy to fly, which neither Easy nor Realistic modes in Gunship 2000 do.

If your Aunt bought you this for Christmas, you'll have some fun for a couple of weeks. But if you got a gift voucher, spend it elsewhere.

Guy Swarbrick

noeuvrability. Under your feet are a pair of rudder controls which alter the pitch of the tail rotor, allowing the helicopter to turn left or right around the axis of the main rotors by increasing or reducing the resistance the tail rotor puts up to the machine's natural tendency to fly.

Motion, in any direction, is a delicate balancing act involving all four controls. So, to take off, you wind up the throttle, pull up the collective, balance the rudder and, to move forward, push the cyclic away from your body. Easy. Gunship's manual explains all this (though it misses out the throttle), but 'realistic' mode omits the throttle (or rather, combines the throttle and

LEISURE LINES

Brainteasers courtesy of JJ Clessa.

A Happy 1992 to you all — may this be your lucky year.

Quickie

A rope passes over a pulley with a weight of 160lbs attached to one end. A man weighing 160lbs starts to climb up the other end of the rope.

Will the weight rise, fall or remain stationary?

Prize Puzzle

A number crossword and an exercise in numeric logic this month. After last month's puzzle, we are painfully aware that there may be more than one solution. If there is, we will accept any valid answer.

Fit the 9 digits supplied into the blank squares of the

grid so that the clues shown alongside are satisfied.

a	b	c
d		
e		

Clues Across

a Prime Number in reverse

d Exact Multiple of 11

e Sum of Digits = 11

Clues Down

a Exact multiple of a 2-digit perfect square

b Digits in Ascending Sequence

c Perfect Square

1 1 2 3 4
4 5 8 9

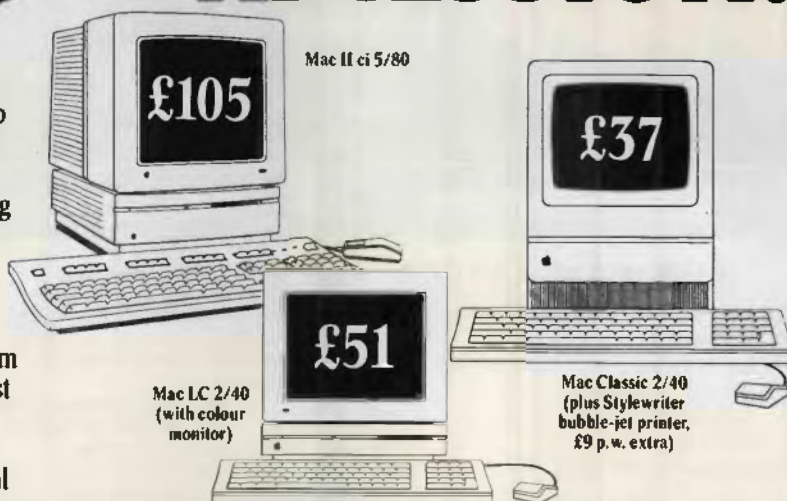
When you have solved the puzzle, stick it (or a photocopy) onto a postcard, or the back of a sealed envelope (no letters, please) and send it to January Prize Puzzle, *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG, to arrive before 31 January 1992. Good Luck!

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The rise and fall of Hailstone Numbers

This title is that of Chapter 3 in the book entitled *Think of a Number* by Malcolm E Lines, Adam Hilger 1990, £7.50; an interesting bedtime read for all those interested in 'Numbers Count'.

The Collatz problem, first visited in *PCW* August 1984, reads thus: Think of a number; if it is odd, triple it and add one; if it is even, halve it and repeat this process until the initial number is recovered... if ever? An interesting algebraic formalism of this iterative scheme is due to David Fisher of Cardiff:

$$x_{n+1} = \frac{1}{2} \left(x_n \cdot 3 + (1 - \cos \pi x_n) / 2 \right)$$

Now, starting with x_0 as 1, 2 or 3 easily leads to the loop 1,4,2,1; and even starting with 7 yields the same

loop quickly although a maximum value of 25 is reached in so doing. However, with $x_0 = 27$ the high of 9232 falls back to $x_{111} = 1$.

Problem A

Investigate the behaviour of 'Hailstone numbers' with starting values 1,2,3... (In the University of Tokyo researched up to $x_0 = 10^{12}$). Graph x_n against n for a range of values of x_0 and hence interpret the name 'Hailstone Numbers'.

Alternative names (printable in *PCW*) for these erratically behaving numbers are invited.

Problem B

By graphical analysis, or otherwise, construct the 'best possible' (from your data) linear relationship between the sequence length and x_0 , paying particular attention to the behaviour for large x_0 .

Problem C

Replace the coefficients 3 & 1 in 'if x_n odd then x_{n+1} becomes $3 \times x_n + 1$ ' by other (small) odd numbers and search for those cases generating a multiplicity of loops. For example, when the above coefficients are 3 & 7 respectively the value $x_0 = 1$ leads to 5,22,11,40,20,10,5, while $x_0 = 7$ leads to 7,28,14,7.

Responses to some or all of the above problems may be sent to Mike Mudge, 22 Gors Fach, Pwll-Trap, St Clears, Carmarthen, Dyfed SA33 4AQ, tel (0994) 231121 to arrive by 1 April 1992.

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, details of programs, run times and a summary of the results obtained; together with suggestions for further work in this area, all in a form suitable for publication in *PCW*. Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

Review, June 1991: a 'Not-Often' Monotonic Sequence due to Robert Vein

This apparently obscure area of investigation produced numerous detailed responses, including those from:

- N Backhouse, who investigated $g(x) = \sum H_r x^r = 1/f(x)$ where $f(x) = \sum p_r x^r$ (p_r being the r th prime and $N = 100$) and conjectured that $H_{n+1}/H_n \sim C$, C is approximately equal to $3/2$.

- G Suggett, who found a number of relevant results, including the case $g(x) = \sum p(n)x^n$, where $p(n)$ is the number of partitions of n , in *Hardy & Wright*.

- N Hodges discovered a sequence $\{g_i\}$ 'which is virtually as small as possible and where $\{H_i\}$ grows very slowly', but was unable to find $\{g_i\}$ & $\{H_i\}$ which both grew linearly at worst.

- B Stewart, after a limited theoretical analysis, began computing in *Mathematica* v1 on a Viglen Genie 386 with 387 co-processor and 4 Mb of RAM. In about 25 minutes he found the first 1000 coefficients related to $1 + \sum p_n x^n$... some very large numbers, and observed: 'I would take modest bets, though, that the matrix formulation you give is a complete distraction'. Any wagers?

- R Bond investigated a range of $\{g_i\}$ including Primes, Lucas Numbers, Polynomials of degree 1,2 & 3, Exponential and Factorial functions and a first order difference equation.

However this month's prizewinner is David Broughton of Freshwater, Isle of Wight. Using C and the Lattice C compiler version 2.01 on an IBM PC, David exhibited evidence to support the remarkable result that if $G()$ has more than one root in the range $[0,1]$ then H_{n+1}/H_n tends to the smallest root.

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.

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- ☐ Sport (4 d)
- ☐ Teddy Bears (2 d)
- ☐ Travel (2 d)
- ☐ Wedding (3 d)

EDUCATION

- ☐ Amy's First Primer - Six learning programs ages 4-8. (CGA)
- ☐ The DOS Learning System - Learn to use DOS with this great program. Covers all versions of DOS 2.0-4.01.
- ☐ Funnels & Buckets - Teach children basic math skills!
- ☐ Lotus 2.2 Learning System (5 d) - Learn Lotus easily and quickly
- ☐ Play 'n' Learn 2.50 - Six programs. Ages 18 months to 4 years. (CGA)
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- ☐ World 2.99 - Globe! Learn about cities & countries. (CGA)
- ☐ Tutor DOS (4 d) - The supreme DOS tutorial. Everything you wanted to know about DOS and more! (HD)
- ☐ Language Tutors - ☐ German, ☐ French, ☐ Spanish, ☐ Italian, ☐ Cantonese, ☐ Japanese, ☐ Hebrew.

GAMES

- ☐ Adventure Game Toolkit (3 d) - To create adventure games.
- ☐ Arcade Games 1 - Pac-man (3 versions!), Mopper, Space Invaders, Fusion (Tetris variation), etc. (CGA)
- ☐ Arcade Games 2 - 2-Double Blocks (another Tetris variation), Q-Bert, Breakout, Beast and others. (CGA)
- ☐ Basslour - The ultimate fishing game
- ☐ CGA Tetris Collection (2 d) - Ten great versions of this game.
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- ☐ Super Solitaire (2 d) - 15 great variations. (CGA)

EGA/VGA GAMES

- Note: These games require EGA or VGA graphics.
- ☐ Commander Keen - Sensational game. Superb sound and graphics!
 - ☐ Caddisnack - Golf game, great graphics.
 - ☐ Captain Comic 4 - Fabulous sound, graphics & more!
 - ☐ Dark Ages - From the creators of Commander Keen!
 - ☐ Duke Nukem - Top quality arcade game 640K (HD).
 - ☐ Hugo II, Whodunnit? - An animated 3D adventure.
 - ☐ Last Half of Darkness - Graphics Adventure game.

WINDOWS 3.0 GAMES

- ☐ Games for Windows 1 - Klotis, Worm War, Almonds, Lunar Landers, Checkers, Backgammon and more!
- ☐ Games for Windows 2 - Space Walks, Hextris, Mines, Tic-Tac-Toe, etc!
- ☐ Games for Windows 3 - Tetris, Concentration, Talpel, Arachnoid (Solitaire version), Alien Force etc!
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- ☐ TAPEITS.0 - Mahjongg for Windows.
- ☐ WinWill 1.2 - 'Wheel of Fortune' type game.
- ☐ War heads 1.0 - Missile command type game.

WORDPERFECT 5.0/5.1

- ☐ Art & Graphics Vol. 1 (2 d) - Over 90 graphics.
- ☐ Art & Graphics Vol 2 (2 d) - Another 90 graphics.
- ☐ Art & Graphics Vol. 3 (2 d) - 90 further graphics.
- ☐ Art & Graphics Vol. 4 (2 d) - 90 more graphics.
- ☐ Art & Graphics Vol. 5 (2 d) - 90 more different graphics.
- ☐ WordPerfect 5.1 Learning System (3 d) - Learn how to use WP easily and quickly with this great tutorial (WordPerfect is NOT required).
- ☐ Super WP 2.2 (4 d) - Can emulate WordPerfect and others.
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- ☐ WordPerfect 5.0/5.01 Tools (2 d) - 17+ Fantastic utilities.
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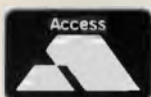
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- ☐ Picture This (4 d) - Produces EPS Language output.
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- ☐ Showpartner Lite 3.7 - To make presentations look their best
- ☐ Text (12 d) - Computer Typesetting language.
- ☐ Typesetter PC 1.8 (2 d) - True WYSIWYG shareware DTP program.
- ☐ Dpika 2.20 - Paste-up program reads all kinds of Graphics files.
- ☐ PrintPartner (2 d) - PrintMaster & PrintShop clone.

WINDOWS 3.0

- Note: These disks require Windows 3.0.
- ☐ Active Life 1.5 - Tremendous "Personal Information Manager".
 - ☐ Almanac - The ultimate calendar for Windows!
 - ☐ Apogia - Icon-oriented user interface.
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Emergent computation

'Emergent computation' is a thriving research area whose aim, among others, is to exploit parallel processing and computational search. Some of its approaches could find their way into mainstream computing, says Nick Beard.

Some computers follow obvious instructions—programs—to solve stated problems, but not all do. For some computing systems, the ability to compute *emerges* from a data soup, digital or analogue, in which the problem is somehow represented.

Emergent computation is the term given to this class of process, a burgeoning research area which attempts to harness principles from brain physiology, immune chemistry, genetics, linguistics and many other realms. Applications areas include exploitation of *parallel processing*, by avoiding having a central controlling program consuming lots of time through communication demands, and *computational search*, searching a large space of possibilities for an optimum value or a particular value.

What brains do

A good example of a system with emergent computational properties is the human brain. Brains perform computations. From that big, wet gland in our skull, computation emerges like the fine structure of a honeycomb emerging from the busy-ness of bees. This is not just something brains do in mathematics class, but something they do all the time.

Sometimes, like in maths class, or in the supermarket when trying to decide which equivalent brand of mayonnaise gives better value for money, it is obvious. You think, 'I'll just do this computation'. Other times, when catching a ball, or running down a flight of stairs while reading the mail, it is less so.

Some people have suggested that computation is merely a fashionable modern *metaphor* for what brains do. They are wrong, but it is easy to see why they might make the suggestion. Part of the problem is that they do not under-

stand the Church-Turing hypothesis, which means that they have a restricted view of computing. There is perhaps a simpler reason too: many people have likened the human mind to bits of technology before.

The Greeks likened the mind to a catapult, and the great mathematician Leibnitz thought of mills as a good model. Our minds have also been likened to steam-driven piston systems, to the system of gears and cranks in a mechanical tide predictor, to various hydraulic devices. When telephone exchanges and telegraphic information theory were developed, they were promptly used to 'model' the mind.

Inevitably, the computer was brought to bear on this problem: the brain is a computer. This, however, is entirely different: no mere metaphor, the brain *is* a computer — at least, it is if you believe the Church Turing hypothesis. This states that any effectively computable function can be computed by a Turing machine. Any — that is, any computation that can be conducted on any computer at all — can, in principle, be done on a Turing machine.

Subtle connection

This was the basis of the first real argument about the possibility of synthesising intelligence (though we will not rehearse the arguments for and against machine intelligence here). Another idea, more subtly connected to the Church-Turing hypothesis, is that computing can take many, many forms. Indeed, it was the action of his typewriter that gave Turing the idea.

Turing was working on one of Hilbert's problems (see 'Frontiers', November 1991). He was investigating the theoretical basis of computing — what can be computed from what. Thinking about his typewriter, he began to see

computation as essentially a *mechanical* process. A typewriter manipulates symbols in accordance with strict 'rules' defined through levers and keys. Unless the typewriter is defective, pressing a particular combination of keys always produces the same result.

Turing extended this idea to propose an abstract machine which could not only write symbols, but could read and act upon them automatically too. Like the levers of a typewriter, the logic circuits of a chip, or the rules of an algorithm, a set of internally coded rules produced an invariable response to a given instruction. Also like a typewriter, a small set of possible operations can produce an infinite variety of outputs, such as the entire works of Kylie Minogue or, in the case of a Turing machine, the solution to any computable problem.

Cranks and quacks

So brains perform computations, but we don't know quite how. A fashionable notion (especially among the cranks and quacks of the alternative medical scene, but in more sensible places too) which might help is *holism*. This is loosely linked to the idea that *the whole is greater than the sum of its parts*. Douglas Hofstadter, in his *mindology* book *The Mind's I*, paraphrased the idea as 'the soul is greater than the hum of its parts' (mind is more than just brain).

All that neural noise prompts sums to be done, and clever thoughts can follow. It seems that in the right circumstances, some computational models display whole system behaviour which is in some sense greater than the hum of its constituent elements. For example, cellular automata and artificial life models (see 'The Logic of Life', PCW September 1991) or co-operation in

social systems without any central authority (Good heavens! No central authority? Make sure Brussels doesn't get to hear about this or some Eurocrat bureaucrat will issue a directive stopping the research!)

Mysterious ways

There is a difficulty — such systems move in mysterious ways. The well known von Neumann architecture of the PC is well understood, well behaved, and rarely does incomprehensible things (well... if treated nicely, and not subjected to toast and marmite in the disk drive). It is merely one facet, however, of what may be an infinitude of computational styles.

Neural networks (more networks than neural) are another approach, spin glass physics and thermodynamics provide others. These systems, offering interesting emergent capabilities, can be likened to non-linear — chaotic — systems. Non-linear systems are renowned for behaving in ways that cannot readily be predicted from the ground up. Here is a difficulty: if computational 'skills' emerge from a confusion of lower-level processes, how can the process be directed, controlled? This is largely a matter of constructing constraints, giving the system broad guidance. Much more precise control would quash emerging behaviours before they had time to emerge.

Identifying requirements

Douglas Hofstadter identifies three requirements for emergent computation: a collection of agents, each following explicit instructions; interactions (according to the instructions) between these agents and global patterns — *epiphenomena*; and the natural interpretation of the epiphenomena as computations. It is important to note that information can exist at 'higher levels' of the system which does not exist within the lower-level activities of particular agents.

This does not confer any *magical* computational properties on the system; the Church-Turing thesis implies that the emergent computations could also, in principle, be mimicked by a Turing machine. (I wouldn't like the job of programming it, or interpreting its behaviour.) The benefits, where these principles are applied appropriately, are practical ones, in terms of efficiency and efficacy of computation.

An example of a completely unwanted emergent behaviour occurred in the US email network *Internet*. This was set up to direct messages down routes selected with a random element, to spread message traffic evenly be-

tween participating machines. Sometimes this prompted a spontaneous organisation of the system into a higher-level structure (a token passing ring) in which messages cluster at one node before being passed to the next — bad news for system performance.

This is an example of self-organisation, one of the key themes of emergent computation. This is the spontaneous formation of ordered structures from initially random systems. Other themes are collective and co-operative behaviours. Collective behaviour involves many agents, processes and interactions, with emphasis on global effects. Co-operation here means the 'holistic' effects noted earlier — strength in numbers, the whole is greater than the sum of the parts, symbiosis.

Genetic algorithms

Genetic algorithms are ideal examples of systems which display emergent computational properties (see 'The Logic of Life', *PCW* September 1991). Using a suitable representation of a problem, 'evolution' can be established in a computer, to ensure that only the 'fittest' solutions survive. First, a 'population' of possible solutions is generated, coded as *strings* of symbols, roughly equivalent to chromosomes. The correct answer might not be there, so new strings are produced by cross-breeding the existing ones. The strings compete and only the fittest — the nearest to the desired result — survive. After many generations, copies of the fitter strings displace unfit ones, and the whole population should be made up of the required answer.

Genetic algorithms are ideally suited to parallel implementations. Daniel Hillis, architect of the massively parallel *Connection Machine*, has further developed the idea to include *co-evolving parasites*. With populations ranging from just 512 to 10^6 individuals, each with up to 256 'chromosomes', running on a *Connection Machine* with 65,536 processors, the system raced through up to 1000 generations per minute — geological time divided by a big number! Parallel processing makes a huge difference if the problem is selected carefully.

The test bed was the location of minimal sorting networks, a sorting algorithm in which the sequence of comparisons and data item exchanges occurs in a predetermined order. The system was able to find respectable networks, with performances close to the known optimal solution. It wasted many computations, however.

One reason was the problem of local optima — the system would get stuck at

a promising but ultimately inadequate 'solution'. This is rather like the problem neural nets can suffer from (see 'Practical Neurocomputing', page 366, this issue). The other was that the evolving networks would no longer find any difficulty in the test problems used to steer the evolutionary process. Hillis overcame this problem by introducing a 'parasite': the test problems would evolve too, in the direction of greater difficulty for the best sorting networks. This significantly improved performance, resulting in the location of a sorting network with performance very close to the known optimum.

Wiring up

There seems little chance that the von Neumann model will be displaced by these approaches, but some of the techniques should find their way into mainstream computing. It is happening with neural nets. Maybe this could be a use for all those unwanted micros in schools around the country: wire 'em all up and wait for something to emerge. This is what many people do with their computers anyway.

Resource Guide

Emergent Computation **Stephanie Forrest (ed),** **MIT/North Holland**

A special edition of the journal *Physica D*, containing the proceedings of a 1990 conference on emergent computation held at the Los Alamos National Laboratories. It is a remarkable feast of a book, stuffed with tasty mixtures of neurobiology and thermodynamics, machine learning systems and fractals, artificial life and linguistics. It is not a light read, but the future is here so it is worth the effort.

1989 Lectures in Complex Systems

Erica Jen (ed), Addison Wesley

A wide-ranging set of papers covering theoretical immunology, neural nets, spin glasses, chaos, algorithmic information theory and a whole lot more.

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Artificial Life II

Christopher G Langton, Charles Taylor, J Dooyne Farmer, and Steen Rasmussen (eds), Addison Wesley

At last! It's here! Volume two! The remarkable *Artificial Life* volume opened lots of new horizons when it was published a couple of years ago. This one further develops some of the themes, and is generally marvellous stuff.

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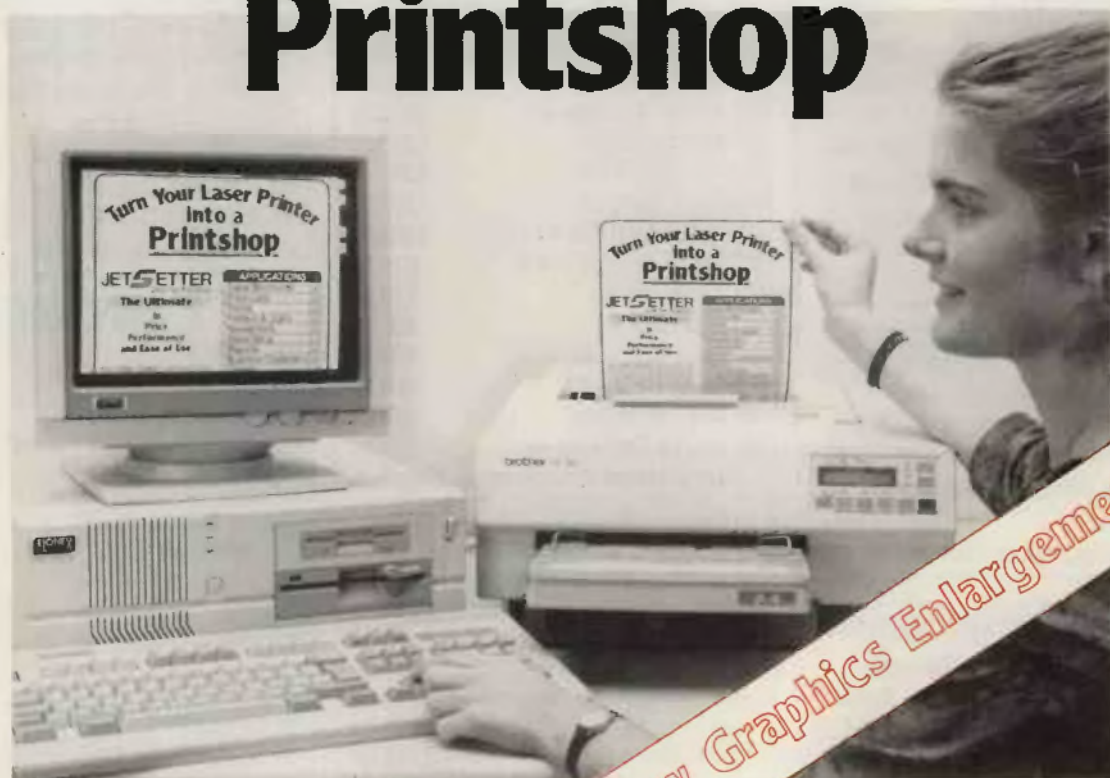
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The art of audio archiving

Tim Frost looks at how the hardware industry is helping to preserve old music recordings and films. Digital techniques are revolutionising the restoration process, he says.

A visit behind the scenes at the British Museum's National Sound Archive brings home just how many developments there have been in audio since the first recordings just over a hundred years ago. If the number of different historical formats — including flat magnetic discs which were played just like 78s but with a magnetic head to pick up the information (now there's a good idea) — is bad enough for an archive to cope with, digital is throwing up dozens more ways of preserving sound; all of them incompatible, but they all require archiving if the country's musical heritage in all its forms is to be preserved.

The NSA has 800,000 recordings, covering everything from the spoken word to pop videos. The Archive is currently trawling the hardware industry to work out what format it should use for the long term, archiving the older 78s and cylinder material so that they can be preserved and made accessible to users.

The Archive leapt into digital some years ago using Sony's system which connects a PCM encoder/decoder to a standard domestic videotape recorder, putting digital sound where the picture would normally be recorded.

Crystal gazing

But the crystal ball-gazing required to predict what format is a good long-term choice can prove unreliable. The Archive opted to use Sony's Betamax video format, although the PCM units would work equally well with VHS or Beta recorders.

Consequently, as new domestic Betamax recorders are thin on the ground and existing machines have to be preserved in working order in order to play the big back catalogue of Beta tapes, the Archive is now in the process of putting PCM onto VHS instead.

Although in the meantime some work is being recorded on RDAT, the major research is into optical formats, with the Archive looking most carefully at the longevity of the disks. Research underway on 5.25in WORM (Write Once Read Many) tentatively indicates that its demand that the disks should last 500 years without signal degradation can be met by existing optical media.

Two types of test are likely to be applied to formats under consideration. The first gives a quantitative indication of the disk's life by recording a test signal on the disk, subjecting it to various archiving conditions and measuring every 400 hours for any bit errors that might have occurred. By using formulae developed by a Swedish chemist, these error values can be extrapolated to predict the long-term deterioration of the disks.

Military procedure

Of course, disks are not always kept in absolutely perfect environments for 100% of the time, so a US military equipment test procedure can be brought into play, which subjects the disks to the extremes of environmental conditions. This will determine how well the disks respond to high and low temperatures, damp or dry conditions — whether they crack, warp or grow moulds.

Archiving an older recording is not restricted just to the audio, but to the whole of the disc and its covers. Current experiments transfer to WORM the audio, together with digitised images of both sides of the record and all of the record cover.

Using Microvitec's image capture boards, the colour image resolution is good enough to be able to read the tiniest print on the cover and the record labels. This not only preserves the art-

work but all the cover information that would otherwise have to be manually typed into some form of database.

Hundreds and thousands

The archive's collection of 78s and cylinders number into the hundreds of thousands, but this pales into insignificance compared to the total number of older-format discs and cylinders that are in private collections with, at the best guess, another half-million recordings in private collections in the UK alone. Apart from the undeniable pleasure these collectors gain from owning all these discs, they are now realising that the record-buying public has an increasing interest in historic recordings, especially where the performers or performances are of special note.

To the classical music lover there is a wealth of material by artists, conductors and composers who died before the 50's when tape first made its impact on the recording scene, preserving performances to a standard that compares adequately with today's technology.

With the popularity of CD compilations as well as classical items there is a whole range of popular music, big bands and jazz that can be re-released but in a form that makes for acceptable listening — that is, without pops and crackles and possibly in stereo. This has created a whole industry working on methods of bringing old recordings back to life with varying degrees of success.

The first big commercial move to update old recordings came with the introduction of stereo. Record executives immediately went into overdrive, believing that nothing would sell unless it had the 'stereo' label on it somewhere. Hits of the 50's and early 60's were re-released in 'reprocessed stereo' or even 'enhanced stereo' descriptions that would these days get the

companies is deep water with trading standards officers.

Stereofication of mono recordings showed up all the pitfalls of applying inappropriate technology just for the sake of it. Techniques varied but mostly relied on some form of tone control. Equalisers were used either manually, or in some automated device, to turn up the frequencies associated with certain instruments on one side and turn them down on the other.

Pulling up the mid-range frequencies on the left-hand side and down on the right, for example, would drag the voice over to the left. This gave a wider-than-mono image, especially if a little random reverberation was added, but an image where instruments moved about depending on the notes they were playing.

All this tone adjustment messed up the overall sound anyway so that in comparison, the untouched mono version was usually much more enjoyable. Record companies have come to this conclusion and for the last decade and more have released mono material in mono. (A company is actively promoting a stereofying unit to TV stations and video companies, so that they can 'improve' mono movies and videos — 'reprocessed stereo' may yet rear its head again.)

Clicks and crackles

Moving away from trying to do the impossible, a lot of work has been put into developing analogue methods for dealing with the most obvious problems in cleaning up old recordings — getting rid of surface noise. This can be split into three main areas: clicks due to single scratches, background crackles due to general wear to the record surface, and tape noise and distortion.

In transferring historical material, the first stage is to pick the best copies available, since most recordings — and films, for that matter — exist on more than one copy, often varying enormously in degrees of preservation. In the case of 78s, by using a stereo cartridge, it is also possible to select the least worn and therefore least noisy of the two groove walls.

The first electronic treatment applied is often frequency limiting. Since the earlier recording systems had limited frequency response, it is quite permissible to roll off the high frequencies, say around 7 or 8kHz and above, as there is no music content there, only surface noise, with the same being done with the very low frequencies.

But after that simple process, the engineer is faced with the problem of trying to separate noise that is buried

deep within music.

In the analogue world, gating systems of increasing complexity have been applied to these problems. At their most basic the gate lets sound through untouched until it drops below a predetermined level, at which point it is faded down to zero. A single channel of gating can be set so that as the music dies away, it shuts down at the end of a track so the surface noise between tracks can't be heard.

More sophisticated systems use many gates, each applied to a small frequency range. Take a rock track: when the bass guitar is playing, a low frequency gate lets the sound through and between notes the gate operates, cutting out any low-frequency background noise.

Digital revolution

But in the last four years digital techniques have been developed which are revolutionising the restoration process. Two systems in particular have emerged, the logically named No-Noise from Sonic Solutions in San Francisco and, relying on acronyms to put the point across, the Cambridge-based CEDAR (Computer Enhanced Digital Audio Restoration).

Both companies have put substantial effort into developing systems that can remove noise without altering the underlying recorded material. Both systems started as high-cost batch operation systems. But, as the understanding of the algorithm used increases at the same rate as the hardware power increases, both systems are now accessible to any record label with an interest in reclaiming early, or just plain faulty, recordings.

When first developed in 1987 the Sonic Solutions system worked at 1000 times real time (a quarter of an hour to process one second of audio). Within a year this was reduced to six times real time, and now both CEDAR and No-Noise operate in real time making it a lot easier for engineers to hear what they are doing.

The process is relatively simple to describe but somewhat more difficult to implement. The audio is first transferred digitally onto hard disk using standard PCM techniques.

De-clicking is the more straightforward of the processes. In the digital bitstream, a click is a fairly recognisable object: it starts and stops very quickly, has a relatively high level, lasts for a very short time and bears no relationship to the previous or following signal. Drop-outs, which are almost negative clicks where the original tape is damaged, producing silence for a

split second, can also be easily identified using the same descriptors, except that in this case, the signal level is virtually zero.

Just passing through

The digitised audio is passed through a digital signal processor that is programmed to recognise these aberrations and remove entirely that portion of the signal. If it just cut out the click or inserted silence in place of it then the effect would be noticeable as the music 'jumping' or as drop-outs. So, the processor takes samples of the audio each side of the click and interpolates them to produce a good 'guess' at what the signal should be, and inserts that guess in place of the click. As we are talking about milliseconds of sound, the accuracy of the guess is likely to be pretty good, so un-noticeably filling the gap.

Mechanical surface noise, from the tiny scratches on disk or film, can be dealt with in the same way. As the signal processing has got fast enough, the CEDAR system looks at surface noise as thousands of small clicks coming one after another, dealing with them at a rate of over 2000 a second, identifying, removing and replacing.

Fairly even background noise like tape hiss has to be handled slightly differently. No-Noise takes a sample of the noise from the blank sections at the start and end of the tape, to create a digital 'fingerprint' of the noise which can then be extracted from the audio.

These systems are not used solely for old recordings. No-Noise's first big success was cleaning up a live recording of the Doors, where a faulty microphone cable all but obliterated several minutes of Jim Morrison's vocals. Channel 4 is using CEDAR to process not only old films like Alec Guinness' *Man in a White Suit* but also some classic episodes of *The Avengers* where the soundtrack falls short of the NICAM standard.

Any regrets?

And the next stage for these systems? Now that it has achieved real-time processing on all these functions Cedar is looking at ways of using similar techniques to cut out distortion another process that would be impossible in the analogue domain.

But price and complexity continues to decrease rapidly and the first domestic machines have already been shown in prototype form, so you may yet be regretting dumping all those noisy, clicky old LPs in the rush to go CD.

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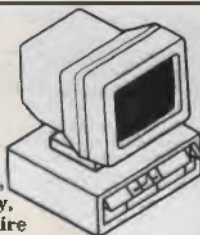
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Chris Cain concludes his look at batch files, explaining the confusing SHIFT and FOR commands before moving on to system startup and the (in)famous AUTOEXEC.BAT.

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Karl Dallas looks at CounterPoint, yet another GUI for the PC, and shows that simple may be better for some applications. There are some tips on how to avoid the dreaded UAEs in a famous not-so-simple GUI, and anyone who refuses to be weaned off the DOS command line can read about the DOSEDIT utility supplied with MSDOS 5.

Word Processing 410



If you've ever wanted to operate your own junk-mailing campaign, Peter Jackson discusses some of the ways in which mail-merging software can make life easier. And is WordPerfect 2.03 for the Macintosh worth the update from 2.01? William Gallagher thought so.

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As spreadsheets get bigger and operating systems get more complex, Steve Cassidy is wondering if they might start collapsing under their own weight.

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What is the difference between a spreadsheet, a word processor and a database? Easy question, eh? Well, it sounds easy, but as Kathy Lang explains it is really a matter of structure. What would every database user want for Christmas? How about a nice new user group.

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Dan O'Brien plays scrooge to compilers, and pours snow onto the Atari ST.

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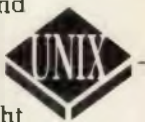
If IBM gets its act (and its marketing) together, it could top the multimedia league with its range of products announced recently at TIME and Comdex. Ken Morse seriously considers the company's offerings.

Macintosh 434



Mick O'Neil visited the MacUser Show where he found some of the furniture rather impressive. Is the GreatWorks integrated package just the software for your new PowerBook 100, and how can Professor Mac help the new user?

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DJ Walker-Morgan, in reflective mood, ponders the past year's events and explains the demise of OSF/1 and the rise of ACE. Back to the present, and the long-awaited arrival of Number Six should bring relief to the lives of Unix hackers everywhere. And then for something very silly you might like to run on a Unix workstation with X-Windows...

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Sailing close to the wind, Ralph Bancroft considers network languages, the fact that they are different and what steps are being taken towards a common lingo.

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How do you stop a bunch of anarchistic students from getting at your PC data? Dr John Wright has come up with a few tips to out-fox the hackers. Nicholas Skelton has some ideas for Windows users, and Lloyd Wood knows a few tricks to make SoftPC on the Macintosh go a bit faster.

Computer Answers 453



Why doesn't Windows know how much memory it has, unlike the Archimedes? Is the DOS copy/v option as reliable as it seems, and if so, why are my files corrupted? What is a cache anyway, and why should I care? For the answer to these and other burning questions, turn to 'Computer Answers' right now!

Guidelines for the Hands On section — how you can contribute to PCW

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For most of the departments we'll pay £60 per printed page. For Computer Answers and Readers' Tips we'll pay £25 per tip, with a bonus of a subscription to the magazine for the Tip of the Month. Contributors should supply an invoice for the relevant amount.

What are we looking for? Well, for the applications section — Databases, Word Processors and Spreadsheets — we're looking for macros, sections of query language or useful tips and shortcuts.

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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 of these is fairly obvious: if you've found a better way of doing something, share your knowledge with the rest of us.

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All submissions should be sent to 'Hands On' at the following address: *Personal Computer World* Editorial, VNU House, 32-34 Broadwick Street, London W1A 2HG.

Make sure that everything you send is clearly addressed to 'The Editor' of the right department.



Mastering MSDOS batch commands

Chris Cain guides you painlessly through the remaining batch-specific commands — CALL, PAUSE, FOR and SHIFT — as he helps you make some sense of MSDOS.

As promised in last month's 'Beginners' column, this month continues with batch files and the commands used to generate them. This instalment introduces the last four batch instructions and a special file called AUTOEXEC.BAT. Once you've mastered them, MSDOS starts to make sense — or at least certain bits of it do. I doubt whether anyone understands it fully. I've been using it for about five years and it still baffles me occasionally.

CALL me

The first of the new batch-specific commands is CALL, which offers the user a way to control batch files from within a batch file. When MSDOS sees this instruction, it looks for another batch routine, executes it and returns control to the original or 'parent' program. For example, the instruction CALL ME would run a routine called ME.BAT, which would then perform a specific action and return control to the main batch file. One file can be run from another simply by including its name as a line, but the original routine is lost when the second is executed.

The CALL command links several batch files together, in order to form one large, all-powerful utility. If you create a program that performs a number of complex tasks, you could have a separate file for each and CALL

them into action. To be perfectly honest though, I can't think of many cases where you would use this command: it's one of those that turns out to be useful every once in a while.

PAUSE for thought

PAUSE, the next new instruction, is far more widely used and can be included in just about every file to provide a spot of user interaction. When it comes into play, execution of the current program is halted until a key is pressed. MSDOS also displays the 'Press any Key to Continue' message, prompting the user

or anyone who happens to be passing to do just that.

A typical use for PAUSE would be in something like a file-copying program, which transfers regularly updated data from a hard to a floppy disk.

User unfriendly

The two remaining commands aren't as easy to use as PAUSE and explaining them without turning techie is just as difficult. The first is FOR, which performs a specified MSDOS command on a number of files. It can be used from the standard command line.

In a batch file, the usage format is `FOR %<variable> IN (set) DO <command>` — a perfect example of the Microsoft definition of user friendly. The FOR instruction isn't hard to understand, but with this kind of syntax it's no wonder people think that using computers is incredibly complicated.

Taking things one step at a time, the %<variable> indicates that a variable of some kind must be specified in order for things to work. Why? FOR acts on a group of files, which all have different names, so a variable stores each name as the command carries out its task. If there were no variable, every name would have to be specified in sequence. Any letter can be used as a variable, %A or %F for instance, except the numerals 0-9.



'FOR [VARIABLES] IN (SET) DO [COMMANDS]

"Ha, that'll fox 'em"

ILLUSTRATION BY MIKE MOSEDALE

Fig 1 Example of a standard AUTOEXEC.BAT listing

```
@ECHO OFF
PROMPT $p$g
PATH C:\WINDOWS;C:\DOS;C:\WINWORD
MODE CON CODEPAGE PREPARE=((437)
    C:\DOS\EGA.CPI)
MODE CON CODEPAGE SELECT=437
C:\DOS\SHARE.EXE
c:\mouse
cls
echo Welcome to Genesis
ver
dir /w
```

The next important bit is (**set**), used to name the group of files, as the word **IN** is a 'keyword' or a *mandatory part* of the **FOR** statement. For (**set**) you need to enter the type of files to be processed, such as *.DOC, *.TXT or whatever your files are called. More than one set can be specified — multiple operations is what the **FOR** instruction is all about.

The brackets around the names (or 'parenthesis', depending on your education) may be confusing but are, unfortunately, absolutely necessary.

Then we come to the command to be carried out, which can be anything from **TYPE** to **DELETE** depending on what you want to do. To make things a bit clearer, a typical complete **FOR** command would be **FOR %A IN (*.TXT *.DOC *.MAC DATA.DAT) DO TYPE %A > PRN:**. This tells MSDOS to **TYPE** all the specified files to a printer connected to the parallel port **PRN:**. In order to do this from the command line rather than as part of a batch program, all you would need to do is use % <variable> instead of %% <variable>.

SHIFT working

The last batch-specific command is **SHIFT**, which lives up to its name as its function is to shift values from one variable to another. The command only affects variables %0 through %9 and it alters all of these at once: the current value in each is copied to the previous one.

Thus, if %2 were 'DOG' and %3 is set to 'CAT', a **SHIFT** would make the former feline and the pooch would be put into %1. Anything stored in the variable %0 is lost, as the command doesn't transfer this over to %9.

System startup

Now that all the batch-specific commands have been dealt with, we can take a look at **AUTOEXEC.BAT**. This file is special: if it exists in the root directory of the system boot disk, MSDOS automatically executes it.

The idea behind this is that it can be used to configure a machine on startup without the user having to get involved in any complex procedure. A typical file might do things like install a mouse driver, change the look of the system prompt and inform you of the current version of the operating system. Fig 1 is a prime example of a standard **AUTOEXEC.BAT** listing.

With a little imagination, this file can be customised to provide a truly personal and easy-to-use computing environment. The fact that it is put into play as soon as MSDOS is fired up means that it is ideal for a number of applications. It could be used to present special options to the user, or to print a friendly message on screen such as 'Hello Chris'. It is edited in exactly the same way as any other batch file, so getting to grips with it shouldn't be a problem.

Several MSDOS commands complement **AUTOEXEC.BAT** and three which instantly spring to mind are **DATE**, **TIME** and **PATH**. The first two allow you to set your PC's internal clock, the third tells MSDOS to search certain directories for any program name entered by the user.

All are easy to use as, just for once, they employ clear parameters instead of techno-gibberish. The **TIME** command, for example, is followed by the current time set out in the format <hours:minutes:seconds.hundredths al>.

Clocking on

Typing **TIME 13:15:30** on a machine configured for use within the UK will set the clock to 1:15 pm and 30 seconds. As in this case, the hundredths and al p bits can be omitted as they aren't 100% necessary. Hundredths only really apply if you want to time events with your system and the A (AM) and P (PM) parameters are for use only with the settings of certain countries.

The **DATE** command uses what can only be described as sensible parameters and the syntax in this case is <month-day-year>. However, if your machine is configured for a European character set, the format of **DATE** changes to <day-month-year>.

Using the default US settings, if you type **DATE 12-25-91** the machine will believe it's the 25th of December 1991 (Merry Christmas). In European mode this would be **DATE 25-12-91**, but both ultimately give the same result. Coun-

try settings are defined in the **CONFIG.SYS** file, a small configuration program that will be covered at a later date.

Having said all this about **TIME** and **DATE**, you may only ever need to use them once. If your system has a battery backup for its internal clock, this will keep the time and date ticking over after power-off. It is important to know how to use these commands though, as other commands such as **BACKUP**, **RESTORE** and **XCOPY** rely on them.

On the right PATH

The **PATH** command is slightly more complex than the last two and should always be included in **AUTOEXEC.BAT**. When executed, it sets up a systematic seek path for programs which allows you to execute things regardless of the current logged directory. In other words, you can be logged on to, say, C:\WP\DOCS and still run a program located elsewhere on the disk simply by typing its name. Sensible users put all their major directories in the path in order to make accessing applications and data as easy as possible.

The command follows the format **PATH <directory names>**, with each name separated by a semi-colon. A typical system would have something like **PATH C:;C:\DOS;C:\WP;C:\ART;C:\WINDOWS;C:\WINWORD**.

Other commands usually found within **AUTOEXEC.BAT** include **ECHO**, **VER** which displays the MSDOS version number, and **PROMPT**. Some systems also employ a file command called **MODE**, a complex beast that alters video, serial and keyboard settings. The command features several different types of parameter and, in some cases, these can be more confusing than those in the **FOR** statement.

Fortunately, **MODE** isn't used for 99% of day-to-day computing activities so we needn't go into it just now. Besides, explaining its many functions in any kind of understandable form would take far more space than is available here.

Mac attack

Now that we've looked at all the batch-specific commands and **AUTOEXEC.BAT**, you should be able to write batch programs to suit your personal PC environment. Even if you have no intention of doing this, you should at least understand what they're all about.

Next month sees a change in direction as we look at the Apple Macintosh: the PC isn't the only type of popular personal computer.

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Come out of your shell

Gain memory and beat those UAEs with a new Windows shell. Karl Dallas on a batch basher and the Pinboard wizard.

Not everyone wants to re-invent the wheel, and readers of recent columns might wonder what is the point of getting to know the convolutions of DOS batch files when you can buy good products to do all the hard work for you.

One of the newest and best is CounterPoint, a windowing-style menu program bundled with Amstrad PCs and available to everyone else for less than £50. Its main advantage is that it can be used in virtually any PC, from the lowest 8080 to the highest 486, with or without mouse, and requires a minimum of only 384K of RAM which vanishes to virtually nothing when running a program from it.

The appearance is quite snazzy. You can edit any PCX image for use as an icon, in addition to CounterPoint's supplied icons — and you can even edit those using either the supplied editor or any PCX-supporting graphics program. The display can include up to 46 icons on screen at any one time. But

since these can be folders, grouping allied programs, many more can be handled by the program. In fact, any icon can have up to 250 sub-menus, which should cover most people's requirements.

One icon is a clock (digital or analogue) which stays on even when the supplied screen blanker operates — but it moves around the screen to avoid burn-in.

Installing a new icon is easy. Select the Create Icon menu option, and you are asked if the icon is to be for a program or a folder. Then a dialogue box is presented for you to type in the exact keystrokes you would use to load the application in question. It's much easier than creating a batch file, since you can move about the editing window quite easily.

If your choice is a folder, then CounterPoint automatically creates the

CounterPoint is happy on almost any PC

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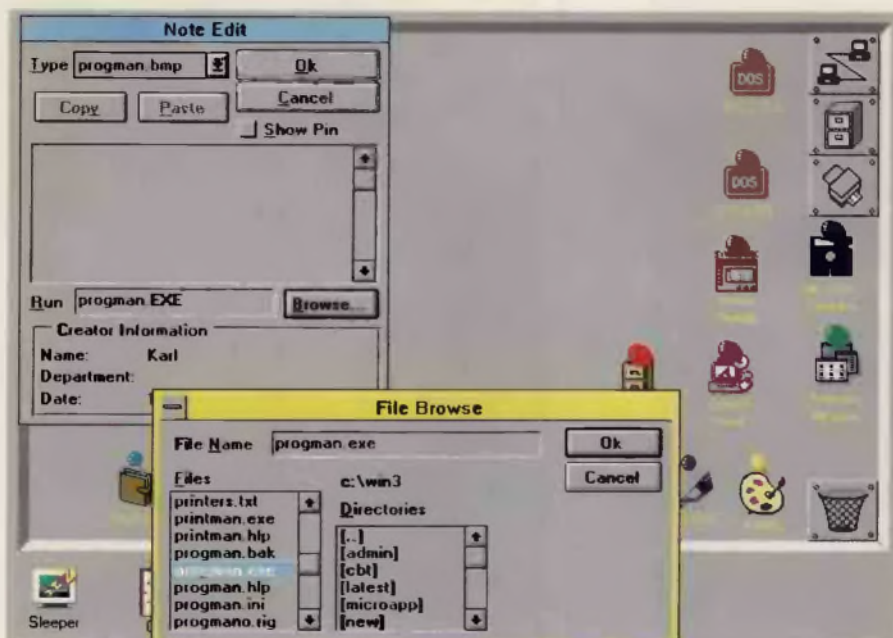
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necessary icon within the folder to return you to the root level. With a program icon you have the option of launching with zero RAM, meaning that CounterPoint gets entirely out of the way to give the program access to all your machine's memory.

Of course CounterPoint doesn't actually do this, because it must retain some kind of 'hook' into the program. But I checked the memory available to very demanding applications like FrameWork 4 when run from DOS and via CounterPoint, and it was identical in both cases. I don't know how CounterPoint does this, but it's certainly impressive.

That, basically, is all it does. There is no copy and paste between applications, and no multi-tasking; but you can use it with DesqView to add those capabilities. You can also run Windows from an icon within it, or set up icons for individual applications like Excel or Word.

CounterPoint costs £49.95 from NewStar Software, The Widford Old Rectory, London Road, Chelmsford, Essex CM2 8TE, tel (0245) 265017, fax (0245) 263969.

RAM starvation

Ask Windows users what they hate about their favourite GUI and I'd take odds you'll get one of two answers: slow performance, or Unrecoverable Application Errors — with UAE probably the top hate. Things should get a bit better with Windows 3.1, whenever that finally ships, because the 'Unrecoverable' has been dropped, thanks to a program called Dr Watson which monitors what's going on and suggests remedies.

Pinboard is brilliant — and British

However, in the real world most of us are still stuck with Windows 3.0, and those UAEs always come at the most dangerous time, when we are about to do a save of a long document which is then irretrievably lost.

(Actually, all is not necessarily lost. A disk management program like Norton Commander may find some or even most of it in a temporary file on your disk. You should then save the file under a new name, since all .TMP files should be deleted automatically when you leave Windows.)

The ridiculous thing about UAEs is that they are not always the fault of the application, nor even of Windows itself — except in the sense that Microsoft has not given adequate warning that UAEs can be caused by shortage of memory. Yes, if you've had a UAE when loading even a relatively small new app, then RAM starvation is almost certainly the cause.

The problem will be remedied to a certain extent in version 3.1, which handles memory much better. But there is a remedy within the existing program, though even aids like the Windows Resource Kit (remarkable value at only £25) don't tell you so. It is simple: don't use the Windows Program Manager. It eats up those system resources, especially if you've been adding lots of program groups and icons.

To check this, go to the Help menu and pull up About Program Manager. This, in addition to naming the guilty men who wrote PM, will tell you how much memory you've got available, and how much system resources. Don't be surprised if the figure is less than 50%,

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because each time you add an icon you can lose about one 1%.

You can ease the strain by installing icons only for your most frequently used programs, and running all others either from the File Manager or the MS-DOS Executive, which is still available. (You can close down File Manager or the Executive once your program is safely running, to conserve memory.)

But cutting out the Program Manager is better still. You can make the MS-DOS Executive the Windows shell, simply by going into the SYSTEM.INI file and changing the relevant line within the opening '[boot]' section, to read
shell=msdos.exe

You can do this with any text editor, including Windows' own Notepad. In fact, if you go to either File Manager or MSDOS Executive and double-click on SYSTEM.INI, it should load itself up into Notepad automatically, unless you have changed the relevant extensions section of your WIN.INI. Of course, if you edit any of the .INI files within Windows, the changes won't come into effect until you leave Windows and return to it.

The effect on my system was astounding: available system resources went up to 87% and (including a sizeable permanent swapfile on disk) I had over 13Mb of memory available, with no apps loaded.

Of course, MSDOS Executive doesn't look as pretty as Program Manager, but it's faster and the whole system fairly zips along. You can always run either Program Manager or File Manager by double-clicking on them when you need them for some special reason. But this, of course, will give you even less system resources to play with.

Post electronic notes with Pinboard

Shelling out

There are about three dozen third-party Windows shells on the market, and few of them are really worth bothering with (you could try Norton Desktop for Windows, which is really rather good, but it's a lot more than just a shell). Lately I've been using the brilliant British-made Pinboard, designed by ex-Microsoft wizard Gary Levelle.

Pinboard is a sort of electronic mail program, based on the metaphor of the Post-It notes which people can leave stuck to your screen, or wherever. Good as it is, you may be sceptical about it taking the place of a proper Windows shell.

However, each note can be used to run a program. You just type in the dialogue box:

RUN filename.ext

not forgetting to type in the complete path, if it is not already within your environment setup. (Type PATH from DOS if you're not sure.)

Pinboard has a number of pre-supplied icons, but you can use any BMP file as created with Windows Paint.

The way to do this is, first, to run the required program by whatever method you're still using. Then iconise it and, making sure it's still selected, press the ALT key and PrintScrn. Most people know that pressing the latter key alone will put the entire screen display onto the clipboard, allowing it to be pasted into Paint and saved in any of the supported three formats (BMP, WMF and PCX). Combining PrintScrn with ALT copies just the selected window, in this case the icon.

DOSKEY FORMAT=ECHO You cannot format disks on this machine

Fig 1 How DOSKEY can prevent accidental formatting

Save this as a BMP file in the Pinboard Admin subdirectory, which will make it available only to the administrator when in Admin mode. Then, when creating the note, select this as the note to be used. Double-clicking on it will run the application.

Pinboard has two kinds of 'boards': shared and private. Put the note on a shared board if it's something you want to make available to everyone on the system; use a private board, otherwise.

I've found another use for private boards, which are usually saved with the names of specific users on a network, like Tom, Dick, or Harriet. I give the private boards the names of different types of apps, such as Graphics, WPs, DTP, Utilities, and so on, and save them as notes to the shared board. Instead of using RUN, I associate the note with the OPEN command (note that the capitals are important in both cases; for some reason Pinboard is case-sensitive here).

I have also created a note using the Pinboard icon as already outlined, and I type in the name of each board before saving it, which allows me to skip between different groups of apps at will.

(Important: when leaving one private board for another, make sure you have saved any changes or you will lose them.)

Interestingly, with MSDOS Executive also loaded, I still had 83% of system resources available and only 63K less memory, a miniscule loss with more than 13Mb still left.

You can use Pinboard as the Windows shell, and this uses even less system resources than MSDOS Executive. But since I use the latter quite a lot for programs I haven't yet iconised as a Pinboard note, I really need to keep both running. For some reason, loading Pinboard last uses 6% less system resources than the other way round, and also leaves me more memory, so that's how I do it.

The whole system works like a dream, and I can't remember the last time I had a UAE. I rest my case.

Pinboard costs £79.95 from Neow, Unit 12, Progress Business Centre, Whittle Parkway, Slough SL1 6DQ, tel (0628) 668334. Five, ten, and 25-user packs are also available, at £245, £395, and £795, respectively.

Using DOSEDIT

Going back to dear old DOS again, there is one feature of MSDOS 5 which we haven't looked at yet: you can use the

DOSEDIT command to write batch files automatically.

DOSEDIT saves your recent DOS commands, so that you can recall them by pressing the up or down cursor keys. Earlier versions of DOS allowed you to recall the immediately previous command by pressing the F3 function key, and to recall it one character at a time, either by pressing the right cursor key or the F1 key.

The problem with the F3 option is that the recalled line is not easily editable. Use the left cursor to go to the middle of the command to insert a letter, for instance, and you will find that it is destructive: the command vanishes as you cursor back through it.

It's still there, however. Press the INS key to go into insert mode, type the omitted character(s), followed by F3, and the entire command will return, as amended.

This isn't nearly as good as DOSKEY (or, for that matter, the similar HISTORY=ON command of DRDOS), because there the cursor is non-destructive. Incidentally, when you are in Norton Commander, which has its own history command, the DOS or DR-DOS version won't work unless you press CTRL-O to lose the Commander window display.

Most people use DOSKEY for its history capability, but this isn't all it will do. A command like

DOSKEY/HISTORY BATCH.BAT will write all the lines in the history buffer to a batch file of that name. Of course, it will write the entire contents, which may not be what you want. So before you start, press ALT-F7 to clear it. Then type in the lines you want plus the DOSKEY /HISTORY command. This, too, will be in the file of course, so you'll need to edit it out using Edit or Edlin.

DOSKEY can also be used to create macros, using the following syntax:

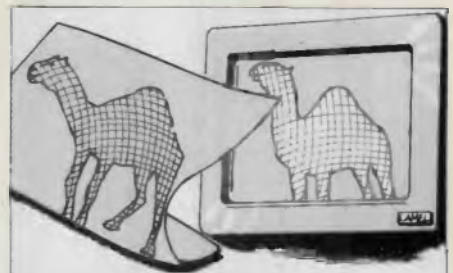
DOSKEY macro=command so that DOSKEY DIRW=DIR/W (to use a nonsensical example) would allow you to omit the slash in the command.

Parameters can be passed, as in batch files. But instead of numbering them %1, %2, and so on, they must be numbered with dollar signs, \$1, \$2.

DOSKEY macros can even substitute for DOS commands, so that the instruction in Fig 1 (above) could prevent disk formatting.

This is a very powerful capability, and one that DRDOS hasn't yet been able to equal.

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Managing mailmerge

Peter Jackson suggests that some of the now-emerging end-user programming techniques could be brought to bear on the general failings of mailmerge. And, reader William Gallagher tells a WordPerfect 2.03 story.

Despite the bad smell that *Reader's Digest* mailshots have given it, mailmerge is one of the main things that makes word processors useful. Write a form letter once, and the word processor's print merge command can produce as many customised copies of the letter as required, and even run off the mailing labels to get them to the right destinations.

However, anybody who is on as many mailing lists as I am will have noticed some odd things about form letters. First there are the labels that repeat my name twice, or have a blank line in the address where my company name would be if I had a company. Then there are the letters that say 'Dear Peter Jackson Esq' at the beginning, and have customised words without spaces after them, and customised paragraphs without the right line spacing above or below. And then there the *Reader's Digest* mailshots, where no attempt is made to disguise the computerised additions despite the chummy tone.

Programming task

All these failings except the last are due to the fact that producing mail-merge documents is a programming task. A mail-merge file holding names, addresses, salutations and corporate credit limits for each customer is a database of a sort, and getting the right information out of that database for insertion into form letters is a database retrieval task.

And no matter how word processor suppliers might disguise it, that task requires some programming to put the right fragments of data in the right places in a document.

To be fair, some word processor developers acknowledge this, implicitly at least. The WordPerfect 5.1 manual has a set of appendices collectively titled 'Macros and Merge', an admission that doing anything more complex than putting addresses in identical formats on form letters has more in common with macro programming than text editing.

However, none of the documentation for WordPerfect 5.1 explains in words of one syllable how users can avoid blank lines in address labels, or make sure that customised paragraphs are neatly spaced between the preceding and following paragraphs. Run through the WordPerfect Workbook exercises, or plough through the appendices, and they might be able to figure out a way to do it by rote. But any complex mail-merge operation requires the user to become a programmer, if only in a small way of business.

All the structures that programmers need — IF...THEN...ELSE, CASE, FOR...WHILE, and the rest — are there for mail-merge as well as macros if required. Users with the right background, and sufficient attention to detail, could put together a WordPerfect 5.1 form letter and an attached merge data file that could personalise a form

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letter so that no two words in two letters to different customers were the same. But on the other hand, users without the right background would follow the rote learning route and produce mailing labels with duplicated name lines and blank lines where the company ought to be.

End-user techniques

So if there is no alternative to programming to get the full benefit out of mail-merge, why not bring some of the now-emerging end-user programming techniques to bear? Why shouldn't producing complex mail-merge documents be as easy as producing a 'hello world' button in a Visual Basic program?

It is only fair to say at this point that all this was prompted by a look at the mail-merge facilities in Word for Windows 2.0, which will also be mirrored in Word 5.0 for the Macintosh if early rumours are to be believed. It is also only fair to say that mail-merge is one of the things that most reviewers check only to the extent of noting its presence; creative writers — and for my purposes I include software reviewers in that category — have no day-to-day need for such things and don't want to understand them. Similarly, grammar checkers tend to get no more than a cursory glance, since all reviewers are convinced that their work is beyond structural improvement.

But the Merge Helper in Word for Windows 2.0 is rather different. Right out of the box, it assumes that users need assistance in setting up merge data files, embedding the right data fields in merge master documents, and some confirmation that the merge will work correctly before a couple of hundred dodgy form letters are run off. And using the Windows interface to the full, it guides them through every stage of the process.

Dialogue box

For example, choosing the Print Merge command on the File menu does not just prompt for a data file and then start running copies off. Instead, it puts up a dialogue box that lets users attach a data file or header file — a header file simply holds the merge file field names — to the current document or detach such connections.

Clicking the Attach Data File button produces another dialogue box with a Create option, and choosing this opens a merge data document with a table already defined to hold the data to be merged. The table is an ordinary Word 2.0 table, and entering data for merge involves standard Word techniques. The only difference is that each column in

the table must be given a unique name, which is then used to identify the data fields embedded in the merge master document.

After entering some data, users can switch to the master document by choosing it from the Window menu or by choosing Print Merge again and clicking the Edit Main Document button. Then a new Merge toolbar is added to the document, with buttons to insert a new merge field, send merged data to another document file or to the printer, or check the logic of the current merge operation. All users need to do is type the master document and click the Insert Merge Field button for customised data.

A new dialogue box presents a list of the fields in the currently-attached merge data file for simple double-click selection, and for more complex merge operations another pane in the box offers the various WordBasic field options for immediate selection. Double-click one of these, and the template for that field is inserted into the document for direct editing.

Radio button

More impressive still, the blank line problem in addresses and labels is solved via a simple radio button in a dialogue box; choose the Print Merge command and click the Merge button, and the box appears. Click the Skip button in the section devoted to blank lines, and any merged documents printed will close up any gaps caused by empty fields.

Other options in this box can merge to the printer or to a new document, print only a selection of form letters, or choose the data file records to be included. Clicking the Record Selection button brings up a new dialogue box with a set of rules for choosing which records in the merge data file will be used, and complex AND and OR rules can be established for any field. For instance, it is possible to print a set of form letters aimed only at customers who live in Lincolnshire, without changing the data file or the merge master document at all.

There is also a 'check' button that makes sure that fields in the master document exist in the data document, and that the logic of the merge is correct. Combine this with the ability to Print Merge to a new document file, and some of the mistakes that appear in my own mail will just not happen.

Doing it yourself

Of course, this process is not perfect. Choose one of the WordBasic commands to insert a conditional field in a

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merge master document, and you still have to enter the expressions and mathematical operators yourself. But despite this, Word for Windows 2.0's Merge Helper is the nearest thing yet to a foolproof way of producing complex mail-merges. WordPerfect 5.1, despite the power of its merge and macro routines, is not in the same league for usability.

And so, for those companies without an in-house programmer who has an obsessive interest in name and address data, Word for Windows 2.0 will let them produce mail-merge documents more quickly and easily than before. Perhaps now I will get letters that miss off the 'Esq' in the salutation at least.

The importance of the Merge Helper in general, though, is that it makes mail-merge easier to set up, easier to get right, and simpler for those who are not already familiar with programming. It is a great leap forward, and would have got more attention than the equation editor if more reviewers had to produce form letters for a living.

We shall see more of this as word processors allow direct links to merge-file tables held on other machines — my current Word for Windows 2.0 beta has this macro 'not implemented' — and users are given much more direct control of what merge data is used where.

No reward

But me, I'm happy with a package that has fast scrolling, handles multiple monitors handily, and can find text in unopened files. I don't need a mail-merge helper, a grammar checker, or, even, a spell-checker most of the time. But I know that mail-merge is a constant activity inside many companies, and that there is no reward for getting a form letter wrong.

Microsoft is showing the way forward in user programming, and from now on merge printing in any word processor will be close to the Microsoft near-ideal.

WordPerfect 2.03

Not a little while ago, I wrote a Long Term Test of WordPerfect 2.01 for the Macintosh in these pages. Now version 2.03 has arrived, with bug fixes, increased speed, and Uncle Tom Cobley

and all. I'll let William Gallagher take over the story...

WordPerfect 2.03 salvaged lost work for me, saved grief over the spelling checker, and is inordinately faster. But the problems it solved were mostly created by trying to use 2.01 for a document that stretched it just too far.

First, a definite, if minor, bug. My documents are legislative and computing ones, with possibly too many abbreviations. With 'U.S.A.', for example, the 2.01 spelling checker passes the 'U.' without comment but stops at the 'S.', claiming that I have a duplicate word. Same with 'A.' In theory, entering 'A B C...' into the user dictionary would solve it, but it didn't work. Besides, my most common mistake is to hit the space bar too early and produce 'i s' instead of 'is'.

Now 2.03 opens documents in about two-thirds of the time I had become used to, and flies flawlessly through the spelling check.

Unstable

On my system, with these types of document, 2.01 was not stable. The work requires tables, screenshots, rigid formatting, imported graphics and a headings hierarchy that is complicated and still

evolving. Every page has at least two imported graphics and everything from the fundamental layout to the finished text is regularly redesigned.

Version 2.01 couldn't cope: it was slow and prone to crashing. As I neared a set of deadlines I started saving documents both regularly and twice, immediately doing a backup. Three times, though (over a month) the original file wouldn't open when I tried to open it. And neither would the backup.

'Fatal Error — Document is damaged and will be closed (F1)' appeared, and appeared, and appeared. The dialogue box strobed, constantly reappearing even before I could reach the 'OK' button. It isn't a WordPerfect error message, it's a system one. WP Support posted me 2.03 but it wouldn't reach me until after the deadline. The best they could suggest was that I strip out all INITs from my System Folder until 2.03 arrived.

I don't know if that worked: it didn't happen again before 2.03 arrived, but I still couldn't open those documents. These could be system-related prob-

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lems, particularly since that error message wasn't a WordPerfect one. But I don't have an unusual system — it's an SE/30 with Radius Pivot monitor — and so far 2.03 has not had the same difficulties.

Incompatibility

There is an incompatibility between the Pivot and WordPerfect. When I open WordPerfect, if there are any temporary files or backups, the monitor setting is instantly changed from four greyscales to plain black and white. That didn't seem to make any difference to the stability problem, but is very irritating.

Fortunately, my deadline slipped back over a weekend. On Sunday I installed the newly arrived 2.03 to save time on the Monday morning. The installation is not good: there are faults. Firstly, while you have the choice of an 'Easy Install' or a pick'n'mix of what you need, the WordPerfect Installer thinks you need enough disk space for the 'Easy Install' option. I knew I didn't want everything, so I picked one configuration and one printer, but was told I was a megabyte or so short. There was no alternative but to clear a megabyte (I deleted PageMaker), until after installing WP.

Second bug: the support documentation (a read.me file that only documents the unreleased version 2.02) says you should rename your old folder if you want to keep 2.01. I decided to, until I was sure of 2.03. The installation failed: it claimed that there was a problem, but reassured me that my existing software had been restored.

There was no clue whatsoever what the problem could be and so on Monday I struggled through with 2.01 and photocopies of old printouts. Clear of the deadline, I tried again. Guesswork did it: I moved WordPerfect 2.01's Preferences folder from the System Folder and it worked. I reinstalled PageMaker and went back to work.

Salvaging the wreckage

Three weeks later 2.03 has proved immeasurably better, if not a godsend. The claimed 27% speed increase is true. Version 2.01 took 45 seconds to open a 209K, 33-page document, and 2.03 took 30. And those wrecked documents?

The Open dialogue box on 2.03 has a Retain menu with options such as 'Complete Document' and 'Text & Attributes Only'. With the latter, 2.03 took in my text from the wrecked documents and salvaged all but one margin setting.

The new, stable WordPerfect 2.03 for the Macintosh has replaced PageMaker for me. Maybe I should have left PageMaker off after saving that essential extra megabyte.

Windows word processors face an uphill battle

The long-awaited (and late) Windows word processors from WordPerfect and WordStar have both shipped recently. Both of them are going to face an uphill battle to compete with Word for Windows, which has taken advantage of the

delay to dominate the Windows market and has recently launched Word for Windows 2.0, which incorporates most of the features that users have been requesting. We reviewed it (favourably) last issue, and it won our Editorial Team Product of the Year and Best Text Processing Software awards in the soon-to-be-announced PCW Awards. But we

haven't had a chance to try out the competition — yet.

Despite our enthusiasm for Word, it won't suit everyone. Certainly, existing users of the DOS versions of WordPerfect and WordStar will be tempted by cheap upgrades to the Windows versions. Users of other word processors may also be tempted by WordStar for Windows' £99 trade-in offer.

Each Windows word processor not surprisingly has 'emulation modes' which use the same keystrokes as their DOS predecessor, and will read its own files better than the competition can, which helps lock in existing users. Interestingly, Word for Windows 2.0 also at least tries to duplicate WordPerfect 5.1 keystrokes, if you ask it to. Because the word processing engine is completely different, this feature doesn't work quite as it should, but it is a good idea and may help people make the transition from one package to another.

David Brake

WordStar International 081-643 8866.
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"Word for Windows has taken advantage of the delay to dominate the Windows market and has recently launched Word for Windows 2.0, which has most of the features that users have been requesting"



Read and right

In Steve Cassidy's experience, 'reading' doesn't always mean what you think it does. And readers write in with Excel improvements and FrameWork observations.

Let's delve into the letter bag first. No further dissertations from workers in the field, alas: instead, a couple of observations on past conundrums. First off, Per-Olof Levinsson writes from Bottnyard in Sweden to say that the YYMMDD date problem in Excel is not such a problem in FrameWork. He is a happy and large-scale FrameWork user, with carefully developed applications in daily use with several thousand lines of Fred code built into his FrameWork integrated environment.

Per-Olof says the program has been much ignored, possibly because its graphics facilities are so poor. This is more of the same bias that we heard about from Peter Jacobs a couple of months ago: the spreadsheet technicians seem to have lost ground, in the minds of application builders, to the business presenters.

Fair point

Per-Olof's point seems to me to be a fair one, that it isn't always absolutely necessary to stick with the leading edge in software to solve your problem. Man-Centuries of effort has gone into the likes of FrameWork and Symphony, and the fashions of analysis and design which inspired the choices made in their production may turn out to fit your needs better than any of the current offerings. The sad truth is often that there is no guarantee of uniform improvements in software design as time passes.

The other improvement which I have mentioned recently is Excel 3 and its habit of inserting the licensee details into the header of all the worksheets

produced by every copy. Paul Gould, from Liverpool, has encountered this problem in the course of using Xtree's file manager on his .XLS files on a network.

It would seem, from his investigations, that the information in question is right at the start of the file and may be edited out using a suitable hex or other non-destructive editor. However, as soon as the sheet is opened by another copy, the registration details from that copy are immediately rewritten. However, as Paul says, there remains the opportunity of undoing the work of Big Brother Bill...

"Today's standards are settling down around three core formats: 1-2-3, Excel and CSV. A product will say that it reads and writes in these formats ..."

Translations

It used to be that programs wouldn't talk to each other. Happily, today, we're dealing with a world in which software companies have come to understand that migration of data is far more important and useful: far better to attract 50 punters through an open architecture than to keep one because he can't move

away from a closed one.

Today's standards are settling down around three core formats: 1-2-3, (commonly release 2.n), Excel (commonly PC release 2), and CSV, or comma-delimited text. Generally speaking, a product will say that it reads and writes in these formats. Excel 3, for instance, claims that it can read all of the above, and Lotus release 3 format too.

However, there is reading and reading of a spreadsheet. I recently had my nose rubbed in a developmental problem which makes this promise of easy conversion ring somewhat hollow.

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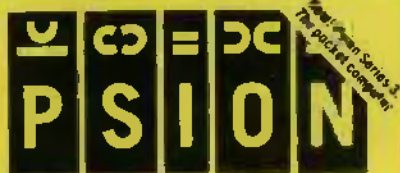
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Monster wodge

The problem is that once a spreadsheet progresses beyond a certain size, unless it's just a monster wodge of data to be sorted and analysed, it ceases to be possible to hone the entire document into a sensible shape. Sections of data will, by the nature of the visible window of a PC screen, become unwieldy. This has the effect, particularly on spreadsheets whose intersheet linkages are underdeveloped (which is to say, all of them save one or two), of making one adopt the practice of 'erroring out' a region.

'Erroring out' is where a set of calculations is made to display an error condition quite deliberately; this seems a little curious as a practice, until the apparent complexity of a large spreadsheet sinks in. To produce an exhaustive analysis of a medium-sized company, or more often to provide analysis over several years, with predictive conclusions added for one or two years into the future, takes at the least 15 columns by two or three hundred rows.

Adding in any kind of detail, specific to the business of the company, starts poking exploratory regions of the sheet out into the AA..AB series of columns; and there's the very worst stuff, in which a number of different business plans, separate branches or multiple business activities can poke your worksheet out to the BA..BB regions, or further in those packages that support it.

Multiple worksheets can help with models of this size: the problem which leads to the practice of 'erroring out' doesn't go away, however, if you use multiple ('3D' but not really 3D) sheets. The problem is that there is no immediate means of telling, from a screen display or printout, what stage your model has reached. 200 rows by row BK, split about 40% space, 30% formatting, and 30% formulae, is 5040 formulae and 3780 labels and other character or formatting cells.

The difficulty doesn't go away, however, if you use multiple ('3D' but not really 3D) sheets. The problem is that there is no immediate means of telling, from a screen display or printout, what stage your model has reached.

Concentration

Now, this is hardly an issue when the worksheet occupies a single screen, no more than 100 cells or so, but 5000 formula cells is another matter entirely. It's a work of concentration comparable with very large-scale software development to manage a sheet that size. Any number of events — like eating, sleep-

ing, and going to the loo — can come along to interrupt a single operation to change a set of cells. Very often, advanced facilities such as named ranges and search and replace of formula contents can shorten a modification cycle by an order of magnitude, but when that changes a day's work into 'merely' an hour, further means of checks and balances become necessary.

So, when faced with projects like this, I recommend subdividing the task into sections — or into '3D' sheets if your spreadsheet allows it. Each section is dependent on others to a very small degree, even if this means the occasional repeated block of base data, which you have to copy or re-establish from a core 'input numbers' region when you're good and ready. The size of these chunks should be set first *not* by the complexity of your problem, but by how much can sensibly fit on your printer or your screen.

Express yourself

It's easy to say that scrolling to and fro to look at your super-complex model is no problem, but there's an element of self-control and elegance in training to express yourself in that size of workspace. Cheating by way of large screens or 'metaview' display engines (like Wingz and Claris Resolve) is allowed, as is zooming in and out by changing the font size on other WYSIWYG displays.

My favourite spreadsheet workstation at the moment is a Mac SE/30 running Excel on a Radius Pivot A4 portrait and landscape display. Since the Mac will use all the monitors connected to it to display a virtual workspace, I am able to have the macro sheet displayed on the built-in screen of the Mac itself, and the worksheets on the Pivot.

So, given that the sheet is designed into separate sections, and you are likely to be changing portions of it in stages, you need to find some way of showing that a segment (a gradually reducing segment, as work continues) is invalid. Not that it contains horribly miscast formulae, but that it doesn't yet match your internal representation of the final state of the sheet.

Out, vile error

Enter the concept of 'erroring out'. In 1-2-3, a formula may quite legitimately contain the string ERR, substituting for a range identifier or other function. This causes the cell, and any other cells which point to it, to display and pass on ERR as their value.

By making a cell into an ERR, it's therefore possible to cascade a whole

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set of otherwise perfectly valid formulae into an error condition. I discovered this feature in the course of translating from 1-2-3 to Excel 3: Excel can't read formulae which have an embedded ERR. It assumes the worksheet it has been given is entirely up to date: in fact, by the time your worksheet is large enough to be worth converting rather than re-typing, it is more likely to be out of date (and errored out) than not.

Excel, given an ERR formula, doesn't even read in the formula and make it a label: it just grumps, complaining that it can't make sense of the text, and passes on to the next cell. As strategies go, this isn't terribly clever. I have yet to try it with other packages, to see whether they cope any better.

In an ideal world, my spreadsheets would be displayed on the PCW A3-sized 'computer of the future' from a couple of years ago, or on a virtual reality machine so that I could fly across a landscape of dimensions, but that's going to have to wait. In the meantime, when working with large and complex models, I'd like some way of marking sections with an update time or revision point, or colouring swathes of the sheet and switching colours when a cell has been 'touched'. Some of this can be done by way of manual calculation modes, but it's not quite enough.

OLE and instant update

Something very interesting happens if this observation of working practices is extended a little further. Several operating system and software suppliers, including Microsoft and Apple/Claris, will talk to you at great length about object-oriented document processing. In this metaphor, they say, the document becomes the important thing, not the program.

Rather than loading 1-2-3 and then picking up some worksheets, you would work with a document by way of a viewer, which would contain and display a number of objects. Thus, a chunk of text is an object which belongs to the word-processing routine.

A table of records showing current bank balances, say, would belong to the database retrieval routine, and a table of figures showing a historical floating average would belong to the spreadsheet routines. About the only remaining concrete system application would be the driver responsible for displaying and printing the document.

Assuming the use of some kind of pointing device, you'd work with your document by clicking on the object you wanted to operate on. The application responsible for fiddling with it would then leap into action, and you would be

presented with the menus and options specific to handling that particular chunk of the document.

Set pieces

There's a pair of gotchas heaving over the horizon, as one sits and thinks about this *modus operandi*. The first one is fairly evident — this mode of operation is extremely 'office-centric': it assumes the entire world lives their lives in imitations of the set pieces from the current Inmac catalogue, and would cause mayhem in some long established areas of computing excellence, such as process control.

The other gotcha, however, is what has caught my eye. Let's look at how this object-oriented strategy mixes with current, practical software features, and let's not restrict ourselves to IBM-compatible machines. After all, there's advancement and gotchas outside the pinstripe camp, too.

The Apple variant of this technology comes in two parts, known as Inter-Application Communication (IAC) and Publish and Subscribe. The former allows programs to talk to one another, both within one machine and across a network; and the second allows users to provide others with read-only files on a file-serving volume which represent a chunk of a document they are producing.

Now, let's assume we're back, pounding away at some poor devil's cashflow, or some complex engineering model with a number of paths to the same end product, with variant costs weighted against the processes in question. Whatever it may be — cost-effectiveness modelling for crop types around cities graphed against different transport mechanisms, or a network traffic analysis with five or six different bridge and router models — it's a pig, spreads across the sheet to the point of unwieldiness, and we've already shown everyone how much work has gone into it by printing the whole thing out, sticking the sheets together with sellotape, and hanging it on the office wall.

Bunch of fives

The conclusion can come down to a five-line by five-column block, buried somewhere in the middle of the sheet: the boss man would like to be able to pick up that conclusion and stick it into his one-page memo. He wants 'the latest figures', so you'll have to 'Publish' the punchline block in order to keep him happy. He runs his word processor, and 'Subscribes' to the block in question. In a year or so's time, I'd guess, the two applications would know

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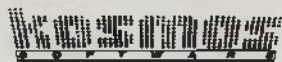
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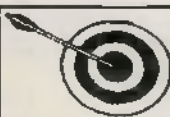
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enough about one another to be able to use IAC across the network, and for the WP package to be told 'It's changed again', so that it can collect the current version.

Except, of course, you've realised that there's a bug in your spreadsheet: something which has been entered in a row-wise fashion should in fact be in a column-wise display.

If you're using Excel, you'd do an Edit Copy, and then a Paste Special... Transpose Values, flipping the data round the way you want it, but leaving cells which refer to the changed section all out of kilter (this bit, at least, works now — but don't bother trying to do it with Edit Cut: Excel can't transpose matrices which reside in only the clipboard).

Hunting the snark

Time for an extended bout of printing sheets with formula contents visible rather than formula results, and a spot of snark-hunting to track the afflicted formulae. Meanwhile, your boss has printed his little one-page *oeuf* of a memo, and your bit reads like junk. Can't you get your act together? What are you, stupid? Trying to get him fired, making his nice organogram of rounded boxes connected by dashed lines with departments picked out in fetching 8-point Camelot, drop onto a page all on its own?

OK, that doesn't quite sound bad enough. One of the earliest implementations of object-oriented software has been PowerPoint for Windows. For quite some time now, it's been feasible to double-click on a PowerPoint chart and pop up a chart manipulation window which looks startlingly like the one in Excel. This is because, in all respects bar one or two, it is like Excel: an Object Linking and Embedding (hence, OLE) mini-program is built in to do the charting functions.

Pork belly prices

Now, let's assume your great work is to be demonstrated to the board/the clients/the fire & safety people/the Farmer's Union. Like most bosses, yours cannot leave the thing alone and keeps showering you with last-minute changes, before dashing off to the presentation suite with the Barco video projector and drop-down screens. His presentation's on the server, with links

to all kinds of stuff — live share price feeds, the callout log of the Fire Brigade, commodity pork belly prices on Comex London. Of course, it's your bit, carefully errored out while you plough through his modifications, which comes up looking like a Hungarian income tax form.

So far, on any machine, with any piece of software, this isn't a problem. However, if the marketing blurb, the previews and the pundits are to be believed, this is where all the competitive effort is going. The question is, do you want to be taken along?

Excel 3.0 shortcuts

Here are a number of double-click shortcuts that Excel 3.0 users may find useful (some of these shortcuts are also applicable to earlier versions).

1) Double-click on the Excel application title bar and you can toggle between a maximised application window

and an intermediate window size between maximised and minimised.

2) Double-click on the title bar of a worksheet and it will maximise. However, you cannot toggle back by this method because the worksheet title bar is gone (it becomes part of the application title bar). Instead, double-click on the lower right-hand corner box

directly below the scroll-down arrow and the scroll-right arrow.

3) When you are working with graphic elements in the spreadsheet, such as circles, lines, boxes and text boxes, if you double-click on the object when the pointer is an arrow, you will get the Format Patterns dialogue box for that object.

4) If you double-click when the mouse pointer is on the line between two column letters, the column width will change to fit the longest text in any cell in that column. A similar, but less obvious, result occurs when you double-click on the line between two row numbers. In this case, the row height changes to fit the largest font in that row.

5) When you have created formulae which link spreadsheets, you can open those linked spreadsheets by double-clicking on the cell containing the linking formula.

Shane Devenshire
Walnut Creek
California
USA

*"It's your bit,
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Form factors

Kathy Lang explains the importance of data structure, and how a poor choice of one can leave you feeling a little flat

In previous articles I've mentioned briefly the question of data structure as being central to the use of databases. Several people have asked me to elaborate on what is meant by structure, and its implications for database handling. I'd like first to answer a related question: why a database at all? What's wrong with using a spreadsheet or a word processor to handle names and addresses, stock records, and the like?

The short answer may be: nothing at all. It's all a matter of 'horses for courses'. To take the metaphor literally for a moment, you can ride almost any kind of horse on quiet country roads and for canter through the park. But to cope with traffic, you need a horse that's 'bomb-proof'; to ride across country, you need one that can jump. To play polo, you need a horse with remarkable agility and a good turn of speed. And if you want to win the Derby or the Grand National or Badminton or the King George V Class at the Horse of the Year Show, you need a horse with very special abilities, and different talents in each case.

Data handling applications follow a similar pattern. For a good many basic tasks, you could get by with a word processor or spreadsheet; and in some circumstances these would have advantages over a database.

Word processors

The essence of a word processor is that material is entered sequentially, and without any checks on its accuracy. I

was once involved in a project in which a complex price list was created and updated weekly using WordPerfect. The flexibility of output layout was considerable, and the staff were using tools which were part of their everyday office work.

The major drawback was the lack of checks on data accuracy. Product codes, for example, had to exist already on the company's mainframe before they could be used in a price list, but only a manual check on this was possible. Some items in the price list were sets consisting of several items, each of which were also sold separately; the price of a set should not be greater than the sum of the individual items, but this could not easily be checked even by hand, since you could not identify the items to be included except by searching for each one individually.

The obvious answer was to use a database system with proper data validation. But this had its drawbacks too, notably in the flexibility of reporting. A database facility for searching for an item in any field, not just in a named field, is a great boon for such applications, but is still quite rare.

Variable length fields are also almost mandatory in a database handling information of mixed type, in which you often want to add comments, or include elements which vary greatly in length.

And in most database packages the editing facilities are significantly inferior, with few making it easy to copy

"For a good many basic data handling tasks, you could get by with a word processor or a spreadsheet; and in some circumstances these would have advantages over a database"

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information between fields within a record, for example. But the gain from being able to handle the information in a structured way is usually quite overwhelming.

Spreadsheets

The dividing line between spreadsheet and database applications is much less clear, because at the basic level they have much in common. A spreadsheet is a table of rows and columns, with the smallest unit a cell; a database file is a table in which each record is a row, all the values of one field a column, and the smallest element is a field.

Data in a spreadsheet can be validated, at least to some degree; one spreadsheet can be related to another, though less flexibly than in a set of database files. At the basic level, and for moderate quantities of data, the major difference is one of philosophy rather than of facilities. The spreadsheet is intended to model a situation as it is now, with the aim of projecting that information, forecasting how it will appear in the future. Many applications do not use this forecasting capability but simply model life as it is, but they are nevertheless constrained by the 'what if' approach.

The focus of most spreadsheet applications is on the whole table, or at least the rectangular section being worked on; the choice of column or row orientation is usually arbitrary. The focus of the database is, at least during data entry, selection and so on, on the record, and the classification into row (record) and field (column) is systematic and usually intuitively obvious.

Size also has a bearing. You can have spreadsheets much larger than memory, but they are not then so easy or fast to handle. Again, this has a lot to do with structure, since a database of any size is normally indexed in such a way as to take advantage of its known characteristics and the ways in which it will be accessed.

Spreadsheets are in a sense indexed by every cell/field, which is fine for small models. But the overheads grow dramatically as the spreadsheet increases in size. And while data validation based on the cell is relatively easy (to make sure that an entry is numeric, for instance), checking which requires inter-record consistency is much harder.

For example, to check that the code being entered for a product in a price list already exists in the appropriate cell in another spreadsheet is usually much more difficult, and much slower, than the corresponding operation in a database.

In both cases, then, a major factor in

the decision to go for a database approach is the need to reflect the structure of the information in the way that it is held and handled on the computer system.

Information structure

There are essentially three main forms of data structure, though within the most complex form are many sub-varieties. Some kinds of records contain information which is highly predictable in both form and quantity. For example, a stock record might need to contain the part number, quantity in stock, price and reorder level. Most of the less expensive data management systems work on the basis that every record will contain the same number and type of items; this is sometimes called a 'flat file' structure.

Greater complexity, but still without flexibility, is often found in a form known as the master/slave relationship, in which the data is related in a hierarchical fashion. In some situations, you cannot predict the number of items which each record will contain. For example, a personnel record system might have a fixed number of items about each employee, together with some items about each post the employee has held. A young trainee would have only one such set of information, while the personnel manager might have four or five. This kind of data structure is usually referred to as a 'one-to-many' relationship — one main record being related to one or more subsidiary records.

More sophisticated packages allow you to store the information which occurs once for each person in one file, usually called the master file, and the records about each post held by each employee in a separate file, often called a transaction file. There were at one time several packages which provided specialist facilities for handling hierarchical data, but nowadays it is generally treated as a special case of the third type of relationship.

Many-to-many

More complex data relationships are needed in many applications. For example, in a stock control system, the basic file may contain a simple stock record of the kind I've already talked about. But to develop a computerised ordering system, you need to record information about the supplier of each product. Usually it will be possible to obtain the product from more than one supplier, and each supplier will be able to deliver more than one product. So the relationship between stock items and suppliers is a 'many-to-many' rela-

tionship. This more complex kind of relationship requires the ability to link sets of records of dissimilar structure in a more flexible way than the simple master/slave case.

All the more powerful data management systems provide features to relate dissimilar sets of records to one another. If your data has a complex structure, you will find that it pays to put quite a lot of effort into planning how best to implement that structure, before you decide what package to buy. Data management systems vary quite a bit in the facilities they provide for setting up relationships between sets of data, and for handling related files (for example, to produce a report containing information from both the stock file and the supplier file). Most important of all is the exact nature of the relationships between each set of records.

When one file is related to another, a key is needed to link the two sets of records. In the stock control example, the supplier file may be keyed on supplier code, the product file on product code, and the invoicing and stock control systems would create records by looking up records in these files using those key fields. Sometimes, if the hierarchy of relationships is more complicated, several fields need to be combined to form a key.

Unique identifier

In the best regulated systems, a complete key is a unique identifier for a record; this is the best way to ensure data integrity. For example, if you invoice by name, to ensure uniqueness your key might need to be the combination of surname and initials. Often even this isn't enough to make sure that the right person gets the bill — hence the common use of the phone number as the primary key, since this should be unique to an individual or company. The use of a unique key also ensures that you don't enter the same customer twice. Nor should the key be longer than necessary, because this adds unnecessary overheads to database house-keeping and slows processing down.

A famous database guru by the name of Codd laid down rules for uniqueness of the primary key, and these have been popularised as 'the key, the whole key, and nothing but the key' — the key, no

extra fields, all the necessary fields. When a database is constructed in this way, it is said to be 'relational'. In the mainframe world it is common for database systems to make you have a unique primary key for each record, but PC systems pay much less attention to data integrity.

A complete set of keys to one file is called an index. In addition to their use to locate individual records, indexes are often also used to speed up selection and access to groups of similar records, and in this case the key will not be unique to the particular record. To avoid confusion, such keys should be known as secondary keys, but the point is often completely confused in database manuals.

"It is well worth considering ways you can get help. You may be able to avoid problems altogether by using a specialist package rather than designing your own: someone may have been there before"

When people first set up a database system, they usually try to start with a simple, 'flat-file' approach and then 'grow' it later. This is understandable, but may not be wise. Partly this is because it is very hard to choose an application which is truly 'flat-file', and therefore the data structure tends to get perverted in order to store the data in a single file. A common example is the 'client contacts' database, in which it seems a simple matter to allow a few spare fields to permit the entry of several contacts at one address. But very soon complications start to creep in — one contact may normally work from a branch office, another is only available on Fridays, and so on. The 'spaghetti' which results may be hard to sort out later.

User groups

At this stage, and often even earlier, it is well worth considering two ways you can get help. You may be able to avoid the problems altogether by using a specialist package rather than designing your own system; someone may have been there before. The contact system is a classic example, as there are several good tailor-made packages to handle this application; the easiest I've come across so far is Tracker, which I plan to have a good look at soon for this column. Accounting, parts assembly, job costing, time recording, management of display advertising — these and many other database applications are marketed as specialist tools by companies with an in-depth knowledge of the par-

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ticular application area.

For more general help, a user group is your best bet. All the popular packages have a user group; probably the best known is the dBase User Group, which caters for users of dBase, Fox and Clipper.

To give you an idea of how helpful a user group can be, I talked to someone who is a keen member of both the dBUG

and the Ventura User Group, Tony Gamble, Managing Director of Rhinegold Publishing in Covent Garden (see the box below).

Thank you to all those who have written about the column — future articles are planned on shareware and on co-operative outworking, both as a result of readers' requests. Please keep writing!

Why be a MUG (Member of a User Group)?

Rhinegold Publishing was formed in 1977 to publish *Classical Music* magazine. By 1981 the company had invested in its first twin floppy Superbrain. A year later it bought the publishing rights to the *British Music Yearbook*; its data was then stored electronically only on the typesetter's disks. Proof forms were entries cut from pages of the latest edition, stuck to pre-printed sheets and mailed in handwritten envelopes. Corrections and updates were marked on pages of the book which were sent back to the typesetters to be keyed. The whole process was labour intensive and potentially inaccurate.

Rhinegold, in the person of MD Tony Gamble, guessed there might be a better way — and over the next few years found that there were several. For the company's first attempt, a software consultant stripped out all the typesetter code from tape supplied by the setting house. The resultant text was appended into dBasell files, using the commas within the entries as field delimiters. The result was a library of files for various sections of the book. The fields needing re-ordering, but at least they were in the right record.

The company now had several boxes of floppies containing all the entries of the book in dBasell. Sending proof forms was easy, using dBasell and a mailmerge utility to produce sheets with individual entries, repeating the address for a window envelope. Equally important, Rhinegold had learnt so much about stripping out typesetter codes that it was relatively easy to write a dBasell routine to put them back.

Each file structure had its particular 'build file' which was very similar to the 'recipe' concept employed in Database Publisher. Appropriately processed data was sent back to the typesetter.

By 1988 the company had five directories, each with its own different set of files and recipes, but was still restricted by the limitations of dBasell. The consultant continued to come up with clever programs, and

Tony Gamble joined the dBase User Group in the hope, as he put it of 'understanding more about what we were doing'. At one meeting, I gave a presentation about my beta-test of the new dBaseIV, in which I made a throw-away comment about 'using Ventura to tidy the output'.

In the coffee break, Tony asked me if Ventura would be any use to 'proper publishers'. (As the managing director of a publishing company he had yet to be approached by anyone selling DTP and the magazines were still being typeset conventionally.) Within four months Rhinegold was producing all its magazines with Ventura; it recovered the cost of the system (including an intensive day's 'there must be a better way' training from Kathy) within the next six.

Following his good experiences with the dBase User Group, Tony joined the Ventura User Group. Because he was not free, one of his book editors went to what would have been his inaugural meeting. She came back to say that she had seen a magic utility which converted databases to Ventura, and did not need a software guru to operate it. It was Database Publisher. An order was placed and Rhinegold took delivery of one of the first sales.

Early in 1990, at the dBase User Group, Tony saw a demonstration of FoxPro. He was particularly impressed with its ease of appending text into memo fields; a facility invaluable when compiling directories. Again Rhinegold placed an immediate order. It has transformed the ease with which Rhinegold's books can be enhanced.

To sum up, Tony says: 'Three products, Ventura, Database Publisher and FoxPro, are now absolutely essential parts of the Rhinegold system. No doubt I would have come across them eventually, but it was at the User Groups that I saw them first!'

Contacts dBase User Group (0256) 768646. Ventura Publisher User Group (0508) 41580.



Compilers for Christmas

Dan O'Brien looks at cheap ways to extend your language base, and introduces a pretty flake routine for snow-time.

An old saw handed down through generations of site foremen goes like this: 'If builders built buildings the way programmers built programs, the first woodpecker to come along would destroy our entire civilisation.'

This column has already in its short life shown a morbid predilection for the failings of others. As a New Year's resolution, I swear to look to my own eye-planks, but as a parting shot, take a look at this code:

```
/* Compiler ID routine */
#include <conio.h>
main()
{
    cprintf('Hello, World!');
}
```

It may look simple, but is in fact a very clever development platform detection routine. With Microsoft C v6.0, for instance, it will return the status message: 'Hello World!'. On early releases of Borland's flagship C++ v2.0 it will return: 'Hello World!Hello World!'. I was sad to see this excellent auto-identification feature disappear in subsequent releases of Borland C++.

Computer languages are rarely free of bugs, especially on first release. It seems to take at least three years for a stable version to emerge — two years after the package becomes outmoded, in fact. This presents a terrible tug-of-love for programming folk, torn between the dependability of an old faithful and the excitement of a new compiler.

If coding is your career, the pain is even greater: a new development system is a big investment.

If the system is good, a switch could halve your developing time (a colleague swears his life changed

when he junked C for Smalltalk). Or it could all be money down the drain. There are big companies who stayed with Microsoft's version 5.1 C rather than upgrade to version 6.0 (slightly suspect, back in mid-1990). They are still there now.

Most programmers, outside DP departments, carry at least two brands of compiler. One will be the latest flash-bang Thunderball XL5 super-optimiser; perhaps the latest offering from Watcom (a Canadian firm famed for the compact, fast code produced by its C systems). The other will be the one they actually use for all compilation (in my case, a battered copy of Turbo C). The two don't even have to be the same language; a respected programmer I know divides life around production code made from cold hard assembler, and prototyping via a well-hidden copy of Microsoft QuickBasic.

Hobbyhorses

The hobbyist (hateful word) can't claim such products as expenses and certainly won't be looking for a second £500+ compiler. Just now, he or she will be noting how the nights are growing long enough for some really intensive hacking sessions. What can poor coders, with less than a ton to spend, do for themselves this Christmas?

Prices for extra languages range from around £150 upwards, less for IBM PC users and for Mac people. But if you're looking for *interesting* products, rather than the latest Porsche systems, there are possibilities.

Absolute beginners first. Users who bought their computers mainly to learn programming are treated horrendously these days. Micros of the same generation as the IBM PC were frequently sold with the best development system built in. AppleSoft Basic and a monitor catered for Apple developers' needs, as



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did Acorn's excellent Basic and assembler in ROM for BBC Micro users. But while computers have advanced to ridiculous levels, the languages supplied with off-the-shelf PCs have frozen, generally at the point at which Microsoft stopped the development of the original Microsoft Basic.

(As an aside: Microsoft Basic was the product that made Bill Gates' name, if not his fortune. All manner of legends surround it: that Bill got his business ferocity after it was ripped off by a pirating computer store owner; or that the 6502 version constructed its own central routine by modifying its own code. Self-modifying code is one of the most widely villified and shunned forms of low-level hackery, so it's worth noting that Gates did it in his first published program and Microsoft does it in Windows — see last month's 'Low Level'. Also, Apple does it in System 7.0.1: on Macs with co-processors, the OS pokes in-line floating point code directly into applications. Sinners all.)

But I digress. No matter how riveting Microsoft Basic is historically, it stinks as a built-in Basic on the PC, and on the Atari and Amiga's derivative versions. On the ST, for example, you are required to poke directly into the program's system area just to re-size the window. Matters have improved very recently, with Microsoft's inclusion of a mildly crippled QuickBasic into MS-DOS v5.0, and the recent packaging of the Atari with the mildly better STOS.

AMOS and STOS

In fact, as a low-cost introduction to programming both the Atari and the Amiga, STOS and her brother AMOS from Mandarin Software should be recommended. Both are Basic interpreters, with compilers available separately; both are notable in the number of intuitive, if somewhat old-fashioned, extensions to handle graphics and sound on the two systems.

By old-fashioned, I mean that unlike most windowing systems these days there's no complicated overall system to be understood. The extensions are, instead, a small set of discrete, extra commands with names like DEF ZONE and MOVE x 1, (1,1,100)(1, -1,100). With a passing knowledge of Basic, you can be doing sophisticated programs, using the full capabilities of either the Atari or the Amiga within a week.

STOS costs £29.99, AMOS £49.99. STOS, incidentally, is by far the weaker of the two, lacking features such as procedures or local variables. Both have very healthy communities of programmers producing subroutines and utility programs. And Mandarin offers an

annual £5000 prize and commercial production for the best program submitted to its offices.

IBM users starting on programming are, naturally, spoilt for choice. The traditional recommendations in the £100 bracket are either QuickC (£50), Turbo Pascal (£69) or Turbo C++ (£50). The hordes who follow these three will be keen to convince you they have clear, logical reasons for which one they chose; in truth, their choice was largely determined by which one they used first.

Windows options

All these compilers work only under DOS, and Windows users should consider the three official Windows equivalents of these compilers — QuickC for Windows (£96), Turbo Pascal for Windows (£103) and Borland C++ (£299). The Borland package is clearly aimed at the professional, containing a full profiler, Windows debugger, assembler, and dialogue design kit.

QuickC, the weakest, seems to be a market stopgap before the final release of Microsoft C++. Its principal selling point, the inclusion of the application generator CASE:W, falls rather flat on customers keen to get stuck into the Windows API. A better choice would be Microsoft's Visual Basic. This and Turbo Pascal for Windows vie for the title of 'Most fun to use Windows Development Environment'. Neither is great for truly low-level spelunking, however: for that you'll need C v6.0 and the Windows Software Development Kit or Borland C++.

A cheap PC option often undeservedly overlooked is Jensen Partners International's range of languages. JPI began life as a scion from Borland, breaking away in the belief that Philippe Kahn's concentration on Pascal was deflecting the company from the true future of programming: multiple language development.

JPI's TopSpeed range has been the very model of mix 'n' match. Each compiler (Pascal, C++, C and Modula 2) costs £59, with a one-time purchase for about the same price of an environment to run it in. You may get, say, a Pascal compiler with environment for £120; then, if you feel like exploring another language, you can splash out £59 on, say, C++ or a DOS Extender. Languages can be mixed within the same program.

JPI isn't the most heavyweight of compiler contenders, but its marketing and pricing policies can be attractive to explorative programmers.

The other advantage JPI and Borland have over Microsoft (at the moment) is OOP technology. Some writers see the

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true value of object-oriented programming (the subdivision of code into modules that can act independently, but whose behaviour can be easily modified) as apparent only in large, commercial endeavours.

This rather misses the point that (perish the thought) OOPing is actually quite fun, once you get the hang of it. Certainly, people mad enough to enjoy programming in their spare time should appreciate the challenge of mastering an entirely different approach to driving a computer. That it also, with a sufficiently extensive library of objects makes programming easier, is a pleasant bonus. Turbo Pascal comes supplied with Turbo Vision, which is an excellent object library to play around with in text mode DOS applications.

The same package is also available for TurboC++, although its native home in Borland's idiosyncratic object-oriented Pascal does make for some awkwardness. If you're buying to use Turbo Vision, buy Turbo Pascal; if you want to learn OOP in all its horrors, get C++.

HiSoft offerings

For a professional C or Pascal or assembler package on the ST and Amiga, most routes lead to British company HiSoft's door. It's not quite a monopoly: HiSoft bought in the code for its main compiler, Lattice C, from the USA's SAS Inc, and its low-range Power Basic (£49.95) and HighSpeed Pascal (£99.95) derive a great deal from QuickBasic and Turbo Pascal.

Nonetheless, the company does rule the roost when it comes to assembler: DevPacST (£39.95) and Amiga (£59.95) are the de facto assembly systems on the two systems these days.

More adventurous Atari programmers might like to try and phone 01049-6221-300-002, where they'll find the makers of Pure C, Borland Germany's port of Turbo C to the Atari. You'll need to speak both C and German to get through the documentation.

And the Mac? To hack on the Mac is a brave act indeed, and traditional wisdom suggests that you'll need nothing short of the Macintosh Programmer's Workbench with Think C even to start. The cheapest route for this software — plus the extensive documentation needed to work it — is to call the Apple Programmers and Developers Association in Germany on 0101-408 562 3910 and order a catalogue. Pascal and C starter kits cost about \$425.

There's always another way, of course. Unsanctioned, but still curiously popular, is the Metrowerks range of Pascal and Modula 2 compilers for the Mac, priced at £90 for full Macin-

```
EM SINCOS.BSC — for FLAKE program
X%=OPENOUT('D:\SINCOS.DAT')
PRINT#X%,'; == SIN == ';CHR$13;CHR$10
FOR I%=0 TO 360-36 STEP 36
  PRINT#X%, ' DC.W ';RIGHT$(HEX$(SINRAD(I%)*32766),4);
  FOR O%=1 TO 35
    PRINT#X%,',',';RIGHT$(HEX$(SINRAD(I%+O%)*32766),4);
  NEXT
  BPUT#X%,13:BPUT#X%,10
NEXT
PRINT#X%,'; == COS == '
FOR I%=0 TO 360-36 STEP 36
  PRINT#X%, ' DC.W ';RIGHT$(HEX$(COSRAD(I%)*32766),4);
  FOR O%=1 TO 35
    PRINT#X%,',',';RIGHT$(HEX$(COSRAD(I%+O%)*32766),4);
  NEXT
  BPUT#X%,13:BPUT#X%,10
NEXT
CLOSE#X%
```

Fig 1 SINCOS>BSC for generating sine/cosine look-up table

tosh Toolkit access. You won't get quite the same degree of support, and you'll need to get hold of the essential Apple Technical notes and Macintosh Revealed volumes separately, but you will be able to eat. Metrowerks products are available from Real Time Associates, which also has some stockpiles of Metrowerks' 30 Starter Modula 2 for the Mac, which should bring a bit of festive cheer to someone.

Season's speakings

A festive contribution, FLAKE, by Simon Oakes of Formby, Liverpool, is a 68000 assembler program for the Atari ST with Microdeal's

MasterSound II digital sampler, but easily adaptable to other Atari sampling equipment as well as the Mac and Amiga platforms.

Simon explains: 'FLAKE is a program based upon Clifford Pickover's theories of symmetrized dot-patterns (SDPs). This is a technique for taking waveform data such as sound and presenting it in a graphical form that humans can readily digest.

'SDPs display a set of sampled amplitude levels in the form of a circle, with each dot mirrored six times to create a 'snowflake' pattern. The dots' distance and angle from the centre of the circle is based on a simple formula

```
R
;FLAKE by Simon Oakes
dmpSize EQU 8000 ;Size of sound buffer
_BUTTON EQU $26E6 ;TOS 1.0 undoc. mouse address
jmp init ;Skip subroutines
clspea clrCode(pc) ;clear screen
move.w #9,-(a7) ;AtariST print string
trap #1
addq #6,a7
rts
clrCode dc.b 27,'E',0
even ;68000 needs even addresses
oldVal dc.w 0
init move.w #0,$26E6 ;Sets up
dc.w $A000 ;ST-specific stuff
move.l A4,$C(A0)
move.l A5,$8(A0)
move.w #1,(A5) ;ST stuff done
bsr cls
record lea dump(pc),a2 ;record sound data
move.l a2,a6 ;into buffer
add.l #dmpSize,a6
reclp move.b $fffa0001,(a2)+;Records waveform
move.b $fffb0001,d3 ;from MasterSound II
move.w #20,d3 ;Time delay
```

Fig 2 Start of FLAKE assembler code

```

timeLp  subq.w #1,d3
        bne timeLp
        cmp.l a6,a2
        blt reclp
        lea dump(pc),a2 ;Go through sound dump
start   moveq #0,d4
        move.b (a2)+,d4 ;Get amplitude (0-255)
        asl.l #2,D4      ;Put in range 0-1020
        lea oldVal(PC),a3
        move.w (a3),d5 ;d5=previous sample
        move.w d4,(a3) ;store new one
        moveq #0,D6     ;Go around circle
loop    move.w D5,D1     ;first plot:
        add.l D6,D1      ;angle=new value
        move.w D4,D2     ;radius=old val.
        bsr plot ;polar plot it
        move.w D6,D1     ;Now do symmetrical
        sub.w D5,D1      ;point to make it
        move.w D4,D2     ;like kaleidoscope
        bsr plot
        add.w #(60*16),D6 ;add 60 degrees
        cmp.w #(360*16),D6 ;All around?
        blt loop
        cmp.w #0,_BUTTON
        beq until
        cmp.w #1,_BUTTON;quit if left
        beq quit ;key pressed
        bsr cls ;cls if right
        jmp record ;and start again
until   cmp.l a6,a2      ;finished sample?
        blt start ;no;continue
        bsr cls
        jmp record ;else get new sound
quit    rts
;Polar plot routine
;d1=(angle*16),d2=(radius*4)
plot    movem.l a0-a6/d0-d6,-(a7) ;Save registers
mkPos   tas d1 ;same as cmp #0,d1
        bpl mkSmall ;If <0
        add.w #(360*16),d1 ;make positive
        bmi mkPos
mkSmall cmp.w #(360*16),d1 ;if >360
        blt trig
        sub.w #(360*16),d1 ;make smaller
        bra mkSmall
trig     asr.w #3,d1 ;get trig values
        and.l #$FFFE,d1 ;from lookup
        lea sin(PC),a3
        lea cos(PC),a2
        move.w 0(a3,d1),d3
        move.w 0(a2,d1),d0
        muls d2,d3 ;Times by radius
        muls d2,d0
        swap d3 ;Makes $XXXXYYYY=$YYYYXXX
        swap d0 ;(divides by $10000 here)
        asr.w #2,d3 ;divide bottom words
        asr.w #2,d0 ;by 4
        add #128,d3 ;Centre on screen
        add #128,d0
        move.w d3,0(a4) ;Atari PlotPoint(d3,d4)
        move.w d0,2(a4)
        dc.w $A001
        movem.l (a7)+,a0-a6/d0-d6 ;restore registers
        rts
;INSERT SIN AND COS DATA HERE
dump    ds.w dmpSize

```

derived from a comparison of pairs of adjacent amplitude levels. The pattern of these "speech flakes" allows humans to spot differences and similarities more quickly than with other methods of presentation.

'Pickover and his colleagues have used SDPs to create systems that can highlight human heart dysfunctions and differentiate handwriting. This assembler program for the ST and an 8-bit sampler (in this listing, I've used the MasterSound II, but the code can be easily adapted) is more modest, using sampled sound to present an attractive and ever-changing flake pattern, coloured with a "pyjama stripe" effect obtained from the ST's quirky A-Line plotting commands.'

Simon's code has the notable quality of being partly computer-generated. The first portion is a Fast Basic program (again, easily adapted) to generate an ASCII file of the data lines for a sine and cosine look-up table, which forms the last few lines of the assembly code.

The structure of the proglette should be self-evident, but for the record, BPUT#<handle> outputs individual bytes to an opened file, and SINRAD returns the sine value for an argument expressed in degrees (as opposed to radians, the default in most languages). The ASCII file produced by this code should be inserted where indicated into the main assembly code.

This data, together with the plot subroutine, make up a standalone polar coordinate plotting routine which you can half-inch with Mr Oakes' blessings for your own 68000 applications. If you do, it might be worth taking advantage of the fact that cosine is just a phase-shifted sine wave, and combine the sine and cosine data tables by using an offset for the cosine look-up; as it stands, the two separate look-up tables are an unnecessary extravagance.

And one final warning — Simon uses an undocumented address to check the current state of the mouse button, which might not work on all TOS versions. Tsk tsk.

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Readers interested in symmetrized dot patterns and other explorations of computer visualisation should consult Clifford A Pickover's *Computers, Pattern, Chaos and Beauty* (Alan Sutton Publishing, ISBN 0-86299-792-5, £24).

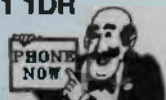
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IBM Ultimedia makes its mark

If IBM gets its act (and its marketing) together, it could top the multimedia league with its range of products announced recently at TIME and Comdex. And if you need OS/2 now and can't wait till next year, IBM can provide a 'limited' version. Ken Morse reports.

At the TIME (The Interactive Multimedia Event) show in October, IBM launched (and re-launched) a series of products under the banner of Ultimedia, a new IBM trademark! The following week these were announced at Comdex. It is IBM's first real attempt to grab people's attention and focus it towards IBM to provide multimedia solutions. The company has recognised that it cannot ignore Windows and many of its older multimedia adaptors have been updated to run with Windows in addition to DOS and OS/2.

The IBM multimedia PC

The largest product announced was a new PC, the PS/2 Ultimedia Model M57 SLC (quite a mouthful). I'll be brief since a full review is bound to appear in PCW in due to course. Its main features are as follows: IBM's new 386 SLC processor (which runs at 40-50% faster than Intel's); 4Mb of RAM; 16-bit XGA graphics adaptor; 80Mb SCSI hard disk; 600Mb SCSI CD-ROM; 3.5in 2.88Mb disk drive; and 16-bit audio subsystem.

This is obviously a serious multimedia PC and IBM bundles three operating systems on CD-ROM with it: DOS 5.0, Windows 3.0 (with Multimedia Extensions 1.0), and OS/2 2.0 (when available). The user therefore has a system that can handle all the major multimedia platforms currently available on the PC.

The audio subsystem is provided by an Audio Capture and Playback Adaptor which I'll describe later.

M-Motion Adaptor/A

This card's primary use is to display full-motion, full-colour video on PS/2 colour monitors. The input images may originate from a variety of sources such as videodisc, video camera, closed-circuit television, or VCR. The adaptor

processes the analogue video signal and presents it in a predefined window or full screen. Alternatively, by using a utility program, frames from the video input can be captured digitally and stored in PS/2 memory. However, the primary use of the adaptor is to support interactive, full-motion applications for immediate viewing under program control.

The software supplied is M-Control Program/2 which gives the multimedia application developer control of multimedia devices using send and receive functions. The standard OS/2

"IBM has recognised that it cannot ignore Windows and many of its older multimedia adaptors have been updated to run with Windows in addition to DOS and OS/2"

messaging interface is available for Presentation Manager classes, including video window and videodisc control.

M-Motion device drivers and player drivers also support Microsoft Multimedia Extensions MCI. Applications can access digital audio through the low-level audio services of MCI. Emulation of the low-level audio services is also provided to enable digital audio in a non-MCI environment. Both mono and stereo sampling rates are supported.

Video Capture Adaptor/A

A new version of the Video Capture adaptor works with PAL video sources. The previous version of this card supported NTSC (American) video sources.

(A short review of the original card appeared in an earlier PCW column.) Basically, the card operates like the previously mentioned M-Motion adaptor but only with still images. The Video Capture Adaptor allows still video to be easily mixed with still images or overlaid with VGA graphics, giving multimedia presentations more front-of-screen impact. It forms the hardware basis for the Audio Visual Connection, a software authoring package for multimedia presentations.

M-Audio Capture and Playback Adaptor/A

M-Motion is capable of audio capture and playback but for professional systems the Audio Capture and Playback Adaptor (ACPA) is available. This card enables audio conversion to and from a digital PCM (Pulse Code Modulation) data format; sampling widths of 8 and 16-bit; mono and stereo; sampling rates of 8,000, 11,025, 22,050 and 44,100 samples per second.

In addition, 16-bit ADPCM (Adaptive Differential PCM) audio compression and decompression is available in several grades of quality. MIDI datafiles can be played back on the adaptor which supports 106 different musical sounds with eight-note multi-timbral support.

Software support takes three forms. Firstly, a Windows 3.0 dynamic link library (DLL) is provided. In conjunction with the Microsoft Windows Multimedia Extensions, the adaptor digitises incoming audio and plays it back on command. The Windows DLL also provides a synthesiser which permits the adaptor to play back standard MIDI files.

Secondly, Audio Device Drivers (ADD) make these same audio capabilities available on a range of other operating systems, including DOS,

Windows 3.0 and OS/2. At the same time, in a multi-tasking environment, the ADD can manage audio requests from multiple applications.

Finally, the Audio Application Program Interface (AAPI) is a set of high-level C routines which permit simplified access to the same audio functions. The Audio API is not as flexible as the Audio DD and requires greater amounts of storage. The Audio API operates under DOS and OS/2.

ActionMedia II

What's ActionMedia II? If I said that it won the Multimedia Product of the Show at the recent Comdex you might get interested. If I then said it went on to win the Product of the Show award you might sit up!

Quite simply, ActionMedia II is an impressive piece of technology waiting for the multimedia market to take off. It is the only card currently available to offer all the major requirements for multimedia presentations.

The ActionMedia II adaptor is an all-digital multimedia solution providing display and capture of high-quality motion video, audio, and still images. The adaptor is based on DVI (Digital Video Interactive) developed by an IBM/Intel partnership and is available on both Micro Channel and ISA machines. With this implementation, DVI is available as a single plug-in card — a far cry from the original seven-slot implementations of five years ago.

Although it only occupies a single slot, a complete ActionMedia II system consists of two cards: the plug-in card can be regarded as a playback card allowing full-motion video to be replayed from CD-ROM or hard disk. To capture real-time video and audio, a capture daughtercard attaches to the playback card.

A variety of input sources can be connected to ActionMedia II. It supports PAL and NTSC video formats with composite, S-VHS, and RGB inputs. These allow equipment such as laserdiscs, video cameras, and VCRs from consumer grade up to professional grade to be connected to the system. Two audio input channels are provided to enable stereo recording.

The system video, VGA or XGA, is attached to the ActionMedia II card by a cable assembly which then connects to the monitor. This allows a single-monitor system to be operated, although it is possible to run with a monitor on the system video and one on ActionMedia II.

The ActionMedia II card can run in several modes of display. The simplest is VGA/XGA passthrough where the

incoming video from the system video is passed directly to the monitor. By this means, the PC can operate as if the monitor were connected to the usual system port.

Secondly, a DVI-only output is available where the ActionMedia II card generates the entire display on the monitor. And there is overlay mode. This uses a variation on chroma keying to replace any black in the incoming system video by DVI output. It allows the mixing of Windows and Presentation Manager screens with DVI displays — it is this final mode that is used most often.

Incoming analogue video can be digitised in real time for display at up to 512 x 480 resolution. More often, a resolution of 256 x 240 is used and displayed within a standard Windows or PM window. Images can be dynamically sized and placed on screen. Still images can be captured up to a maximum resolution of 612 x 576 in either 9-bit or 24-bit formats. JPEG stills are available at 9-bit resolution.

Features like these are available on several other vendors' cards including some produced by IBM (the aforementioned Video Capture and M-Motion adaptors). But where ActionMedia II really shines is in its ability to digitally compress full-motion video in real time using DVI's Real Time Video (RTV) capabilities.

The on-board Intel i82750 pixel processor is used to the full to compress to disk the incoming video at up to 256 x 240 resolution. These files can then be replayed in real time on the system. The playback quality of RTV is best described as below VCR quality but for local applications is more than sufficient.

Optionally, your data can be sent to Intel for compression using PLV (Production Level Video) compression. This results in a better quality playback file but at a price. PLV files can be played back on the standard ActionMedia II card and are near-VCR quality. It is envisaged that developers will use RTV while developing their applications and then convert to PLV for the final product. Since the compression system is programmable, new implementations can be released to run on the current hardware. An example of this would be an upgrade to support MPEG full-motion compression.

The data rates of RTV and PLV allow them to be stored on CD-ROM which has a transmission rate of 150K per second. Both RTV and PLV make full use of this bandwidth and it is possible to store up to an hour of compressed full-motion video and audio on a single

CD-ROM. Future applications for the system will probably be supplied with both the application and its full-motion, still and audio data together on the same CD-ROM.

The software provided is a C callable programming interface called the Audio Visual Kernel (AVK). IBM intends to support AVK on future DVI-based products and is thus seen as a stable interface for application development. An optional Developer's Toolkit provides sample programs and source code written using AVK for applications such as capture and playback — both windowed and full-screen.

By providing developers with the source code to typical applications, IBM hopes to increase the acceptance of AVK at this early stage of its availability. Initially, AVK is only available under OS/2 1.3 but IBM has stated that it intends to provide compatibility with Windows 3.0 and the Multimedia Extensions for both Windows and OS/2.

What price these features? At the time of writing these had not been fixed but a combined playback/capture system was expected for close to £2000. With the features provided for the price IBM has at last leaped ahead of the opposition in the multimedia stakes. ActionMedia II deserves to be a success but its real success in the marketplace is now up to IBM and its marketing machine.

OS/2 launch

IBM has delayed the availability of OS/2 until next year but has indicated that it will provide a limited version by December to customers who say they need it. At Comdex IBM asked its customers to wait until March for a shrink-wrapped product that will offer seamless Windows integration.

The version planned for limited availability in December will run Windows only full screen but will include full service and support. In the March release, OS/2 2.0 users will be able to run a Windows application on a desktop simultaneously with other DOS and OS/2 applications and not see any difference. IBM also revealed that over 500 software developers have committed to developing applications for the new 32-bit environment.

The same shrink-wrapped copy of OS/2 2.0 will be certified to run on both IBM PS/2s and compatibles. Also, OEMs will be able to buy OS/2 directly from IBM.

The pricing structure was announced at Comdex but at the time of writing no UK prices were available. OS/2 2.0 will be priced at \$195, with additional licences at \$149, and volume discounts

will be available as well as a \$129 annual support contract. DOS and Windows users will be able to upgrade for \$149, or \$99 for additional licences.

Extended Services for OS/2, priced at \$595, includes Database Manager and Communications Manager and runs on client workstations. A second package, Extended Services with Database Server for OS/2, priced at \$1995, runs on servers and lets DOS, Windows or OS/2 clients access the server data. LAN Server 2.0 costs \$1995 per server and \$75 per client.

Borland C++ update

The first major upgrade to Borland's C++ Windows development environment has entered a second phase with a new Windows interface toolkit and added optimisations to help developers write more efficient code.

While the compiler in the Borland C++ 3.0 beta releases is basically the same as in Borland C++ 2.0, the betas have added 15 optimisations, including size, speed, loop, unrolling and global optimisations.

If the condition of the latest beta is any indication, Borland C++ 3.0 could be on the verge of release, possibly in two to three months, since the beta appears to be bug-free.

The new beta shows that Borland is attempting to narrow the competitive gap between its compilers and Microsoft's by addressing developers' needs for code optimisations, which Microsoft has already incorporated into its C compiler. As the first Windows-specific C++ development environment, Borland C++ 3.0 will give Borland a head start with enthusiasts of the object-oriented method who are waiting for an easier and less time-consuming way to develop Windows code.

Borland compilers are an easy and fast way to develop code, but most high-end developers used Microsoft for the final compile due to its optimisation capabilities.

High-end developers have been concerned about getting maximum efficiency out of their code, and, in the past, a number of developers wouldn't use the Borland compiler because it didn't have optimisations. Squeezing that extra mileage out of your code is very difficult, especially now, with developers moving to Windows where there is no limit on code size.

Borland will also ship its own home-grown resource toolkit, called the Resource Workshop, for building Windows interface elements such as dialogue boxes and radio buttons. Currently, developers writing Windows code in a DOS-based environment must

switch from DOS to Windows every time they need to test application code, a task which can be tedious and time-consuming. The ability to edit, run and debug in Windows can speed development time by 40 or 50%.

Yet more accelerator cards...

Weitek recently unveiled a Windows accelerator card based on its W5086 chip. The \$299 Weitek Power for Windows card off-loads the PC's CPU by incorporating Windows graphics functions in hardware. The 16-bit card, which offers 1024x 768 pixel resolution with 16 colours, fits in a half-slot and comes with 512K of video RAM and drivers for Microsoft Windows 3.0 and AutoCAD. The board is due in the first quarter of 1992 through dealers.

Matrox also unveiled a Windows accelerator card, as well as three high-

"Borland is attempting to narrow the competitive gap between its compilers and Microsoft's by addressing developers' needs for code optimisations"

end graphics boards. The \$695 HiPerVGA, Matrox' Windows accelerator, uses S3's 86C911 chip and offers 1024 x 768 non-interlaced resolution with 256 colours.

Video Dynamics, of San Francisco, recently rolled out its FlashXGA Accelerated Graphics Adaptor. The \$649 adaptor includes 1Mb of RAM and offers 1024 x 768 non-interlaced resolution with 256 colours. It also incorporates a bus-mastering co-processor that implements drawing functions, such as bit-block transfers, into hardware. The card should be available now from Video Dynamics.

Hercules has unveiled a Windows accelerator called the Hercules Graphics Station Gold. The \$495 board is based on Texas Instruments' 60MHz TMS34010 processor, and offers 1024 x 768 non-interlaced and as many as 32,768 colours. A \$595 version offers 16.7 million colours. The board is due in early 1992 through distributors.

Talking Windows

Finding information on a busy Windows screen can be a struggle, but one company has found a way to cut through the visual clutter for buyers willing to lend an ear. Released in October,

FirstByte's \$149 Monologue for Windows text-to-speech conversion utility takes any English phrase and verbalises it — literally. To produce sound, the program uses a PC's built-in speaker and can also use third-party audio boards.

There are three methods to produce spoken output with Monologue. The simplest is to copy the text to the Windows clipboard, then click on the Monologue icon with the mouse: Monologue immediately reads the clipboard text out loud. The program can also take advantage of Dynamic Data Exchange and set itself up as an automatic speech server. Links can be made to such programs as Excel, allowing English messages to be spoken for warnings or help.

Speech capabilities are implemented in a dynamic link library (DLL) called SPEECH.DLL, so programmers can easily access them to customise their own applications without having to sift through on-screen displays.

Unfortunately, while text is being spoken, Monologue requires all the CPU cycles on a 25MHz 386 to be available. No other applications can run while speech is in progress. However, the program checks after speaking each line of text to see if the user has requested that speech be stopped.

Monologue uses an effective set of rules to parse English words and pronounce them. Since there are many exceptions to the general rules of pronunciation, Monologue provides a dictionary. A special phoneme (speech sound) language allows precise control over the articulation of any word.

Using Monologue's Dictionary Editor, creating or changing the pronunciation of a word is easy. It is possible to create a new entry from scratch using the phoneme codes listed in the Monologue manual, but it is usually easier to modify the phoneme codes of a similar-sounding word.

More music for Windows

Passport Designs is readying a Windows version of its Encore music composition software, as well as Media Music Library, a collection of musical clip-art on CD-ROM. Used to compose and edit musical scores on screen, Encore will record and display notes played on a musical instrument that is attached to a sound board in the PC.

Currently available for DOS PCs and Macs, Encore lets users import files that adhere to the MIDI standard for sending musical signals between devices. Once music is created it can be played back, repeated and changed. Clips from pre-recorded soundtracks can also be edited and used.

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Apple's party pieces

Apple turned out in fine style at the recent MacUser show — even John Sculley was there. Mick O'Neil rounds up the products of note... and gets strapped into a chair.

The things that impressed the most at MacUser 1991 were Apple's new range of hardware, a preview of Word 5.0, the Nada-Chair, and the surprise appearance of Apple CEO John Sculley. Supporting MacUser (the show) for the first time since *MacUser* (the magazine) allowed grey-market advertising, Apple trotted out five new Macs, two new LaserWriters, and a Scanner. Apple now has a full product line and rumours abound that seven additional machines are slated for release in 1992.

Clearly, the day when you could look forward to a simple Mac upgrade are over. Increasingly, you'll have to give serious thought to just what you want your computer to accomplish. Fortunately, the Macintosh software market has matured enough to allow you to choose from a variety of established options.

Microsoft Word is the overwhelming market leader in Mac word processing. It got there because it was first and

remains there because it's the best. Undoubtedly, there are a few Nisus, FullWrite, MacWrite, and WordPerfect users out there who will strongly disagree. To engender that kind of loyalty means that there must be something good about each of these programs.

After sitting through a preview of Word 5.0, however, I'm even more convinced that Microsoft will continue its domination. Word has always included powerful features, but now it appears that the company has streamlined the interface to make them more accessible. Intervening dialogue boxes have been minimized and more options are directly available from a toolbar.

In the chair

The Nada-Chair looks a little like a saddle and includes two knee-strap loops, a pad, and a buckle. In the sitting position, placing the loops over the knees, the pad around the lower back, and pulling the strap gives you an amaz-

ing degree of back support.

It may look a bit strange and take some getting used to but it could prevent lower back strain. When office ergonomics are about to become big business, the £25 Nada-Chair looks like a good deal for the employer and the employee.

Joining the party

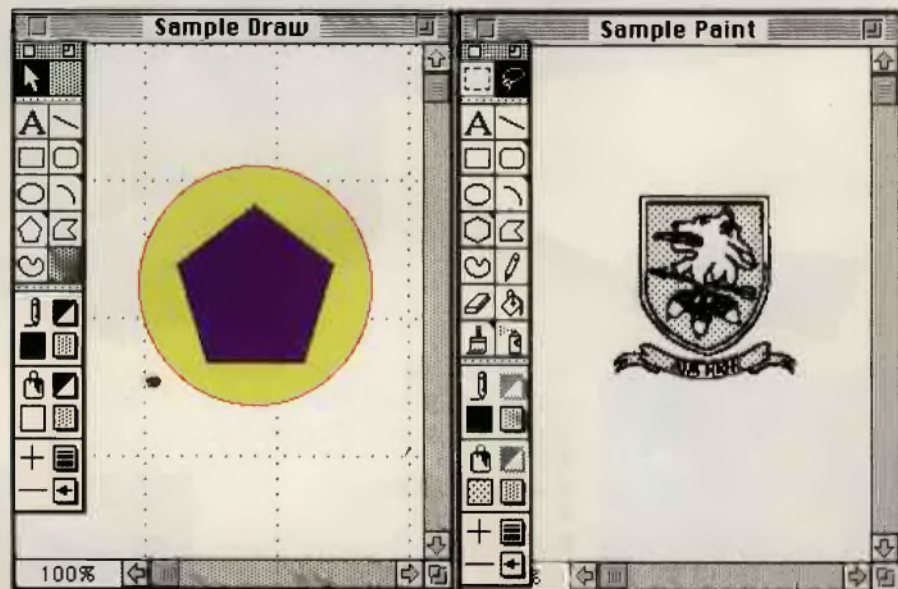
Apple CEO John Sculley put in an appearance at the MacUser Show party, along with other notables like Mike Spindler and Apple UK's own Mike Newton. Newton informed PCW that Sculley and Spindler were in town to talk to a number of financial analysts about Apple's prospects in the UK market in the coming year. They concluded that if the recession bottoms out, as widely expected, the company's new product line is poised for significant market penetration.

Power on the go

It's hard to believe that just three years or so ago, when I started this column, the Mac Plus and SE were the workhorses of the Mac world. Business users were quite content to run PageMaker, Excel, Word and the like on the Plus and many raved about how the Mac had finally grown up.

Today, you can buy an Apple PowerBook 100 that blows the Plus and SE away in terms of speed, weighs only 5.1lbs, includes an internal hard drive and twice the RAM, costs less, and fits neatly in your attaché case.

But who needs a portable computer? The answer, of course, is everyone who needs a computer. As the functionality of portables continues to expand, the question really becomes: 'Who needs a desktop computer?'. Why should your desk be dominated by enormous boxes with spaghetti cabling and cathode ray tubes emitting invisible radiation? And



GreatWorks' Paint and Draw modules have all the requisite features and few surprises

why should you feel the need to purchase another machine so that you can work at home?

The PowerBooks elegantly resolve both of these problems by eating up significantly less desk space and being 'take-homeable'. Take-homeable computers must represent a significant portion of the portable market.

When was the last time you noticed someone on a plane or train using a portable computer? I'm fairly well travelled and I can count the instances on one finger. The vast majority of portable computers sold today run MSDOS, and MSDOS software, as most users know but few are willing to admit, is the great sleep inducer. On the other hand, I'll bet even money that within a few years, you'll see PowerBooks all over the place. The 'power to be your best' has suddenly become the 'power to be your best wherever you go'.

Norton Utilities revisited

Bilbo, the internal hard disk on my FX, died on me the other morning right in the middle of a crucial project and, of course, I didn't have it backed up. I tried booting from Gandalf, my external Jasmine 100Mb drive, but no joy. Panic ensued. I had visions of bad chips or burned-out boards and started thinking about dragging the whole system down to my local dealer. I tried booting from a 6.07 System disk and, sure enough, up popped Bilbo and Gandalf. After saving the crucial data files on floppy, I decided to try my Norton Utilities Emergency Disk.

I've been a proponent of utility software like Norton and SUM, but I've never had much success with them as far as saving data on a floppy or rescuing a hard disk goes. Most of the problems I've experienced have been real physical problems with the disk and Norton generally couldn't help me. This time, though, Norton did the job. I booted from the emergency disk and ran the Norton Disk Doctor. The doctor asked me a few relatively unintelligible questions about whether I wanted it to fix things and, of course, I said go ahead. Lo and behold, I'm back to normal without any loss of data.

To this day I'm not sure what went wrong, but in that half hour of panic, Norton Utilities paid for itself many times over.

GreatWorks

You buy a PowerBook 100 with a 20Mb hard disk and 2Mb of RAM. What software do you load on it? Clearly, not System 7.01 as System 7.01 will eat up much of that RAM and severely limit your choice of software. Even running

System 6.07 with just 2Mb of RAM will make MultiFinder relatively useless. You'll have to resign yourself to running one program at a time.

You could load Excel 3.0 (about 2.5Mb), Word 4.0 (1Mb), MORE 3.0 (3.5Mb), Vicom Multiterm (1Mb), UltraPaint (1.3Mb), Canvas 3.0 (4Mb), and FileMaker Pro (1.3Mb) on your hard disk. Together, you'd have a suite of programs that would give you state-of-the-art spreadsheet, chart, outlining, communications, paint, draw, and database capabilities. Of course, at the end of the day you'll have eaten up most of your hard drive, spent about the same as the price of the computer, and have to switch painstakingly through applications passing information either via the clipboard or scrapbook.

A better strategy might be to install just one program, GreatWorks (about 2Mb), that gives you basic functionality in each one of these areas. Though none of GreatWorks' modules can compete with the equivalent high-end application, the program is so economical in terms of disk space and price that you can afford to add a few top-end applications for advanced work in particular areas.

Word processing

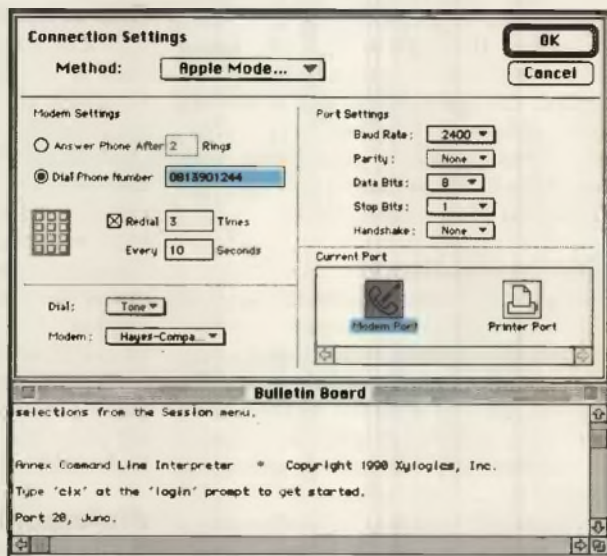
The GreatWorks word processor is bare-boned by today's standards, but it still includes the vast majority of the features likely to be used in a standard business office or classroom. In fact, the accessible power offered by this module must rival the actual power generally achieved by using software from the low end of the Mac word processing market or the high end of the MSDOS market. That is, PC word processors like DisplayWrite or WordPerfect may pack in more features, but they're lost somewhere behind Ctrl-Alt-Function key combinations and 1000-page manuals. GreatWorks wears its power on its sleeve.

The word processor includes the standard ruler/layout options including margins, indents, tabs, justification, and spacing, and can handle headers, footers, and multiple columns. And there's the ubiquitous spell-checker and thesaurus with yet more dictionaries added to your hard drive.

The only obvious omission is footnotes and I suspect many users can get along fine without them.

Outlining

At the MacUser Convention a local Mac guru asked me: 'Do you know of anyone who really uses an outliner to write?' I was stunned that he would even put forward such a question, as I can think of nothing that has had a more profound effect on the way I write. At the risk of boring you, let me re-state why I think outlining is important.



GreatWorks sports a fairly typical range of comms facilities

Dynamic 'outlining' on a computer, or 'idea processing', gives the writer the freedom to express ideas in a non-linear way without sacrificing the organisation of the finished product. That is, the user can be guided by inspiration alone and can accomplish any part of a work without worrying about structure until the very end. When all of the pieces have been produced, the writer can then experiment with structure until the required continuity is achieved. Although something similar is possible using a simple word processor and cut-and-paste techniques, the process itself often gets in the way of the writing.

The outliner in GreatWorks looks very like Living VideoText's original ThinkTank software that served as a kind of precursor to MORE. ThinkTank carved out the idea processing niche and GreatWorks' outliner includes many of the same features. Having said that, it seems a shame that the word processing module and the outliner are not more closely integrated.

The one major weakness of ThinkTank stemmed from the complications that arose in moving text from an outline to a word processor. Since

then, Microsoft and Ashton-Tate have seamlessly integrated outlining capabilities directly into their word processors. Requiring the movement of outlining text through the clipboard seems a firm step backwards, sacrificing simplicity for complication. But GreatWorks' outliner is well worth the price of admission!

Spreadsheets and charts

Like the word processing module, Symantec appears to have got the basic features of the spreadsheet and chart modules just right. With the spreadsheet you can paste any of some 100 functions and fill right or down to insert corresponding formulae. Selecting an area of the spreadsheet and choosing Chart generates a bar, column, pie, line, or picture graph. Like Excel, the GreatWorks Chart does a good job anticipating your requirements.

Communications

I found the Communications module the most difficult to install. Supposedly, under System 7 the Communications Toolkit is included as part of the System. Not so with my System 7 installation and the GreatWorks communications module steadfastly refused to work. I finally located some 'communications tools' on one of the system disks that have icons like pieces of a puzzle, dropped them into the System Folder, and had no more problems.

I found this part of the program fairly typical for communications software. Most of the power hides up in the menus and you still have to know too many nerdy details to run the thing. For an experienced hand at communications, GreatWorks offers all the power needed to handle most on-line tasks.

Paint and Draw

Both the Paint and the Draw modules have all the requisite commands and tools. The Draw module provides colour support while the Paint module is strictly black and white.

There's nothing to get terribly excited about here except that you can access these tools from within the same program and copy and paste graphics into word processor, outline, and database documents.

Database

In contrast to the databases available in AppleWorks or Microsoft Works, the GreatWorks database is simple to use but powerful. Field types include text, number, date, time, picture, memo, calculation, and summary. Calculation fields can use constants, functions, and values in other text, number, date, or

time fields within the same record, while summary fields store the result of a summary calculation for values in a field over a group of records.

GreatWorks provides a handy navigation palette for moving around records and allows you to select certain records, all records, or omit records. There's also a fairly sophisticated set of layout options including labels, column reports, and custom labels. You can also design your own layout which will then appear as a selection in the Forms menu.

The whole

The whole is certainly greater than the sum of its parts, as one of the major strengths of GreatWorks is its 'Core Technologies'. Cooperative Resources include standard text, maintaining attributes across modules; the spell-checker, which is a valuable addition to the database and spreadsheet; the thesaurus; standard object graphics; online help; and translators. 'Find and Replace' is also a powerful feature to have across all modules.

GreatWorks does not support System 7's Publish and Subscribe but does support TrueType fonts, Balloon Help, 32-bit addressing, and virtual memory.

Professor Mac

When you've used a Mac as long as I have, it's easy to lose sight of the fact that the system may intimidate the novice. No matter how slowly and methodically you explain the interface, you will be accused of going too fast, partly because you were going to fast and partly because it's a lot of information to assimilate at once. Clearly what's needed is a way for new users to learn the system at their own pace.

Individual Software's Professor Mac is a self-paced tutorial that covers the basic operating system as well as topics on hardware and software. The Basics menu includes lessons on 'Getting Started', 'What Makes a Macintosh', 'Basic Operating Principles', and 'Disks, Data, and Files'.

The Hardware menu covers 'Basic Computer Structures', 'Disk and Other Storage Devices', 'Printing', 'Communications and Networking', and 'SCSI and NUBUS Devices', while the Software menu includes lessons on 'The Operating System', 'Applications Programs', and 'Advanced Topics'. Each lesson employs a series of interactive screens that use sound, colour, and graphics for presentation and feedback.

Like some HyperCard-based tutorials, Professor Mac explains a concept and then asks the student to accomplish a task on screen. If the user gets it

right the tutorial advances to the next screen; otherwise, a reference is provided asking the user to step back and re-learn the concept. In fact, you can step backwards or forwardwards a step at any time, or you can switch to a different lesson.

I liked the fact that Professor Mac appeared to cover all the bases. (Although there's occasional mention of System 7, Professor Mac is basically a System 6 tutorial.) I also liked the graphic design and pace of the program. I was a little disappointed in its flat nature, though. When you consistently answered incorrectly, the basic flow of the tutorial wasn't modified. It would also be nice to be able to keep track of which individuals had used the tutorial and which lessons were completed.

As it is, Professor Mac serves as a valuable tutorial for the new Mac user. Given a little more depth and some record-keeping facilities, this software could be compulsory in every Macintosh office or classroom. The same company offers similar tutorials for DOS, power macros for Excel users, training for Microsoft Word and PageMaker, etc., etc.

Details

Professor Mac

Price: £59.95
Individual Software
125 Shoreway Road, #3000
San Carlos, CA 94070, USA

Norton Utilities

Price: £89.95 + VAT

GreatWorks

Price: £145.00 (£99 limited introductory price); £49 to upgrade from AppleWorks and Microsoft Works
Symantec UK
MKA House
36 King Street
Maidenhead
Berks SL6 1EF
Tel: (0628) 776343

Apple PowerBook 100

RRP: £1375
Apple UK
6 Roundtree Avenue
Stockley Park
Uxbridge, Middlesex
UB11 1BB
Tel: 081-569 1199

Nada-Chair back-sling

Price: £25
Nada-Chair Ltd
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ST138-I	RLL	32Mb	28ms	£161
ST157-I	RLL	49Mb	28ms	£164
ST150R	RLL	133Mb	15ms	£418
ST125N	SCSI	20Mb	28ms	£157
ST138N	SCSI	32Mb	28ms	£172
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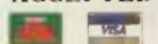
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PC WORLD



It's been a good year for....

DJ Walker-Morgan tries to put some of the confusing events of 1991 into perspective — the death of OSF/1, the ACE consortium shambles. He's also become attached to ants...

Looking back over 1991, what with all the comings and goings and alliances and disputes, you can find yourself a smidgen confused. The strangest things is that all this activity hasn't actually resulted in anything apart from a couple of prototype systems at exhibitions, at best.

Firstly, there was the death of an operating system. OSF/1 hasn't happened and even where it's name is mentioned, it's usually submerged with another brand of Unix. Just take a look at what the founders of the Open Software Foundation are doing.

IBM has been dallying with so many operating systems, it makes your head spin, but current Unix efforts are very much not OSF/1-based. The IBM/Apple collaboration seems to point IBM in a quite different direction for future upgrades, with talk of grafting the Mac user interface onto AIX on the RS/6000 workstations, and eventually onto 'Pink', a new operating system, for both IBM, Apple and anyone else who wants it.

Magic word

Hewlett-Packard stood off on the question of using OSF/1 quite early on, saying that it wasn't really interested in OSF/2. OSF/2 is not written yet, and won't be for a while. The magic word for OSF/2 is Microkernel — it's a way around the vastness of Unix. Unix is based around a kernel of code, which is in memory all the time.

The idea of microkernels is to reduce how much is kept in memory by only loading what is needed; a kind of global dynamic linking. It is supposed to have lots of advantages. Getting Unix closer in size to the slip of a thing it was in its early incarnations is a possible benefit, but more importantly it should split the

core into more manageable parts.

The theory is that these more manageable parts should be more amenable to testing and in turn lead to a more reliable system. Much of this is in the realms of academia. First detailed announcements on OSF/2 are said to be pencilled in for mid-92. Work out for yourself when it'll actually be in the shops, and realise that HP hasn't actu-

"ACE, you will remember, is the consortium that is developing a new platform based around the MIPS R4000. Its members include Microsoft, DEC, and Compaq. You would think that DEC would have released all this new technology before anyone else"

ally committed itself to too much immediate work.

DEC, meanwhile, has taken the OSF/1 label and popped it on anything of theirs that runs Ultrix. It has also been putting the 'ACE-compliant' label on practically every one of those boxes too. ACE, you will remember, is the consortium developing a new platform based around the MIPS R4000. Its members include Microsoft, DEC, Compaq. You would think that DEC would have released all this new technology before everyone else.

Reading more closely, you'll find that it's mostly a renaming exercise, and that the OSF/1 stuff is actually

Ultrix and a few bits of OSF/1; DEC has a real OSF/1 but is not putting it out as its standard operating system. The ACE-compliance claim is pure marketing-speak: the machines are similar to the ACE specification, but as that isn't released, you can't verify the DEC claim.

Simple things are a giveaway that this is a tenuous claim, though. Like the DEC boxes use the MIPS R3000 processor, not the R4000 (which is only just becoming available). Like the apparent lack of the ACE hardware/software interface (which has been played up by Compaq as the most important hardware part of ACE). And the fact that these ACE-compliant machines look just like DecStations before the ACE announcement.

So far the entire ACE consortium effort has been a shambles. Three operating systems — Microsoft's NT, which DEC still calls OS/2 version 3.0; a hybrid Unix comprising SCO's Open Desktop hosted on Ultrix and OSF/1 merged; and, most recently added to ACE, Unix System V Release 4. If you think that's bad, they are still arguing over the graphic user interface. XDesktop/3 is the favourite to win, but Compaq has made noises that it would prefer HP's HP-Vue environment. The ACE consortium seem to be the only people pressing on with OSF/1 in any guise.

Why is OSF/1 dying? Unix V4 is not perfect, but it is already on machines. The Intel versions are maturing slowly, many OSF members have put it on their machines, and all the major features of V4 are in the present release, which is relatively easy to port.

OSF/1, on the other hand, requires quite an investment in resources and has become available after Unix V4. In the world of commercial reality, Unix

V4 seems to be preferred.

Unix System Laboratories, USL, the people who make Unix V4, have also acquired a more pragmatic response to market demands. This could well be a result of various other companies being allowed to buy into USL. AT&T started that process to make Unix more open, along with the creation of Unix International. The net effect of these changes has made Unix V4 the de facto standard Unix.

In the look and feel wars, though, it still looks like Motif has won by default. Motif has been an Open Software Foundation success in the user interface wars. It doesn't suffer the same extreme quirkiness of the various OpenLook implementations. OpenLook is still out there, bolstered mainly by Sun's steadfast support on its machines. Now though, even Sun has been able to mention the M word, with its software side, SunSoft, making more positive noises towards Motif.

SunSoft has entered the operating systems race itself with Solaris. Solaris is derived from SunOS. Solaris 1 is based on SunOS 4.1.2, Solaris 2 will be based on SunOS 5 which uses Unix V4 as its base. Solaris 2 will run on SPARC and Intel-based systems, whereas Solaris 1 runs only on SPARC. The idea is to shrinkwrap the entire operating system, complete with graphical user interface, desktop, networking, multi-processing support *et al*, all on a CD-ROM.

Which environment?

The main debate isn't about which operating system, but which environment. Microsoft's NT, IBM/Apples 'Pink' and Solaris all aim to supply this complete. The Ultrix/SCO system for ACE plans to use XDesktop and Motif look-and-feel for their environment. The ACE Unix V4 camp is still debating: they could go a number of ways, from using Solaris (unlikely) to bundling in an existing desktop, but signals are very confused from that camp, what with Mips switching to bundling Visix' Looking Glass from XDesktop, and Compaq looking to HP's environment (which, as it happens, is also available for SPARC systems).

Enter NeXT into the fray, which has quietly announced its intention to port NeXTstep onto non-NeXT platforms. NeXTstep is the GUI side, rather than the whole operating system, so it does seem that NeXT wants to try and pick up the 'undecided' manufacturers out there. The word from inside NeXT is that work is well in progress, even to

the point of pre-alpha Intel NeXTstep systems floating around.

NeXTstep is a good proprietary environment, but some people might remember what happened to NeXTstep on the IBM RS/6000. That just withered on the branch, and a believable reason has never been forthcoming.

As you were...

For everyday Unix users though, things are pretty much as they were at the start of the year: on Intel machines, the mainstream Unix systems are still SCO Unix V3.2 and Interactive V3.2, both of which had upgrades released. Unix V4 on Intel platforms still isn't felt to be sturdy enough, apart from honourable exceptions like Dell's Unix V4. On SPARC boxes, SunOS had a minor upgrade from 4.1.1 to 4.1.2 in preparation for Solaris. Very few 'own-brand-Unix' vendors, like DEC, HP, and IBM,

"There's a lot of promises to fulfil in the announced specifications of all the major new environment offerings. Add to that Microsoft and IBM bludgeoning each other over OS/2: such a bitter divorce, and all the other wrangling, I'd be a fool to even try and predict the winner"

dropped their proprietary Unix products, so there's still Ultrix, HP-UX and AIX to support out there.

By the second half of 1992, a lot of today's corporate politics will be appearing as the first shipped versions of the new environments. There's a lot of promises to fulfil in the announced specifications of all the major offerings. Add to that Microsoft and IBM bludgeoning each other over OS/2: such a bitter divorce, and all the other wrangling, and I'd be a fool to even guess at who is going to win. Me, I'm sticking with Unix, X and Motif to do my work on, but I'm always ready to change. I just hope that if I have to, it's for the better.

X11 Release 5

One arrival in 1991 was X11 Release 5 (X11R5 for short), the latest release of the X Window System from MIT and the X consortium. Apart from the gen-

eral speeding up of the code, new features include:

- Standard support for Intel 386 Unix systems with VGA and EGA displays, thanks to Thomas Roell who was behind the widely used 386 port of X11R4.
- Scalable font support and font servers, allowing one machine to hold the fonts for a group of displays and send fonts over the net when needed.
- Support for the RS/6000 and Sun's GX graphics accelerator.
- Support for 'Internationalisation'.
- New clients, including an interactive run-time resource editor.

I got hold of a copy recently and unpacked it on my nearest SPARC-based Sun-compatible workstation. There are around 90Mb of code in the core set, but unbelievably, all I had to do was type 'make World' and it did. True, the Sun is one platform MIT tests for, but I'm still impressed by how simple it is to build.

There are some commercial packages which could learn a thing or two about installation from X11R5. For a piece of free software, which is what the MIT release of X11R5 is, it is quite an achievement.

You should see X11R5 incorporated in commercial products in early 1992; but remember that some companies (like IBM) are dreadfully slow updating, and are still shipping X11R3. Toolkits like Motif are being updated to support the internationalisation in X11R5: Motif 1.2 is due to have that support, when it appears.

For most people — excluding developers — the order of the day will be X11R4 while the developers get into X11R5. Still to arrive is the contributed software library for X11R5: that is software contributed by its authors to the MIT distribution tape, obviously because those authors are now testing their software with X11R5. It should arrive Real Soon Now, though.

If you do want X11R5, you can get it commercially copied onto tape by IXI in Cambridge on (0223) 462131. It costs around £200. Otherwise, ask around on places like CIX and Usenet; some users run informal copying services for things like X11R5. It's also available for anonymous FTP from a number of sites, including, in the UK, src.doc.ic.ac.uk (in graphics/X.V11R5) and hpb.mcc.ac.uk (in pub/X11r5). Remember that it's quite large though, around 29Mb compressed.

The Missing Number Six

A mysterious hole has recently been filled. The hole in question was in

O'Reilly's manuals for the X system. O'Reilly and Associates publishes a set of manuals called *The definitive guides to the X Window System*.

Quite a claim, but there are volumes 0 to 5 covering everything from the X protocol, Xlib, Xt Intrinsics, and an X User's Guide. There is also a volume 7, all about Xview.

All these manuals are on my shelf, and it is to them I turn first. But there was no volume 6. Volume 6 was to be about the OpenLook and Motif toolkits and it was announced along with volumes 4 and 5.

The toolkits, though, proved to be a moving target, and updates tended to make them difficult to write about. For well over a year, the mysterious volume 6 did not appear; some people gave up hope, believing it to be wood-pulp-ware.

Motif has settled into version 1.1. Version 1.2 is a reasonable amount of time away, and in this 'window of opportunity', Dan Heller, author of other volumes in the series, has written the Motif Volume 6 for Motif 1.1.

Understatement

To say it's a weighty tome is an understatement. It's 990 pages, laid out in classical O'Reilly style. It is packed with example code throughout: practically every concept has example code within a few pages, rather than shoved in an appendix at the back.

It's large because Heller takes you through the Motif toolkit in a structured tutorial, dealing with each major class of widget. This includes the dreaded Form widget, the explanation of which involves a lot of diagrams of a 'mechanical' version of how the Form widget lays things out. It seems to cover everything which has appeared in most of the previous books I've had on Motif, but in more detail. Because it covers Motif 1.1, the book uses the X11R4 Toolkit Intrinsics.

Xt Intrinsics is the part of X which looks after widgets, and lets programmers create toolkits with an object-oriented feel and consistent programmer interface. Most X toolkits use Xt Intrinsics, the only notable exception being XView which was specifically designed to support the older SunView programmer's interface.

Your choice

Once you've got the hang of using Xt Intrinsics, you'll be able to concentrate on using whatever toolkit you want to use, rather than on the 'What function call do I use to do...' kind of problems.

The X11R4 version of Xt Intrinsics

adds an easier to use syntax for setting and getting at widget information. In turn, I found the example code in the book is easier to read because that easier syntax is used. Most other Motif books I've seen use the older syntax, in an attempt to cover the older Motif 1.0, and although valid, it doesn't help the programmer get the best code out of his learning experience.

Pretty programs

I must admit that I've started using more of the Intrinsics API than ever before after reading this book, and my code has taken on a much more controllable feel, and my programs have got 'prettier' as a result.

I've also started using more of Motif,

"Xantfarm is a program that simulates an ant farm, which is normally made from two sheets of glass, some earth, a bit of wood and a smattering of ants. The little virtual beasts dig around, doing the usual ant sort of thing"

like its multifont strings which I'd always found a hassle before. The chapter on Motif's XmString made me realise what I was missing.

I'd always thought that the brief and obscure references to XmStrings was because they weren't really useful. Now my programs bristle with assorted fonts, bold and italic.

A damn fine book

I emerged from reading this book feeling like I hadn't programmed Motif before, not properly at least. I know it sounds a tad evangelical, but Dan Heller has done a damn fine book. It has supplanted all but my copy of the Prentice Hall *Motif Reference Manual*, which only stays around because the reference section at the back of the Heller Motif manual is not organised in a one-widget or function-per-page format. Then again, if it were one per page, the book would be almost uncarryable and very ecologically unsound.

If you want to program Motif 1.1 well, get this book. It complements the other volumes which are, as they say, on the cover, 'The Definitive Guides to the X Window System'. It is published by Addison-Wesley, on (0734) 794000,

and should be in all good book shops now. ISBN 0-937175-70-6.

Bizarre X syndrome

For lovers of strange programs, may I bring to your attention Xantfarm. It's a program that simulates an ant farm, which is normally made from two sheets of glass, some earth, a bit of wood and a smattering of ants. Xantfarm simulates just that but without the glass, earth, wood and ants.

The little virtual beasts dig around on your background, burrowing holes, looking for food; the usual ant sort of thing. After a while, you find that they've burrowed strange tunnels. That's about it. If you're looking for incredible graphics, they're not here, but it's fun to leave running while you work: it gives you the feeling that at least something is being industrious.

Xantfarm is available via Anonymous FTP as xantfarm23oct91.tar.Z at export.lcs.mit.edu:contrib and ftp.ee.lbl.gov. It has also been posted on Usenet, and I have put it up on CIX.

Games for X

X is picking up quite a selection of games these days. Worth seeing are Xinvaders and Pool. Xinvaders is your basic space invaders. It opens in a small window though; on a good high-resolution screen, it's a bit like playing on a postage stamp, about 300x200 resolution. If you change the windows size, and it does let you, everything stays the same size but vast amounts of space are added to the playing area.

It's a good version as long as you don't resize the window. All that's missing is the sound effects, but they never put sound into the X protocol.

Smooth animation

Pool manages to look like the classical game of electronic arcade pool, complete with green table and numbered balls. What impresses is the smoothness of the animation of the ball movements: they bounce well on the screen, and yet again, the only thing missing is the sound of the click as they hit.

Pool suffers the inverse problem of Xinvaders when it comes to screen sizes. It needs a 1024 x 768 display at least, and can't be made smaller.

Xinvaders and Pool have also been posted onto Usenet, and are available on CIX in the x.system conference.

DJ Walker-Morgan is a full-time software developer. You can contact him on CIX (081-399 5252) as dj or via email as dj@micromuse.co.uk.



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Language barrier

All the different network operating systems use different languages at different levels for specific purposes. Ralph Bancroft tries to find a way in which they can communicate.

Wouldn't it be nice if we all spoke the same language? This thought came to mind when a reader phoned with a query. Could a LAN Manager network on one site talk to a NetWare network on another site over a wide area link? The short answer is yes. The long answer, however, is yes but.

The problem here is that these two network operating systems speak different languages. What may appear as a set of perfectly understandable commands for one operating system appears as total gibberish to the other. To complicate matters further, each operating system does not use one single monolithic language, but several. These polyglot environments use different languages at different levels for specific purposes.

Layers

The best way to understand networks is to consider the operating system as consisting of several layers. Starting at the workstation, there needs to be a layer of software, called a re-director or workstation shell, that sits between an application and DOS (or whatever operating system is running).

The purpose of the re-director is to trap any requests from an application for file and print services. If the request is for a file on a local disk or a printer attached to a local port, the re-director passes it on to the workstation's operating system to service it in the normal manner. However, if an application tries to access a file on, say, drive G: where drive G: is actually a directory on a network file server, the re-director diverts the request across the network.

To do this, the request has to be packaged up and properly addressed so that the request can be delivered to the right machine on the network. This brings into play another layer of software known as the transport protocol.

Finally, the packet containing the request has to be formatted in a way that the underlying network hardware understands. This involves a third layer of software known as the device driver.

Complementary layers exist on the file server that capture the Ethernet or Token Ring packet, pass it through the transport layer and extract the request for the server's operating system to act upon.

Needless to say, everyone has different ideas as to how all these things should be done. Mercifully, standards have emerged that make the network-

"Time was when the existence of different protocols mattered little. All that mattered was that the transport layer did its job and didn't get in the way of memory hungry applications"

ing process simpler to understand and to implement.

The most important standards are in the transport layer. Historically, mainframe and minicomputer companies developed their own transport protocols. So, IBM has SNA and DLC protocols while DEC has DECnet and LAT.

To try and bring order out of this protocol chaos, Xerox, in its pioneering work in the networking field, developed XNS. This was picked up by several companies, one of whom was 3Com and the other was Novell. But whereas 3Com went for a straight implementation in its 3+ and 3+Open network operating systems, Novell decided to

engage in a bit of re-engineering to produce IPX.

Alongside this development, IBM and Microsoft produced some networking extensions to DOS called NetBIOS which simplified the process of writing network aware applications. To more or less complete the picture, the Unix world has long favoured the use of TCP/IP as a transport protocol because of its usefulness in both local area and wide area networking.

Time was when the existence of all these different protocols mattered little. If all you were doing was connecting up half a dozen PCs to a file server, all that mattered was that the transport layer did its job and didn't get in the way of memory-hungry applications.

However, in most sizeable organisations the networks are now linked between departments, between offices and into minicomputers and mainframes. As a result, it is common to find two or more transport protocols running across the same network.

Malaise

The LAN Manager and NetWare coexistence problem is just one symptom of this multi-protocol malaise. LAN Manager uses NetBEUI, an enhanced version of NetBIOS, to transport information around the network, while NetWare uses the aforementioned IPX. Just how do you get the two to talk to each other?

The solution is to have multiple protocols running on the workstation so that applications can talk via NetBIOS to the LAN Manager servers and IPX to the NetWare servers. But all is not sweetness and light.

The problem is that once you have loaded the device drivers, transport protocols and the two re-directors/shells you will have gobbled up a large chunk of conventional memory. One

way round it is to offload some of the networking software onto the network adaptor. BICC uses such an approach with its ISOLINK cards, as does Excelan (now part of Novell) with its EXOS cards.

Solve it in software

An emerging solution is to solve the problem in software by inserting an extra layer of software between the protocol stack and the device driver for the network card. Traditionally, the device driver you installed was specific to the transport protocol used. In the case of NetWare, you go further and create a single piece of software that encompasses both the transport protocol and the device driver.

To get round the hardware-specific issues, both Novell and Microsoft proposed standard specifications for interfacing the transport protocols to the network adaptor. Novell called its specification Open Data Interface (ODI) while Microsoft, in conjunction with 3Com, drew up the Network Device Interface Specification (NDIS).

In principle, the way the system works is that the card manufacturers supply ODI and/or NDIS device drivers. The network suppliers, including third parties, then write their protocol stacks to talk ODI or NDIS. The aim is to let users mix and match network adaptors and transport protocols. This would allow two users with identical hardware to be connected to the same network with one talking IPX to a NetWare server, while the other talks NetBEUI to a LAN Manager server or even TCP/IP to a Unix host.

Short of the ideal

In practice, life is a little short of this ideal. Firstly, the card manufacturers have been slow to write their ODI and NDIS drivers. And, as is the norm in the computer industry, these suppliers fall into one of two camps. Predictably, the NE series of cards, initially from Novell and now from Eagle (previously known as Anthem), come with ODI drivers but not NDIS drivers. 3Com, meanwhile, happily supplies NDIS drivers but none for ODI. Novell and Microsoft, of course, provide support in NetWare and LAN Manager for ODI and NDIS respectively but not for each other. But the situation is not as dire as this sounds.

Apart from providing a flexible choice of transport protocols, both ODI and NDIS have been designed to allow two or more protocol stacks to run on a single PC. The first company to spot the opportunity was 3Com, which developed a protocol manager for NDIS that allowed a user to load and unload trans-

port protocols as they were required. Its TCP with Demand Protocol Architecture was designed to allow a user on a NetBIOS network to 'demand load' a TCP/IP protocol stack for a session to a Unix or minicomputer host and then unload the stack when finished. Of course, if you can demand load TCP/IP, why not demand load IPX? 3Com now bundles an IPX stack with the product to provide precisely this functionality.

3Com is not alone in taking this route. Another US company, Hughes LAN Systems, has for some time supported multiple protocols on its HLS Ethernet cards through its proprietary Multiple Protocol Architecture (MPA). Its ProLINC product goes a stage further by also supporting NDIS drivers.

ProLINC comes with a rich set of protocol stacks, including TCP/IP, NFS (widely used in Unix environments),

"Third-party solutions are fine but expensive. A more desirable alternative would be one that came in the same box as the network operating system"

LAT (for terminal access to DEC minicomputers), IPX and DLC with NetBIOS (for IBM Token Ring networks).

These third-party solutions are fine but expensive. A more desirable alternative would be one that came in the same box as the network operating system. A year ago such a concept would be unthinkable. But, as the saying goes, stranger things have happened at sea. First to offer some protocol choice was Novell: its NetWare 3.11 now comes with a TCP/IP protocol suite. Microsoft has followed up by announcing support for TCP/IP and IPX in LAN Manager 2.1 in addition to NetBEUI.

On the face of it, it should be possible to create a solution to our reader's problem by using either a mixture of NetBEUI and IPX or, better still, by using TCP/IP as a common protocol. So just what is on offer?

The starting point for this exercise is a workstation attached to two Novell NetWare servers and an OS/2 server running an application that communicates via NetBIOS over IPX using Novell's NetWare Requestor for OS/2. The workstation is running MSDOS 5.0 with Windows and is generously

provided with 8Mb of memory.

It is not a particularly well tuned machine but some of the drivers and DOS are poked up into Upper Memory Blocks and the High Memory area, leaving around 492K of conventional memory free after the network software has been loaded. The objective is to install a LAN Manager server on the network, and have the workstation talking to all the servers on the network, and still have enough space left on the workstation to run applications.

The first option to dispose of is thoughts of using Novell's NetBIOS as a means of talking to the LAN Manager server. NetBIOS is a programming interface that sits on top of the transport protocol — IPX in this case. LAN Manager's NetBEUI is a combined NetBIOS interface and transport protocol. Therefore, any application talking to NetBIOS over IPX will be unable to converse with a server running NetBEUI.

This dialogue of the deaf has other implications. You cannot have NetBEUI and NetBIOS over IPX co-resident on the workstation. In this example, our NetBIOS-using application gets very, very confused when it tries to find the OS/2 server and gets caught in an infinite hour glass loop. As result, if you have a NetBIOS using applications you will have to install them on either the LAN Manager server or use a separate machine which is using NetBEUI rather than NetBIOS over IPX.

Manual configuration

A second option can also be discarded. LAN Manager NetWare Connectivity is based on the premise that you want connectivity from the workstation out to the servers. Microsoft therefore assumes that you don't want to use IPX with the LAN Manager servers. Although the company doesn't give you the means of doing so, it should be possible, in theory at least, to manually configure an OS/2 system to use IPX in place of NetBEUI.

I haven't tried to do this so I can't vouch that it will work or that the LAN Manager server would be happy talking to Novell's NetBIOS in place of NetBEUI. A sub-option is to use Novell's NetWare Requestor for OS/2 which does provide IPX and a NetBIOS interface. This certainly works for the database server currently installed on the network but again it is not a solution tested with the LAN Manager server software.

Messy procedure

With the single, NetBIOS-over-IPX solution ruled out, the next step is to install LAN Manager's NetWare Connectivity. There are several parts to this

procedure which can get a bit messy. The first thing to do is to back up your existing CONFIG.SYS and AUTOEXEC.BAT. I did it twice, once to alternative filenames in the root directory of the workstation's hard disk and once to a bootable floppy disk.

If you are running Windows you should also do the same for WIN.INI and SYSTEM.INI. The principal reason for doing so is that LAN Manager's setup program quite happily goes off and makes changes to all these files and only tells you about it afterwards.

On the whole this creates few problems, but you would be well advised to protect yourself against the risk of conflicts that leave you with an unbootable system or one that won't run Windows.

The other preparatory action is to tidy up the workstation's hard disk. If LAN Manager's setup program sees less than 3Mb of disk space it will abort the installation. LAN Manager has a reputation for being disk-hungry and version 2.1 is no exception.

The first part of the installation is to run the LAN Manager setup program. This creates directories and sub-directories and copies the required drivers and programs. In the process it makes changes to some or all of the files mentioned earlier, and creates in a LANMAN.DOS directory two new ones called LANMAN.INI and PROTOCOL.INI. These are text files that hold basic configuration information for LAN Manager's workstation software and for the transport protocols and network adaptor.

You are prompted for some information like a name to give the computer and a default user name. There are a reasonable spread of network adaptors supported, with the notable exception of the Novell/Anthem/Eagle NE family. If the card in the machine is not listed, it's NDIS driver can be loaded from floppy disk or installed later.

Making assumptions

This is not a trouble-free operation. LAN Manager makes assumptions, like your network adaptor has been installed with factory default settings. In the case of the test machine, its Western Digital Ethercard Plus was on the supported list but had been installed with IRQ and memory address settings that were different from the defaults.

When it was re-booted at the end of the installation process, the network software failed to load. To get round this local difficulty, the PROTOCOL.INI file had to be opened in a text editor and the driver configuration details amended manually.

LAN Manager attempts to make some

intelligent decisions during installation. It recognises MSDOS 5.0 and will partially tune your system if have not already done so to make maximum use of Upper Memory Blocks and the High Memory Area.

This process will lessen the burden on conventional memory but may need some manual tuning to get an optimally configured system. But you don't need to do it yet.

At this stage, all we had was a LAN Manager workstation that allowed us to boot the system and log on to the LAN Manager network. The next step is to install the NetWare Connectivity software. This comes on a single disk and is invoked by typing A:SETUP. Yet more subdirectories are created and more files copied.

"Clearly, running LAN Manager and NetWare concurrently on anything less than a 386 with a memory manager installed is going to impose major constraints"

You are then prompted to insert a Novell SHGEN-1 or WSGEN-1 disk into your floppy disk drive. This enables the setup program to create a genuine Novell IPX.COM driver for NDIS. If you have Windows installed, the setup program senses this and launches Windows and its setup program to allow you to configure for NetWare. In fact, you end up with Windows configured for both LAN Manager and NetWare!

With the NetWare Connectivity software installed, all that remains is to run the LAN Manager setup program in the LANMAN.DOS directory to configure your system to run both NetBEUI and IPX.

To access a NetWare server you have two choices. Firstly, you can run IPX and NETx as per normal, having previously run READPRO, a utility that allows IPX to be loaded while LAN Manager's workstation is running. Secondly, you can run a batch program called NWLOAD which effectively runs IPX and NETx as removable TSRs. To unload the NetWare software you type NWUNLOAD to free them from memory.

For NetWare to start automatically when the workstation is booted you add the required commands into AUTOEXEC.BAT. The main difference

between the two ways of running NetWare is that the latter allows you to free up around 60K of memory by unloading it when it isn't needed.

Tidying up

So does it work? In a word, yes. After some tidying up, the workstation rebooted running LAN Manager, and NetWare was able to see both types of servers and was capable of copying files between them.

One of the bits of tidying up is the LASTDRIVE command in CONFIG.SYS. The LAN Manager setup program takes a guess that you want to allocate an equal number of drive letters between the two kinds of server. Helpful LAN Manager uses drive letters below LASTDRIVE to allocate network drives, while NetWare always uses drive letters after LASTDRIVE for drive mappings. The setup program therefore writes a LASTDRIVE=P or Q into CONFIG.SYS.

This can create problems in most NetWare networks where F: is normally the first network drive, particularly if you have batch files that rely on the right letters being mapped to the right network directories. In the test installation this proved to be easily surmountable as all the workstations are set up with a LASTDRIVE=M. Editing CONFIG.SYS soon had the workstation functioning correctly.

There's a catch...

So what's the catch? In a word, memory. When we started the exercise, the workstation had 492K free with NetWare loaded, which is tight. With NetBEUI and the LAN Manager workstation loaded, the free memory came to 483K and loading NetWare on the top of that took the figure down to 423K, which would be too sparse for some memory-hungry applications.

Because our test workstation is a 386 machine there is scope for further fine-tuning, but clearly running LAN Manager and NetWare concurrently on anything less than a 386 with a memory manager installed is going to impose major constraints.

What would be ideal would be to use a single protocol stack to reduce the RAM cram. LAN Manager 2.1 comes with TCP/IP and so does NetWare 3.11. Next month's column will look at the practicality of using this as a *lingua franca* of the networking world.

Ralph Bancroft is research director of networking consultancy, GCO Communications. He can be contacted on 071-895 9765 or on CIX as ralphb and Telecom Gold as JNL522.

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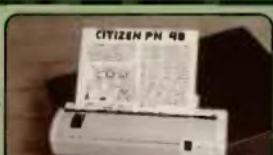
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Making a Date with Word

If you are writing letters and memos in Word for Windows it is often useful to be able to insert the date quickly. The macro in Fig 1 (below) does exactly that, and then underlines it.

Type in the macro using the Macro Edit command. You can then place it on the bottom of the Insert menu with the Assign to Menu command from the Macro menu, or if you prefer give it a shortcut key with Assign to Key.

The macro could be adapted to insert the time, or in fact any useful field.

Also, did you know Windows has several icons that you can use to replace any other icon? Several Windows files contain more than one icon. These include CONTROL.EXE, PROGMAN.EXE, WINFILE.EXE and SETUP.EXE. To change an icon to, say, a globe, select the icon and then choose the File Properties command. Click on Change Icon and then type in CONTROL. Simply cycle through the icons with the View Next button until you reach the globe and then select OK.

Finally, if you find it difficult to control the mouse in Paintbrush (who doesn't?) these tips may help:

- To move small distances at a time, try pressing the cursor keys and Ins instead of using the mouse. This makes precise, detailed work much easier.
- The View Cursor Position command displays a little floating window which tells you the co-ordinates of the cursor.
- If you need to draw straight lines horizontally, vertically, or at 45 degrees, hold down Shift while dragging the mouse. This works with the line and polygon tools, and produces exact circles and squares with the rectangle and ellipse tools.

Nicholas Skelton
Surrey

Speeding up SoftPC for Macs

This tip is for users of Insignia Solutions' SoftPC 1.3, with or without the EGA/AT option module 1.4.

SoftPC is fairly speedy at calcula-

tions on my Mac IIsi, but drawing the screen slows it down. A PC-compatible has dedicated hardware for screen output, whereas SoftPC must translate the PC screen to a Mac screen in software.

To boost SoftPC's performance, you need to boost the graphics performance. Short of buying an expensive graphics accelerator card, what can you do? The following tips will speed up SoftPC slightly:

- Use the small (9in) window rather than the large (12in) window.
- If you have colour but don't need it for SoftPC, try switching your Mac to black-and-white via the Monitors control panel. This will speed any Mac application's screen output. If you select black-and-white for startup on the Options part of the control panel, you will gain more memory too.
- Keep often-used files in hard-disk documents rather than in the network drive folder, and increase the size of your Macintosh disk cache.

Lloyd Wood
Peterborough

There will be more tips for SoftPC users in next month's PCW.

How to hide sensitive PC files

Personal details of students and staff at our small college are stored on three PCs, together with exam results and even exams. The PCs may be left unattended and students may gain access. Keeping the sensitive data on floppies was ruled out as several staff members need to use the same data: if each kept a personal copy, the data would differ from disk to disk if individuals made alterations.

Password protection, although providing some security, is a challenge to some people. So how could we hide the

data and yet have easy access?

Using XTree Gold 2, a set of hidden directories was created for the sensitive data. This is something you cannot do from DOS. Not only that, but ATTRIB cannot even display these attributes. Several knowledgeable PC users I spoke to didn't even know that directories could have attributes like a file. Now our important directories do not show up in a DIR listing, but this does not stop them being accessed by a program.

We avoid obvious names in case someone tries DIR EXAMS, as you can still list the contents of a hidden directory with the DIR command unless you make the files hidden as well.

Admittedly the trick would not stop a determined hacker with the right utilities, but the opportunist will see nothing worth investigating.

Another worry we had was the possible 'FORMAT C:' vandal. The batch file we use to format floppies excludes any format that would destroy data on the hard drive. But that wouldn't stop a knowledgeable vandal.

The standard advice is to rename FORMAT, but again the more inquisitive students might try PREPARE or whatever new name the utility has, just out of interest, and of course the new name shows up in the batch file, so calling it FORMAT.BAT is risky too.

Here the trick was to rename FORMAT to, say, "PREPARE". Look closely: there is a space after the name.

If you enter a space in a filename at the DOS level, you are told it is an invalid filename, but if you name it PREPARE(ALT-255) then DOS will accept it. Entering FORMAT or PREPARE now gets the 'Bad command or filename' error message.

Placing 'Prepare' as a hidden file in a hidden directory increases the difficulty of prying fingers easily finding it.

Dr John G Wright
Oxford

```
Sub MAIN
Underline 1
InsertField .Field="date \@"+Chr$(34)+"dd, MMMM, yyyy"+Chr$(34)
Underline 0
End Sub
```

Fig 1 Macro to insert date into Word document

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Waking up sleepy Yellow Pages

I've just tried for the first time to use Electronic Yellow Pages (via modem) on (0345) 444444, with no parity, eight data bits and one stop bit. After connecting, it simply displays 'EYPUK' at the top of the screen and then does nothing.

Am I doing something wrong?

Peter Jacobs
Chatham

Just press the Enter key a few times to wake up the remote system.

Tony Capelli

Cache points

What is the difference between a memory cache and a disk cache and which type is best?

Greystone Byrd
Bath

A cache, in computing terms, is a form of memory used for storing data which may be useful on a regular basis. It speeds up the operation of the machine because it saves data having to be found from a more time-consuming source.

Caching is a technique, and can be applied in many situations. If data from the disk drive is cached, it saves reading the disk (a very time-consuming operation). RAM chips will not all operate at the same high speeds, and particularly in PCs, a fast RAM cache can allow the processor to work faster.

Disk caches can operate in three ways. Some drives, though not those generally found in PC class machines, can have a cache built in. Popular data, such as the directory and commonly-used program and data files, will tend to be cached and therefore available very rapidly.

A cache built into the drive controller tends to be much larger than an on-drive cache and is shared between all connected drives. The presence of a caching controller should be completely transparent to the PC — it will just appear to be a very fast disk.

The third type of disk cache is an

extension to the operating system, such as SMARTDRV.SYS or PC-CACHE. These programs store data from the disk in RAM, holding on to popular locations as long as possible. They are the cheapest to install and work very well. But they can use a large amount of RAM — a problem for some users.

Memory caches are completely different to disk caches. A memory cache consists of an area of fast (and therefore expensive) RAM chips located close to the processor, between it and the slow dynamic memory (DRAM). A special chip called a cache controller checks each attempt to read the slow memory to see if that data is already in the cache. If it is, the processor is handed the data instantly, otherwise it must be read from the DRAM; after which the same data is stored in the cache in case it is needed again.

Some processors, such as the i486, have caches built in to the processor chip itself. Some manufacturers still add a larger cache outside the chip to increase the likelihood of a cache 'hit'.

Tony Capelli

Verifying the /v parameter

Exactly what happens, under DOS 3.3, when you run a copy command and use the /v parameter? I was under the impression it verified that the copy was accurate. Acting on this, I have been copying files from drive a: (5.25in) to drive b: (3.5in) and assuming that copy a: b: /v would ensure no errors.

Obviously I've missed a trick because there are errors. Having read the manual a few times, I'm still missing it because I don't know what I'm misreading.

Guy Kewney

The /v switch simply makes sure that data written to the destination file is readable. It does not check that the data is the same as that in the source file, as one would imagine. MSDOS can be made to perform a similar verification on all disk writes using the VERIFY command.

There is probably a fault with your

floppy disk controller, or the interface to the controller causing the problems. If the data is corrupted in the controller before the error detection code is calculated, the damaged data will be written with a valid CRC and therefore pass the read-back verification.

If data is being corrupted in RAM you would probably get system parity errors occurring regularly and nothing much would work. If you want to ensure data is written to a floppy disk correctly, the best method is to use the MSDOS FC command to compare the source and destination files.

Tony Capelli

Strange Word

I use a 1Mb 286 machine at work running Word for Windows (barely). It's very short of free memory, and while we're waiting for some expanded memory to arrive, I thought I'd try reconfiguring the machine to increase the amount of free space.

I edited CONFIG.SYS to remove a few unnecessary device drivers (a small RAM drive, HIMEM.SYS, ANSI.SYS and an RX50 disk reader) and rebooted, but W4W reported even less memory!

By experimenting a little I'm able to get W4W to report anything from 19K to 75K free (!) with no pattern or consistency. Obviously more memory is the long-term answer, but I'm puzzled by this strange behaviour. At the risk of drawing flak from PC aficionados, on my Archimedes, if I reduce the RAM drive by 128K I get exactly 128K more memory for other tasks. Why doesn't this happen with Windows?

Lorcan Mongey
Belfast

HIMEM.SYS is necessary for Windows 3.0 to run in standard mode. By removing it you limit Windows to real mode with 640K of RAM. Word may be giving you strange figures because it is interacting with the operating system in a strange way. Windows (rather than Word) will tell you how much free memory is in the system when you select the About option from the Program Manager or File Manager menus.

Tony Capelli

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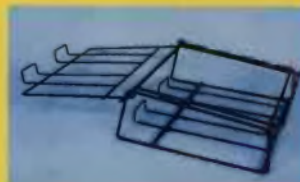
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WITH FULL TECHNICAL SUPPORT

Microsoft Basic PDS 7.1	£222
Microsoft C PDS 6.0	£222
Microsoft C & Windows SDK	£335
Microsoft Cobol 4.5	£435
Microsoft Fortran 5.1	£205
Microsoft Macro Assembler 6.0	£75
Microsoft Pascal 4.0	£139
Microsoft QuickBASIC 4.5	£50
Microsoft QuickC 2.51	£50
Microsoft QuickC & Assembler	£83
Microsoft QuickC for Windows	£95
Microsoft QuickPascal 1.0	£50
Microsoft Source Profiler	£45
Microsoft Visual Basic	£95
Microsoft Windows 3.0	£70
Microsoft Windows SDK 3.0	£225
MS Win Multimedia Dev Kit	£225
MS Win MDK & SB Pro Card	£365
Borland C++ 3.0	£295
Borland C++ & AFX 3.0	£330
Borland Corporate Prod Pack	£330
Turbo C++	£50
Turbo C++ & Turbo Vision	£69
Turbo C++ for Windows	CALL
Turbo Debugger & Tools	£89
Turbo Pascal 6.0	£69
Turbo Pascal Professional 6.0	£137
Turbo Pascal for Windows	£103
Paradox 3.5	£340
Paradox Engine 2.0	£223

GREY MATTER

Prigg Meadow, Ashburton, Devon TQ13 7DF

Prices do not include VAT or other local taxes, but do include delivery in the UK and Europe.

Please check prices at time of order as ads are prepared some weeks before publication.

This page lists some of our products - call us for a complete price list and details of discount structure.

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TEL: (0364) 53499

FAX: (0364) 53071

DEBUGGING TOOLS

Bounds Checker	386	£220
Multiscope for DOS	DOS	£140
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Periscope II-X	DOS	£130
Quaid Analyser	DOS	£130
SoftICE	386	£340
SoftICE & Bounds Checker	386	£470
Turbo Debugger & Tools	DOS	£89
Multiscope for OS/2	OS2	£315

ASSEMBLERS

MS MASM PDS v6	OS2&DOS	£75
PharLap 386DOS Ext SDK	DOS	£330
PharLap 386ASM/Linkloc	DOS	£830
Optasm	DOS	£125
Turbo Debugger & Tools	DOS	£89
2500AD Z80 ASM	CPM-280	£70
SLR Z80ASM	CPM-280	£40
SLR Z80ASM-PLUS	CPM-280	£140
SLR MAC	CPM-280	£40
SLR MAC-PLUS	CPM-280	£140
SLR 180 (64180)	CPM-280	£40
SLR 180-PLUS (64180)	CPM-280	£140

Not all assemblers are supplied with a linker.

PROGRAMMING TOOLS

Ada Compilers	Algol Compilers
Assemblers & Libs	AWK
Basic Compilers	Basic Interpreters
Basic Utilities	Basic Libraries
C Compilers	C Utilities
C Interpreters	C Libraries
C++	Cobol Compilers
Comms Libraries	Cross Assemblers
Database Libs.	Debuggers
Dis-assemblers	Editors
Fort	Fortran Compilers
Fortran Libraries	Graphics Libraries
Icon	Linkers/Locaters
Lisp	Libraries
Modula-2	Object Oriented
Pascal Compilers	Pascal Libraries
Prolog	Rexx
Screen Libraries	Smalltalk

We stock many items for which there is no space in these advertisements.

THE C LANGUAGE

Refer also to the C++ section.

C COMPILERS

NEW Watcom C 8.5/386 supports 32-bit Windows & DOS apps, 32-bit DLL's, includes royalty free DOS/4GW extender with 32Mb Virtual Memory, new debugger, etc all at a SPECIAL INTRODUCTORY PRICE of £495. CALL US NOW.

NEW QuickC for Windows includes QuickCase:W, image & dialog editors, Windows hosted environment, etc. If you want to write Windows programs, BUY ONE NOW. We're waiting for your call.

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Aztec C86-c	DOS	£275
High C 1.61	Win&DOS	£390
Hi-Tech C	DOS	£165
Microsoft C 6.0	OS2&Win&DOS	£222
MS QuickC 2.5	DOS	£50
MS QuickC & QuickAsm	DOS	£83
MS QuickC for Windows	Win	£95
Mix Power C & lib s/c	DOS	£30
Topspeed C Std	DOS	£110
Topspeed C Prof	Win&DOS	£165
Watcom C 8.5	OS2&Win&DOS	£295
High C 386 Local 1.7	PL386	£585
High C 386 Global 2.3	PL386	£650
Hi-Tech C 386 PDS	386	£385
Intel 386 C Code Builder	Win&386	£455
Watcom C 8.5/386	Win&386	£495
Topspeed C Prof	OS2	£165
Aztec CII-p	CPM-80	£120
Aztec CII-c	CPM-80	£200
Hi-Tech C	CPM-280	£105
Mix C	CPM-280	£35
Aztec C68K MPW C	MAC	£110
Aztec C68K/Am-P	AMIGA	£120
Aztec C68K/ST-P	ATARI	£120
Hi-Tech C 68000	ATARI	£140
Prospero C	ATARI	£55

We supply 2500AD, Avocet, Aztec, Lattice, IAR and Hi-Tech Cross Compilers hosted on DOS and targeted on Z80, 6502, 6801, 68HC11, 6301, 6809, 7811, 8051, 8096 & 68000/020. Please call for information or advice.

C INTERPRETERS

New V5 Instant-C is MS C V6 compatible.
C-terp V3.5 DOS £165
Instant C V5 DOS CALL

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We can copy files to and from 600 disk formats including CP/M, CP/M-86, MS-DOS, PC-DOS, APPLE, SIRIUS, BBC, TORCH, APRICOT, HP-150, TRSDOS, AMSTRAD, ATARIST, MACINTOSH. Our charge is £10.00 + disk + VAT with discounts on small quantities and disks are normally despatched within 24hrs of receipt.

For more information call us.

ADA COMPILERS

IntegrAda	DOS	£645
OpenAda DOS	DOS	£260
OpenAda DOS 286	286	£935
OpenAda DOS 386	386	£1865

CROSS ASSEMBLERS

We supply cross-assemblers by Avocet, 2500AD, Crash Barrier (META) and IAR Systems hosted on DOS, CP/M-86 and CP/M-80 with over 30 target processors. In total over 200 products with no space to list them here. We hold some stock but you should allow 10-14 days for delivery. Please call for information or advice.

C++ COMPILERS

NEW BORLAND C++ 3.0 includes Windows hosted IDE, Global Optimiser, ObjectBrowser, Resource Workshop and new versions of Debugger, Profiler (both for DOS and Windows) and Assembler.

NEW BORLAND C++ & AFX 3.0 includes ObjectWindows and Turbo Vision (both with source) and Run-time Library source.

NEW TURBO C++ FOR WINDOWS includes ObjectWindows, Resource Workshop and the new version of Turbo Debugger for Windows.

WE HAVE THEM ALL IN STOCK. CALL US NOW.

Borland C++ 3.0	Win&DOS	£206
Borland C++ & AFX 3.0	Win&DOS	£295
Topspeed C++ Std	DOS	£110
Topspeed C++ Prof	Win&DOS	£165
Turbo C++	DOS	£50
Turbo C++ & Turbo Vision	DOS	£69
Turbo C++ for Windows	Win	CALL
Zortech C++	OS2&Win&DOS	£360
Zortech C++ S&E	OS2&Win&DOS	£540
Topspeed C++ Std	OS2	£110
Topspeed C++ Prof	OS2	£165

LIBRARIES

NEW POET C++ Object-Oriented Database System from BKS - Persistent Classes, Container Templates, Set operations, Class Browser, etc. Supports Borland & Zortech. Ask about special bundle with Zinc Interface Library.

NEW OBJECT PROFESSIONAL FOR C++ offers more functionality than Turbo Vision for those writing DOS user interfaces.

NEW PROTOVIEW Screen Painter for C & C++ includes Dialog Editor, Data Validation, International Controls (reads WIN.INI), DDE, Customisable Workbench & Tool Palette, etc. Expensive, but worth it for the serious developer.

GUI Master	Win	£380
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Win++	Win	£160
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Zinc (inc Source)	Win&DOS	£325
Codebase++	Win&DOS	£195
POET	DOS	£295
POET	Win	£360
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Our charge is £10.00 + disk + VAT with discounts on small quantities and disks are normally despatched within 24hrs of receipt.

For more information call us.

BASIC LANGUAGES

BASIC COMPILERS & INTERPS

BBC BASIC-86 Plus	DOS	£75
GFA-BASIC	DOS	£85
GFA-BASIC for Windows	Win	£170
MS BASIC PDS 7.1	OS2&DOS	£222
MS QuickBASIC 4.5	DOS	£50
MS Visual Basic	Win	£95
PowerBASIC	DOS	£110
BBC BASIC	CPM-Z80	£95
MS QuickBASIC	MAC	£79

LIBRARIES & UTILITIES

Communications

Comms Lib (Microhelp)	Win,DOS	£95
PDQ Comm	DOS	£70
ProBas Telecomm Toolkit	DOS	£65

Database

Btrieve v5.1 (QB)	DOS	£390
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dbLib Network (MB7&QB)	DOS	£390
MS VB Lib for SQL Server	Win	£300
ObjectTrieve (VB)	Win	£280
PowerLibW (VB)	Win	£195
qbFilter (QB)	DOS	£90

Graphics

Graphics Server for VB	Win	£99
Graphics Workshop (MB7)	DOS	£105
GraphPak Pro (MB7)	DOS	£105
GSS GDT	DOS	£425
GX Graphics	DOS	£120

GREY MATTER

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PASCAL LIBRARIES

TURBO PASCAL LIBRARIES

Just a small selection!

Asynch Plus	DOS	£120
Asynch Professional	DOS	£95
Asynch Plus	DOS	£120
B-Tree Filer 5.22	Win&DOS	£115
graphics-MENU & Data Entry	DOS	£180
Huge Virtual Array & NAT	DOS	£215
Mathpak 87	DOS	£85
Object Professional	DOS	£120
Power Tools Plus/5.1	DOS	£105
Real-Time Graphics & M/C/T	DOS	£145
Science & Eng.Tools	DOS	£79
TEGL Windows Toolkit II	DOS	£70
TesSeRact TSR Dev Sys	DOS	£42
Topaz Single-User	DOS	£79

PROGRAMMING TOOLS

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Database Libs.	Debuggers
Dis-assemblers	Editors
Forth	Fortran Compilers
Fortran Libraries	Graphics Libraries
Icon	Linkers/Locators
Lisp	Logo
Modula-2	Object Oriented
Pascal Compilers	Pascal Libraries
Prolog	Rexx
Screen Libraries	SmallTalk

We stock many items for which there is no space in these advertisements.

PROGRAM EDITORS

Brief	OS2&DOS	£199
EC Editor	DOS	£40
Epsilon v5	DOS	£165
Kedit v4	DOS	£95
MKS v1	DOS	£99
Multi-Edit Standard	DOS	£79
Multi-Edit Professional	DOS	£110
Norton Editor v2	DOS	£45
PVCS Prof Editor	DOS	£195
QEdit Advanced	DOS	£45
QEdit TSR	DOS	£70
Syndie	DOS	£445
Vedit-Plus	DOS	£120
Kedit v4	OS2&DOS	£105
Epsilon v5 for OS/2	OS2	£165
QEdit Advanced for OS/2	OS2	£62
MKS v1 for OS/2	OS2	£130
PVCS Prof Editor	OS2	£195
PVCS Prof Editor	OS2&DOS	£255
MDX Editor	CPM-Z80	£25
Vedit-Plus v2.33	CPM-80	£110

Turbo Analyst	DOS	£75
Turbo Professional	DOS	£79
Turbo Vision Dev Toolkit	DOS	£105
TurboWINDOW/Pascal	DOS	£92

FORTRAN COMPILERS

NEW Watcom Fortran 77/386 8.5 includes royalty free DOS/4GW extender, DOS and Windows support, all at a SPECIAL INTRODUCTORY PRICE of £495. CALL US NOW.

FS-Fortran 77	DOS	£34
Lahey F77L 5.0	DOS	£420
Lahey Personal Fortran	DOS	£85
LPI RM/FORTAN 3.1	DOS	£535
MS Fortran 5.1	OS2&Win&DOS	£205
Prospero Fortran	DOS	£145
Pro Fortran for GEM	DOS	£55
Prospero PC Fortran	DOS	£55
Utah Fortran	DOS	£35
Watcom F77 8.5	OS2&Win&DOS	£295
FTN77/386	386	£765
FTN77/486	386	£895
Lahey F77L-EM/32 & OS/386	386	£895
Watcom F77/386 8.5	Win&386	£495
Prospero Fortran	OS2&DOS	£195

We have Fortran Libraries in stock.

LOW PRICES

FOR MICROSOFT & BORLAND PRODUCTS

WITH FULL TECHNICAL SUPPORT

Microsoft Basic PDS 7.1	£222
Microsoft C PDS 6.0	£222
Microsoft C & Windows SDK	£335
Microsoft Cobol 4.5	£435
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Microsoft Source Profiler	£45
Microsoft Visual Basic	£95
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Microsoft Windows SDK 3.0	£225
MS Win Multimedia Dev Kit	£225
MS Win MDK & SB Pro Card	£365
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Turbo C++ for Windows	CALL
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Turbo Pascal Professional 8.0	£137
Turbo Pascal for Windows	£103
Paradox 3.5	£340
Paradox Engine 2.0	£223

PASCAL LANGUAGE

TURBO PASCAL PROGRAMMERS - find out about the NEW VERSION of Stony Brook Pascal+. 100% Turbo Pascal V6 source code compatible, tighter, faster code, OBJ files (CodeView compatible), smart linking, debugger, profiler, supports DOS and Windows. CALL US NOW.

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Prospero PC Pascal	DOS	£55
Prospero Pascal	DOS	£145
Stony Brook Pascal+	Win&DOS	£265
Topspeed Pascal Std	DOS	£110
Topspeed Pascal Prof	Win&DOS	£165
Turbo Pascal V6	DOS	£69
Turbo Pascal Prof V6	DOS	£137
Turbo Pascal for Windows	Win	£103
Professional Pascal/386	PL386	£570
Prospero Pascal	OS2&DOS	£195
Topspeed Pascal Std	OS2	£110
Topspeed Pascal Pro	OS2	£165
Power System Pascal	IBM PC	£120
Power System Pascal Pro	IBM PC	£210
Pro Pascal V2.18	CPM-Z80	£195
Power System Pascal	Atari ST	£120
Prospero Pascal for GEM	Atari ST	£55

We have many Pascal Libraries. Enquire.



◀ Ever since we ran last month's Chipchat picture of Paddy Ashdown our switchboard has been jammed with Conservative readers complaining of political bias. This month, therefore, it's Tory pin-up time. Michael Portillo, Local Government Minister, seen here leading the country out of recession, can't get the dead-looking computer thingy on his desk to work. To keep himself occupied, he's shouting at the 13amp socket in his hand. (Probably made in Britain...)

The recession has bottomed out and British manufacturing is beginning to boom again: we have proof at PCW. DEC, one of the computer industry's largest multinationals, is now sourcing vital high-tech components from the UK. The DECstation 320, reviewed in this issue's Group Test, brings together system, keyboard and mouse from different booming economies around the globe and as we unpacked the last, yet essential part, a cheer broke out in the office. There, British to its copper core, was the sign of technology-driven economic recovery we had been waiting for. Hallmarked with the exclusive 'Made in the UK' label was the grey plastic mains lead...

Almost swamped by irate Tory voters after last month's ChipChat, we took a call from an irate BT worker with a WordStar query. 'What!' we said. 'Can't rolling-in-dosh British Telecom afford technical support?' 'Yes,' came the answer, 'but you can't get through on the phone, it's always engaged. But for

God's sake don't quote me"...

Don't hold your breath when installing Borland's new 'Screenery' disk, especially if you follow the instructions printed on the label. 'Insert disk in drive B: ...and type A:INSTALL'...

PCW is doing its part in the meteoric export-lead Great British boom with its own product reaching as far afield as Syria. Our reader there, Mr Manuf Haman, of Aleppo, writes:

'Dear Sir, I have the will to recognise more information about my specification, so I decided to write to your 'Personal Computer World' magazine for some help wishing that you will do me some favour by giving me an idea about your publications and communities. I will be so happy if you send me your answer.'

The cynics who claim grammar checkers don't work should send their answers care of Chipchat here at PCW. If Mr Haman would like to explain exactly what he means, we'd be only too glad to help. Probably...

Bits & Pieces

Sorry about the slight variation from our normal spot-on accuracy in the December issue. We really will try to do better next time...

In the Software Group Test, we inexplicably swapped the picture of Borland/Ashton-Tate's Full Impact spreadsheet with that of PC CALC. It was a long night and Molson Extra Dry has some seriously strange side effects.

It also seems that the effects are infectious. The person behind the spreadsheet mix-up was in no way responsible for the transposed pictures in 'Books'.

The dreaded Black Windows disease (a symptom of too many file conversion utilities) struck again in the Unix section of Hands On. Exactly what happened to the messy colour Macintosh screenshot in Hands On is unclear, especially since it started life in black and white.

The Editor says if it happens again he'll make us write a Hardware Group Test on mains leads...

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B model: 5 free 16-bit card slots, 5 drive bays (3 in front), 34.3(W) x 38.1(D) x 15.3(H) cm

Keyboard, mouse, MS-DOS 5, Windows 3.

Universal motherboard

2MB RAM (max 32MB), VGA (512k/1MB VRAM)
1 parallel 2 serial ports, advanced graphics connector.

PC-450M & PC-433M

50/33 MHz 486DX cpu card, 64k cache (max 1MB),
Weitek 4167 maths socket, 40MB HD, 1.44MB FD

PC-420XM

20MHz 486SX cpu card, 8k cache, 40MB HD,
1.44MB FD. Optional maths upgrade.

PC-333M

33MHz 386DX cpu card, 32k cache (max
512k), maths socket, 40MB HD, 1.44MB FD

Sample Prices

excluding VAT and carriage

Adaptor	VGA	VGA	VGA	AGC91
VRAM	512k	512k	512k	2MB
Monitor	V/mono	SVGA	XV17	XV17
450M	£1995	£2145	£2645	£3745
433M	£1445	£1595	£2095	£3195
420XM	£1095	£1245	£1745	£2845
333M	£1045	£1195	£1695	£2795

For B model ADD £75

SVGA: Super VGA Colour (14" tube).

AGC91 Advanced Graphics Card

60MHz 34010 cpu, 2MB VRAM, 512k DRAM,
1280 x 1024 pixels, 256 colours from 16.7 million.

XV17 Advance Colour Monitor

17" tube, user-adjustable digital presets,
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100MB ide Add £120 400MB scsi Add £ 950
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Built to the quality associated with far more expensive brands and taking up an incredibly small space on your desk.

Produced by a leading manufacturer with a reputation for professional Technical Support and in-depth expertise in connecting PCs together.

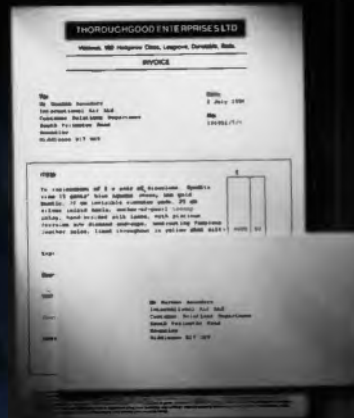
From a full 33MHz 386 colour system at £1195 to a mighty 50MHz 486 at £1995, the new Elonex PCs now bring to countless users the power that they once could only dream of.

It takes Innovation to turn Imagination into Reality

We thought about what you wanted in a laser printer.



Two paper trays for two different types of paper.



Automatic envelope-handling, for easy mail-merge.



Easy form-generation capabilities.

This is what came out.



79 pre-loaded fonts.



Overhead film and label printing facilities.



650-sheet total capacity, as standard.

Isn't it time someone produced a laser printer that provides what users really need?

Anybody would like, for example, the convenience of two paper trays. So why move up in price, and pay for other features you don't need, just to get them?

Why should envelope-handling come as an extra — after all, in what else can you send letters?

And why should high paper capacity be only for big, expensive printers?

We don't know why, either. Which is why we've produced the new F-820 laser printer ...

The Kyocera F-820 provides two paper trays, as standard. You can mix and match your stationery — and as one tray also takes envelopes, you can interleave them with letters.

Its total paper capacity is 650 sheets, so you can run off the longest reports, without running to the stationery cupboard.

It prints on acetate, on labels. It has 79 fonts, form-design facilities, even seven emulations, including LaserJet.

What more could you ask from a compact, competitively-priced 8 ppm printer? (But just try asking for so useful a set of features elsewhere.)

See for yourself. *Laser Printers: A Purchaser's Guide* is yours, free, when you use the coupon.

You'll find it's the F-820 that comes out on top.



The manufacturing makes the difference.

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Gillette Way, Reading, RG2 0BP.
Telephone (0734) 311500.

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